

Not the state of the science – critique of an article about water fluoridation by Nicole Davis

Professor Michael Lennon
Professor Denis O'Mullane
Dr Ray Lowry

The article by Nicole Davis in Harvard Public Health magazine appears under the banner “State of the Science” but is far from a comprehensive, balanced and evidentially supported analysis of the state of the science of water fluoridation.

1. Health concerns

Davis mentions ‘health concerns’. It is misleading to leave the reader with the impression that concerns expressed about fluoridation are peremptorily ‘dismissed’ or that there has been no scientific investigation of such concerns until recently. Peer-reviewed studies comparing the prevalence of a wide range of health conditions in fluoridated and non-fluoridated communities have been published in the scientific literature over many decades. They include analyses of relevant data relating to cancer, osteosarcoma, bone fractures, and a range of other health conditions. These are in addition to routine public health monitoring.

Major reviews of the best available scientific evidence – whether across a wide spectrum of the ‘concerns’ expressed by opponents or in a specific area of health (cancer, for example) – have been conducted by, among others, the Royal College of Physicians (1976)¹; Department of Health (1985)²; US Public Health Service (1991)³; University of York (2000)⁴; Medical Research Council (2002)⁵; Australian National Health and Medical Research Council (1999 and 2007)^{6,7}; Royal Society of New Zealand (2014)⁸; Public Health England (2014)⁹; and Irish Health Research Board (2015)¹⁰. None has found evidence that community water fluoridation is harmful to health.

2. Cochrane review

Davis claims the Cochrane review report said CWF does not appear to have benefits for adults. It did not say that. Rather, it said that “there were no studies that met the review’s inclusion criteria that investigated the effectiveness of water fluoridation for preventing caries in adults”. This is a long way, in terms of actual meaning, from the Davis interpretation. Further, Davis omits to mention extensive sections on page 31 of the Cochrane review that draw attention to the existence of evidence (outside its own inclusion criteria) of dental benefits for adults. Examples cited were the Griffin et al systematic review (2007)¹¹, which found a prevented fraction of 34.6% in all the studies reviewed and a prevented fraction of 27.9% in post-1979 studies, and an Australian study by Slade (2013)¹², which found that greater lifetime exposure to water fluoridation was associated with lower levels of caries experience.

The Cochrane report also points out that, in the past 20 years, the majority of the research evaluating the effectiveness of water fluoridation for the prevention of dental caries has been undertaken using cross sectional with concurrent control, with improved statistical handling of confounding factors. The authors acknowledge that 'there may be concerns about the exclusion of these studies from the current review'.

3. Introduction of fluoride toothpaste

Davis says the early studies included in the Cochrane review did not take account of the subsequent widespread use of fluoride toothpaste. She implies that this undermines the case for water fluoridation. However, the very early studies were largely comparing like with like – fluoridated communities and non-fluoridated communities without widespread use of fluoride toothpaste.

More recent studies published between 1990 and 2010, such as those reviewed by Rugg-Gunn and Do (2012)¹³, were also largely comparing like with like in an era *with* widespread use. The York systematic review notes: "The study included in the review with the highest validity score (Hardwick et al, 1982)¹⁴ showed a statistically significant difference in caries increment between fluoridated and non-fluoridated areas. Those in the non-fluoridated area had the greatest increment, in spite of fluoridated toothpaste being used by both groups (94% vs 95% used only fluoride toothpaste in the fluoridated and non-fluoridated groups, respectively)."

4. Comparison of caries rates in fluoridated and non-fluoridated countries

Considerable space is devoted by Davis to graphs showing general declines in caries rates in different countries. There are numerous problems with this. First, there are several misclassifications of fluoridation status. Australia, Chile and Canada are shown as non-fluoridated, whereas all three countries have extensive water fluoridation schemes. All the major cities of Australia are, for example, fluoridated. On the other hand, only relatively small proportions of the total populations of South Korea and Spain are served by CWF schemes. In the UK, population coverage is only around 10%. Some of the countries listed as without water fluoridation have extensive salt fluoridation programmes, including Germany, France, Belgium and Switzerland.

There are other problems arising from a simplistic – or, indeed, in the case of the Davis article – no analysis at all of the data presented in graphs which fail to reflect which parts of the countries in question have water fluoridation schemes and which parts have relatively high caries rates. Comparisons of caries across nations are necessarily complex and multi-factorial. Davis comes nowhere near to a sound, scientific presentation.

The fact that there have been widespread reductions in the prevalence and severity of tooth decay in many communities over the past 20 to 30 years is to

be welcomed. It could be described as a ‘public health success story’ and is attributable in no small measure to the use of fluoride in a range of delivery modes, including toothpaste, water and table salt, as well as an increased focus on oral hygiene generally and strategies to reduce sugar consumption. However, significant dental health inequalities persist between different communities and between different socio-economic groups within individual communities.

The York review found that “the greater the population prevalence of tooth decay at the baseline examination the greater the effect of water fluoridation in decreasing this decay in the fluoridated area”. As argued by O’Mullane et al (Fluoride and oral health, 2016), new fluoridation schemes should be introduced where the prevalence of dental caries is high or moderate or there are firm indications that the caries level is increasing.¹⁵

5. Dental fluorosis

Davis introduces dental fluorosis with the words “Fluoride may be dangerous at high levels. Excessive fluoride causes fluorosis.” This is yet another misleading juxtaposition because it appears to link fluorosis with ‘danger’. The Cochrane report (which Davis cites elsewhere) says: “It should be acknowledged that moderate fluorosis may be considered an ‘unwanted effect’ rather than an adverse effect. In addition, mild fluorosis may not even be considered an unwanted effect.” The NRC report (2007)¹⁶ found that in the United States, the prevalence of severe dental fluorosis is “very low (near zero) at fluoride concentrations below 2 mg/litre.” This is nearly three times the standardised fluoride concentration used in US fluoridation schemes.

6. Bone health

Davis briefly mentions fluoride and bone, implying that there may be a connection between CWF and a weakening of the skeleton. She cites none of the reassuring evidence from two systematic reviews of bone health studies. Having conducted a meta-analysis of 18 studies, the York report (2000) concluded that “the majority of the measures and their confidence intervals were distributed around 1, the line of no effect for related measures (suggesting no association), with no obvious outliers noted.” The Australian NHMRC review (2007) noted the findings of York and reported on two other systematic reviews (Jones et al, 1999¹⁷ and Demos et al, 2001¹⁸) that found no association between fluoridated water and bone fractures.

7. The bottom line

In what she calls ‘the bottom line’ at the end of her article, Davis cites only adjunct professor Philippe Grandjean. We are surprised that, in what is portrayed by the magazine as a major piece of work on ‘the state of the science’ of water fluoridation, there was not a broader sweep of experts in the dental aspects of this public health measure and on the wider public health context. There are other experts within and outside Harvard University who could and perhaps should have been invited to comment.

Community water fluoridation is the replication of a dental benefit observed in populations with naturally occurring fluoride at a particular concentration in their water supplies. It has rightly been described by your country's CDC as one of the ten great public health achievements of the 20th century.

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The authors of this critique

Michael Lennon, Professor Emeritus in Dental Public Health, University of Sheffield, UK

Denis O'Mullane, Professor Emeritus in Oral Health Services Research, University College Cork, Republic of Ireland

Ray Lowry, Consultant in Public Health (rtd), Northern Regional Health Authority, NHS, UK