"Honesty is the first chapter in the book of wisdom." — *Thomas Jefferson*

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Here in the UK there has been a flurry of media activity regarding the evidence base of water fluoridation. This has been due in part to the passage of a new Water Bill through the Houses of Parliament.

Many Health Authorities here in the UK have been through long and extensive public consultations as part of the process of introducing water fluoridation, only to have requests to water companies to fluoridate supplies turned down. Following the vote on the 11th November Parliament approved Clause 58 of the Water Bill. This means that the final decision will shift to strategic health authorities; effectively giving local people the right to decide. While this is positive step for fluoridation in the UK the controversy is far from over.

Following the publication of the York Review of water fluoridation[1,2] the Medical Research Council (MRC) were asked to take forward the conclusions and recommendations of the York Review and consider what further research might be required to improve the evidence base in the area of fluoride and health.

The MRC established a Working Group with the following terms of reference

- Provide advice on current scientific evidence regarding the health effects of fluorides in the context of water fluoridation;
- Consider what further research in this area might be required and what priorities should apply to usefully inform public health policy in this area;
- Report to the MRC Physiological Medicine and Infections Board and the MRC Health Services and Public Health Research Board; and
- Report to the Department of Health.

The MRC recommendations[3] were:

Total exposure and uptake

1. New studies are needed to investigate the bioavailability and absorption of fluoride from naturally fluoridated and artificially fluoridated drinking water, looking also at the influence of water hardness. This is particularly important because if the bioavailability is the same, many of the findings relating to natural fluoride can also be related to artificial fluoridation (see recommendations 2, 4 and 14).

2. Further attempts should be made to estimate lifetime intakes of fluoride using both urinary excretion (as an exposure marker) and dietary ingestion data, and to determine the relative contribution of fluoride in artificially fluoridated water to total fluoride uptake. If the bioavailability of fluoride from artificially and naturally fluoridated water (see 1 above) is the same, then studies of fluoride accumulation in people who have lived in naturally high fluoride areas could be informative.

3. Continuing information is needed on trends in fluoride exposure resulting from changes in the use of discretionary fluorides (eg use of toothpaste use by infants).

4. If the bioavailability of fluoride from artificially fluoridated water is found to be substantially greater than from naturally fluoridated water (see 1 above), then new studies should address the aggregate rate of accumulation of fluoride in target tissues from artificial fluoridation and assess whether this is fast enough to produce a risk of pathological change within a reasonable life span in more than a small (and defined) minority of those exposed.

5. Within the National Diet and Nutrition Survey, 24-h urine samples are being collected for fluoride analysis. It is recommended that:

Periodic 24 h urinary fluoride sampling should remain a feature of at least some national diet surveys, to monitor trends and particularly to look at fluoride intake across the population.

Fluoride ingestion (from all sources) and fluoride excretion — and therefore fluoride retention — should be measured in children.

The relative importance of water as a source of fluoride ingestion in children should be determined.

Dental caries

6. Studies are needed to provide an estimate of the effects of water fluoridation on children aged 3–15 years against a background of widespread use of fluoride toothpaste, and to extend knowledge about the effect of water fluoridation by social class (or other relevant measures of socioeconomic status), taking into account potentially important effect modifiers such as sugar consumption and toothpaste usage.

7. Further information is required on the impact of water fluoridation on recurrent caries in adults and root caries in older adults.

8. There is a need to extend understanding of the impact of fluoridation on quality of life and economic indices in addition to the more customary outcome measures based on the prevalence of decayed, missing and filled teeth.

Dental fluorosis

9. Cross-sectional studies are required to determine the current prevalence of dental fluorosis in fluoridated and non-fluoridated communities, taking careful account of potential confounding factors and effect modifiers (see also recommendations 6 and 7 above).

10. Further studies are needed to determine the public's perception of dental fluorosis, with particular attention on the distinction between acceptable and aesthetically unacceptable fluorosis.

11. Any prospective epidemiological studies of fluoridation and dental caries should incorporate dental fluorosis as one of the outcome measures (see recommendation 9 above).

Social class

12. Further studies are needed to address appropriate measures of social inequalities in relation to water fluorida-

tion, dental caries, dental fluorosis and the role of confounding factors such as tooth brushing with fluoride toothpaste, other fluoride therapeutic agents, non-water dietary fluoride ingestion and dietary sugar ingestion (see also recommendations 6 and 10 above).

Bone health

13. If research demonstrates important differences in the bioavailability of fluoride according to the nature of water fluoridation and water hardness (see recommendation 1 above), a case control study should be carried out to investigate the relation of hip fractures to long-term consumption of artificially fluoridated water.

Cancer

14. An updated analysis of UK ecological data on water fluoridation and cancer rates is required.

It is interesting in the light of a recent press release (see box) for the Centre for Reviews and Dissemination in York who conducted the Fluoride review to note that the MRC concluded:

"The York review, published in September 2000, confirmed the beneficial effect of water fluoridation on dental caries (cavities), but also highlighted the increased prevalence of dental fluorosis (a defect of the enamel ranging from mild speckling to more gross effects) associated with fluoridation. The review concluded that little high quality research had been carried out on the broader question of fluoride and health, and that the available evidence did not allow confident estimates to be made of other possible risks to health or of the benefits of water fluoridation in reducing dental health inequalities"

If the figures from the York review are looked at they show that the addition of fluoride to water could result in a change in the number of children who are caries free. This could range from a reduction in the proportion of caries free children by 5.0% to a 64% increase in the number of children free of caries, the median being a 14.6% (0.05–22.1%) increase in caries free children.

While the majority of the studies favoured fluoridation, problems with the quality of the studies result in the summary of the effectiveness running from a slight disbenefit to a substantial benefit from water fluoridation as noted in the CRD Press release.

While most would agree that a 15% improvement in people suffering from any disease is desirable, which is what the median figure suggests, confidence that this can be achieved is very limited because the range included a disbenefit.

The majority of the dental research community has yet to accept that the quality of our research needs substantial improvement. They have believed for years that there was a substantive body of evidence supporting fluoridation. There is evidence that suggests a beneficial effect but despite more than 50 years of experimentation we still do not have high quality evidence of its effectiveness or the size of any benefit. If following the passage of the Water Bill fluoridation schemes are implemented they should also incorporate high quality studies of their effectiveness to fill in some of the gaps identified by the York Review and MRC.

What the 'York Review' on the fluoridation of drinking water really found

28 October 2003

For immediate release

A statement from the Centre for Reviews and Dissemination (CRD)

In 1999, the Department of Health commissioned CRD to conduct a systematic review into the efficacy and safety of the fluoridation of drinking water. The review specifically looked at the effects on dental caries/decay, social inequalities and any harmful effects. The review was published on the web and in the *BMJ* in October 2000.

We are concerned about the continuing misinterpretations of the evidence and think it is important that decision makers are aware of what the review really found. As such, we urge interested parties to read the review conclusions in full at http://www.york.ac.uk/inst/crd/summary.pdf.

- We were unable to discover any reliable good-quality evidence in the fluoridation literature world-wide.
- What evidence we found suggested that water fluoridation was likely to have a beneficial effect, but that the range could be anywhere from a substantial benefit to a slight disbenefit to children's teeth.
- This beneficial effect comes at the expense of an increase in the prevalence of fluorosis (mottled teeth). The quality of this evidence was poor.
- An association with water fluoride and other adverse effects such as cancer, bone fracture and Down's syndrome was not found. However, we felt that not enough was known because the quality of the evidence was poor.
- The evidence about reducing inequalities in dental health was of poor quality, contradictory and unreliable.

Since the report was published in October 2000 there has been no other scientifically defensible review that would alter the findings of the York review. As emphasised in the report, only high-quality studies can fill in the gaps in knowledge about these and other aspects of fluoridation. Recourse to other evidence of a similar or lower level than that included in the York review, no matter how copious, cannot do this.

1. Systematic Review of Water Fluoridation. website www.york.ac.uk/inst/crd/fluorid.htm.
2. McDonagh MS, Whiting PF, Wilson PM, Sutton AJ, Chestnutt I, Cooper J *et al.* Systematic review of water fluoridation. Br Med J 2000; 321:855–859.
3. Water Fluoridation and Health. The Medical Research Council. www.mrc.ac.uk/index/public-interest/public-news-4/public-news_archive/public-news-archive_sep_oct_02/public-fluoridation_report-2.htm.