THE UNIVERSITY of York

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HEALTH ECONOMICS
CONSORTIUM

Water Fluoridation - An Economics Perspective

- Although caries levels did indeed fall during the 1970s, and average dmft/DMFT scores in the 1990s are considerably lower than they were 20-30 years ago, the reductions have ceased and there remain considerable variations across the UK in dental status (eg more than a 6-fold difference in the dmft scores of 5 year olds between the best and worst districts in 1993).
- Furthermore, there are considerable geographical variations, with much higher levels of caries in Scotland, Wales, Northern Ireland, Merseyside, North West England and parts of West Yorkshire than in the Midlands and the South East of England, and parts of the country, especially relatively deprived areas, which do not receive fluoridated water generally have higher levels of tooth decay than areas which are affluent and/or receive fluoridated water.
- Studies comparing the cost-effectiveness of water fluoridation compared with other strategies for reducing caries always conclude that water fluoridation is the most cost-effective approach.
- For example, Akehurst and Sanderson writing in 1993, concluded that "*in terms of cost, effect and the certainty of that effect the most cost-effective policy is fluoridation of water supplies*".
- One of the greatest strengths of water fluoridation is that it does not require any behavioural changes from its recipients, unlike other possible strategies (eg campaigns encouraging people to improve their oral hygiene and/or visit their dentist regularly).
- The scale of the effect of campaigns to change behaviour cannot be predicted, and such campaigns may be ignored by those who would benefit most from them. It is, however, possible to predict the costs and benefits with water fluoridation, and to be confident that those people likely to benefit the most from it will do so. Furthermore, the costs are borne by the NHS, and no private contribution is required.
- Although several studies have been undertaken of the costs and benefits of water fluoridation, these were often calculated using data from the 1960s and 1970s. These studies showed that water fluoridation is indeed cost effective, but their relevance, and indeed the relevance of water fluoridation itself, has been questioned in the light of the steady decline in caries levels during the 1970s.
- Calculating the capital and revenue costs of fluoridation for a population of a particular size is relatively straightforward, although these costs have to be discounted to determine the equivalent annual cost over each year of the installation’s life (discounting allows the capital cost to be depreciated over

the period and reflects society's preference for having a sum of money now rather than at some future date). From this, an equivalent annual cost per person of fluoridation can be calculated, and indeed a ready-reckoner devised to determine this for populations of different sizes and plants with different capital and revenue costs.

- Calculating the benefits of fluoridation is less straightforward, but the approach used in this study draws upon work undertaken by Sanderson and Wilson (1994) for Yorkshire data, based on the methodology of Birch (1990), which identifies the expected reduction in caries each year for children receiving fluoridated water from birth until they reach 14 years.
- To improve accuracy, the underlying oral status of the recipients should, if possible, be sub-divided into the proportions of children with "high' risk of caries (dmft at 5 years of 2.65), "medium" risk of caries (dmft at 5 years of 1.5 - 2.6) and "low" risk of caries (dmft at 5 years of less than 1.5) if they receive non-fluoridated water. Using population projections and knowledge of underlying oral status, it is possible to predict the numbers of decayed teeth, fillings and extractions that will be prevented each year of the life of the fluoridation installation (ie 14 years) for children born after fluoridation.
- A monetary value con then be assigned to these "benefits", which are also discounted over the period to estimate the annual equivalent "saving". For example, monetary values of £10 (ie "saving" the approximate cost of a filling, £20 ("saving" the approximate cost of filling plus other health service costs such as general anaesthesia for extractions) and £30 ("saved' health service costs plus savings to society and benefits to society of reduced pain and anxiety) were used in the Yorkshire study and in this one. However, it should be noted that total dental costs are unlikely to be reduced, due the need for more restorative and periodontal treatment m later years.
- This study draws together the results of this earlier work to indicate the likely "benefits" of fluoridation for populations with differing underlying oral status. For example, a population with very poor oral status (eg with 50% or more children in the high risk category) would produce a "benefit" per person per year of at least 50p if preventing decay, a filling or an extraction is valued at £20 per problem avoided. If the capital costs of fluoridating a treatment works serving a population of 250,000 people are £300,000 and the annual revenue costs are £50,000 (these cost estimates are relatively high), the equivalent annual cost per person (for each of the 14 years of the life of the installation) would be 33p. In such a situation, the annual benefits per person exceed the annual costs by at least 17p (or by at least £42,500 per annum for the population served).
- It should be noted that these calculations only consider the benefits to people born after the fluoridation of the water supply. However, those born prior to fluoridation will also benefit, although to a lesser extent. There is a paucity of on the magnitude of the benefits of receiving fluoridated water for all of one's life, but all dentate residents would benefit to some extent For example, adults would have fewer root caries and young children would have fewer caries in their permanent teeth. Due to the difficulties associated with quantifying such benefits, these have not been included in the calculations, but their omission means that the benefits of fluoridation are underestimated in the model.
- Considering the costs and benefits associated with water fluoridation shows which areas of Britain would benefit most. Such analysis also identifies which

areas are not a priority for fluoridation, either due to good underlying oral status and/or the local treatment works only serve a small population (eg less than 50,000). In such situations other approaches should be taken to target the families of children with particularly poor oral status. However, as the size of the population served by a particular water treatment works increases, the cost per person of fluoridation decreases, making fluoridation much more attractive to policy makers.

- It is recommended that local studies should be undertaken to identify the costs and predict the benefits associated with fluoridation in areas where the average dmft for 5 year olds is 2.0 or more (and especially if there are districts where it is over 2.65) and where the local water treatment works serve populations of 200,000 people or more.
- Where these conditions apply, the benefits of water fluoridation are likely to be significantly greater than the costs. Such areas include most or all of Scotland, Wales, Merseyside and North West England, plus some parts of West Yorkshire.

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