Is New Zealand water fluoridation justified?
Yindi Jiang, Lyndie A Foster Page, John McMillan, Karl Lyons, Jonathan Broadbent, Kate C Morgaine

Abstract
Public health programmes extend beyond the clinical context and focus on measures that affect the lives of large subgroups or the population as a whole. An example of this is community water fluoridation (CWF), the altering of fluoride levels in the water supply with the aim of preventing the initiation and slowing the progression of dental caries lesions for the benefit of entire populations. Despite the unfeasibility of randomised controlled trials of CWF, a large volume of evidence is available on the topic. However, CWF remains a polarising and keenly contested issue. CWF is also an intervention where it is difficult to provide everyone affected with a choice. The Nuffield Council on Bioethics is an independent body that examines and reports on ethical questions, and they have provided a useful ethical framework for considering CWF via the ‘stewardship’ model. This commentary aims to discuss each of the public health aims and how they can be applied and weighed to reach a justified position about CWF.

The ethical principles that are relevant to public health are distinct from those that have been developed for other issues within health care. This commentary will explain the ethical principles that are relevant to public health and how they can be balanced and applied to public health dentistry. Public health programmes often affect the lives of large subgroups or the population as a whole and extend beyond the clinical context. Because of the population focus of public health and its emphasis upon prevention, it can often have implications for those who would not consider themselves to be ill or do not agree with a particular public health measure.

Fluorides are naturally-occurring compounds found in soil, air and water. It is present naturally in water with varying concentrations from less than 0.5 parts per million (ppm) to 25ppm. Fluoride is effective in preventing the initiation and slowing the progression of dental caries lesions and it works best via frequent applications at low concentration with community water fluoridation (CWF) being its optimal system of delivery. This benefit was discovered when researchers in the USA compared areas with different levels of naturally-occurring fluoride in water and found that at approximately 1 ppm, the caries preventive benefit was maximised while the prevalence and severity of dental fluorosis (a type of developmental defect of enamel which appears as diffuse white patches or streaks on the teeth) was low. The current New Zealand Ministry of Health guideline for CWF is between 0.7 and 1.0ppm.

Adjusting fluoride levels in the water supply is keenly contested by some. Although CWF has been implemented in some areas for several decades and there is a large volume of evidence available on the topic, ethical and technical issues mean high level research such as randomised controlled trials are virtually impossible to perform. CWF directly affects whole populations and it is not straightforward to provide each affected individual with a choice. Because of this, CWF raises ethical and policy issues.

Individuals or groups may object to and question the responsibilities and authority of the state and other agents to affect people’s lives in such ways. For example, a libertarian might argue that consent is required for every public health measure. While that perspective might be consistent and theoretically appealing to some, it would have the consequence that universal public health measures which could have a profound impact upon health and carry no risk of harm, would become impermissible without universal consent.

Strictly speaking, a libertarian view would also require individual consent in order to remove excess fluoride in regions where very high levels of fluoride occurs naturally in water. At the other end of the spectrum, a utilitarian approach might focus upon achieving the greatest possible collective benefit.
This means that the interests of some people may be ‘sacrificed’ if this were to lead to an increase in overall welfare.5

Between the libertarian and utilitarian there are highly divergent ways of viewing public health. To adjudicate and balance those divergent views, a principlist approach can be used, and the principles developed by the Nuffield Council on Bioethics provide a useful framework for considering CWF. The Nuffield Council on Bioethics is an independent body that examines and reports on ethical questions. In 2007, the Nuffield Council published a report which aimed to address the key ethical considerations that are relevant to public health, including CWF, and developed a ‘stewardship’ model of public health.1 The “stewardship” model includes six prima facie public health aims of the state or district council that can be applied and weighed to reach a justified position about CWF.5,7

The stewardship model states that public health measures should aim to:

- Reduce the of risk of ill health;
- Address the health of children;
- Reduce health inequalities;
- Not intervene without the consent of those affected;
- Minimise interventions that affect important areas of personal life; and
- Not coerce ordinary adults to lead healthy lives.

Reducing the risk of ill health

Oral health is fundamental to general health and well-being.8 Poor oral health has significant effects on the quality of life as a result of pain, discomfort and impaired oral functioning.8 Teeth also make a substantial contribution to physical appearance, and oral health problems can have negative impact on earnings and employment opportunities.9

Just as water is treated in several ways to improve safety, fluoride levels can be adjusted to promote and improve health for the population. The level to which CWF reduces ill-health is keenly debated. The Nuffield Council’s view is that the fluoridation of water does reduce the prevalence of caries, but the degree to which it is reduced is not clear from the evidence.1 Others have argued that the role of fluoridated water in preventing caries has decreased significantly following the introduction and widespread use of other fluoridated products such as fluoridated toothpaste.10

It should be noted however, that a halo effect may be functioning,11 in that the benefits from a fluoridated public water supply might be weakened because beverages and food products processed in fluoridated communities are exported to surrounding non-fluoridated communities. Studies measuring the effectiveness of CWF that consider only its direct benefit may therefore have underestimated the total contribution of CWF to caries reduction.12

Despite this, existing evidence indicates the CWF remains one of the most effective and socially equitable means of achieving community wide exposure to the caries prevention effects of fluoride.12 The York Review acknowledged that the beneficial effects of CWF were still evident in spite of the assumed exposure to non-water fluoride in the populations studied.6 They also found that after adjustment for potential confounding variables, introducing CWF into an area significantly increased the proportion of caries-free children, and decreased mean decayed, missing and filled primary/permanent teeth (dmft/DMFT) compared to areas that were non-fluoridated over the same time period.6 Studies have found the reduction in caries to range from 15% to as high as 50%,13,14 whilst others have demonstrated that the prevalence of caries increased when fluoride was removed from the water.15
To date, the only established adverse effect of CWF is a dose-response relationship between fluoride levels and the risk of dental fluorosis. Dental fluorosis is one of several different types of defects of the tooth enamel that causes visible markings on the teeth. It can vary from mild speckling which is imperceptible to the naked eye through to more severe staining and mottling of teeth. At concentrations below 1 ppm, which has commonly been used for CWF, most incidences of fluorosis are mild and only 3-12.5% of fluorosis are considered to be of aesthetic concern.

Other than fluorosis, there is no evidence of an increase in risk of other harms, such as bone fractures, cancer, or any other adverse effects. In fact, some studies have identified lower rates of hip fractures among those exposed to optimally fluoridated water. It is important to note that it may be difficult to determine whether particular harms are caused by CWF because of the presence of confounding factors, difficulties in estimating people’s total fluoride exposure and whether there is a long lag between exposure and occurrence of harm.

Despite this, a large reduction in caries incidence for a small increase in the incidence of visible fluorosis may be considered a worthwhile trade off. Furthermore, it has been reported that children with mild fluorosis tend to rate their teeth as healthier and more attractive than those that do not have dental fluorosis.

Reducing health inequalities

Despite significant gains in oral health in recent decades across the developed world, social inequalities in oral health remain. The bulk of the scientific literature indicates that the oral health of lower socioeconomic status (SES) groups does not match that of their higher SES counterparts.

Disadvantaged people often have unhealthy habits or knowledge about oral health and are less likely to visit a dentist if available. As an extreme, “poor oral health could threaten job security and economic productivity that in turn may exacerbate adverse social, psychological and economic circumstances, resulting in a downward spiral that further damages health.”

It is clear from the New Zealand Oral Health survey that significant inequalities in oral health still exist within New Zealand. The reduction of health inequalities should be a central goal of any public health programme and, according to Petersen and Kwan, CWF is one of the most cost-effective public health measures to improve oral health and reduce inequalities.

While it provides some benefit to all social groupings, the effects are greater among the most deprived populations; this is particularly the case where access to oral health services is limited. The Nuffield Council states “prioritarian programmes that address inequalities can, in principle, be ethically justified”. Therefore the potential for CWF to reduce inequalities is an important argument in favour of the intervention.

One objection to the oral health inequalities argument for CWF is that there are other methods of preventing dental caries. Instead of adjusting fluoride levels in the water we should be attending to the social determinants of poor oral health and in addition improve dental hygiene to reduce the incidence of caries. However, changing social determinants would require a broad range of government initiatives and time for such initiatives to make a difference. Evaluations of oral health education campaigns in Scotland, found significant improvements in oral health in children from schools located in non-deprived areas compared to higher deprivation areas. This suggests that oral health education in some cases, may increase inequalities in oral health.

Systematic reviews of the health education literature have found that dental health education interventions have no discernible effect on rates of tooth decay. Educational approaches aimed at reducing health inequalities in disadvantaged social and economic groups are unlikely to be effective unless they are sensitive to the environment in which such people live and are backed by wider policies to create a supportive community.

In contrast, CWF is an intervention that can be provided directly to everyone, meaning it is accessible to all. The ability of CWF to reduce health inequalities may also be a function of its passive mode of delivery. CWF has the advantage over toothpaste and mouth rinse of ensuring complete uptake of the
measure at no added cost to the individual. Changes to lifestyle or behaviour is also not required, which can be difficult to achieve.\textsuperscript{27}

**Special attention to the health of children**

The public health aim to provide an adequate level of care for all children is also a good argument in favour of CWF. Children are born into a defined social stratum and are consequently exposed to the oral health benefits or vulnerabilities that come with it.\textsuperscript{28} Children represent a particular vulnerable group in many public health contexts and this is also true for oral health. They are less able to make informed choices about their oral health, and are dependent on parents and caregivers to assist with, or promote preventive measures such as tooth brushing.\textsuperscript{1}

While other methods of delivering fluoride such as the fluoridation of salt, milk, and toothpaste have the advantage in that it is easier for adults to opt out of being exposed to fluoride, they have the disadvantage of reaching fewer children. Research has shown that given a choice, those from higher SES groups are more likely to choose fluoridated salt and supplements.\textsuperscript{27} This indicates that these measures do not necessarily reach the whole population and may miss those who are most likely to develop caries, especially children from lower SES groups.\textsuperscript{27} The social origins hypothesis proposes that early childhood disadvantages, exposures, and oral health status ultimately determines oral health in adulthood.\textsuperscript{29}

Life course analysis has shown how social advantage and disadvantage accumulates or clusters at critical periods, particularly in early life, thus contributing to the creation of health inequalities. Results from the Dunedin Multidisciplinary Study provided strong evidence for this theory.\textsuperscript{29,30}

**Not coercing ordinary adults to lead healthy lives:**

Not being overweight or obese, not drinking more units of alcohol per week than is recommended and having 30 minutes of exercise a day are things that are good for health. While there is no doubt that the majority of people would agree that these public health aims would be good for them, there are people who choose to not live healthy lives and we should not coerce or pressure them into living a healthier way. This is because some people are content with a lifestyle that might contribute to a shorter life but is one where they can eat what they wish and or drink more than is recommended if they choose.

It could be argued that these public health aims are so important that they outweigh worries about people being coerced into living healthy lives, but if we are serious about respecting the right of all people to decide how they will live, coercive public health measures are ethically dubious. Even though drinking to excess, over-eating and smoking are unhealthy; many people prefer to do these things even though they are unhealthy. However, CWF is different in that it does not involve forgoing anything; drinking tap water is something that people would do in any case. Unlike many other public health interventions, CWF does not require any change in a person’s lifestyle, so it does not coerce people into leading healthy lives.

**Not intervening without the consent of those affected and minimising interventions that affect important areas of personal life**

When fluoride concentration is adjusted in the water supply, there is no doubt that for some members of the community the public health aim of not intervening without the consent of those affected will not be achieved.

Consent is important for medical interventions, and this could be used to argue that public health interventions should not be introduced where some individuals, however few, are opposed to it. However, it could be argued that the removal of fluoride from the drinking supply should also require universal consent. Both of these implications would be problematic because they would give a great deal of weight to the importance of choice and consent and allow a few people to override the collective good that might be achieved through such public health interventions.
Another argument that might be made against CWF is that it restricts the choices of individuals in a significant way, as individuals are less able to exercise choice over the water they consume. Likewise, some would claim that CWF is an intervention that impacts upon important areas of personal life.

It is hard to dispute that people who wish to avoid fluoridated water have to go to some lengths to do so, however, it is less clear CWF coerces people into drinking fluoridated water. Someone who does not want to drink water that has had the fluoride concentration adjusted could drink tap water that has been filtered so as to remove the fluoride, collect and drink rain water, access bore water or purchase bottled water. However it does have to be conceded that the degree of inconvenience involved in sourcing non-fluoridated water may be significant for some, and this frustration to a person’s interests is a cogent argument against CWF. This frustration, however, would be more than counterbalanced by the potential inconvenience of accessing fluoridated water should there be no CWF.

Conclusion

Ultimately, how the public health aims, identified by the Nuffield Council, should be applied and weighed up will be contested. There are some who will argue that the evidence that CWF reduces ill health and the lack of evidence of there being significant risks is not compelling enough to outweigh concerns about consent. There will be others who contest the claim that CWF is especially beneficial for children or that it is the best option for reducing oral health inequalities.

Debate about those issues is healthy and should be welcomed. Given how controversial CWF is for some, it is appropriate that we are vigilant about the evidence base for CWF. However, given the oral health of many children, that poor oral health is disproportionately high among lower social economic groups, and that CWF appears to be an effective way of addressing these public health aims, it seems reasonable for city and district councils to adjust the level of fluoride in the water supply, given our current state of knowledge about CWF.

Not being coerced into living a health life is an important consideration that needs to be factored in when considering public health initiatives. We showed that this is not an issue for CWF because it does not require any change in lifestyle. The absence of individual consent to being provided with fluoridated water might be taken to imply that one public health objective of the Council is not met, although as we showed, consent is also applicable to decisions to cease CWF.

Given that there are strong and divergent views about CWF this can be mitigated by finding other ways in which a state, or local authority, can demonstrate “deliberative democracy.” The Nuffield Council’s suggestion of a “transparent decision making processes”, with involvement of stakeholders in the decision making process, and the opportunity to challenge such interventions, can counter balance concerns about CWF and also provide an opportunity for decision makers to be transparent about the considerations they are acting on. The Nuffield Council concluded that the most appropriate way of deciding whether fluoride should be added to a water supply is to rely on democratic decision-making procedures. This is the status quo in New Zealand at present where elected local authorities are charged with making decisions about public health in their region.

Doubts have been expressed about whether district and city councils are best placed to make evidenced-based decisions about CWF, despite them being well placed to engage in deliberative democracy. However, our view is that regional, evidence-based decision making, be it via councils or DHBs, is an appropriate way for decisions to be made about CWF.

**Competing interests:** Dr McMillan reports personal fees from South Taranaki District Council, during the conduct of the study.
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References


Author information: Yindi Jiang, Student, Faculty of Dentistry, University of Otago, Dunedin; Lyndie A Foster Page, Senior Lecturer/Head of Discipline, Faculty of Dentistry, University of Otago, Dunedin; John McMillan, Professor/Director, Bioethics Center, University of Otago, Dunedin; Karl Lyons, Professor/Head of Department, Faculty of Dentistry, University of Otago, Dunedin; Jonathan Broadbent, Senior Lecturer, Faculty of Dentistry, University of Otago, Dunedin; Kate C Morgaine, Senior Lecturer in Public Health, Department of Psychology, Social Work and Public Health, Oxford Brookes University, Oxford, UK

Correspondence: Dr LA Foster Page, Department of Oral Rehabilitation, University of Otago, PO Box 647, Dunedin 9054, New Zealand. lyndie.fosterpage@otago.ac.nz


