

Supplementary paper on water fluoridation for Bedford Borough Council Adult Services and Health Overview and Scrutiny Committee

Written information to supplement answers given to questions
raised by OSC members at their meeting on 16th December 2014

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Supplementary paper on water fluoridation for members of Bedford Council Adult Services and Health OSC

The paper submitted by Public Health England to the Bedford Council Adult Services and Health OSC at its 16th December 2014 meeting provided information on:

- * the responsibilities of local authorities for promoting the oral health of their population;
- * specific legislation and regulations pertaining to decisions on the introduction and maintenance of water fluoridation schemes;
- * the evidence on the benefits of fluoridation for oral health;
- * the evidence on water fluoridation and dental fluorosis; and
- * the evidence on safety of water fluoridation in relation to general health.

OSC members took the opportunity to ask the two PHE representatives a number of questions, to which they gave verbal answers. This supplementary paper provides more detail in support of those answers which, it is hoped, OSC members will find helpful.

1. “BEFORE AND AFTER” STUDIES OF DENTAL BENEFIT

An OSC member asked whether the dental benefits studies reviewed in the York report were ‘before and after’ studies. In other words, did those studies compare the state of children’s oral health before a fluoridation scheme started and after it had been in operation for some time?

The vast majority (23 out of 26) of the studies reviewed by York to assess whether fluoridation reduces tooth decay looked at children before and after fluoridation schemes were implemented. The studies, which compared places that had introduced fluoridation with places that had not, recorded the average levels of tooth decay per child and/or the percentages of children with and without decay.

http://www.york.ac.uk/inst/crd/CRD_Reports/crdreport18.pdf

Average benefits identified from analysis of all the results

When the York team combined and analysed the results of all these studies, they found that children between the ages of 5 and 15 in fluoridated areas had, on average, 2.25 fewer decayed, missing and filled teeth than those in non-fluoridated areas (representing approximately a 40% reduction in decay levels). The York team also found that, on average, around 15% more children were completely free of tooth decay in fluoridated areas than in non-fluoridated ones.

Sections 2 and 3 of this paper explain the nature of the studies reviewed by the York team in relation to the benefits of water fluoridation over and above other sources of fluoride and its impact on reducing oral health inequalities between social groups.

2. DENTAL BENEFITS OVER AND ABOVE THOSE OF OTHER SOURCES OF FLUORIDE

The York review looked at a range of studies to determine whether fluoridation achieved dental benefits over and above the effect of other sources of fluoride such as mouth rinses, tablets and, in particular, toothpaste.

Again, the majority of these studies (8 out of 10) were conducted before and after the introduction of a fluoridation scheme in one of the communities being compared. According to the York review, the evidence suggests that fluoridated water has an effect over and above that of fluoridated toothpaste and other sources of fluoride.

3. DENTAL BENEFITS IN TERMS OF REDUCED ORAL HEALTH INEQUALITIES BETWEEN SOCIAL GROUPS

Most of these inequalities studies were ‘cross sectional’ rather than ‘before and after’

The York review also looked at studies that had explored whether or not fluoridation reduces oral health inequalities between social groups. All but three of the 15 studies reviewed were ‘cross sectional’ rather than ‘before and after’ studies.

In other words, the majority of these studies began after a fluoridation scheme had started in a particular community. Then, at a single moment in time, the studies compared the oral health of children from different social groups in the fluoridated community as well as in another community that had not been fluoridated.

Evidence of a narrowing of the gap between the most and least affluent groups

The cross sectional oral health inequalities studies were not rated by the York team as being of as high a quality as the ‘before and after’ studies, which indicates that a degree of caution should be applied when evaluating the results.

However, the York review did find evidence to suggest that the differences between 5 and 12-year old children from the most and least affluent social groups in non-fluoridated areas were narrower in fluoridated areas.

Reduced inequalities identified in recent Newcastle v Manchester study

A study (McGrady et al) published 12 years after the York review looked at the teeth of 11 to 13 year olds in two major English cities. It found that the difference in the average number of decayed teeth between children from the most and least affluent social groups in

non-fluoridated Manchester was greater than between children from the most and least affluent social groups in fluoridated Newcastle upon Tyne. In other words, there was evidence that water fluoridation reduces oral health inequalities.

<http://www.biomedcentral.com/1471-2458/12/1122>

4. DENTAL FLUOROSIS

An OSC member asked about the prevalence of severe dental fluorosis (characterised by the pitting of tooth surfaces and brown staining). As stated in the earlier PHE briefing (see sections 6.6 and 6.9) and in the answer given at the December OSC meeting, this level of dental fluorosis is very rare in the UK.

Severe fluorosis virtually non-existent

For example, a 2012 study of 11 to 13 year olds (McGrady et al) found that only 0.1% of those in fluoridated Newcastle upon Tyne, and 0.2% in those in non-fluoridated Manchester had severe dental fluorosis.

When the numbers of children with moderate dental fluorosis in the study are also taken into account, the prevalence figures were 1.1% for Newcastle and 0.2% for Manchester. There was, however, an increased risk of developing mild fluorosis.

<http://www.biomedcentral.com/1471-2458/12/1122>

Very low prevalence of fluorosis of possible aesthetic concern

A Medical Research Council report published in 2002 estimated that between 3 and 4% of people in fluoridated areas of Europe have dental fluorosis of potential aesthetic concern.

<http://www.mrc.ac.uk/news-events/publications/water-fluoridation-and-health/>

Some studies have suggested most of the milder forms of dental fluorosis (characterised by pearlescent areas on tooth surfaces that in many instances make the teeth look whiter than normal) do not bother those whose teeth are affected, may not be noticeable and may even be judged more aesthetically pleasing (e.g., [Hawley GM, Ellwood RP, Davies RM \(1996\): *Dental caries, fluorosis and the cosmetic implications of different TF scores in 14-year old adolescents.* Community Dental Health, 13: 189-192.](#))

Study of 12-year olds found very few had noticed or were concerned about white marks on teeth

In September 2011, the NHS Dental Epidemiology Programme published its report of a national survey conducted in 2008/09 among 89,000 twelve-year old children who were asked whether they had noticed any white marks on their teeth and whether they were bothered by those marks. The children lived in both non-fluoridated and fluoridated parts of the country.

[http://www.nwph.net/dentalhealth/reports/12 Yr Old Supplementary Report Sept 2011.pdf](http://www.nwph.net/dentalhealth/reports/12_Yr_Old_Supplementary_Report_Sept_2011.pdf)

The results showed very little difference between regions. Nationally, 16% of 12-year olds said they had noticed white marks on their teeth, while 84% said they had no white marks or did not know whether they had any. Across the different regions, the numbers who said they had marks ranged from 14.6% to 18.4%. In the West Midlands, the most extensively fluoridated region, the figure was 16.8%. In London, where there is no fluoridation, it was 17.4%.

The white marks were not necessarily all due to dental fluorosis. There are many different causes of 'enamel opacities' on tooth surfaces.

Of the small minority of 12-year olds across England who thought their teeth had white marks, about a quarter said they were bothered by them. This represented just 4% of all the children who took part in the national survey.

5. RECONSTITUTING INFANT FORMULA WITH FLUORIDATED WATER

An OSC member asked about claims that the American Dental Association (ADA) warns against making up infant formula feeds with fluoridated water. The ADA does not do this and has publicly expressed concern that its position on this issue is being misrepresented.

American Dental Association supports fluoridation and advises parents to continue using fluoridated water to reconstitute infant formula feed

The ADA has for long been and remains a strong supporter of the water fluoridation. In 2011, following a systematic review by an expert panel of the evidence on infant formula and dental fluorosis, the ADA's Council on Scientific Affairs published recommendations for parents and health professionals. Parents were advised to continue to use optimally fluoridated water to reconstitute infant formula feed.

<http://www.ada.org/en/public-programs/advocating-for-the-public/fluoride-and-fluoridation/recent-fluoridation-issues/infant-formula-and-fluoridated-water/fluoride-and-infant-formula-faq>

The recommendations suggest that, if some parents are especially keen to minimise the risk of dental fluorosis, they should consider purchasing a ready-to-use feed with a low fluoride content or use fluoride-free or low fluoride water to make up the feed. As OSC members can see, all this is a very long way from warning against the use of fluoridated water with infant formula feed.

As in the UK, health agencies in the United States recommend breastfeeding of infants. The American Academy of Paediatrics guidelines for infant nutrition, for example, advocate exclusive breastfeeding until the child is six months of age.

6. NEUROTOXICITY

An OSC member asked about a report by Grandjean and Landrigan (published in the Lancet in 2014), which lists fluoride and a number of other substances as ones they believe to be 'neurotoxicants'.

They present no supporting arguments for their belief about fluoride, other than citing a review (which one of them had co-authored) of studies on the possible effects of high levels of naturally occurring fluoride in water in some rural areas of China. Furthermore, since the Lancet report was published, Landrigan has gone on public record as saying that in small amounts 'fluoride is beneficial'.

Analysis of the studies covered by the review which Grandjean and Landrigan cite in their 2014 report shows that where the naturally occurring fluoride in water supplied to these rural communities in China was at or around the same low level as in artificially fluoridated communities in England and the United States, children appeared to have higher average IQs than those living in areas with much higher naturally occurring fluoride levels.

New Zealand research paper found no differences in IQ between people born and growing up in areas with fluoridated and non-fluoridated water

A research paper on water fluoridation and IQ in New Zealand has recently been published which, unlike earlier studies reported mainly from China, relates specifically to a comparison of the IQs of people living in areas with and without community water fluoridation schemes ([Broadbent et al, 2014, *Community water fluoridation and intelligence – a prospective study in New Zealand*. American Journal of Public Health, published online May 15, 2014.](#)).

The study tracked individuals who were born in 1972/73 over a period of nearly 40 years, with IQ assessments conducted at regular intervals between the ages of seven and 38. Use of fluoride toothpaste, and consumption of fluoride tablets in early life, were taken into account in

the analysis, along with potential confounding variables such as socio-economic status, birth weight, breastfeeding and educational attainment.

The New Zealand research team found no significant differences in IQ between people in fluoridated and non-fluoridated areas.

International and UK expert bodies

There is no suggestion from expert bodies worldwide that neurotoxicity is likely to occur following exposure to fluoride concentrations present in the UK Public water supply (e.g. University of York 2000, Medical Research Council in 2002, World Health Organisation 2004, International Programme on Chemical Safety (IPCS 2002), European Food Safety Authority (EFSA 2005) and the European Commission's Scientific Committee on Health and Environmental Risks (SCHER) 2011.

While any substance can cause toxic effects if consumed at high enough concentrations or in high enough amounts, the overall available evidence does not support the conclusion that fluoride at the levels permitted in UK drinking water causes a neurotoxic effect.

7. THE SAFETY OF THE SYSTEMS USED TO FLUORIDATE WATER

An OSC member asked about the system used to fluoridate water and, specifically, whether the target was to achieve a level of one part of fluoride per million parts of water regardless of how much naturally occurring fluoride is already in the water supply.

Naturally occurring fluoride is already present in all water supplies. The precise level may vary from one community to another. It could, for example, be 0.1 ppm, 0.2 ppm, 0.3 ppm or higher or lower than that. In Bedford, which is not currently being fluoridated, the natural fluoride level is reported to be on around 0.25 ppm on average.

Aim to achieve and maintain a fluoride level of one part per million

Whatever the natural background level of fluoride in the water, the fluoridation equipment at a water treatment plant is calibrated to raise it to, and maintain it at, 1 ppm (the target level set in legislation). In other words, the amount of fluoride added takes into account the natural background level already in the water.

Fluoride compounds permitted under UK legislation

The two fluoride compounds permitted in UK fluoridation schemes must conform with European standards governing chemicals used for water treatment purposes. The manner of their use must also comply with a Code of Practice (CoP) developed and overseen by the Drinking Water Inspectorate (DWI).

Drinking Water Inspectorate Code of Practice on operation of plant and equipment

The DWI Code of Practice sets out principles for the safe design and operation of fluoridation installations and are intended to assist water suppliers in maintaining, as far as practicable, the fluoride concentration specified in legal agreements with Public Health England (1 ppm) and ensuring that it does not exceed the maximum permitted value of 1.5 ppm set out in the Water Supply (Water Quality) Regulations 2000 (as amended).

Specifically, there are requirements for:

- * safe delivery and storage of fluoride chemicals;
- * controlling the transfer of fluoride chemicals from bulk storage to the mains water by means of a 'day tank' that holds, as its name suggests, a maximum of one day's supply at any time;
- * specially calibrated pumps that can add fluoride to the mains supply only in proportion to the flow of water;

- * continuous electronic monitoring of the fluoride concentration, linked to automatic alarms and shutdown of the process if more than the permitted level is present;
- * a programme of staff training and supervision;
- * sampling of water from taps within the fluoridated area and laboratory analysis of the fluoride content in those samples (the results of which are accessible to the public through water suppliers' online water quality reports for individual postcodes).

Compliance with the Code of Practice is monitored by the Drinking Water Inspectorate. This is achieved through the DWI's ongoing programme of technical audits of water company performance. These results are also reported to and monitored by the Drinking Water Inspectorate.