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Research

Qualitative investigation of the reasons behind opposition to water fluoridation in regional NSW, Australia

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Key points

- Water fluoridation is subject to continuing challenges from those who oppose it
- Few studies have used qualitative methodologies to understand the reasons for strong antifluoridation views
- Participants identified key areas of opposition: scepticism about government bodies and research, health impacts, ethics, environmental impacts, economics, and alternatives to fluoridation
- Addressing all reasons for opposition when designing persuasive educational campaigns may help in engaging with the public, and could be used to inform future campaigns, public education and decisions about resource allocation

Abstract

Objectives: To investigate reasons behind strong opposition to water fluoridation in regional New South Wales, Australia, and to make recommendations to improve community engagement.

Importance: Few studies have used qualitative methodologies to understand the reasons for strong antifluoridation views. An understanding of these reasons could be useful when designing public campaigns to combat the strong antifluoridation message.

Methods: The qualitative study used semistructured interviewing and thematic analysis. Ten participants were recruited using purposive and snowball sampling methods until data saturation was reached. Thematic analysis and graphical representation of themes assisted in analysing the data for logical connections and relationships.

Results: Six dominant themes and numerous subthemes were identified. Five of the major themes were reasons for opposition: scepticism, health effects, ethics, environmental impacts and economics. Each of these was inextricably linked to a sixth major theme: alternatives to fluoridation.

Conclusions: All participants had strongly held antifluoridation views, and provided a unique insight into their perceptions and reasons for opposing water fluoridation. Concerns about 'fraudulent research' and the influence of industry on government bodies were novel themes. The concerns raised could be used to inform future population health campaigns, research, public education and resource-allocation decisions. Open community consultation may be able to address the issues raised in a nonjudgemental and collaborative manner.

Introduction

Water fluoridation is the process of adjusting levels of fluoride in a public water supply by adding supplemental fluoride, to prevent or minimise dental caries.[1,2] This public health measure is supported by the World Health Organization, and medical and dental associations in Australia, and is seen as a major primary preventive health strategy in improving oral health outcomes.[1] Although health professionals acclaim the benefits of water fluoridation, some people perceive the risk of adverse health effects to be unacceptable.[2] There are claims that the adverse effects of water fluoridation involve a wide range of organ systems and disease states, including the thyroid gland, the pineal gland and cancer growth.[3] Many of these claims have minimal scientific support, and others have been rejected for poor scientific methodology.[3]

The vast majority of the Australian population accesses fluoridated water supplies. In each state and territory except for the Northern Territory, the percentage of the resident population served by public water supplies who receive fluoridated water exceeded 80% in August 2013; for the Northern Territory, the figure was 70%.[4,5]

In New South Wales (NSW), NSW Health reports that 96% of its population accesses fluoridated water.[4] Those who do not have access either reside in communities where fluoridation is yet to be introduced or are not connected to a public water supply and rely on household water systems, such as water tanks. NSW Health aims to increase community access to fluoridated water to 98% by 2020.[6]

To our knowledge, there is little qualitative research internationally that has investigated why certain populations strongly oppose water fluoridation, and even less exploring this issue in Australia. Some qualitative research has focused on the general public.[7,8] For example, a qualitative study involving 68 focus groups in 16 countries looked at European citizens' views on water fluoridation.[7] The authors reported that the majority of participants were against water fluoridation, with the exception of countries where citizens had not experienced adverse effects of water fluoridation.[7]

Overall, the evidence available demonstrates community support for water fluoridation in Australia. Since 2007, published surveys and many unpublished government surveys have explored the attitudes of Australians towards water fluoridation. In 2011, an Australian study found that, of 510 participants, 70% supported water fluoridation, and up to 13% of those opposed would be likely to change their view if presented with new information.[9] Similarly, two large locality-based studies from southeast Queensland (2012) and the Central Tablelands of NSW (2010) found that 60% and 70% of participants, respectively, supported water fluoridation.[10,11]

Certain population demographics may be associated with support for water fluoridation. Studies have identified socio-economic status as an independent factor in determining support, with those of lower socio-economic status more likely to oppose water fluoridation.[9,10,12] As well, both a lack of trust in authority and a desire for greater community autonomy have statistically significant predictive values for opposition to water fluoridation.[11,12] Previous data have been derived mainly from studies using quantitative methodologies, limiting the breadth of potential responses and restricting effective exploration of the reasons for opposition. The Royal Society of New Zealand published a review of the scientific evidence on the health effects of water fluoridation and reported that:

> *… at the core of opposition to water fluoridation is the viewpoint that it conveys an unacceptable risk to public health. It is also argued that adding fluoride to public water supplies is an infringement on individual rights.*[13]

Howat and colleagues commented in a recent editorial that it is difficult to understand the viewpoint of people who oppose water fluoridation, given the scientific evidence.[14]

The aim of this study was to explore in detail the reasons behind strong opposition to water fluoridation in regional NSW, Australia, through qualitative methodology using semistructured interviews.

Methods

A semistructured interview script was developed in association with a general practitioner, a public health physician and a local government area official. The interview was pretested, and then pilot tested (n = 1) and refined before its use with participants. The areas of questioning were:

- Relevant background information (education levels, activity within local lobby movements, length of time within the local government area)
- Reasons for opposing water fluoridation (personal viewpoints and how these were reached, evidence used)
- Reasons for refuting reported positives (self-identified positives, World Health Organization recommendations) and exploration of why perceived negatives outweigh any self-identified positives.

Participants were recruited between September 2014 and February 2015 in regional NSW. Local government staff and research centre staff from a regional area in NSW distributed invitations to participate to community members via email. Staff distributing invitations were asked to forward invitations to 10 individuals in the community who were known to have antifluoridation views. The invitations included a request for these individuals to invite 3–5 of their own contacts who also opposed fluoridation. Inclusion criteria included living within the local government area and being opposed to

fluoridation of the local water supply. No participants were personally known to the researchers.

All subjects were provided with a Participant Information Statement. Four researchers, grouped into two interviewing pairs, conducted the interviews, which lasted 15–25 minutes. Interviews were audio-recorded with the participants' consent and transcribed verbatim by the researchers.

Both an inductive and a deductive approach were used. The interview data were subject to qualitative thematic analysis, as described by Braun and Clarke.[15] Transcripts were read and coded by two researchers to establish the major themes and subthemes. Themes were graphically represented, and examined for logical connections and relationships. Discussion focused on the significance of the themes identified and how these translated to the involved community. Microsoft Word was used to code the transcripts and to assist with the organisational aspects of the data analysis.

The Western Sydney University Human Research Ethics Committee approved the project.

Results

Recruitment and interviewing of participants continued until data saturation was achieved, resulting in a total of 10 participants with a variety of backgrounds (Table 1). Data saturation refers to the number of new topics that were brought up during the interviews. The final two or three interviews revealed no new information. No participants dropped out following initial contact. Although skewed in gender towards females, the participants represented a range of ages, levels of education and degrees of local activism. All participants had some degree of local activism, ranging from attending rallies and campaigns to more active involvement in organising events and contacting local government or NSW Health officials.

The thematic analysis revealed six dominant themes, which are discussed below, and numerous subthemes (Table 2). Five of the major themes were reasons for opposition, and each of these served as a lead-in to the sixth major theme: suggested alternatives to water fluoridation (Figure 1).

Scepticism

All participants expressed scepticism about water fluoridation. The majority discussed the evidence for the benefits of water fluoridation. Some participants were sceptical about whether fluoride was beneficial in preventing caries. This was based on anecdotal reports and personal understanding of the water fluoridation literature. A predominant belief was that the evidence for fluoridation of water was outdated and not applicable in a modern context.

Table 1. Participant characteristics

Characteristic	Category	Number of participants (N = 10)
Gender	Male	1
	Female	9
Age (years) (mean ± SD)	na	55.2 ± 7.2
Duration living in LGA (years) (mean ± SD)	na	19.5 ± 13.8
Highest level of education	Secondary school	2
	Diploma	1
	Bachelor degree	5
	Higher degree	2
Highest level chemistry education	Nil	4
	Secondary school	1
	University	5
Involvement in local campaigning	Minimal	4
	Moderate	4
	High	2
Belief that fluoride has at least one benefit	Yes	3
	No	5
	Unsure	2

LGA = local government area; na = not applicable; SD = standard deviation

> *As far as I know, no large-scale double-blind study has ever been done which goes over many years … it's the only thing I would trust. (ID02)*

Many participants cited concern about the adverse effects of fluoride (see 'Health', below), and the lack of evidence that fluoride was a safe additive to drinking water. Several participants viewed fluoride as an industrial waste product and unsafe for consumption. There was concern that there was 'fraudulent research', because of pressure by industrial powers attempting to find a cheap way to dispose of industrial waste.

> *When large corporations start to twist arms of bureaucrats to pushing their own agendas onto communities to have things like this happen, then you know there's a problem … once science is being manipulated by corporations to get what they want, through governments, that's it … (ID09)*

There was a considerable lack of trust in the bodies responsible for making decisions about fluoridation, including NSW Health and local governments. Many participants believed that the government lacked transparent public consultation, and that the decision to fluoridate had already been made.

> *There was a survey done by the Department of Health. It was very leading … but the question they asked, 'are you aware of the benefits of fluoride*

Table 2. Major themes

Theme	Category	Main subcategories
Scepticism	Benefits of fluoride	• Belief that fluoride does not prevent dental caries • Belief that it is unsafe
	Industry	• Concern about where it is sourced from
	'Fraudulent research'	• Concern about pressure on governments from large corporations • 'Leading' surveys
	Authority bodies	• Lack of public consultation
	International practice	• Belief that fluoridation is uncommon overseas
Health	Concentration vs dosage	• Individual dosing • Difficult to regulate daily intake
	Personal health concerns	• Personal health concerns
	Public health concerns	• Band-aid measure for a wider problem • Not targeting vulnerable population (children, low SES) • 'One size fits all' approach
Ethics	Ethical concerns	• Mass medication • Right to choose • Lack of affordable options to opt out
Environment	Downstream effects	• Effect on the water supply • Effect on agriculture • Build-up in the environment and increased fluoride in food
Economics	Expensive	• The overall cost of fluoridating the water supply • The cost of removing fluoride from water in individual households
	Cost-effectiveness	• The cost-effectiveness of providing fluoride through the water supply
Alternatives	Different method of delivering fluoride	• Tablet • Topical
	Alternative health programs	• Dental programs • Education programs • Dental hygiene
	Target specific populations	• Children • Lower SES

SES = socio-economic status

> *in the water supply?' And if people said no, well then they were told about the benefits and then asked if they supported it, and if they said yes, well they were still told about the benefits after they supported it, so the whole questionnaire was really leading … (ID01)*

Finally, some concern was expressed about international fluoridation practice. Many believed that Australia was following the United States and should instead be looking to Europe, where they believed fluoridation was less common.

> *I know that most European countries, mostly for ethical but for other reasons too, have moved away from fluoridation by now. (ID02)*

Health

There were two main reasons for people's health concerns. Firstly, participants were concerned about their own health and that fluoridation might exacerbate pre-existing disease symptoms.

> *You know, it seems like chronic fatigue [and] arthritis people are the people that get concerned about these issues. (ID05)*

Secondly, community health concerns were raised. People believed that fluoridation was a 'band-aid' fix for a much wider problem, and that it did not target the vulnerable populations it was designed to benefit, including children and lower socio-economic groups. The concept of a 'one size fits all' approach to medicine was considered inappropriate.

> *I think it's a band-aid measure to a more complex health issue. (ID02)*

> *The preferred kind of health promotion project appears to be ... not this community-development style intervention, but more 'one size fits all' … (ID06)*

The majority cited concentration versus dose concerns, specifically that differing ingestion amounts between individuals could not be regulated.

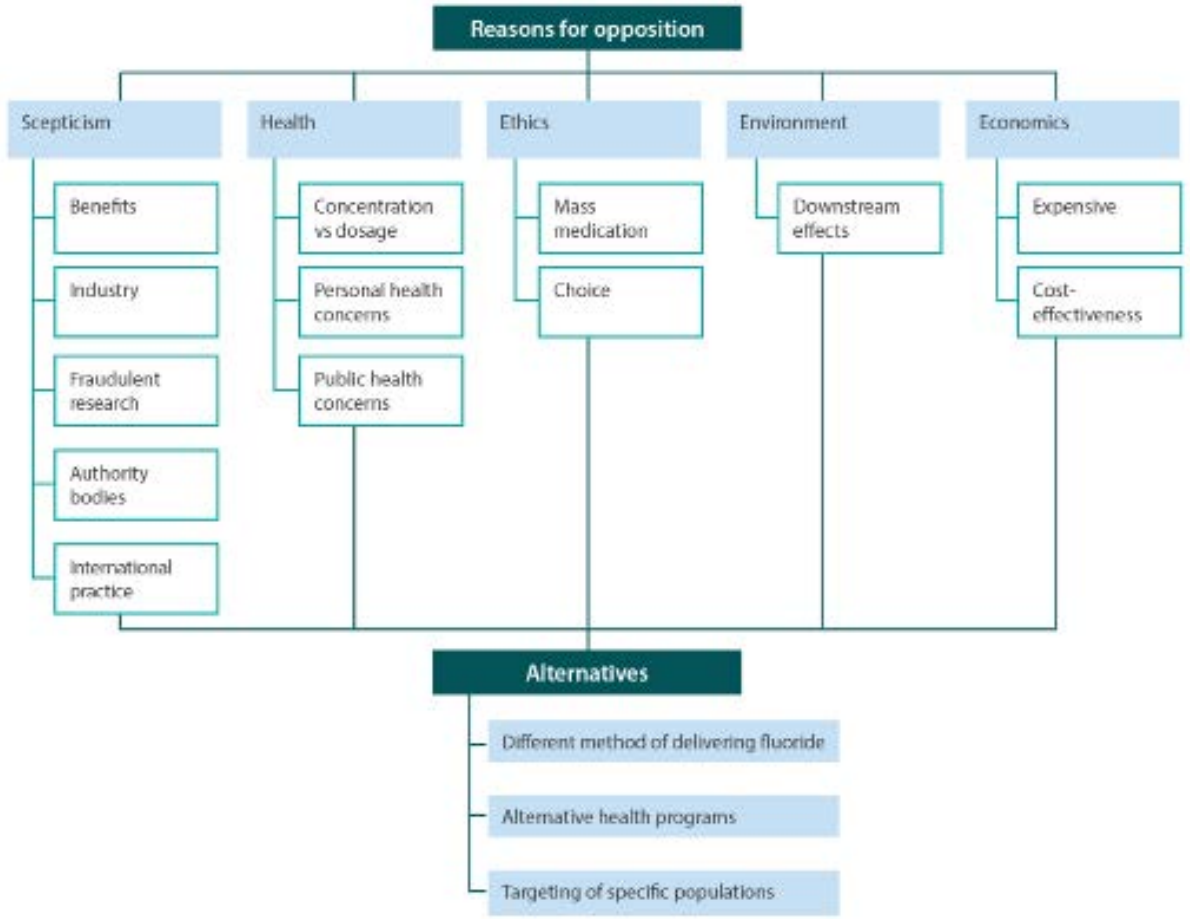
> *A little, tiny 5-week premature baby … should he be having the same amount as my six-foot-five child? (ID07)*

Ethics

Eight participants discussed the ethical issues of fluoridating an entire population's water supply. Two subthemes that emerged were the concept of mass medication and an individual's right to choose.

> *There's also the issue with the UN [United Nations], where fluoride ... being put in the water is being classed as mass medication which contravenes UN human rights issues, so basically they're taking away our choice. (ID08)*

Figure 1. Themes identified in interviews



Not being able to choose – that is, being forced to be exposed to fluoride – was considered unjust. Being able to choose alternatives such as toothpaste or tablets was considered just.

Environment

Five participants discussed the potential downstream environmental impact of water fluoridation.

> *… every human needs to be fighting to preserve our clean water and what's under us … (ID09)*

Downstream environmental concerns also included effects on plants, agriculture and invertebrates.

> *And also there's quite a bit of research coming out on the downstream toxic effects of fluoride on invertebrates and other animals in the downstream environment, and there's no assessment of what happens … (ID01)*

Several participants linked environmental concerns back to the effects on the health of the local population (see 'Health', above), mostly through ingestion of fluoride from agricultural products.

Economics

Four participants raised concerns about the set-up and maintenance costs of a water fluoridation program, believing that this money could be better spent on alternative public health programs.

> *It was a massively expensive thing, to the tune of ... half a million a year ... that's a lot of little dental services for people ... (ID10)*

Cost-effectiveness of water fluoridation was a dominant subtheme, specifically that a large amount of domestic water is used for purposes other than drinking, such as washing and flushing.

> *I know that household water use, only 2% of household water use is used in drinking and cooking. Only 2% ... (ID01)*

The inability to opt out of water fluoridation was a major concern (see 'Ethics', above), and the personal cost for people to remove fluoride from their own water was raised.

> *It doesn't give people a choice, and it's very expensive and rather complicated to get rid of fluoride if you don't want it … (ID02)*

Alternatives

All participants proposed various alternatives to water fluoridation. Three participants acknowledged the benefits of fluoride, but believed that it was better applied topically or in tablet form. Overwhelmingly, participants favoured a program involving dentists and dental hygiene education as a viable, cost-effective alternative.

> *I think the money would be better spent at doing the work that we are absolutely failing to do, which is holistic work with those families in those suburbs, including interventions around dental care and health promotion projects … (ID06)*

Most participants believed that fluoride was targeted at children, and the majority suggested alternatives. The predominant perception was that at-risk children do not drink water in sufficient quantities for water fluoridation to prevent dental caries.

> *Now, I worked for a while in public housing and I think I've never come across, in lower socio-economic spheres, a child that drinks water. They drink Coke, they drink Sprite, they drink soft drink, they drink apple juice... and unless you mix it with the water supply of these drinks, these children won't get the fluoride anyway. (ID02)*

Discussion

This study explored the reasons behind opposition to water fluoridation in a regional area of NSW. Six major themes were identified, and their interrelationship is summarised in Figure 1.

Our research added to existing knowledge and identified new reasons for opposition to water fluoridation. In particular, concerns about the claimed benefits of water fluoridation being based on 'fraudulent research' and about the influence of industry on government bodies were, to our knowledge, new themes identified in the academic literature. Our study allowed participants to voice possible alternatives to water fluoridation, and these are intrinsically linked to reasons for opposition to fluoridation. These novel themes present an area for further investigation and use by government bodies. In contrast, a number of themes identified have previously been reported and investigated in the literature, and these are discussed below.

Scepticism about the benefits of water fluoridation[9] and its safety[7,9] are commonly reported reasons for opposition. A systematic review examined the efficacy and safety of water fluoridation, concluding that it is a safe and effective community-based intervention for preventing caries.[4] The only adverse effect with a strong dose–response relationship (overall intake, inclusive of nonwater sources) was dental fluorosis; however, mild cases of dental discolouration are common, and are often not considered to be an adverse effect. Other adverse effects, such as bone fracture and cancer, were found to have no association with fluoridation. This was confirmed recently by another large systematic review, based on the current available evidence, in New Zealand.[13]

A significant concern was the perceived lack of public consultation by the government, and the belief that the government used deceptive strategies to educate the public. Indeed, previous studies show that the public believe they should be provided with more information about water fluoridation and other public health initiatives.[4,9,11,16]

Participants discussed concentration versus dose concerns, specifically that differing ingestion amounts between individuals could not be regulated. The difference between a concentration and a dose, and the difficulty in regulating an individual's fluoride consumption have been reported previously.[7,17] Fluoride has a cumulative effect in the development of fluorosis[17], which occurs during formation of teeth in childhood.[18] Several factors influence the amount of fluoride ingested, including fluid consumption patterns, type of fluid ingested, type of toothpaste used, socio-economic status and race/ethnicity.[19]

Ethical concerns regarding a lack of choice have previously been voiced.[7,11] Freedom of choice is the most prominent ethical concern in the literature. The concerns raised by participants in this study do not differ substantially from those previously reported in the literature, and strengthen this body of evidence.

Several participants voiced concern about the cost-effectiveness of water fluoridation. Their concern centred on the amount of household water that is consumed by the population, and their belief that providing other services, such as dental services, would be more cost-effective – this concern is consistent with previous studies.[7] However, several models have demonstrated that water fluoridation is a cost-effective intervention in populations of more than 1000 people, compared with the cost of providing dental services or the cost per disability-adjusted life year.[20,21]

Another significant belief was that water fluoridation is targeted at children, particularly those with a lower socio-economic status. It has been conclusively shown that children from lower socio-economic backgrounds are at increased risk of caries.[20,22–24] Additionally, previous research has shown that water fluoridation benefits children from all socio-economic backgrounds[4,20,22,23], as well as having a lifetime benefit in adults.[4]

Study strengths

This study focused on a population with strong antifluoridation views. Therefore, we were able to investigate the reasons held by those who oppose fluoridation. Furthermore, the study focused on the reasons for opposition only, in contrast to the majority of related literature. To our knowledge, this is the first study using qualitative methodologies that is solely focused

on participants with strong antifluoridation views, giving insight into their perspectives and opinions.

Our qualitative design and open interview structure allowed participants to voice their opinions, without being limited as they would have been in a quantitative study. The interview structure was continuously revised and adapted to improve participant rapport and depth of discussion.

Study limitations

The sample was relatively small, and people were recruited from only one region, which has limitations for representativeness. A larger study region could potentially have provided a wider range of reasons for opposition and potential alternatives. However, data saturation was reached.

It should be taken into account when interpreting the study results that all participants had some involvement in local activism. By design, this paper specifically explores the views of participants who openly oppose water fluoridation; care should be taken not to interpret the results as representing the views of the wider public.

Additionally, our advisers consisted of only profluoridation members. This may form a potential source of bias with regard to construction of the interview. However, the semistructured design allowed participants to discuss their viewpoints in detail.

Finally, opposition to fluoridation is a community-based phenomenon; local history, circumstances, demographics and politics are highly relevant. To protect the privacy of participants, it was felt that it was inappropriate to provide this context in detail.

Implications

Research has shown that water fluoridation benefits people from all socio-economic groups and may reduce inequities in oral health.[4,13] Keeping the study limitations in mind, our study presents three potential recommendations for relevant government bodies. First, a number of presented themes are generally not addressed in profluoridation campaigns, and including them in future campaigns may prove beneficial. Second, authorities could potentially address participants' concerns by conducting further research into environmental impacts, economic impacts, viability of alternatives and specific health concerns not previously covered in research, such as equitable weight-related effective doses and concentrations. Third, further research may be beneficial into what effective inclusion of the public in open and transparent discussion about fluoridation might look like – participants in this study perceived that public concerns are not being effectively addressed, and that government should include the public, including minority lobby groups, in discussions.

Conclusions

Water fluoridation has been shown to be an effective, safe and cost-effective means of preventing dental caries. This study explored the reasons behind opposition to water fluoridation in a regional area of NSW, Australia. Scepticism and concerns about health, ethics, economics and the environment are the major reasons for opposition to water fluoridation, and these are inextricably linked to possible alternatives to fluoridation. Using these data and addressing all reasons for opposition when designing persuasive educational campaigns may help governments to better engage with the public. The concerns raised could potentially be used in future population health campaigns, research, public education, consultation and allocation of resources.

Competing interests

MK, AG, AD and TP are employed as medical officers by NSW Health.

Author contributions

All authors were involved in the conception of the study and editing the manuscript; all authors approved the final manuscript. MK, AG, AD and TP conducted and transcribed interviews, and performed data analysis. AD and TP coded the transcriptions. MK and AG drafted the manuscript. MK and SP revised the manuscript.

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