

**ARTIFICIAL FLUORIDATION:
STANDPOINTS OF SELECTED STAKEHOLDERS
WITH REFERENCE TO PUBLIC ENGAGEMENT**

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Abstract

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Introduction

The aim of this project was to gain an understanding of the stance taken by selected stakeholders with regard to artificial fluoridation. This was investigated by means of both literature review and interviews. The stakeholders selected were stakeholders who were in favour of artificial fluoridation (proponents) and stakeholders who were against artificial fluoridation (opponents).

Literature Review

A literature search was carried out and the background to artificial fluoridation was outlined and views regarding artificial fluoridation were discussed. The literature review that was carried out was discussed under the themes of trust, risk, ethics and public engagement.

Methods

Interviews of proponents and opponents of artificial fluoridation were carried out.

Results

Divergences in views existed between proponents and opponents regarding the safety and efficacy of artificial fluoridation, with proponents indicating a level of trust in its safety and efficacy but with opponents expressing concerns about potential risks of this measure.

During interviews with opponents, concerns were expressed that more account needed to be taken of the views of the public following public consultations.

Discussion

Interviews were conducted and responses to questions 9 to 15 were discussed under the themes of trust, risk, ethics and public engagement.

Conclusion

Both proponents and opponents mentioned the need for improvements in the information that was available to the public regarding artificial fluoridation and for this information to be balanced.

The importance of public consultations was commented upon by some of the proponents and opponents. Some of the opponents interviewed in this study favoured public participation but from comments made regarding the importance of the views of the public being taken into account following public consultations, it appears that a 'substantive' approach to public engagement was favoured.

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Chapter 1. Introduction

1.1. Aim and objectives

The title of this S810 MSc project is ‘Artificial fluoridation: Standpoints of selected stakeholders with reference to public engagement’. Thus the aim of this project is to gain an understanding of the stance taken by selected stakeholders. This will be investigated by means of both literature review and interviews.

The stakeholders selected will be both stakeholders who are in favour of artificial fluoridation (proponents) and stakeholders who are against artificial fluoridation (opponents). Questions will be included in the interview schedule to ascertain the views of the aforementioned stakeholders with regard to public engagement in relation to the topic of artificial fluoridation.

The objectives of this project are as follows;

1. The first objective is to carry out a literature search to obtain information regarding the background to artificial fluoridation and to obtain information regarding views about artificial fluoridation.
2. The second objective is to investigate reasons (such as those relating to scientific findings or ethical issues) for the views of both proponents and opponents of artificial fluoridation by means of interviews.
3. The third objective is to review the results of the literature research and interviews in relation to the themes of ‘trust’, ‘risk’, ‘ethics’ and ‘public engagement’.

In Chapter 1. Introduction, the way in which artificial fluoridation was selected as a topic for this research project will be described and a brief introduction to the subject of artificial fluoridation will also be provided. In Chapter 2. Literature Review, the background to the promotion and the background to the opposition to artificial fluoridation will be outlined. Chapter 3. Methods will contain details of the methods used for this project. In Chapter 4. Results, the results of interviews carried out will be summarised. The results obtained will be discussed in Chapter 5. Discussion. The conclusions reached will be summarised in Chapter 6. Conclusion.

1.2. Selection of the topic of artificial fluoridation

The way in which the topic of artificial fluoridation was selected to be investigated during the Master of Science (MSc) project module (S810) will be described next. During the study of the Science and the Public MSc module (S802) material by Turney (1998), the subject of artificial fluoridation was mentioned by Miller (1983, p.45) who comments that scientific literacy is needed by a large percentage of society so that informed judgements can be made regarding science-related subjects such as artificial fluoridation. However, Miller (1983, p.42) also notes that due to the vast number of political issues, people can only become knowledgeable in a select number of issues.

Following this mention of artificial fluoridation, it was decided in consultation with the Open University that this topic was suitable for this project. In addition, it was decided that the topic of artificial fluoridation could be looked at in relation to certain themes referred to in S802's Introduction and guide (S802, 2010, p.31) such as 'trust', 'risk', 'ethics' and 'public dialogue'.

Lennon et al. (2008, p.66) make the suggestion that artificial fluoridation ought to be extended so that it reaches thirty per cent of the people in the United Kingdom rather than only ten per cent.

However, Wrapson (2005, p.17) notes that the issue of artificial fluoridation has been a matter of considerable debate. With regard to debate, artificial fluoridation is also a contemporary topic because it has recently been reported that some of the water in the Southampton area is to be artificially fluoridated (BBC NEWS, 2011, February 11, <http://www.bbc.co.uk/news/uk-england-hampshire-12427955?print=true> and MAIL ONLINE, 2011, February 12, <http://www.dailymail.co.uk/health/article-1356208/Citys-fight-fluoride-tap-water-dismissed-judge.html>).

1.3. Types and levels of fluoride used for artificial fluoridation

Although fluoride is referred to throughout this project it needs to be noted that there are different fluoride compounds, for example a naturally occurring fluoride compound in water supplies is calcium fluoride (Maguire et al., 2005, p.989).

The British Fluoridation Society et al. (2004, p.48) cite the Water Act 2003 and the Water Industry Act 1991 to point out that for the purposes of artificial fluoridation, no other fluoride compounds are permissible for addition to the water supply in the United Kingdom apart from disodium hexafluorosilicate (Na_2SiF_6) sometimes referred to by the name sodium fluorosilicate and hexafluorosilicic acid (H_2SiF_6) sometimes referred to by the name fluorosilicic acid.

As summarised by the Drinking Water Inspectorate (2010), artificial fluoridation is when fluoride is added to the supply of water so that the level of fluoride reaches 1 milligram per litre (mg/L or mg L^{-1}) with the intention of taking preventive action against dental caries.

Diesendorf (1995) points out that this level is also referred to as 1 part per million (ppm). The Drinking Water Inspectorate (2010) points out that with regard to artificially fluoridated water supplies, a level of fluoride higher than 1.5 ppm is not allowed.

With regard to the level of fluoride found naturally in water, Diesendorf (1995) notes that the fluoride level found in most water supplies is not higher than 0.2 ppm.

However, Cantor (1997, p.302) points out that the naturally occurring fluoride level can occasionally be higher than 5 ppm. Mohapatra et al. (2009, p.67) cite a range of references to indicate that groundwater fluoride levels in some parts of the world can sometimes exceed 30 ppm and thus review de-fluoridation techniques available to reduce levels of fluoride in water.

Ironically, with regard to lowering the level of fluoride naturally present in water, as referenced by Sellers (2004, p.188), at the time that artificial fluoridation was being implemented in some parts of the USA, de-fluoridation was also being implemented in other parts of the USA.

Furthermore, Sellers (2004, p.183) points out that when artificial fluoridation was being promoted in America in the fifties, methods of de-fluoridation were being sought in India.

1.4. Opposing scientific opinions regarding the efficacy of artificial fluoridation

With regard to the advantages of artificial fluoridation, Beltrán-Aguilar et al. (2002, p.161) cite the statement of the Centers for Disease Control and Prevention (CDC) that artificial fluoridation is one of the major progressive steps made in the last century for the improvement of the health of society. In an article by the CDC's Division of Oral Health (CDC, 2000, pp.1283 & 1286), it is claimed that artificial fluoridation is a key contributor to dental decay decline in the last century.

The efficacy of artificial fluoridation has been discussed by Hass (1966, p.328) who cites an article to show consumption of artificially fluoridated water with fluoride levels at 1 to 1.5 ppm as reducing dental caries by two thirds. More recently, Lennon et al. (2008, p.67) cite information provided by the British Association for the Study of Community Dentistry in 2007 indicating that when a substantial number of five year olds had their teeth monitored, six out of ten primary care trusts in which there was the least decay of the teeth were artificially fluoridated.

However, with regard to the efficacy of artificial fluoridation, Pizzo et al. (2007, p.189) cite references to indicate a decrease in the comparative efficacy of artificially fluoridated water since the middle of the 1980s. Pizzo et al. (2007, p.191) cite references indicating that fluoride containing dental products have been shown to result in a reduction in dental caries by around a quarter whereas in recent years artificial fluoridation of water results in a 15% decrease in dental decay.

Cheng et al. (2007, p.700) note that there has been a decline in levels of dental decay in recent years and ascribe this to factors such as toothpastes containing fluoride being used and possibly nutritional factors but not to fluoridated water or salt because the trend is apparent irrespective of whether these measures are in place.

In addition, although Dean (1952) discusses the potential benefits of artificial fluoridation, in the same article by Dean (1952, p.212) it is pointed out that even if artificial fluoridation is used, other measures to prevent dental decay should not be stopped including topical use of fluorides and reducing refined sugar intake.

Gibson-Moore (2009, p.293) notes that in the UK dental health has improved recently and that this is considered to be due to factors such as toothpaste containing fluoride which became available during the 1970s. However, Rodrigues et al. (2011, p.236) note that with regard to comparisons of the effectiveness of toothpastes with and without fluoride, extended prospective clinical trials can't be conducted due to ethical reasons.

Chapter 2. Literature Review

2.1. Background to the promotion of artificial fluoridation

The British Fluoridation Society et al. (2004, p.1) outline the link between excessive ingestion of fluoride and dental fluorosis or mottled teeth. Gibson-Moore (2009, p.293) notes that when teeth are being formed, dental fluorosis can be caused by intake of excessive fluoride. According to a reference cited in a review by Ayoob and Gupta (2006), when cells involved in the formation of teeth (the ameloblasts) are damaged by fluoride, dental fluorosis results. Burgstahler (1965, p.224) cites Hunter's observation of 'dark spots' on enamel in 1771. Burgstahler (1965, p.224) also references Black and McKays's observations of 'mottled enamel' in Colorado Springs in 1916 and their hypothesis that it was related to something present in the water supply. However, Burgstahler (1965, p.224) cites that a link between mottled teeth and reduced dental decay in children was also supported by research findings.

With regard to fluoride, Wrapson (2005, p.19) cites a comment made by Crichton-Browne as far back as 1892 who was concerned about the decreasing availability of fluoride in the diet and the possible negative effect on teeth. Wrapson (2005, p.19) also refers to a pamphlet in Denmark in 1902 in which daily calcium fluoride was recommended for the benefit of the teeth.

According to the British Fluoridation Society et al. (2004, p.viii), a link between higher levels of naturally occurring fluoride in water supplies and lower levels of dental caries was noted by researchers in the 1930s. Burgstahler (1965, p.225) cites Dean's conclusion that 1 ppm of fluoride led to on average a reduction in dental caries of between fifty and sixty per cent in twelve to fourteen year olds but Burgstahler (1965, p.225) also cites research indicating that dental decay was delayed by fluoride as opposed to being prevented.

With regard to the background to the promotion of artificial fluoridation, Arnold et al. (1956, p.652) outlined the progress of the early Grand Rapids-Muskegon research in America, which commenced in the middle of the 1940s looking at the effect of adding sodium fluoride to the supply of water in Grand Rapids compared to Muskegon (which initially acted as a control for half a decade).

After a decade, Arnold et al. (1956, pp.654-655) noted reduced tooth decay and slightly elevated dental fluorosis in children selected to be studied. Lennon (2006, p.760) emphasises the influence of this study but does point out that fluoridation of the control area within a small number of years weakened the research.

Nevertheless, Gibson-Moore (2009, p.292) summarises that having been introduced in America during the middle of the 1940s, artificial fluoridation was introduced in the United Kingdom a decade later.

Although fluoride ingestion via artificially fluoridated water was looked at in the study by Arnold et al. (1956), for a more comprehensive study, other sources of fluoride could also have been investigated. Ozsvath (2009, p.59) notes that intake of fluoride may be higher than advisable if other sources of fluoride apart from fluoride in the water supply are not considered. Please see Appendix 1 for Chart 1, which provides examples of different sources of fluoride.

Newbrun (2010, p.228) notes that there is uncertainty regarding total fluoride intakes of individuals but Ozsvath (2009, p.60) considers that it is extremely difficult to carry out research into the intake of fluoride of a population. However, Rodrigues et al. (2009, p.145) conclude that prior to commencement of schemes to artificially fluoridate the water supply, intake of fluoride by dietary means should be investigated.

In addition, in the study by Arnold et al. (1956), the population to be supplied with artificially fluoridated water could also have been looked at. For example, Dhar and Bhatnagar (2009) comment on evidence indicating increased susceptibility to fluoride's toxicity in certain individuals such as those with cardiovascular problems, problems of the kidney, the elderly or those who are deficient in certain nutrients such as vitamin C, magnesium or calcium. In the study by Arnold et al. (1956), factors could also have been looked at which could have an effect on fluoride retention and excretion, for example according to references cited by Poureslami et al. (2011, p.62) even altitude can have an effect on fluoride retained, with less fluoride being retained at low altitudes as compared to high altitudes.

Confounding factors that could have had an effect on levels of dental decay could also have been looked in the study by Arnold et al. (1956). For example, after conducting research to investigate the dietary patterns of those participating in the study with a low income, Burt et al. (2006) concluded that nearly a fifth of their sugar intake was due to the consumption of soft drinks, the frequency of which was linked to dental caries. Burt et al. (2006) also concluded that improvements in participants' circumstances were needed to increase the likelihood of success of measures for the benefit of oral health.

Sellers (2004, p.182) references material to highlight the way that artificial fluoridation was endorsed at the beginning of the 1950s by organisations such as the US Public Health Service and the American Dental Association even though the Grand Rapids research hadn't yet been completed and how this was followed by campaigning to increase the extent of fluoridation in the USA and introduce it globally.

According to references cited by Whipple (2010), after endorsements of artificial fluoridation in the USA, fluoridation was increasingly implemented in the USA at the beginning of 1950s and in 1952 investigators were sent from Britain to USA to look into establishing UK trials of artificial fluoridation. Whipple (2010) cites that trials were to be carried out in Andover, Anglesey, Kilmarnock and Watford. Pizzo et al. (2007, p.190) cite references in order to outline that countries in which artificial fluoridation has been implemented to varying degrees include America, Britain, Ireland, Spain, Canada, New Zealand, Australia, Columbia, Argentina, Chile, Israel, Malaysia, Brazil and also the cities of Singapore and Hong Kong.

2.2. Background to the opposition to artificial fluoridation

With regard to the background to the opposition to artificial fluoridation, it does not appear that artificial fluoridation was warmly welcomed by everyone in Britain because Whipple (2010) refers to local anti-fluoridation movements that arose and refers to the involvement of the Scottish Housewives Association and the British Housewives League with local anti-fluoridation movements. In addition, Whipple (2010) cites that even some Members of Parliament from both Conservative and Labour produced an 'Open Letter' in 1965 opposing artificial fluoridation particularly on the grounds of violation of freedom of the individual and uncertainty about its effect on people.

Whipple (2010) cites questions that were raised regarding the possibility that certain industries were promoting artificial fluoridation and profiting from fluoride by-products. Wrapson (2005, p.23) comments on anti-fluoridation sentiment when artificial fluoridation was first introduced in New Zealand and cites material to indicate that some made the connection between sodium fluoride added to water for artificial fluoridation and sodium fluoride commonly used in rodenticides and insecticides. However, viewpoints in favour of artificial fluoridation were also noted by Wrapson (2005, p.24) who cites a reference to indicate that at that time many medics and dental professionals considered the public who were against fluoridation to be anti-scientific in their attitude.

2.3. Disagreement amongst scientists regarding the safety of artificial fluoridation

Collins and Pinch (1993, p.3) note that when there is disagreement amongst scientists such as during scientific controversies, there may be disagreement regarding standards of opposing research in addition to results. Ozsvath (2009, p.62) considers that although chronic ingestion of fluoride has been said to lead to numerous health problems, in the case of some of these problems including for example, birth defects, genetic mutations, Alzheimer's disease and reactions due to hypersensitivity, the current evidence is not conclusive.

Carlson (2007, p.325) cites a reference to show that the pineal gland is located in the brain and notes its importance for the production of the hormone melatonin. Harrison (2005, p.1454) comments on the hypothesis that the pineal gland could be affected by excessive ingestion of fluoride and that there could be links between other problems such as senile dementia and excessive ingestion of fluoride but cites material to indicate that little research into such health effects is available and such research is not conclusive.

A study was carried out by Whitford et al. (2009, p.210) looking at the relationship between extended ingestion of elevated fluoride and rats' learning ability with regard to operant tasks. The authors (Whitford et al., 2009, p.210) concluded that extended fluoride intake at much higher levels than humans would have if their chief fluoride intake was via water that was artificially fluoridated did not have a significant impact on the rats' learning ability that was appetitive-based. Nevertheless, Junker (1998, p.8) points out that animal research may not necessarily correlate with situations involving humans.

Poureslami et al. (2011, p.61) conclude that children living in an area in which there was a higher level of fluoride in the water supply had a lower mean intelligence quotient (IQ) than children living in an area in which there was a lower level of fluoride in the water supply. However, Poureslami et al. (2011, p.63) note that arsenic levels in the water could also be investigated. Junker (1998, p.8) emphasises that epidemiological research may reveal correlations but not whether a particular factor causes something. However, there is a need for further research in this area because Ozsvath (2009, p.64) also refers to several studies linking elevated fluoride intake with a lowered IQ in children.

A study by Sawan et al. (2010, pp.21-22) involving rats found that when lead was administered with and without co-administration of fluoride as fluorosilicic acid, there were raised levels of lead in calcified tissues examined when fluoride had also been administered. However, Yearley (1994, p.252) notes that if animal research demonstrates that something is hazardous, the relevance of taking account of such research can be disputed.

Darmani et al. (2001, p.242) outline their research with female mice which indicated that extended exposure to high levels of sodium fluoride was associated with a reduction in fertility. Darmani et al. (2001, p.242) also cite epidemiological research which demonstrates an association between high levels of fluoride in water consumed and a reduced rate of fertility. However, Dhar and Bhatnagar (2009) cite a reference which indicates that based on information available, it can't be concluded that intake of artificially fluoridated water with 0.7-1.2 ppm fluoride could lead to reproductive problems in humans. Ozsvath (2009, p.64) also refers to research linking higher levels of fluoride in drinking water with increased risk of kidney stones but considers that definite conclusions can't be made due to the potential confounding factor malnutrition.

2.4. Trust

Prior to implementation of artificial fluoridation, there needs to be a level of trust in its efficacy and safety. With regard to the efficacy of artificial fluoridation, Hass (1966, p.329) claimed that it was necessary for fluoridated water to be drunk at the same time as the permanent teeth's enamel was being formed (i.e. birth to around the age of eight) so that fluoride incorporated into enamel gave rise to lifelong protection against the problem of dental caries.

Snow (1962, p.133) considers science to be 'self-correcting' in that incorrect conclusions will be re-evaluated and overturned in due course. Moreover, Cury and Tenuta (2008, p.13) note that fluoride's major effect against dental decay is after the eruption of teeth.

Cury and Tenuta (2008, p.13) cite Featherstone 1999 in order to outline that fluoride was previously thought to operate mainly in a systemic manner (internally) but is now thought to operate mainly in a topical manner (on the surface) against the development of dental decay. However, Cury and Tenuta (2008, p.13) note that whilst fluoride containing toothpaste is utilising fluoride in a topical manner, with artificially fluoridated water, fluoride is being given systemically.

Cheng et al. (2007, p.701) consider that should fluoride be considered as a medicine, evidence required for its efficacy ought to be the same as that required for drugs. However, Cheng et al. (2007, p.701) note that with regard to artificial fluoridation, randomised trials have not been carried out.

2.5. Risk

It is to be expected that proponents will focus on risks of not taking preventive measures against dental decay rather than on any potential risks of artificial fluoridation. Moynihan (2005, p.571) notes that there has previously been a tendency to look at oral health separately from health in general.

According to a 2008 article written by the Medical Research Council Human Nutrition research for the BBC, it is noted that with regard to the percentage of the population affected by dental caries in the United Kingdom, the figure is just under half for teenagers and children but just over half for adults (BBC Health, 2008, http://www.bbc.co.uk/health/treatments/healthy_living/nutrition/dietary_dental.shtml).

Moynihan (2005, p.572) notes the rarity of dental decay prior to the mid nineteenth century with the introduction of sugars as part of the diet. Zero et al. (2009, p.26S) cites various sources to outline the development of the conclusion that fermentable carbohydrates supplied by the diet were necessary for the occurrence of dental caries.

In addition, Hujoel (2009, p.490) refers to the hypothesis of Cleave and Yudkin that too much intake of fermentable carbohydrates could give rise to dental disease at an early stage followed by systemic disease.

Furthermore, Zero et al. (2009, p.26S) cites references to outline that many different microorganisms have been implicated in dental decay's development. Saffrey and Stewart et al. (1997, p.72) detail that if there is carbohydrate in an individual's mouth this can be broken down by bacteria in the mouth which produce lactic acid which can then slowly dissolve the salts of calcium present within the enamel, proteolytic enzymes produced by bacteria and salivary enzymes can then also break down protein composing the enamel.

Cheng et al. (2007, p.700) describe dental caries as being due to dietary sugars being fermented by bacteria to produce acid which can demineralise enamel but remineralisation also slowly occurs due to saliva depositing minerals but cavities form if there's more demineralisation than remineralisation. Kumar (2008, p.11) concludes that there ought to be investigation of innovative ways in which dental decay could be prevented.

However, with regard to artificial fluoridation, it is to be expected that opponents will focus on potential risks of artificial fluoridation rather than on risks of dental decay. Ozsvath (2009, pp.66-67) considers that even though there is consensus with regard to the risk of extended intake of fluoride at elevated levels, there is a lack of consensus with regard to the risk at lower levels.

Dean (1952, p.210) cites Cox and Hodge's review concluding that consumption of artificially fluoridated water with fluoride at 1 ppm does not pose any health risks to the public.

As outlined by Dhar and Bhatnagar (2009), extended ingestion of fluoride in lower quantities can cause chronic toxicity. Ozsvath (2009, p.59) notes that extended ingestion of fluoride at elevated levels is not safe due to health risks such as IQ decreases in children, dental fluorosis, reduced function of the thyroid and skeletal fluorosis. Dhar and Bhatnagar (2009) point out that isolated ingestion of fluoride at a higher quantity can cause acute toxicity and if too much is taken death.

According to Martin (1988, p.6) who interviewed proponents of artificial fluoridation, proponents were adamant that evidence was insufficient to conclude that there was any problem with the safety of artificial fluoridation. However, the Royal College of Physicians (1976, p.57) point out that with regard to defending fluoridation, the fact that logically it is not possible to prove a lack of adverse effects does not help with this.

The World Health Organization (http://www.who.int/oral_health/action/risks/en/index1.html, accessed 2011, August 13) acknowledges it could be impossible to avoid an increase in dental fluorosis when strategies to prevent tooth decay include the use of fluoride.

In addition, after their research into fluoride exposure, Erdal and Buchanan (2005, p.115) conclude that some children could be ingesting too much fluoride compared to the amount recommended to prevent decay.

Harrison (2005, p.1452) refers to the York review, which indicated that nearly half of those in locations that are fluoridated may be affected by varying degrees of dental fluorosis compared to 15% in areas where there is no fluoridation of the water supply. Although, Harrison (2005, p.1450) cites material to highlight that fluoride containing toothpastes may contribute to the ingestion of fluoride in addition to fluoride added to the water supply. Meneghim et al. (2007, p.205) cite references warning of the possibility that infants aged two to three ingest over half of the toothpaste on their toothbrush during brushing. Newbrun (2010, p.230) notes that a reduction in the fluoride level in children's toothpaste to 400-550 ppm does not cause a significant reduction in caries protection but reduces the prevalence of fluorosis.

The level of concern about dental fluorosis appears to vary for example Erdal and Buchanan (2005, p.111) reference the United States Environmental Protection Agency's viewpoint that dental fluorosis is considered to be a cosmetic problem but Iida and Kumar (2009, p.855) cite the 2006 report by the National Research Council in which severe dental fluorosis is categorised as an adverse effect on health. Furthermore, Opydo-Szymaczek and Opydo (2010, p.2702) cite references in order to highlight that severe fluorosis results in brown/black marks and pitting and cracking of enamel.

However, Harrison (2005, p.1449) refers to the York review, which indicated the need for consideration of the link between artificial fluoridation and the rise in the number of people with dental fluorosis in addition to its effects on dental health.

Day (2005, p.8) cites Bennett 1999 who summarizes that certain factors increase public concern about potential risks including for example, if risks arise by artificial means not natural, if they are compulsory as opposed to chosen, if they are not possible to avoid and if future generations could be at risk. According to research carried out by Armfield and Akers (2010, p.61) those who completed questionnaires with regard to artificial fluoridation had a tendency to consider there to be a lack of individual control, with hazards that were not familiar and to consider that if there were effects they would take place during an extended time period.

The Water Act 2003 includes requirements for the monitoring of residents' health in locations that become artificially fluoridated (Water Act 2003, http://www.legislation.gov.uk/ukpga/2003/37/pdfs/ukpga_20030037_en.pdf, accessed 2011, August 14).

2.6. Ethics

Reiss and Straughton (1996, p.231) note that it is not possible to provide assurances that substances and procedures have zero risk based on scientific evidence thus decisions involving values placed on the potential benefits and risks are made.

Martin (Scott et al., 1990, p.480) considers that the controversy over fluoridation entails issues such as the ethics of placing something in water so that its intake is compulsory. Hence, ethical issues will be looked at next.

With regard to ethical reasons against artificial fluoridation, Pizzo et al. (2007, p.190) cite references in order to emphasise that artificial fluoridation could be criticized for being against human rights as the fluoride is given without medical supervision or informed consent. Cheng et al. (2007, p.701) refer to the guidance of the General Medical Council with regard to consent which emphasises the right of a patient to refuse a medical intervention.

With regard to ethical reasons in favour of artificial fluoridation, Lennon et al. (2008, p.68) refer to the 2007 report of the Nuffield Council on Bioethics on the necessity of balancing the rights of the individual with the wellbeing of society as a whole taking into account the need to protect children's health and reduce inequalities in health.

Furthermore, Dean (1952, p.212) considers that rather than being 'mass medication' or a treatment for the problem of dental decay, artificial fluoridation is preventive and merely mimics the higher levels of fluoride at 1 ppm sometimes found naturally.

Diesendorf (1995) comments that some proponents will assert that it is ethical to carry out artificial fluoridation for the purported benefit of children of low-income families whose diets may be inferior and who may not be encouraged in regular brushing of teeth. Zero et al. (2009, p.25S) cite a reference in order to highlight that there are increases in levels of dental decay in people in lower income groups in America.

Thus as concluded by Goodwin (2003, p.9), science may be considered to be a factual subject but science-related public debates have the tendency to be to do with 'values'.

2.7. Public engagement

According to Miller (2001, p.119), in 2000 the House of Lords report encouraged public involvement in debate and dialogue regarding scientific issues.

With regard to Wales and England, the British Medical Association (2010) notes that the Water Act 2003 gives the Welsh Assembly and Strategic Health Authorities powers to make decisions regarding fluoridation of the relevant water supply following the process of public consultation.

The British Medical Association (2010) points out that in Northern Ireland, the Water Order 1987 gives the Department of the Environment responsibility with regard to artificial fluoridation and in Scotland, the Water (Fluoridation) Act 1985 governs fluoridation.

However, a review of the public consultation events that have occurred since the introduction of artificial fluoridation is beyond the scope of this project.

The Water Fluoridation (Consultation) (England) Regulations 2005 (http://www.legislation.gov.uk/ukxi/2005/921/pdfs/ukxi_20050921_en.pdf, accessed 2011, August 14) detail the way in which Strategic Health Authorities are required to carry out consultations regarding artificial fluoridation and include the requirement that the Strategic Health Authority should only arrange for artificial fluoridation to be carried out if satisfied that the case against artificial fluoridation is outweighed by its health benefits.

According to BBC News (2011, February 11, <http://www.bbc.co.uk/news/uk-england-hampshire-12427955?print=true>), the High Court did not conclude that it would be against the law for the South Central Strategic Health Authority to artificially fluoridate water in Southampton, although following public consultation 72% of respondents had been against artificial fluoridation of the water supply.

Thus, in the South Central Strategic Health Authority's statement on 16th June this year announcing that after a legal judgement that day, fluoridation was to go ahead in the area of Southampton, it was noted that the South Central Strategic Health Authority was satisfied that the case against fluoridation and opposition to this measure were outweighed by its benefits to health (South Central Strategic Health Authority, <http://www.southcentral.nhs.uk/16/06/2011/statement-water-fluoridation/>, accessed 2011, August 14). Therefore artificial fluoridation is to be implemented in the Southampton area despite the high level of public opinion against its implementation.

2.8. Previous research regarding standpoints of selected stakeholders

Martin (1988, p.5) interviewed several key people in Australia who were either in support of artificial fluoridation or were against artificial fluoridation.

Martin (1988, p.6) asked several questions which included questions regarding the reasons for and against artificial fluoridation, alternatives and suitable processes for making decisions about artificial fluoridation.

A paper was also written by Martin (1989) and a book was written by Martin (1991) in which the sociological aspects of the debate regarding artificial fluoridation were discussed.

The proposal for my project was submitted in 2010 prior to looking at the research carried out by Martin (1988). In my project, proponents and opponents of artificial fluoridation have also been interviewed but it has been carried out in the United Kingdom in 2011 and therefore adds to the research already carried out in this area by Martin (1988).

However, since Martin has written extensively about the division of opinion regarding artificial fluoridation (for example Martin 1988, 1989 and 1991), the findings of Martin will be referred to in due course.

A disadvantage of the approach of looking at the standpoints of proponents or opponents of artificial fluoridation is that the information obtained is not representative of the views of the general public nevertheless it does provide an insight into the reasons for people's polarised views regarding artificial fluoridation, which according to Armfield and Akers (2010, p.58) are still not well understood.

Chapter 3. Methods

3.1. Selection of research methods and interview schedule production

Initially a questionnaire was designed but this was amended into an interview schedule. Comments are made by Wilson (1979, p.16) that there may be improvements in the response rate and accuracy of surveys conducted by an interviewer. In addition, Sapsford (1999, p.109) notes that the use of interviews may be more appropriate when questions are less straightforward.

During production of the interview schedule, S810 resources for example information by Le Voi (1998) provided on the S810 CD Rom were utilised.

Please see Appendices 2, 3, 4, and 5 for introductory information for proponents, introductory information for opponents, the interview schedule for proponents and the interview schedule for opponents respectively. In emails sent to proponents and opponents, telephone numbers were requested so that qualitative interviews could be carried out over the telephone. If favourable replies were received, it was then possible to arrange interviews via the telephone with potential participants.

Miller and Bell (2002, p.53) emphasise the importance of informed consent and participants being aware of what is being asked of them therefore the interview schedule was provided to potential participants so that they could view it prior to deciding whether to volunteer to be interviewed or not.

The introductory email was relatively brief and interview questions were more open-ended because stakeholders had been selected who were likely to be reasonably knowledgeable regarding the topic of artificial fluoridation. Questions were asked to elicit interviewees' views regarding their trust in various sources of information about this subject issue, their ethical viewpoints and their perception of risk in relation to the topic of artificial fluoridation. Questions were also asked in relation to the interviewees' views regarding public engagement with the issue of artificial fluoridation.

3.2. Conducting a review of the literature

As intended, key words were used in order to carry out regular literature searches of the databases of the Open University's online library thus increasing understanding and knowledge regarding 'artificial fluoridation'. An example of a database utilised via the Open University's online library is Web of Science. One-Stop Search and Google Scholar were also utilised via the Open University's library.

Relevant search terms were used for example; 'artificial fluoridation', 'dental fluorosis', 'hexafluorosilicic acid', 'disodium hexafluorosilicate', 'fluoride', 'artificial fluoridation public consultation' and 'artificial fluoridation public engagement'.

In addition, to facilitate the literature search, Google Scholar alerts via email were arranged using key words such as 'fluoride'. Having found articles, the article title and abstract were read in order to decide which ones were sufficiently relevant to put in Zotero.

3.3. Selection of interviewees

The main stakeholders involved in the issue of artificial fluoridation of the water supply in the UK were categorised as follows;

- 1) Individuals/ organisations promoting artificial fluoridation,
- 2) Individuals/ organisations campaigning against artificial fluoridation,
- 3) Authorities currently delegated with decision making regarding fluoridation,
- 4) Scientists involved in research into the effects of artificial fluoridation,
- 5) Members of Parliament/ those involved in legislation regarding fluoridation,
- 6) Authorities who may be delegated with decision making regarding fluoridation in the future,
- 7) Companies producing products to be used for artificial fluoridation,
- 8) Water companies adding such products to water supplies,
- 9) Members of the public living in fluoridated areas,
- 10) Members of the public visiting fluoridated areas or consuming products produced in fluoridated areas or awaiting decisions regarding fluoridation of their water supply.

The problem arose that the stakeholders categorised overleaf would be too numerous to contact during this MSc project. Therefore, due to the large numbers of stakeholders involved, it was necessary to narrow the scope of the study to look at selected stakeholders in categories 1) and 2) overleaf for this investigative research project. In order to limit bias, the viewpoints of interviewees who were both for and against artificial fluoridation were obtained. However, a limitation of the project is that due to the small number of interviewees, their views would not necessarily be representative of all those who are either in support or opposed to artificial fluoridation.

It is important that anonymity is retained as highlighted by Le Voi (1998, p.3) and the Open University (2003) in its guidelines and thus the exact way in which groups/ organisations were selected or the groups/ organisations selected has not been detailed so as not to compromise the anonymity of the interviewees who kindly agreed to be interviewed. In addition, full transcripts have not been provided due to the need to protect the anonymity of interviewees.

Information provided by organisations both for and against fluoridation was studied. It was decided that information both for and against fluoridation with international perspectives would be looked at as part of the literature search but so that the investigative project did not become too expensive or impractical, it was planned for stakeholders to be limited to those based in the UK.

An introductory message was provided to ten groups/ organisations against artificial fluoridation and to ten groups/ organisations in support of artificial fluoridation. However, when the covering message and attached interview schedule were sent by email, one email address was used for sending this to groups that were against artificial fluoridation and a different email address was used for sending this to groups that were in favour of artificial fluoridation so that it was instantly evident which category of stakeholders was responding.

Groups/ organisations were contacted that could act as gatekeepers to potential participants involved with the particular group/ organisation.

Therefore, the introductory letter, covering letter and interview schedule were designed so that the interview schedule could be completed by respondents based on their individual viewpoints rather than on behalf of their groups/ organisations.

3.4. Project planning and time management

A couple of face to face pilot interviews were conducted so that slight improvements could be made to the interview schedule. The interviewees were chosen because they were both involved with an informal group and had carried out independent campaign work against fluoridation. As a result of this pilot stage, it was not necessary to make many amendments to the interview schedule prior to proceeding with emailing potential participants and carrying out interviews over the telephone and thus these interviewees were included with the collated results.

Although most interviews were carried out over the telephone, a small number (4 out of 32) of respondents opted to email or post completed interview schedules. The investigative project entailed project planning, followed by distribution of interview schedules. Thus the deadline for carrying out interviews by end of May 2011 was created to give sufficient time for collation of the results and analysis of results.

Planning activities in advance meant that progress could be monitored in light of planned activities. Having provided introductory information and an interview schedule, making appointments for interviews at times that were convenient to interviewees sometimes took a while entailing a few interim emails or phone calls.

The interview stage was also time consuming as the time taken for an interview to be carried out varied between approximately ten minutes to two hours and therefore it was necessary to restrict the number of interviews arranged each day so that there was no risk of overlap.

However, the interview stage was still completed by the beginning of June 2011. A systematic analysis of media information about artificial fluoridation was not carried out but information about artificial fluoridation available in the media was looked at as part of a general literature review.

A strength of this research is the richness of the qualitative information received. It was decided that thematic analysis (as outlined by Greenhalgh, 2010, p.171) of results would be carried out. Due to the relatively small numbers of interviews carried out it was not applicable to carry out statistical analysis.

Chapter 4. Results

4.1. Results of question 1

Table 1.1. Results of question 1 for proponents

1. Please could you confirm that you are over 18 years of age by providing your age range? (e.g. 18-29, 30-39, 40-49, 50-59, 60-69 etc.)

Age range (years)	Total
A. 18-29	1 (8%)
B. 30-39	0 (0%)
C. 40-49	4 (33%)
D. 50-59	4 (33%)
E. 60-69	1 (8%)
F. 70-79	2 (17%)
G. 80-89	0 (0%)

Where applicable percentages have been included in brackets, if the total does not add up to exactly 100% this is because percentages have sometimes been rounded up or down.

Table 1.2. Results of question 1 for opponents

1. Please could you confirm that you are over 18 years of age by providing your age range? (e.g. 18-29, 30-39, 40-49, 50-59, 60-69 etc.)

Age range (years)	Total
A. 18-29	0 (0%)
B. 30-39	0 (0%)
C. 40-49	1 (5%)
D. 50-59	3 (15%)
E. 60-69	10 (50%)
F. 70-79	4 (20%)
G. 80-89	1 (5%)
H. No age given (Retired)	1 (5%)

4.2. Results of question 2

Table 2.1. Results of question 2 for proponents

2. The first part of your post code (e.g. SR4):

[Google maps (<http://maps.google.co.uk/>, accessed 2011, July 1) were used to find out the areas to which the partial post codes related.]

Location to which postcode relates	Frequency mentioned
A. England	9 (75%)
B. Scotland	2 (17%)
C. Northern Ireland	1 (8%)

Table 2.2. Results of question 2 for opponents

2. The first part of your post code (e.g. SR4):

Location to which postcode relates	Frequency mentioned
A. England	16 (80%)
B. Wales	3 (15%)
C. Overseas	1 (5%)

4.3. Results of question 3

Table 3.1. Results of question 3 for proponents

3. Your gender (e.g. male/ female):

Number of females	Number of males	Total number of participants
A. 6 (50%)	B. 6 (50%)	12

Table 3.2. Results of question 3 for opponents

3. Your gender (e.g. male/ female):

Number of females	Number of males	Total number of participants
A. 12 (60%)	B. 8 (40%)	20

Figure 1. Results of question 3 for proponents

Your gender (e.g. male/ female)

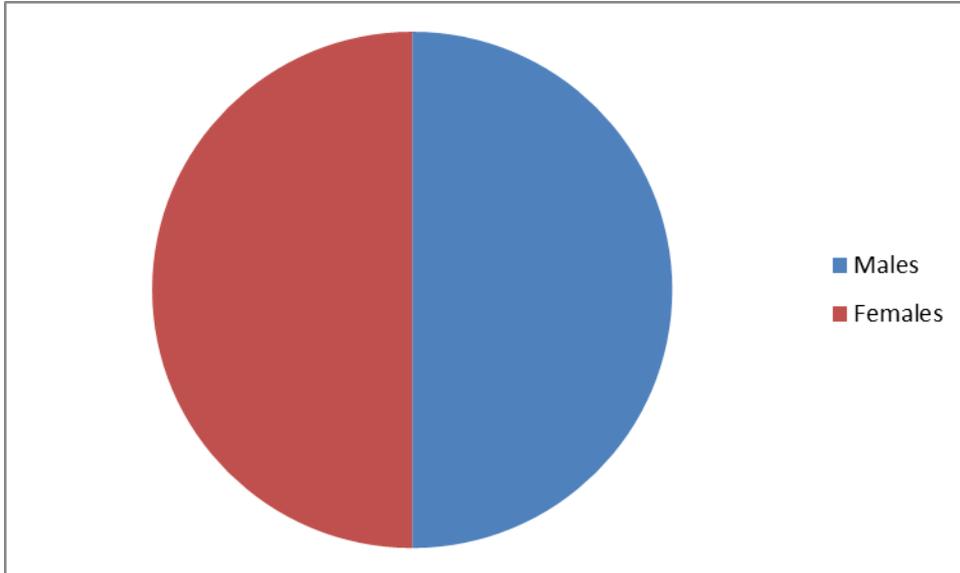
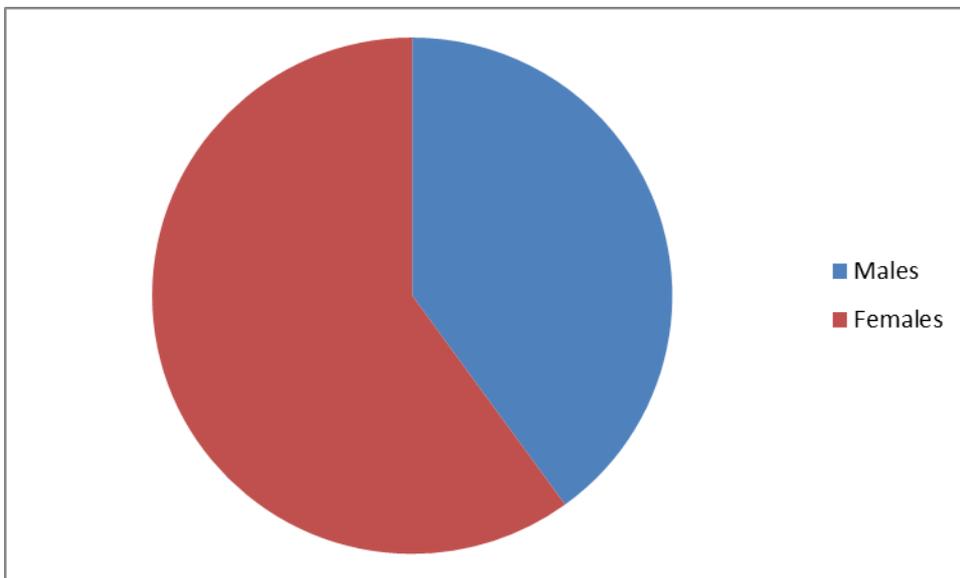


Figure 2. Results of question 3 for opponents

Your gender (e.g. male/ female)



4.4. Results of question 4

Table 4.1. Results of question 4 for proponents

4. Your occupation:

Type of occupation	Frequency mentioned
A. Dentistry/ dentistry education	8 (67%)
B. Retired from dentistry/ dentistry education	2 (17%)
C. Health promotion management	1 (8%)
D. Public relations	1 (8%)

Table 4.2. Results of question 4 for opponents

4. Your occupation:

Type of occupation	Frequency mentioned
A. Retired (health/medicine/ science/ technology related)	8 (40%)
B. Retired (post not specified as scientific)	5 (25%)
C. Job role not described as scientific	2 (10%)
D. Voluntary worker	2 (10%)
E. Medical doctor	1 (5%)
F. Self employed	1 (5%)
G. Science student	1 (5%)

4.5. Results of question 5

Table 5.1. Results of question 5 for proponents

The level and subject(s) of your highest qualification (e.g. A-level English, History):

Level of highest qualification	Frequency mentioned
A. Postgraduate qualification e.g. PGCE/ Masters/ PhD/ Fellowship (health/ dentistry related)	10 (83%)
B. Degree (dentistry related or not specified)	2 (17%)

Table 5.2. Results of question 5 for opponents

The level and subject(s) of your highest qualification (e.g. A-level English, History):

Level of highest qualification	Frequency mentioned
A. Postgraduate qualification or equivalent (health or science related)	4 (20%)
B. Postgraduate qualification (not science related)	2 (10%)
C. Degree (health or science related)	3 (15%)
D. Degree/ Graduate diploma (not science related)	2 (10%)
E. 'O' levels or equivalent/ 'A' levels or equivalent (science related)	2 (10%)
F. 'O' levels or equivalent/ 'A' levels or equivalent (not science related or not specified)	6 (30%)
G. No formal qualifications	1 (5%)

4.6. Results of question 6

Table 6.1. Results of question 6 for proponents

6. Do you live in an area in which the water is artificially fluoridated? (e.g. yes/ no/ I don't know)

Water supply where resident	Total
A. Not artificially fluoridated	10 (83%) (1 of whom mentioned they had previously)
B. Artificially fluoridated	2 (17%)

Table 6.2. Results of question 6 for opponents

6. Do you live in an area in which the water is artificially fluoridated? (e.g. yes/ no/ I don't know)

Water supply where resident	Total
A. Not artificially fluoridated	19 (95%) (1 of whom mentioned they had previously)
B. Artificially fluoridated	1 (5%)

4.7. Results of question 7

Table 7.1. Results of question 7 for proponents

7. With regard to the pro-fluoridation group or organisation with which you are involved, please could you state your role? (e.g. running the group or organisation/ spokesperson for the group or organisation/ paid employee of the group or organisation/ unpaid volunteer/ member of the group or organisation/ other role)

Role	Total
A. Member of one or more groups/ organisations	7 (58%)
B. Member of one or more groups/ organisations plus one or more key roles	3 (25%)
C. Key role as an employee	1 (8%)
D. Not a member of a group/ independent campaigner/ contact of group/ ex-member of a group	1 (8%)
E. One or more key roles with one or more groups/ organisations	0 (0%)

Table 7.2. Results of question 7 for opponents

7. With regard to the anti-fluoridation group or organisation with which you are involved, please could you state your role? (e.g. running the group or organisation/ spokesperson for the group or organisation/ paid employee of the group or organisation/ unpaid volunteer/ member of the group or organisation/ other role)

Role	Total
A. Member of one or more groups/ organisations	6 (30%)
B. Member of one or more groups/ organisations plus one or more key roles	1 (5%)
C. Key role as an employee	0 (0%)
D. Not a member of a group/ independent campaigner/ contact of group/ ex-member or a group	5 (25%)
E. One or more key roles with one or more groups/ organisations	8 (40%)

4.8. Results of question 8

Table 8.1. Results of question 8 for proponents

8. With regard to your personal viewpoint, do you agree with artificial fluoridation of the water supply? (e.g. yes/ no/ I don't know)

Responses regarding whether they agree with artificial fluoridation	Total
A. Yes (one added in the comment about it being carried out where needed)	12 (100%)
B. No	0 (0%)

Table 8.2. Results of question 8 for opponents

8. With regard to your personal viewpoint, do you agree with artificial fluoridation of the water supply? (e.g. yes/ no/ I don't know)

Responses regarding whether they agree with artificial fluoridation	Total
A. Yes	0 (0%)
B. No	20 (100%)

4.9. Results of question 9

Table 9.1. Results of question 9 for proponents

9. What are the main reasons for your views regarding artificial fluoridation (e.g. scientific reasons/ ethical reasons/ reasons related to parenthood/ other reasons), please could you outline these?

Main reasons behind views	Frequency mentioned
A. Scientific reasons/ dental health reasons	12
B. Ethical reasons	3
C. Financial reasons	3
D. Reasons relating to parenthood	2
E. Professional reasons	1

Table 9.2. Results of question 9 for opponents

9. What are the main reasons for your views regarding artificial fluoridation (e.g. scientific reasons/ ethical reasons/ reasons related to parenthood/ other reasons), please could you outline these?

Main reasons behind views	Frequency mentioned
A. Scientific reasons/ health/ medical/ dental health reasons	19
B. Ethical reasons	16
C. Financial reasons	3
<i>D. Legal reasons/ decision-making process (not mentioned by proponents)</i>	2
E. Professional reasons	1
<i>F. Environmental reasons (not mentioned by proponents)</i>	1

4.10. Results of question 10

Table 10.1. Results of question 10 for proponents

10. Do you think that sufficient information is made available to the public about artificial fluoridation? (e.g. yes/ no/ I don't know)

Satisfied with information made available	Total
A. Yes	7 (58%)
B. No	5 (42%)

Table 10.2. Results of question 10 for opponents

10. Do you think that sufficient information is made available to the public about artificial fluoridation? (e.g. yes/ no/ I don't know)

Satisfied with information made available	Total
A. Yes	0 (0%)
B. No	20 (100%)

4.11. Results of question 11

Table 11.1. Results of question 11 for proponents

11. Which sources of information about artificial fluoridation would you most trust? (e.g. information from local government officials/ central government officials/ doctors/ dentists/ independent scientific researchers/ company funded scientific researchers/ friends/ family/ information via charities/ via television, magazines or newspapers/ via academic journals/ via the Internet/ other sources)

Source of information	Frequency mentioned
A. Independent scientific researchers	8
B. Academic journals/ scientific papers & reviews	8
C. Department of Health literature/ NHS or NHS related organisations	3
D. Medical and dental associations/ recognised bodies representing dentists/ public health professionals	2
E. Doctors and dentists	1
F. Scientific organisations	1
G. Reputable online scientific library	1
H. Company funded scientific researchers	1
I. Historical evidence	1

Table 11.2. Results of question 11 for opponents

11. Which sources of information about artificial fluoridation would you most trust? (e.g. information from local government officials/ central government officials/ doctors/ dentists/ independent scientific researchers/ company funded scientific researchers/ friends/ family/ information via charities/ via television, magazines or newspapers/ via academic journals/ via the Internet/ other sources)

Source of information	Frequency mentioned
A. Independent scientific researchers	14
B. Internet (certain websites)/ anti-fluoridation organisation(s)	7
C. Academic journals/ scientific papers & reviews/ referenced books	5
D. Family/ friends/ personal experience of others	4
E. Doctors or dentists (some)	3
F. Charities (some)	3

4.12. Results of question 12

Table 12.1. Results of question 12 for proponents

12. Who do you believe should be involved in decisions regarding artificial fluoridation of one's water supply? (e.g. the individual consumer/ local communities/ local government/ central government/ health authorities/ scientists involved in research into artificial fluoridation/ others)

Stakeholders that should be involved	Frequency mentioned
A. Health authorities	9
B. Local government	7
C. Local communities	7
D. Scientists involved in such research	6
E. Central government	5
F. Individual consumer(s)	4
G. Health professionals/ health visitors	2
H. Water companies	1
I. Dentists	1
J. Doctors	1

Table 12.2. Results of question 12 for opponents

12. Who do you believe should be involved in decisions regarding artificial fluoridation of one's water supply? (e.g. the individual consumer/ local communities/ local government/ central government/ health authorities/ scientists involved in research into artificial fluoridation/ others)

Stakeholders that should be involved	Frequency mentioned
A. Individual consumer(s)	15
B. Nobody (as artificial fluoridation should be stopped)	6
C. Scientists involved in such research/ independent scientists	6
D. Local communities	3
E. Local government	3
F. Health authorities	2
G. Central government	2
H. Water companies	1
I. Anti-fluoridation campaign groups	1

4.13. Results of question 13

Table 13.1. Results of question 13 for proponents

13. Are you aware of any recent or current opportunities for public involvement with regard to the issue of artificial fluoridation (e.g. opinion polls, questionnaires, public consultations, public engagement activities such as focus groups, citizens' juries, consensus conferences, stakeholder dialogues or internet dialogues or other activities involving the public), if so please could you outline these?

Public consultations mentioned	Frequency
A. Southampton opinion polls/ public consultation	10
B. Other events/ previous events	3
C. None	1

Table 13.2. Results of question 13 for opponents

13. Are you aware of any recent or current opportunities for public involvement with regard to the issue of artificial fluoridation (e.g. opinion polls, questionnaires, public consultations, public engagement activities such as focus groups, citizens' juries, consensus conferences, stakeholder dialogues or internet dialogues or other activities involving the public), if so please could you outline these?

Public consultations mentioned	Frequency
A. Southampton opinion polls/ public consultation	16
B. Other events/ previous events/ events overseas	6
C. None	3

4.14. Results of question 14

Table 14.1. Results of question 14 for proponents

14. Are you satisfied with current levels of public involvement regarding the issue of artificial fluoridation? (e.g. yes/ no/ I don't know)

Satisfied with public involvement	Total
A. Yes	8 (67%)
B. No	3 (25%)
C. I don't know	1 (8%)

Table 14.2. Results of question 14 for opponents

14. Are you satisfied with current levels of public involvement regarding the issue of artificial fluoridation? (e.g. yes/ no/ I don't know)

Satisfied with public involvement	Total
A. Yes	1 (5%)
B. No	18 (90%)
C. I don't know	1 (5%)

Figure 3. Results of question 14 for proponents

Are you satisfied with current levels of public involvement regarding the issue of artificial fluoridation? (e.g. yes/ no/ I don't know)

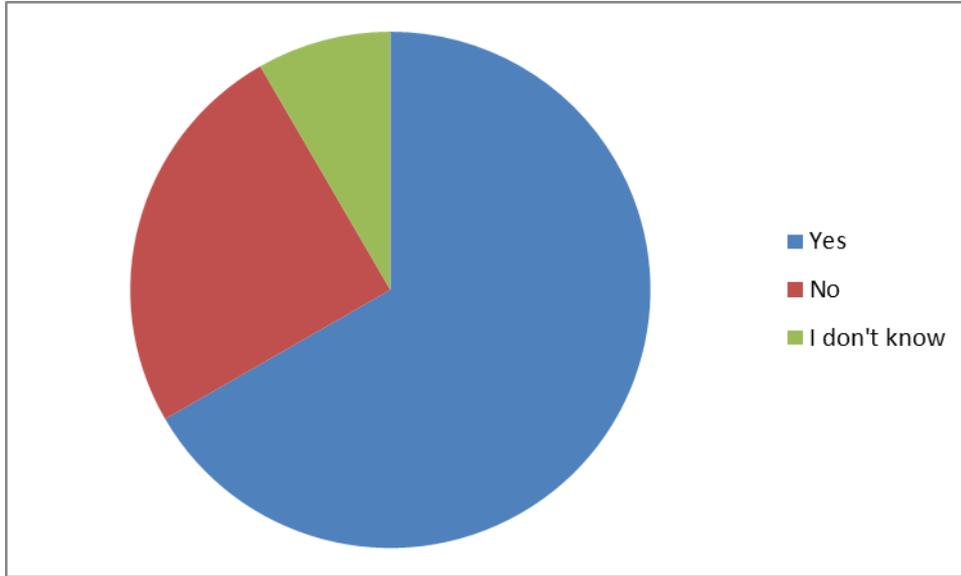
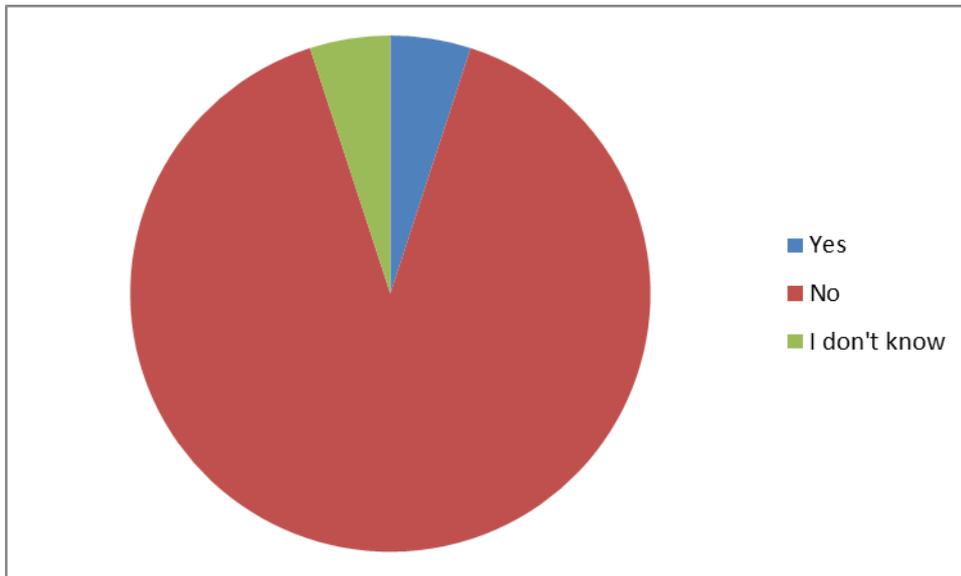


Figure 4. Results of question 14 for opponents

Are you satisfied with current levels of public involvement regarding the issue of artificial fluoridation? (e.g. yes/ no/ I don't know)



4.15. Results of question 15

Table 15.1. Results of question 15 for proponents

15. With regard to involvement of the public with the issue of artificial fluoridation, in what ways (if any) should this be undertaken?

Suggestions for public involvement mentioned	Frequency
A. Provision of accurate/ balanced information by media	5
B. Meetings/ open public meetings with wide cross section of people/ debate	4
C. Public consultations	3
D. Provision of information via the Internet/ questionnaires via the Internet	2
E. I don't know	2
F. Provision of balanced information about artificial fluoridation	1
G. Raising awareness via health authorities	1
H. Provision of information (about public meetings) by media and at dental/ doctors surgeries	1
I. Input from the public/ community groups	1
J. Workshops	1
K. Audience participation	1
L. Referendum	1
M. Due to emotive nature of the subject, avoidance of public meetings	1

Table 15.2. Results of question 15 for opponents

15. With regard to involvement of the public with the issue of artificial fluoridation, in what ways (if any) should this be undertaken?

Suggestions for public involvement mentioned	Frequency
A. Raising awareness/ provision of balanced information about artificial fluoridation/ provision of accurate/ balanced information by media	7
B. People should have individual choice	5
C. Comment regarding the problem of unequal funding i.e. funding for pro-fluoridation but not anti-fluoridation groups	4
D. Public consultations/ input from the public/ following public consultations notice should be taken of the public's views	4
E. Practice should be stopped	3
F. Good scientific research is needed/ scientific evidence against this practice needs to be considered by those responsible for decisions	2
G. There should be informed/ balanced public debate	2
H. Referendum (at very least)/ requiring significant majority e.g. 99% to proceed *	2
I. Time to hear anti-fluoridation groups	1
J. Publicity/ provision of information about public meetings/ public consultations	1
K. Independent assessments of the health effects in artificially fluoridated areas	1
L. Independent group providing independent information	1
M. Elected representatives should make decisions (at very least)	1
N. I don't know	1

* A comment was also made that referenda were inappropriate for fluoridation decisions.

Chapter 5. Discussion

For this qualitative investigative research project, introductory messages and interview schedules were sent to ten pro-fluoridation groups or organisations, two of which were able to help. However this resulted in a total of twelve completed interview schedule(s) due to the forwarding of the original message by one of the organisations.

An introductory message and interview schedule were also provided to ten named contacts of groups or organisations that were anti-fluoridation, half of whom responded. However, this led to a total of twenty completed interview schedules due to the original message being forwarded.

Armfield and Akers (2010, p.65) consider that there would be greater likelihood of response to their questionnaire from individuals with less apathy about the subject of artificial fluoridation. Thus it is surprising that a higher response rate was not obtained considering that groups were contacted with definite stances on the issue of artificial fluoridation and in which the contacts may have been expected to have clearly defined viewpoints on this issue. However, it is possible that not all of the emails were received.

However, a total of 32 completed interview schedules were obtained. These were comprised of 12 interview schedules from respondents who were in favour of artificial fluoridation or proponents and 20 interview schedules from respondents who were opposed to artificial fluoridation or opponents.

Groups/ organisations that could act as gatekeepers to potential participants who were involved with the particular group/ organisation were contacted and so the introductory information and interview schedule were designed so that the interview schedule could be completed based on interviewee's individual viewpoints rather than on behalf of their groups. However, one respondent at a pro-fluoridation organisation completed the interview schedule themselves but referred to their response as a corporate response on behalf of the organisation. In the beginning of this section there will be a brief discussion of responses to questions 1 to 8. The remaining responses to questions 9 to 15 will then be discussed under the themes of trust, risk, ethics and public engagement.

As can be seen from tables 1.1. and 1.2. which summarise the results of question 1, there were more interviewees in the 60 to 69 age group in the anti-fluoridation group than the pro-fluoridation group but due to the relatively small number of people interviewed altogether, no conclusions can be drawn regarding whether this trend would exist if more individuals had been interviewed.

With regard to question 2, the results summarised in tables 2.1. and 2.2. indicate that interviewees in both the pro and anti-fluoridation groups were located throughout the United Kingdom. It had been planned that interviews were limited so that only people in the United Kingdom were interviewed but some interviewees forwarded the email sent to them to other contacts and one of the interviewees (who was against fluoridation) was based overseas but they had previously been based in the United Kingdom and were able to respond to questions in relation to the situation in the United Kingdom.

Tables 3.1. and 3.2. indicate that there was a relatively even mix of males and females in both groups with there being a slightly higher ratio of females amongst the anti-fluoridation interviewees. Turney (1996, p.14) refers to a study which demonstrated that women indicated a preference for more rigorous product testing as compared to the men involved in the study. However, due to the relatively small numbers interviewed for this project, it would not be appropriate to draw conclusions from the slightly higher ratio of female interviewees in the anti-fluoridation group.

With regard to the pro-fluoridation organisations contacted, most of the interviewees were or had been involved in dentistry or dentistry education (please see table 4.1.) and would therefore be interested in preventive measures against tooth decay. The fact that most of the proponents had dentistry related occupations would be likely to lead to responses orientated towards concerns about dental health. After carrying out interviews of key stakeholders, Martin (1988, p.6) found that proponents of artificial fluoridation considered it to be extremely effective in reducing dental caries. As for the anti-fluoridation groups contacted, half of the interviewees currently or previously had roles which were related to health, medicine, science or technology (please see table 4.2.). As cited by Martin (1989, pp.65-66), some scientists have been against artificial fluoridation.

Martin was a co-author of a paper by Scott et al. (1990, p.482) in which Martin reflects on having been supplied with more additional information by respondents against artificial fluoridation than those in support of the practice despite there being similar response rates. Whilst carrying out interviews for this project, large amounts of additional scientific information was frequently supplied both during and after interviews by interviewees who were against artificial fluoridation.

The results of question 5 are summarised in tables 5.1. and 5.2. They indicate that all of those interviewed who were in favour of artificial fluoridation had postgraduate qualifications or degrees many of which were dentistry related. The interviewees who were against artificial fluoridation had a more varied range of qualifications not all of which were specified as being science related or degree level. It is possible that the qualifications of the interviewees could have an influence on their views, with dental health professionals having more of a focus on dental health than other professionals.

Durant et al. (1989, p.13) comment on the strength of the link between level of educational achievement and level of comprehension of scientific subjects but as noted by Gregory and Miller (1998, p.228), some individuals belonging to various advocacy groups, with no scientific training have become highly informed 'lay experts' in certain scientific subjects.

Martin and Tait (1992, p.39) highlight that previous scientific controversies have motivated people to make rapid improvements in their level of scientific knowledge regarding such issues. In addition, Day (2005, p.12) notes that due to the increased general availability of information, there can be less of an obvious division between the knowledge of scientific experts and lay experts.

The results of question 6 summarised in tables 6.1. and 6.2. indicated that in both groups interviewed, whether in favour of or against artificial fluoridation, most of the interviewees resided in areas that were not artificially fluoridated. As expected, respondents appeared to have a high level of awareness with regard to the topic of artificial fluoridation and thus nobody indicated that they did not know whether they lived in an artificially fluoridated area or not.

As can be seen from tables 7.1. and 7.2., although most of the interviewees were members or held key roles with one or more groups or organisations (either in favour of or against fluoridation depending on the interviewee), a small number of interviewees were not actually members of a group/ organisation but had been forwarded the original message and often were ex-members of groups or independent campaigners.

However, as expected all those who were contacted via pro-fluoridation organisations agreed with artificial fluoridation and all those contacted via anti-fluoridation groups or organisations did not agree with artificial fluoridation (please see tables 8.1. and 8.2. summarising the results of question 8). Responses to questions 1 to 8 have been briefly outlined. The remaining responses to questions 9 to 15 will be discussed next under the themes of trust, risk, ethics and public engagement.

5.1. Standpoints of selected stakeholders regarding trust

The responses to question 9 (please see tables 9.1. and 9.2.) and question 11 (please see tables 11.1. and 11.2.) will be discussed in relation to the theme of trust. With regard to the results of question 9, both proponents and opponents often cited scientific reasons as being behind their views regarding fluoridation which indicates that scientific evidence had influenced their level of trust in the merit or otherwise of artificial fluoridation. After conducting research, Martin (1988, p.8) also noted that many of his interviewees (both for and against fluoridation) had attributed scientific reasons for their views. Please also see Appendix 6. Chart 2. Examples of some of the sources of information provided by proponents and Appendix 7. Chart 3. Examples of some of the sources of information provided by opponents. Please also refer to Appendix 8. Chart 4. Further details regarding scientific reasons given for artificial fluoridation and Appendix 9. Chart 5. Further details regarding scientific reasons given against fluoridation.

As can be seen from Appendix 8., proponents made general comments regarding the existence of scientific evidence for the efficacy of artificial fluoridation in reducing dental decay which indicates that they had trust in its efficacy. This is in agreement with an article by the CDC's (Centers for Disease Control and Prevention) division of Oral Health (2000, p.1283) in which it is claimed that artificial fluoridation is a key contributor to dental decay decreases.

However, Rodrigues et al. (2011, p.244) consider that it is not easy to come to conclusions regarding fluoride's impact on dental decay in adults due to fluoride's widespread use which raises difficulties with regard to setting up valid clinical trials.

With regard to proponents' trust in the efficacy of artificial fluoridation, it was noted that artificial fluoridation was effective in reducing the amount of acid that bacteria on teeth can produce (please see Appendix 8.). Steinmetz et al. (2011, p.100) cite a reference to indicate that too little exposure to topical fluoride could heighten dental decay risk.

As for the benefits of fluoridation, fluoride's efficacy in strengthening tooth enamel was also commented upon (please see Appendix 8.). Thomas (1998, p.7) notes that science progresses through the criticism of previous scientific research and Pizzo et al. (2007, p.191) cite references to highlight that research has discounted the idea that a chief way in which fluoride protects teeth is through its incorporation within enamel. In their review, Pizzo et al. (2007, p.191) cite references to outline that in recent years, it has come to be accepted that fluoride's cariostatic action mainly occurs after the emergence of the teeth.

During interviews with opponents, comments were made about the uncertainty of scientific evidence in favour of artificial fluoridation (please see Appendix 9.). Horlick-Jones and De Marchi (1995, p.142) consider that there could be loss of public trust if scientific work does not take uncertainty and values into consideration.

When there is a lack of certainty with respect to the conclusions of various scientific studies, this may indicate that more research is needed to clarify which scientific conclusions are to be trusted.

Clarkson et al. (2000, p.895) conclude that there had not been much research into fluoride during the previous decade and point out the merit of cooperation between researchers around the world for improving insight into fluoride's effects on teeth and health in general. Responses to question 11 (please see tables 11.1. and 11.2.) give an indication of the sources of information that were trusted by interviewees.

When proponents outlined the sources of information that they trusted, independent scientific researchers or academic journals, scientific papers and reviews were the most frequently mentioned sources.

When opponents outlined the sources of information that they trusted, independent scientific researchers were the most frequently mentioned source of information. Thus there were similarities in the most frequently mentioned sources of information trusted by proponents and opponents because independent scientific researchers were mentioned by the both.

Based on interview responses, it appears that efforts to improve the independence of research and information would increase interviewees' levels of trust in that research and information.

Wilkie (1996, May 28) refers to material to indicate that there is an increasing trend for those who write scientific articles to be employed by companies rather than at academic establishments. Peters (1998, p.3) states that a range of measures may be needed to enable scientific experts to retain their independence.

The report by McDonagh et al. (2000, http://www.york.ac.uk/inst/crd/CRD_Reports/crdreport18.pdf, accessed 2011, August 18) and the report by the Medical Research Council (2002, <http://www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d=MRC002482>, accessed 2011, August 18) were provided as examples of sources of information by both proponents and opponents (please see Appendices 6. & 7.).

Lennon et al. (2008, p.67) cite the review by McDonagh et al. 2000 as being in support of artificial fluoridation but with reference to the same review, Cheng, Chalmers and Sheldon (2007, p.699) bring attention to deficiencies in quality of some of the research into fluoridation.

As can be seen from table 11.2., with regard to sources of information trusted by opponents, anti-fluoridation organisations and also family, friends and personal experience of others were frequently mentioned.

Marris and Langford (1996, p.39) also found that information via friends and family was highly trusted by participants. With regard to the personal experience of others, Salter (1988, p.14) points out that research using case studies can provide valuable detail.

5.2. Standpoints of selected stakeholders regarding risk

The theme of risk will be discussed making use of responses to question 9 regarding the scientific reasons behind stakeholders' viewpoints regarding artificial fluoridation.

Hass (1966, p.331) concludes that at the levels placed in water for artificial fluoridation, fluoride is not harmful. Interviewees who were in favour of artificial fluoridation also did not appear to consider that artificial fluoridation posed risks because proponents made general comments regarding the safety of artificial fluoridation, the lack of reliable evidence showing detrimental effects of fluoridation or the limited evidence against fluoridation (please see Appendix 8.).

Nevertheless, Hass (1966, p.331) concludes that fluoride can be harmful in excessive amounts. Ozsvath (2009, p.62) cites references in order to summarise adverse effects due to acute toxicity of fluoride via sodium fluoride containing dental products and pesticides, which include for example vomiting, cardiac arrest and potentially death.

With regard to interviews with opponents, concerns were expressed about risks to children due to the use of fluoride containing gels or swallowing fluoride containing toothpaste (please see Appendix 9.).

However, opponents expressed concerns about the safety of fluoride even at low levels (please see Appendix 9.). This confirms the view of Ozsvath (2009, pp.66-67) who considers that even though there is consensus with regard to the risk of extended intake of fluoride at elevated levels, there is a lack of consensus with regard to the risk at lower levels.

Opponents expressed concerns regarding exposure to fluoride from multiple sources and absorption of fluoride through the skin (please see Appendix 9). Specific concerns were expressed by opponents regarding an association between fluoride and thyroid under-activity (please see Appendix 9).

Ballinger and Patchett (2007, p.610) outline that hypothyroidism can cause a wide range of symptoms which can include weight gain, tiredness, intolerance of the cold, muscle weakness, depression and coma.

In addition, concerns were expressed that there could then be difficulty in diagnosing the resultant impaired thyroid function (please see Appendix 9). Ozsvath (2009, p.65) cites Doull et al. 2006 who considers that the precise way in which fluoride affects the thyroid is uncertain. Thus it can be concluded that this is an area in which further research would be valuable.

Proponents of artificial fluoridation expressed concerns regarding the dental health of children, it was also emphasised that children from lower socio-economic status backgrounds were protected from dental decay by artificial fluoridation (please see Appendix 8). Jones et al. (1997, pp.1 & 4) conclude that in the UK, locations that are artificially fluoridated need to be increased in order to reduce dental decay in people with lower incomes, however, the previous places where children had lived was not looked at in their study.

Nevertheless, opponents expressed concerns about the efficacy of artificial fluoridation in that it may benefit teeth but also harm the teeth and the issue of the risk of dental fluorosis was raised by opponents (please see Appendix 9.). Pizzo et al. (2007, p.192) highlight that irrespective of its severity, dental fluorosis is an indication that too much fluoride has been ingested at the age that enamel is being formed.

Results of a study by Beltrán-Aguilar et al. (2002, p.157) indicated a rise in levels of dental fluorosis in the USA since the 1930s, which they concluded may be due to exposure to fluoride via multiple routes. Beltrán-Aguilar et al. (2002, p.164) question whether the results of their study indicate the need for a lowering of levels of fluoride used for fluoridation and cite a reference to show that this suggestion has already been made.

This is an issue of widespread concern because Pizzo et al. (2007, p.192) cite proposals to reduce the concentration at which water is artificially fluoridated to the range of 0.6 to 0.8 ppm so that dental fluorosis risk could be reduced without much effect on levels of caries.

Newbrun (2010, p.228) notes that in Hong Kong it has been reduced from the level of 1 ppm to the level of 0.7 ppm and there has been a decrease in fluorosis.

Research has been carried out into problems caused by dental fluorosis and according to the research article by Williams et al. (2006, p.153) debates regarding fluoridation ought to include consideration of the disadvantages of dental fluorosis. Research by Rodd et al. (2011, p.89) indicated that defects of the enamel of the teeth may have an adverse effect on children's confidence. The authors (Rodd et al., 2011, p.93) themselves commented that since the children participating in the research were specifically referred due to their enamel defects, they were not necessarily representative of all children with problems in the appearance of their enamel.

With regard to interviews with opponents, the insufficient account of the iodine intake of populations being taken prior to artificial fluoridation of a population was questioned with a comment made regarding the risks of insufficient iodine intake (please see Appendix 9.). Dissanayake (2005, p.884) highlights that just under a third of people in the world are estimated to be at risk of iodine deficiency disorder and that inadequate iodine intake is the most common reason for brain damage in the world. However, Susheela et al. (2005, pp.98 & 106) who carried out research to look at the thyroid hormone profiles of children in India with and without dental fluorosis conclude that even if there is sufficient iodine intake, excessive fluoride intake could also result in iodine deficiency disorder.

In the interviews carried out with opponents, concerns were voiced that an individual's state of health was not being taken into account in relation to artificial fluoridation (please see Appendix 9.).

This is in line with the findings of Martin (1988, p.6) who notes that opponents of fluoridation were concerned about a minority of individuals who may be intolerant to artificially fluoridated water.

During interviews with opponents, questions were raised about excessive fluoride intake in certain people such as kidney dialysis patients (please see Appendix 9.).

This is not at odds with the Kidney Health Australia's statement referred to by Ludlow et al. (2007, p.2766) that for those who have stage 4 or 5 chronic kidney disease, it is sensible to monitor intake of fluoride so that substances that are high in fluoride could be excluded from the diet.

Concerns were also expressed by opponents that artificial fluoridation could lead to excessive fluoride intake in those who consumed relatively high quantities of water such as small people who drank more water in relation to their body weight, athletes and babies drinking formula if it was made with fluoridated water (please see Appendix 9.).

This does not contradict Roveri et al. (2009, p.200) who cite references in order to warn that children have a lower weight to dose ratio which has implications for the toxicity of ingested fluoride. This also ties in with Diesendorf's (1995) comment that certain people would consume higher levels of water and thus fluoride if the water supply was artificially fluoridated, including athletes who run long distances and formula fed babies if this is made with water that has been fluoridated.

Roveri et al. (2009, p.201) point out that human milk only contains 0.2 mg L^{-1} of fluoride but Siew et al. (2009, p.1230) cite the CDC to note that there was a tendency for mothers with lower incomes to undertake less breastfeeding. In addition, Siew et al. (2009, p.1228) conclude that certain infants may ingest excessive fluoride compared to the levels recommended if consuming formula that has been made with water that has been fluoridated at 1 ppm.

Steinmetz et al. (2011, p.101) cite the American Dental Association's recommendations that infant formula be reconstituted with water that does not contain high fluoride levels to decrease dental fluorosis risk.

However, if as already mentioned there's less of a tendency for mothers with a lower income to breastfeed, they may also find it too expensive to buy bottled water for reconstitution of formula.

There was concern during interviews with opponents that insufficient account of the total fluoride exposure and the diet of populations was being taken prior to artificial fluoridation of a population (please see Appendix 9.). This is of concern because Rodrigues et al. (2009, pp.142 & 145) looked at children's fluoride consumption and concluded that it is important that consumption of fluoride via foods is considered prior to implementation of artificial fluoridation schemes.

Beltrán-Aguilar et al. (2002, p.162) note the difficulty in investigating total exposure to fluoride as there is no consensus regarding a suitable 'biological indicator'.

Opponents expressed concerns about excessive fluoride intake leading to health problems including for example, kidney problems and osteosarcoma (please see Appendix 9.).

Ludlow et al. (2007, p.2763) note that there is lower than expected consideration of the association between ingestion of fluoride and function of the kidneys in light of the kidney's role in fluoride metabolism.

With regard to osteosarcoma, Bassin et al. (2006) conclude that in males there is a link between childhood exposure to fluoride in water and osteosarcoma incidence. Bassin et al. (2006) point out weaknesses in their research including not investigating indicators of uptake of fluoride in bone or actual fluoride ingestion and unavailability of information about possible confounding factors. Bassin et al. (2006) comment on the necessity of further research in this area.

With regard to extended exposure to fluoride, Ozsvath (2009, p.65) notes that there are difficulties linking potential causes with cancer for various reasons including the long time lag involved, the multiple causes of cancer and multiple types of cancer.

Concerns about problems of excessive levels of fluoride in the water in countries such as China were expressed by opponents (please see Appendix 9.). Hussain et al. (2010, p.1) emphasise that in many parts of the world, there are health problems because of drinking water containing over 1.5 mg L^{-1} of fluoride.

Silva de Castilho et al. (2009, p.557-558) cite the WHO 2008 to highlight how widespread endemic dental fluorosis is, being found in Afghanistan, Algeria, the Americas, China, Egypt, India, Iran, Iraq, Japan, Jordan, Kenya, Libya, the Sudan, Syria, Thailand and Turkey.

In addition to dental fluorosis, Susheela and Bhatnagar (2002, p.335) refer to the problems of skeletal fluorosis and fluorosis of non-skeletal tissues. The British Fluoridation Society et al. (2004, p.28) describes skeletal fluorosis as a disease of the bones in which the bone does not mineralise as it should leading to weakness and deformation.

Harrison (2005, p.1453) cites that the Medical Research Council working group have recommended that analysis be carried out of the extent of artificial fluoridation and rates of cancer in the United Kingdom and also that exposure to fluoride should be assessed if research is being conducted into incidence of cancer of the bone.

Lennon et al. (2008, p.68) note that it is required by the 2003 Water Act that Strategic Health Authorities that artificially fluoridate their water carry out health trend monitoring and publish such reports at intervals of four years.

However, Newbrun (2010, p.231) considers that it is unlikely that acceptable long-term research into the differences between fluoridated water and non-fluoridated water in the form of a double-blind study will be carried out.

5.3. Standpoints of selected stakeholders regarding ethics

Ethical reasons were provided by both proponents and opponents for their views regarding artificial fluoridation which will be discussed next. Please see Appendix 10. Chart 6. Further details regarding ethical reasons given for artificial fluoridation and Appendix 11. Chart 7. Further details regarding ethical reasons given against fluoridation.

With regard to artificial fluoridation, Diesendorf (1995) notes that ethical debates are involved. Diesendorf (1995) considers that the balancing of benefits of artificial fluoridation versus hazards can't be done in a way that is value free.

During interviews with proponents of artificial fluoridation, comments were made that if an action was safe and effective and prevented disease and suffering, it was unethical not to implement that action (please see Appendix 10.).

Lennon et al. (2008, p.68) cite Lord Colwyn 2003 who considered that since artificial fluoridation could contribute to reduction in dental decay it was not morally acceptable to deprive children of this if it resulted in the suffering of dental decay.

Concerns were voiced by opponents that it was wrong to add something to the water supply other than what was needed to make it safe to drink and it was not considered ethical to use the water supply for the delivery of medication (please see Appendix 11.). Pizzo et al. (2007, p.190) also cite references in order to highlight that artificial fluoridation may be criticized on the grounds of medical ethics, since the fluoridation agents for artificial fluoridation have not been licensed as medicinal substances.

Concerns were expressed by opponents that there was no control over the dose received (please see Appendix 11.). Diesendorf (1995) outlines the difference between daily dose of fluoride (mg of fluoride consumed per day) and concentration (mg of fluoride present in one litre).

During interviews with opponents, comments were made that no account was being taken of the medical history of individuals and certain groups may be more vulnerable to the effects of excessive levels of fluoride such as babies and there was no individual monitoring (please see Appendix 11.).

It was noted by proponents that even if an action reduced individual choice, it was sometimes necessary to take measures for the health of the population/ good of society (please see Appendix 10.).

However, during interviews with opponents, it was found that opponents did not consider that it was ethical to force mass medication on people who didn't want it or need it or without their informed consent (please see Appendix 11.).

According to Diesendorf (1995), opponents consider that artificial fluoridation is not ethical due to it providing a dose over which there is no control of a 'mass medication'. The British Medical Association (2010) refers to fluoridation of salt as being an alternative to the artificial fluoridation of water that also allows for individual choice.

Concerns were expressed by opponents regarding human rights being contravened by artificial fluoridation and doubts were expressed regarding the legality of artificial fluoridation (please see Appendix 11.). Martin (1988, p.10) also found that opponents were against fluoridation due to its infringement of people's individual rights.

After conducting research, Martin (1988, p.8) noted the wider range of reasons voiced by opponents of artificial fluoridation compared to proponents. As can be seen from Appendices 9. and 11., many other concerns were expressed by opponents including concerns about the harm that artificial fluoridation could cause to animals and the environment.

5.4. Standpoints of selected stakeholders regarding public engagement

In the final part of this section, the viewpoints of both proponents and opponents as to whether public engagement with regard to the issue of artificial fluoridation is necessary and views regarding how it could be improved will be discussed.

Wrapson (2005, p.17) notes that the issue of artificial fluoridation has been a matter of considerable debate. Cheng et al. (2007, p.700) note that artificial fluoridation is partially practised in England but not practised in Northern Ireland, Wales or Scotland.

Cheng et al. (2007, p.700) note that there is also utilisation of artificial fluoridation in Ireland, Spain, USA, Canada, New Zealand, Australia, Malaysia, Israel, Hong Kong, Colombia, Chile, and Brazil.

However, Cheng et al. (2007, p.700) also point out that this practice has been stopped in certain countries including Switzerland, the Netherlands, Sweden, Finland, Germany and Japan.

As for the United Kingdom, the British Fluoridation Society et al. (2004, p.50) note that artificial fluoridation has previously been carried out by Welsh Water, Thames Water, Yorkshire Water and the Department of the Environment for Ireland. However, recent information provided by the Drinking Water Inspectorate (2010) shows that there is partial or complete provision of artificially fluoridated water by the water companies United Utilities, South Staffordshire Water, Severn Trent Water, Anglian Water and Northumbrian Water.

With regard to public engagement with the issue of artificial fluoridation, from tables 10.1. and 10.2. showing the results of question 10, it can be seen that all of the opponents were dissatisfied with the information available to the public about artificial fluoridation. However, only just over half of the proponents were satisfied with the information made available to the public about artificial fluoridation. This indicates that improvements in the information available to the public about this topic would be welcomed by opponents and many proponents of artificial fluoridation.

Martin (1989, pp.71-72) cites Sklair's (1973) argument for increased involvement of the public in decisions regarding scientific issues who indicates the necessity of improving media and education as opposed to having concerns about the public's ability to grasp scientific discussions.

Lowry (2000, p.17) suggests that increased knowledge with regard to artificial fluoridation is likely to lead to more favourable views about it. However, Gregory and Miller (1998, p.12) cite references to indicate that although increased scientific knowledge can increase the level of support towards science, increased scientific understanding can also result in negativity regarding certain scientific issues. Gregory and Miller (1998, pp.14-15) cite Thomas and Durant's warning that consensus will not necessarily be the result of increased comprehension of science by the public.

Penman et al. (1997, p.403) outline acute fluoride toxicity incidents due to accidental contamination of the water supply in Mississippi in 1993 with up to 200 mg L⁻¹ of fluoride and emphasise the need for fluoridation systems to be well maintained for avoidance of similar accidents.

Penman et al. (1997, p.404) describe the fluoride toxicity symptoms experienced by people involved as ‘potentially misleading’ and possible to overlook. Hence Penman et al. (1997, p.407) note that prior to the survey carried out, symptoms had not been reported by the affected residents. Under similar circumstances to those described by Penman et al. (1997, p.403), improvements in the public availability of relevant information could increase public awareness so that appropriate and prompt feedback could be provided to pertinent authorities.

As for who should be involved in decisions about artificial fluoridation of one’s water supply, as can be seen in tables 12.1. and 12.2., a wide range of stakeholders were mentioned by both proponents and opponents. Proponents mentioned health authorities the most frequently. Lennon et al. (2008, p.68) note advantages of the local consultation required by the Water Act 2003 but agree that the decision should ultimately be made by ‘accountable public bodies’ with responsibility for public health. In addition, Martin’s research (1988, p.11) indicated that proponents were in favour of ‘expert bodies’ being heavily involved in the process of making decisions regarding artificial fluoridation.

On the other hand, with regard to who should be involved in decisions about artificial fluoridation of one’s water supply, the individual consumer was most frequently mentioned by opponents of artificial fluoridation. Although the comment that nobody should be involved in decisions about artificial fluoridation of the water supply because the practice should be stopped was made by some opponents.

Tables 13.1. and 13.2. summarise the results of question 13 in which interviewees were asked if they were aware of any recent or current opportunities for public involvement with regard to the issue of artificial fluoridation. Recent Southampton opinion polls and public consultation were the most frequently mentioned events by both proponents and opponents of artificial fluoridation. According to BBC News (2011, February 11, <http://www.bbc.co.uk/news/uk-england-hampshire-12427955?print=true>), the High Court did not conclude that it would be against the law for the South Central Strategic Health Authority to artificially fluoridate water in Southampton, although following public consultation 72% of respondents had been against artificial fluoridation of the water supply.

In addition, in the South Central Strategic Health Authority's statement on 16th June this year announcing that after a legal judgement that day, fluoridation was to go ahead in the area of Southampton, it was noted that the South Central Strategic Health Authority was satisfied that the case against fluoridation and opposition to this measure were outweighed by its benefits to health (South Central Strategic Health Authority, <http://www.southcentral.nhs.uk/16/06/2011/statement-water-fluoridation/>, accessed 2011, August 14).

The results of question 14 are summarised in tables 14.1. and 14.2. in which interviewees were asked whether they were satisfied with current levels of public involvement regarding the issue of artificial fluoridation. The majority but not all of the proponents interviewed were satisfied with current levels of public involvement. The majority but not quite all of the opponents interviewed were not satisfied with current levels of public involvement.

The responses to question 15 are summarised in tables 15.1. and 15.2., both proponents and opponents provided helpful suggestions with regard to ways in which involvement of the public with the issue of artificial fluoridation could be undertaken.

Comments regarding the importance of provision of accurate and balanced information by the media were frequently made by both proponents and opponents of artificial fluoridation.

With regard to public engagement, Wilsdon and Willis (2004, pp.41-43) cite a reference in order to outline that there are a variety of ways in which the public can be involved including deliberative polling, citizens' juries, focus groups, consensus conferences, internet dialogues and stakeholder dialogues.

Although during interviews with proponents, a comment was made that public meetings ought to be avoided due to the emotive nature of the subject, the importance of holding public meetings with diverse groups of people and also public consultations was emphasised by some of the proponents. The importance of public consultations was also commented upon by some of the opponents.

Calman (2009, pp.e6 & e9) refers to the conclusion of the Nuffield Council on Bioethics that with regard to artificial fluoridation, it is appropriate for decisions to be made in a democratic way locally. Martin (1988, p.12) also found that participation of the public in decisions regarding artificial fluoridation was often favoured by opponents.

During a discussion of the public engagement exercise 'GM Nation' Wilsdon and Willis (2004, p.38) note the importance of initial clarification of the objectives of public engagement procedures. Wilsdon and Willis (2004, p.38) cite a reference in order to highlight that the approach to public engagement can be considered as being 'instrumental', 'normative' or 'substantive' as outlined next.

Wilsdon and Willis (2004, p.39) describe the 'instrumental' approach to engagement as meaning that the motivation for the public engagement process is that it is in the interests of for example corporations or governments to investigate public viewpoints regarding innovations when considering their reputations.

Wilsdon and Willis (2004, p.39) describe the 'normative' approach to engagement as meaning that dialogue is to be carried out as an expected component of democratic strategies.

The 'substantive' approach to engagement is described by Wilsdon and Willis (2004, p.39) as meaning that the motivation for public engagement is for there to be enhancements in the value of the process of making decisions, with the public having an active role in the process of making decisions. Some of the opponents interviewed in this study favoured public participation but from comments made regarding the importance of the views of the public being taken into account following public consultations, it appears that a 'substantive' approach to public engagement was favoured.

Garritt (2006, p.4) cites the Office of Science and Technology's statement in 2000 that all society members should participate in debate regarding scientific issues that have social and ethical implications. Day et al. (2006, p.8) notes that public consultation involves finding out about public opinion prior to production of policy.

Day et al. (2006, p.8) notes that with regard to public opinion, quantitative information can be provided by opinion polls and qualitative information can be provided via a public consultation process. However, Day et al. (2006, p.8) note that 'public consultation' could still be considered as a deficit model because the public input may not contribute to later debate regarding policy. Irwin (1995, p.120) points out that official organisations may be reluctant to take account of information provided by the public during processes of decision-making.

Wilsdon and Willis (2004, p.40) consider that it would not be desirable for procedures to be carried out so as to be seen to be engaging with the public but without making a difference to the reality of the decision-making process. There could thus be more focus on 'substantive' approaches to public engagement.

Wilsdon and Willis (2004, p.40) note that in order for there to be meaningful public engagement, the public need to be enabled to ask pertinent questions but cites a reference to indicate that it is possible for those making decisions about public engagement to have a deliberate or inadvertent influence on the outcome of the process. Smith (2007, p.6) points out that questions in polls could be worded so as to elicit biased responses and questionnaires could be produced which don't probe into people's views sufficiently deeply enough.

The possibility of a referendum was noted by one of the proponents. During interviews the possibility of a referendum was also mentioned by a couple of opponents. Although another opponent made a comment that referenda were not appropriate for decisions regarding the issue of artificial fluoridation. This is in line with the findings of Martin (1988, p.12) that although the use of a referendum was mentioned by opponents, one opponent was not in favour of the use of referenda regarding fluoridation comparing it to deciding the religion of a community via referendum. From table 15.2., it can be seen that the importance of an independent group providing independent information was mentioned during interviews with opponents. The importance of independent assessments of the health effects in artificially fluoridated areas and the importance of good scientific research was also mentioned during interviews with opponents.

Chapter 6. Conclusion

In this section, there will be reflection on whether the original objectives have been met and the main conclusions reached after conducting this project will be provided.

6.1. Review of objectives

The first objective was to carry out a literature search to obtain information regarding the background to artificial fluoridation and to obtain information regarding views about artificial fluoridation. A literature search was carried out and the background to the promotion of artificial fluoridation was outlined in section 2.1., the background to the opposition to artificial fluoridation was outlined in section 2.2. and disagreement amongst scientists regarding the safety of artificial fluoridation was outlined in section 2.3. and thus the first objective has been met.

The second objective was to investigate reasons (such as those relating to scientific findings or ethical issues) for the views of both proponents and opponents of artificial fluoridation by means of interviews. Interviews of proponents and opponents of artificial fluoridation were carried out and question 9 of the interview schedule asked for the main reasons for the views of interviewees regarding artificial fluoridation. Responses to this question were discussed within sections 5.1. Standpoints of selected stakeholders regarding trust, 5.2. Standpoints of selected stakeholders regarding risk and 5.3. Standpoints of selected stakeholders regarding ethics and therefore the second objective has been met.

The third objective was to review the results of the literature research and interviews in relation to the themes of 'trust', 'risk', 'ethics' and 'public engagement'. A literature review was carried out and discussed under the themes of trust in section 2.4., risk in section 2.5., ethics in section 2.6. and public engagement in section 2.7. Interviews were conducted and responses to questions 9 to 15 were discussed under the themes of trust in section 5.1., risk in section 5.2., ethics in section 5.3. and public engagement in section 5.4. and thus the third and final objective has also been met.

6.2. Divergences in standpoints of selected stakeholders

Divergences in views existed between proponents and opponents regarding the safety and efficacy of artificial fluoridation, with proponents indicating a level of trust in its safety and efficacy but with opponents expressing concerns about potential risks of this measure.

If artificial fluoridation was to be carried out, the importance of independent assessments of the health effects in artificially fluoridated areas and the importance of high quality scientific research was mentioned during interviews with opponents.

With regard to public engagement, although opponents preferred that artificial fluoridation was not carried out in the first place, concerns were raised that more account needed to be taken of the views of the public following public consultations.

6.3. Similarities in standpoints of selected stakeholders

Both proponents and opponents mentioned the need for improvements in the information that was available to the public and for this information to be balanced. The importance of public engagement activities was indicated by both proponents and opponents.

6.4. Future progress

As already mentioned, both proponents and opponents mentioned the need for improvements in the information that is available to the public regarding artificial fluoridation and for this information to be balanced. Based on interview responses, it appears that efforts to improve the independence of research and information would increase interviewees' levels of trust in that research and information.

Some of the opponents interviewed in this study favoured public participation but from comments made regarding the importance of the views of the public being taken into account following public consultations, it appears that a 'substantive' approach to public engagement was favoured. The 'substantive' approach to engagement is described by Wilsdon and Willis (2004, p.39) as meaning that the motivation for public engagement is for there to be enhancements in the value of the process of making decisions, with the public having an active role in the process of making decisions.

Wilsdon and Willis (2004, p.40) consider that it would not be desirable for procedures to be carried out so as to be seen to be engaging with the public but without making a difference to the reality of the decision-making process. There could thus be more focus on ‘substantive’ approaches to public engagement.

In this project the need for further research in the subject area of artificial fluoridation has been noted on several occasions, for example, Kumar (2008, p.11) concludes that there ought to be investigation of innovative ways in which dental decay could be prevented. Clarkson et al. (2000, p.895) conclude that there had not been much research into fluoride during the previous decade and point out the merit of cooperation between researchers around the world for improving insight into fluoride’s effects on teeth and health in general. In addition, Cheng et al. (2007, p.701) consider that should fluoride be considered as a medicine, evidence required for its efficacy ought to be the same as that required for drugs. However, Cheng et al. (2007, p.701) note that with regard to artificial fluoridation, randomised trials have not been carried out.

In addition, Rodrigues et al. (2009, p.145) conclude that prior to commencement of schemes to artificially fluoridate the water supply, intake of fluoride by dietary means should be investigated and thus there is a need for research into the fluoride intake of populations.

Ozsvath (2009, p.64) refers to several studies linking elevated fluoride intake with a lowered IQ in children and therefore this is an extremely important area for further research. Ozsvath (2009, p.65) cites Doull et al. 2006 who considers that the precise way in which fluoride affects the thyroid is uncertain. Thus it can be concluded that this is another area in which further research would be valuable.

The ‘substantive’ approach to engagement is described by Wilsdon and Willis (2004, p.39) as meaning that the motivation for public engagement is for there to be enhancements in the value of the process of making decisions, with the public having an active role in the process of making decisions. With regard to artificial fluoridation, research could be carried out in order to investigate ways in which improvements could be made to strategies for public engagement so that the approach to public engagement was more ‘substantive’.

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Appendices

Appendix 1. Chart 1. Examples of different sources of fluoride

<p>Examples of different fluoride sources (the types of fluoride compounds weren't necessarily specified and so have not been included)</p>
<p>Ozsvath (2009, p.67) cites a range of references to highlight that fluoride can be found naturally due to sources such as emissions of volcanic gas, marine aerosols and air-borne dust of soil.</p>
<p>Ozsvath (2009, pp.67-68) cites a range of references indicating that fluoride can be emitted through human activity including emissions via burning of fossil fuels, steel production, iron production, aluminium smelters, brickwork production, production of phosphate fertilizer and production of ceramic.</p>
<p>According to references cited in a review by Ayoob and Gupta (2006, p.5), intake of fluoride may be increased via cigarette smoking and via use of cooking utensils coated with Teflon.</p>
<p>In addition to fluoride intake via water containing fluoride, Harrison (2005, p.1450) cites material to highlight the increased use of fluoride containing toothpastes.</p>
<p>Erdal and Buchanan (2005, p.116) cite references in order to highlight that children from certain ethnic groups may be consuming higher levels of tea and thus more fluoride.</p>

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Appendix 2. Introductory information for proponents

Dear Sir or Madam,

I am an Open University MSc student. My research project involves investigating the reasons behind the standpoints of a selection of stakeholders with regard to **artificial fluoridation**. I am making contact with you as you are involved with a group or organisation that is in support of artificial fluoridation.

Please could you let me know if you would be willing for me to interview you over the telephone during April/ May 2011? The interview schedule that I would use is shown as an attachment to this email. If you are willing to be interviewed, please could you email me at [OU email address] with your name and telephone number and I will contact you to arrange a suitable time.

If you are aware of other people involved in your group/ organisation who would also be willing to be interviewed, you are welcome to forward this email to them with their permission so that they could also email me with their name and telephone number if they are willing to be interviewed by me over the telephone.

In line with Open University guidelines (The Open University, 2003), information provided would be utilised purely for purposes of research and there would be no disclosure of the information to third parties and any information presented in my research report would be anonymized.

I would be grateful if you would get in touch if you are willing to help in this way and I look forward to hearing from you soon.

Yours faithfully,

D Roach BSc (Hons)

Reference

The Open University. (2003). *'Guidelines for Open University students on the use of personal data for research purposes'*, Milton Keynes, The Open University.

Appendix 3. Introductory information for opponents

Dear Sir or Madam,

I am an Open University MSc student. My research project involves investigating the reasons behind the standpoints of a selection of stakeholders with regard to **artificial fluoridation**. I am making contact with you as you are involved with a group or organisation that is against artificial fluoridation.

Please could you let me know if you would be willing for me to interview you over the telephone during April/ May 2011? The interview schedule that I would use is shown as an attachment to this email. If you are willing to be interviewed, please could you email me at [email address] with your name and telephone number so that I can contact you to arrange a suitable time?

If you are aware of other people involved in your group/ organisation who would also be willing to be interviewed, you are welcome to forward this email to them with their permission so that they could also email me with their name and telephone number if they are willing to be interviewed by me over the telephone.

In line with Open University guidelines (The Open University, 2003), information provided would be utilised purely for purposes of research and there would be no disclosure of the information to third parties and any information presented in my research report would be anonymized.

I would be grateful if you would get in touch if you are willing to help in this way and I look forward to hearing from you soon.

Yours faithfully,

D Roach BSc (Hons)

Reference

The Open University. (2003). *Guidelines for Open University students on the use of personal data for research purposes*, Milton Keynes, The Open University.

Appendix 4. Interview schedule for proponents

FLUORIDATION - INTERVIEW SCHEDULE

Dear participant,

I am an Open University MSc student. My research project involves investigating the standpoints of a selection of stakeholders with regard to artificial fluoridation. I am making contact with you as you are involved with a group or organisation which is in support of artificial fluoridation. Please could you let me know if you are willing to be interviewed by me over the telephone during April/ May 2011? The interview schedule that I would be using is shown below. If you are happy to be interviewed, please could you email me at [OU email address] with your name and telephone number? Thank you for your help. In line with Open University guidelines (The Open University, 2003), information provided would be utilised purely for purposes of research and there would be no disclosure of the information to third parties and any information presented in my research report would be anonymized. I look forward to hearing from you soon.

Many thanks,

D Roach BSc (Hons)

Reference: The Open University. (2003). *'Guidelines for Open University students on the use of personal data for research purposes'*, Milton Keynes, The Open University.

Part I – Personal information

- 1) Please could you confirm that you are over 18 years of age by providing your age range? (e.g. 18-29, 30-39, 40-49, 50-59, 60-69 etc.)

Please could you provide the following information?

- 2) The first part of your post code (e.g. SR4):
- 3) Your gender (e.g. male/ female):
- 4) Your occupation:
- 5) The level and subject(s) of your highest qualification (e.g. A-level English, History):

Part II – Artificial fluoridation

- 6) Do you live in an area in which the water is artificially fluoridated? (e.g. yes/ no/ I don't know)
- 7) With regard to the pro-fluoridation group or organisation with which you are involved, please could you state your role? (e.g. running the group or organisation/ spokesperson for the group or organisation/ paid employee of the group or organisation/ unpaid volunteer/ member of the group or organisation/ other role)

D M Roach S810 EMA

- 8) With regard to your personal viewpoint, do you agree with artificial fluoridation of the water supply? (e.g. yes/ no/ I don't know)
- 9) What are the main reasons for your views regarding artificial fluoridation (e.g. scientific reasons/ ethical reasons/ reasons related to parenthood/ other reasons), please could you outline these?

Part III – Engagement with information about artificial fluoridation

- 10) Do you think that sufficient information is made available to the public about artificial fluoridation? (e.g. yes/ no/ I don't know)
- 11) Which sources of information about artificial fluoridation would you most trust? (e.g. information from local government officials/ central government officials/ doctors/ dentists/ independent scientific researchers/ company funded scientific researchers/ friends/ family/ information via charities/ via television, magazines or newspapers/ via academic journals/ via the Internet/ other sources)
- 12) Who do you believe should be involved in decisions regarding artificial fluoridation of one's water supply? (e.g. the individual consumer/ local communities/ local government/ central government/ health authorities/ scientists involved in research into artificial fluoridation/ others)
- 13) Are you aware of any recent or current opportunities for public involvement with regard to the issue of artificial fluoridation (e.g. opinion polls, questionnaires, public consultations, public engagement activities such as focus groups, citizens' juries, consensus conferences, stakeholder dialogues or internet dialogues or other activities involving the public), if so please could you outline these?
- 14) Are you satisfied with current levels of public involvement regarding the issue of artificial fluoridation? (e.g. yes/ no/ I don't know)
- 15) With regard to involvement of the public with the issue of artificial fluoridation, in what ways (if any) should this be undertaken?

*Please could you email me as soon as possible at [OU email address] with your name and telephone number if you are willing to be interviewed by me over the telephone during April/ May 2011.
Many thanks! Your help is greatly appreciated!*

Appendix 5. Interview schedule for opponents

ARTIFICIAL FLUORIDATION - INTERVIEW SCHEDULE

Dear participant,

I am an Open University MSc student. My research project involves investigating the standpoints of a selection of stakeholders with regard to artificial fluoridation. I am making contact with you as you are involved with a group or organisation which is against artificial fluoridation. Please could you let me know if you are willing to be interviewed by me over the telephone during April/ May 2011? The interview schedule that I would be using is shown below. If you are happy to be interviewed, please could you email me at [email address] with your name and telephone number? Thank you for your help. In line with Open University guidelines (The Open University, 2003), information provided would be utilised purely for purposes of research and there would be no disclosure of the information to third parties and any information presented in my research report would be anonymized. I look forward to hearing from you soon.

Many thanks,

D Roach BSc (Hons)

Reference: The Open University. (2003). *'Guidelines for Open University students on the use of personal data for research purposes'*, Milton Keynes, The Open University.

Part I – Personal information

- 1) Please could you confirm that you are over 18 years of age by providing your age range? (e.g. 18-29, 30-39, 40-49, 50-59, 60-69 etc.)

Please could you provide the following information?

- 2) The first part of your post code (e.g. SR4):
- 3) Your gender (e.g. male/ female):
- 4) Your occupation:
- 5) The level and subject(s) of your highest qualification (e.g. A-level English, History):

Part II – Artificial fluoridation

- 6) Do you live in an area in which the water is artificially fluoridated? (e.g. yes/ no/ I don't know)
- 7) With regard to the anti-fluoridation group or organisation with which you are involved, please could you state your role? (e.g. running the group or organisation/ spokesperson for the group or organisation/ paid employee of the group or organisation/ unpaid volunteer/ member of the group or organisation/ other role)

D M Roach S810 EMA

- 8) With regard to your personal viewpoint, do you agree with artificial fluoridation of the water supply? (e.g. yes/ no/ I don't know)
- 9) What are the main reasons for your views regarding artificial fluoridation (e.g. scientific reasons/ ethical reasons/ reasons related to parenthood/ other reasons), please could you outline these?

Part III – Engagement with information about artificial fluoridation

- 10) Do you think that sufficient information is made available to the public about artificial fluoridation? (e.g. yes/ no/ I don't know)
- 11) Which sources of information about artificial fluoridation would you most trust? (e.g. information from local government officials/ central government officials/ doctors/ dentists/ independent scientific researchers/ company funded scientific researchers/ friends/ family/ information via charities/ via television, magazines or newspapers/ via academic journals/ via the Internet/ other sources)
- 12) Who do you believe should be involved in decisions regarding artificial fluoridation of one's water supply? (e.g. the individual consumer/ local communities/ local government/ central government/ health authorities/ scientists involved in research into artificial fluoridation/ others)
- 13) Are you aware of any recent or current opportunities for public involvement with regard to the issue of artificial fluoridation (e.g. opinion polls, questionnaires, public consultations, public engagement activities such as focus groups, citizens' juries, consensus conferences, stakeholder dialogues or internet dialogues or other activities involving the public), if so please could you outline these?
- 14) Are you satisfied with current levels of public involvement regarding the issue of artificial fluoridation? (e.g. yes/ no/ I don't know)
- 15) With regard to involvement of the public with the issue of artificial fluoridation, in what ways (if any) should this be undertaken?

Please could you email me as soon as possible at [email address] with your name and telephone number if you are willing to be interviewed by me over the telephone during April/ May 2011.

Many thanks! Your help is greatly appreciated!

Appendix 6. Chart 2. Examples of some of the sources of information provided by proponents

Websites
Department of Health. (Accessed 2011, August 18) <i>Department of Health</i> . Available from: http://www.dh.gov.uk/en/index.htm .
The Cochrane library. (Accessed 2011, August 18) <i>The Cochrane Library</i> . Available from: http://www.thecochranelibrary.com/view/0/index.html .
Papers and other material
McDonagh, M. et al. (2000). <i>A Systematic Review of Public Water Fluoridation</i> . University of York, NHS Centre for Reviews and Dissemination. Available online at: http://www.york.ac.uk/inst/crd/CRD_Reports/crdreport18.pdf ; accessed 2011, August 18.
Medical Research Council. (2002). <i>Medical Research Council working group report: Water fluoridation and health</i> . London, Medical Research Council. Available online at: http://www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d=MRC002482 ; accessed 2011, August 18.

Please also see references or bibliography. As full references were not provided, these were found using the information that was provided.

Appendix 7. Chart 3. Examples of some of the sources of information provided by opponents

Websites
All Party Parliamentary Group against Fluoridation. (Accessed 2011, August 18) <i>Welcome to the appgaf website</i> . Available from: http://www.appgaf.org.uk/ .
Fluoride Action Network. (Accessed 2011, August 18) <i>Fluoride Action Network Get the real facts on fluoride</i> . Available from: http://www.fluoridealert.org/ .
Mercola.com (Accessed 2011, August 18) <i>Mercola.com Take Control of Your Health</i> . Available from: http://www.mercola.com/ .
Parents of Fluoride Poisoned Children. (Accessed 2011, August 18) <i>Parents of Fluoride Poisoned Children</i> . Available from: http://www.poisonfluoride.com/ .
Second Look. (Accessed 2011, August 18) <i>Second Look – A rational approach to controversial public policy issues</i> . Available from: http://www.slweb.org/ .
UK Councils Against Fluoridation. (Accessed 2011, August 29) <i>UK Councils Against Fluoridation</i> . Available from: http://www.ukcaf.org/ .
Books
Blount, P. C. (1964). <i>Compulsory Mass Medication; A factual guide to the fluoridation issue</i> , London, The Clair Press.
Bryson, C. (2004). <i>The fluoride deception</i> , New York, Seven Stories Press.
Carson, R. (1962). <i>Silent Spring</i> , London, Penguin Books.
Connett, P., Beck, J. and Micklem, H. S. (2010). <i>The Case Against Fluoride</i> , Vermont, Chelsea Green Publishing.
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Groves, B. (2001). <i>Fluoride Drinking Ourselves to Death?</i> , Dublin, Newleaf.
Honeyman-Lowe, G. and Lowe, J. C. (2003). <i>Your Guide to Metabolic Health</i> , Boulder, Colorado, McDowell Health-Science Books, LLC.
Martin, B. (1991). <i>Scientific Knowledge In Controversy; The Social Dynamics of the Fluoridation Debate</i> , Albany, State University of New York Press.
Waldbott, G. L. et al. (1978). <i>Fluoridation The Great Dilemma</i> , Kansas, Coronado Press, Inc.
Yiamouyiannis, J. (1986). <i>Fluoride The Aging Factor (Second edition)</i> , Ohio, Health Action Press.
Papers and other material
Bassin, E. B., Wypij, D., Davis, R. B. and Mittleman, M. A. (2006). Age-specific Fluoride Exposure in Drinking Water and Osteosarcoma (United States), <i>Cancer Causes & Control</i> , pp. 1-14.
McDonagh, M. et al. (2000). <i>A Systematic Review of Public Water Fluoridation</i> . University of York, NHS Centre for Reviews and Dissemination. Available online at: http://www.york.ac.uk/inst/crd/CRD_Reports/crdreport18.pdf ; accessed 2011, August 18.
Medical Research Council. (2002). <i>Medical Research Council working group report: Water fluoridation and health</i> . London, Medical Research Council. Available online at: http://www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d=MRC002482 ; accessed 2011, August 18.
Mullenix, P. J., Denbesten, P. K., Schunior, A. and Kernan, W. J. (1995). Neurotoxicity of Sodium Fluoride in Rats, <i>Neurotoxicology and Teratology</i> , 17(2) , pp. 169-177.

Please also see references or bibliography. Sometimes full references were provided but sometimes not in which case references were found using the information that had been provided. Due to the time restriction for completion of this MSc, other than the references shown above, it was not possible to refer to every source of information provided directly or indirectly by opponents.

Appendix 8. Chart 4. Further details regarding scientific reasons given for artificial fluoridation

Examples of scientific reasons/ dental health reasons given;
General comments were made regarding scientific evidence indicating its efficacy in reducing dental decay.
Its efficacy in strengthening tooth enamel and reducing the amount of acid that bacteria on teeth can produce was commented upon.
Concerns were expressed regarding the dental health of children.
It was emphasised that children from lower socio-economic status backgrounds were protected from dental decay by artificial fluoridation.
General comments were made regarding the safety of artificial fluoridation, lack of reliable evidence showing detrimental effects or the limited evidence against artificial fluoridation.

NB. Each comment was not necessarily expressed by every interviewee.

Appendix 9. Chart 5. Further details regarding scientific reasons given against fluoridation

Examples of scientific reasons/ health/ medical/ dental health reasons provided;
Concerns were expressed about the efficacy of artificial fluoridation in that it may benefit but also harm the teeth.
The issue of the risk of dental fluorosis from artificial fluoridation was raised.
Concerns were voiced about risks to children due to the use of fluoride containing gels or swallowing fluoride containing toothpaste.
Comments were made about the uncertainty of scientific evidence in favour of artificial fluoridation.
Questions were raised regarding multiple exposure to fluoride and absorption of fluoride through the skin.
Concerns were expressed about the safety of fluoride even at low levels.
Comments were made about an uncontrolled dose being provided via artificial fluoridation.
Questions were raised about the difference between calcium fluoride found naturally and the fluorides added to water during artificial fluoridation.
Concerns about variations in the toxicology of different fluorides were expressed.
The discrepancies between studies looking at pure forms of fluoride and what is being put in water being contaminated with other impurities were questioned.
There was concern that toxic waste from the phosphate fertiliser industry or previously the aluminium industry was being dealt with via artificial fluoridation.
Concerns about problems of excessive levels of fluoride in the water in countries such as China were expressed.
Concerns about fluoride's effect on enzymes were voiced.
There was concern that insufficient account of the total fluoride exposure and the diet of populations was being taken prior to artificial fluoridation of a population.
The insufficient account of the iodine intake of populations being taken prior to artificial fluoridation of a population was questioned with a comment regarding the risks of insufficient iodine intake.
Specific concerns were expressed regarding an association between fluoride and thyroid under-activity. In addition concerns were expressed that there could then be difficulty in diagnosing resultant impaired thyroid function.
Concerns were expressed about excessive fluoride intake leading to health problems e.g. kidney problems, stillbirths, circulatory problems, cancer, osteosarcoma and lowered IQ.
Concerns were voiced that an individual's state of health was not being taken into account in relation to artificial fluoridation. Questions were raised about excessive fluoride intake in certain people e.g. those with allergies, kidney dialysis patients and those with liver problems. Concerns were also expressed that artificial fluoridation could lead to excessive fluoride intake in those who consumed relatively high quantities of water such as athletes, small people who drank more water in relation to their body weight and babies drinking formula if it was made with fluoridated water.
There was concern about the harm that artificial fluoridation could cause to animals and the environment.

NB. Each comment was not necessarily expressed by every interviewee.

Appendix 10. Chart 6. Further details regarding ethical reasons given for artificial fluoridation

Examples of ethical reasons given;
Comments were made that if an action was safe and effective and prevented disease and suffering, it was unethical not to implement that action.
It was noted that even if an action reduced individual choice, it was sometimes necessary to take measures for the health of the population/ good of society.
The comment was made that some areas were naturally fluoridated where there were dental benefits and it would be unethical to deprive areas which weren't naturally fluoridated of such benefits.

NB. Each comment was not necessarily expressed by every interviewee.

Appendix 11. Chart 7. Further details regarding ethical reasons given against fluoridation

Examples of ethical reasons given;
Concerns were expressed that there was no control over the dose received.
Comments were made that no account was being taken of the medical history of individuals and certain groups may be more vulnerable to the effects of excessive levels of fluoride e.g. babies and there was no individual monitoring.
Concerns were voiced that it was wrong to add something to the water supply other than what was needed to make it safe to drink.
Comments were made regarding human rights being contravened by artificial fluoridation.
Doubts were expressed regarding the legality of artificial fluoridation and concerns were expressed about the decision-making process.
It was not considered ethical to use the water supply for the delivery of medication. It was not considered ethical to force mass medication on people who don't want it or need it or without their informed consent.

NB. Each comment was not necessarily expressed by every interviewee.

Appendix 12. Log

Week 1 starting Monday, 31st Jan;

- ✓ Did some background reading (*please see bibliography*)
- ✓ Commenced project planning i.e. commenced log, draft skills audit and Gantt chart
- ✓ Joined RefWorks

Week 2 starting Monday, 7th Feb;

- ✓ Continued with background reading
- ✓ Contacted tutor by email on 8th February, 2011
- ✓ Continued with project planning, started to think about methodology
- ✓ Became more familiar with RefWorks

Week 3 starting Monday, 14th Feb;

- ✓ Continued with background reading
- ✓ Commenced literature review i.e. systematic internet search for selected stakeholders
- ✓ Contacted tutor by email on 14th February, 2011
- ✓ Continued with project planning

Week 4 starting Monday, 21st Feb;

- ✓ Continued with background reading
- ✓ Continued with literature review (searched for literature, saved to Zotero, printed literature, read literature, highlighted literature and made notes)
- ✓ Contacted tutor by emails on 22nd February, 2011 at 15.44, 22nd February 22, 2011 at 19.24, 23rd February, 24th February and 26th February
- ✓ Project planning i.e. thought about research methods

Week 5 starting Monday, 28th Feb;

- ✓ Continued with background reading
- ✓ Continued with literature review
- ✓ Contacted tutor by email on 28th February, 1st March, 3rd March 2011 at 19.24 and 3rd March 2011 at 20.20
- ✓ Continued with project planning i.e. Skills audit, Gantt chart and questionnaire
- ✓ Joined Zotero

Week 6 starting Monday, 7th Mar;

- ✓ Continued with literature review
- ✓ Participated in Elluminate session
- ✓ Contacted tutor by email on 8th March, 11th March and 12th March
- ✓ Contacted tutor by phone on 9th March
- ✓ Continued with project planning/ preparing emails for tutor

Week 7 starting Monday, 14th Mar;

- ✓ Continued with literature review
- ✓ Contacted tutor by email on 14th March, 16th March, and 17th March
- ✓ Continued with project planning/ preparing emails for tutor
- ✓ Submitted dummy TMA00
- ✓ Prepared TMA01

Week 8 starting 21st Mar;

- ✓ Submitted TMA01
- ✓ Continued with literature review
- ✓ Continued with project planning

Week 9 starting 28th Mar;

- ✓ Continued with literature review
- ✓ Continued with project planning

Week 10 starting 4th April;

- ✓ Continued with literature review
- ✓ Contacted tutor by email on 5th April
- ✓ Continued with project planning

Week 11 starting 11th April;

- ✓ Continued with literature review
- ✓ Continued with project planning
- ✓ Carried out 2 pilot interviews
- ✓ Contacted tutor by email on 12th April
- ✓ Contacted tutor by telephone on 13th April

Week 12 starting 18th April;

- ✓ Continued with literature review
- ✓ Continued with project planning
- ✓ Contacted anti-fluoridation groups and pro-fluoridation organisations
- ✓ Contacted tutor by email on 21st April
- ✓ Sent letters to 25 UK water companies for information
- ✓ Replied to emails

Week 13 starting 25th April;

- ✓ Continued with literature review
- ✓ Began carrying out interviews
- ✓ Replied to emails

Week 14 starting 2nd May;

- ✓ Continued with literature review
- ✓ Replied to emails
- ✓ Contacted tutor by email on 3rd May and 8th May
- ✓ Carried out interviews

Week 15 starting 9th May;

- ✓ Continued with literature review
- ✓ Replied to emails
- ✓ Carried out interviews

Week 16 starting 16th May;

- ✓ Continued with literature review
- ✓ Replied to emails
- ✓ Carried out interviews

Week 17 starting 23rd May;

- ✓ Continued with literature review
- ✓ Replied to emails
- ✓ Carried out interviews
- ✓ Participated in Elluminate conference on 25th May

Week 18 starting 30th May;

- ✓ Continued with literature review
- ✓ Replied to emails

Week 19 starting 6th June;

- ✓ Continued with literature review
- ✓ Replied to emails
- ✓ Commenced TMA02

Week 20 starting 13th June;

- ✓ Continued with literature review
- ✓ Continued with TMA02
- ✓ Contacted tutor by email on 17th June

Week 21 starting 20th June;

- ✓ Continued with literature review
- ✓ Continued with TMA02
- ✓ Contacted tutor by email on 26th June

Week 22 starting 27th June;

- ✓ Continued with literature review
- ✓ Continued with TMA02
- ✓ Contacted tutor by email on 3rd July

Week 23 starting 4th July;

- ✓ Submitted TMA02
- ✓ Continued with literature review

Week 24 starting 11th July;

- ✓ Participated in Elluminate conference on 11th July
- ✓ Continued with literature review

Week 25 starting 18th July;

- ✓ Contacted tutor by email on 18th July and 19th July
- ✓ Continued with literature review

Week 26 starting 25th July;

- ✓ Contacted tutor by telephone on 27th July
- ✓ Continued with literature review/ making notes for project

Week 27 starting 1st August;

- ✓ Continued with literature review/ making notes for project

Week 28 starting 8th August;

- ✓ Contacted tutor by email on 9th August
- ✓ Continued with literature review/ making notes for project

Week 29 starting 15th August;

- ✓ Continued with literature review/ making notes for project

Week 30 starting 22nd August;

- ✓ Contacted tutor by email on 22nd August
- ✓ Continued with literature review
- ✓ Began production of project

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Week 31 starting 29th August;

- ✓ Contacted tutor by email on 30th August and 1st September
- ✓ Completed literature review
- ✓ Continued with production of project

Week 32 starting 5th September;

- ✓ Contacted tutor by email on 8th September
- ✓ Continued with production of project

Week 33 starting 12th September;

- ✓ Contacted tutor by email on 13th and 18th September
- ✓ Continued with production of project

Week 34 starting 19th September;

- ✓ Amended and proofread project