

*Fluorosis Neurosis:
Describing the Attitudes of Residents of San Marcos on the New
Water Fluoridation Policy.*

By

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Abstract

Research Purpose

The purpose of this research is to design and execute a study that describes the attitudes of San Marcos, Texas residents affected by the new public policy that ends fluoridation of municipal water supplies. Furthermore, the study assesses resident's knowledge of the fluoridation policy.

Methods

This descriptive study employed a survey of residents of San Marcos, Texas. The survey results were augmented by interviews with public servants and activists. The study is also bolstered by research and reporting of relevant studies concerning fluoride to clarify and calm the controversy that surrounds water fluoridation into an academic context.

Results

The results of the survey show that residents of San Marcos, Texas most-commonly support the fluoridation of water. However, residents of San Marcos are also largely ignorant of the nature of fluoride as a drug and are not aware of how much fluoride they consume every day. The results of the interviews show that Mr. John Thomaides seemed to share a similar position with those from the survey who supported the petition, and Mr. Sam Brannon's opinion aligned against water fluoridation because of the general ignorance and the ethical implications which water fluoridation presents.

Full Disclosure

Given the researchers past diagnosis of Osteosarcoma and its connection to fluoride, there is the possibility that the results and overall tone of this research to be biased against water fluoridation.

Fluoride Basics

Electronegativities of the Elements

1998 Dr. Michael Blaber

1A 2A 3A 4A 5A 6A 7A

8B 1B 2B

3.0-4.0

2.0-2.9

1.5-1.9

<1.5

Blaber, Michael; PhD. "Electronegativites of the Elements."
<http://www.mikeblaber.org/oldwine/chm1045/notes/BondingPolarity/Bond05.htm>. (Accessed April 17, 2016).

periodic table except neon, helium, and argon to create compounds known as fluorides.

Due to fluorine's highly reactive nature, it took a lot of effort to isolate fluorine. French chemist, Henri Moissan, was the first person to isolate fluorine on June 26, 1886; after beginning his studies on fluorine chemistry in 1884. Moissan was successful in isolating fluorine by cooling potassium fluoride in hydrogen fluoride to subzero temperatures, then electrolyzing the solutions to isolate fluorine. Moissan conducted a full-scale study of the properties of fluorine and its reactions with other elements, and Moissan won the 1906 Nobel Prize in Chemistry for his efforts. Moissan died shortly after receiving the award on February 20, 1907 (Nobel Media, 2014b).

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areas of the world, fluorides occur naturally at high levels, sometimes exceeding 8.0 parts per million (ppm) (Ali, 2014). The Center for Disease Control (CDC) reports that in 2012, 210,650,401 United States (US) citizens received fluoridated drinking water which is 67.1% of the total US population (CDC, 2013a).

The Discovery of Water Fluoridation

The practice of adding fluorides to municipal water supplies is a relatively new practice gaining currency during the mid-20th century. Water fluoridation is based on the research of Dr. Frederick McKay, who was interested in a fluoride-related condition he had noticed during his time in Colorado Springs, Colorado (NIH, 2014b). The condition medically defined as "dental fluorosis" Dr. McKay and his colleague Dr. Green Vardiman Black dubbed “Colorado Brown Stain” or “mottled enamel.” Aside from the obvious staining Dr. Black and Dr. McKay observed; they also noted that the “mottled enamel” teeth were abnormally resistant to decay (NIH, 2014b).

Beginning in 1901, Dr. McKay, who had just recently graduated from the University of Pennsylvania, moved to Colorado Springs, Colorado. McKay was working as a dental associate when he began to notice severe permanent stains on the teeth of the local children (Pierre Fauchard Academy, 2016). McKay became fascinated by the condition and in particular the lack of information on the disorder. However, McKay initially seemed to be the only local dentist interested in the condition (NIH, 2014b).

By 1909, Dr. McKay had persevered long enough to gain support and interest from other practitioners, and even convinced Dr. Black who was a renowned dental researcher to join the investigation. Dr. Black originally refused to believe that such a condition would go without

mention in the scholarly literature (NIH, 2014b). What ultimately persuaded Dr. Black to go to Colorado Springs was a study conducted by the Colorado Springs Dental Society to examine the teeth of 2,945 children which showed that nearly 87.5% of the city's locally-born children had signs of "Colorado Brown Stain" (Pierre Fauchard Academy, 2016).

Dr. Black contributed to the investigation for six years before he died in 1915; Dr. Black made unmeasurable contributions for two main discoveries. The first discovery was that mottled enamel (as dubbed by Dr. Black) resulted from developmental imperfections in the child's teeth (NIH, 2014b). This finding had two ramifications, first that children whose secondary teeth were yet to erupt are at a higher risk of the condition, and second for those whose secondary teeth had calcified without developing the condition were not at risk. The second discovery was that teeth affected by the Colorado Brown Stain were more resistant to decay (NIH, 2014b).

As relevant as the discoveries were, they did not bring the researchers any closer to determining the cause of the Colorado Brown Stain. Dr. McKay made a breakthrough in 1923 when he went to Oakley, Idaho after receiving reports of similar stains on children's teeth. The stains began appearing shortly after Oakley constructed a new communal water pipeline to a local spring (NIH, 2014b). After analyzing the water, Dr. McKay found nothing suspicious but advised town leaders to stop using the pipe and use a different water source. McKay's advice worked and within a few years the children of Oakley, Idaho were sprouting secondary teeth without any stains (NIH, 2014b).

The Oakley case confirmed the theory that Dr. McKay had long postulated that there was something in the public water supply causing the condition. Dr. McKay eventually got his answer when he and Dr. Grover Kempf of the United States Public Health Service (PHS) received reports of similar stains in a town named Bauxite, Arkansas which was company town

owned by the Aluminum Company of America (ALCOA) (NIH, 2014b). The two doctors discovered that the disorder was prevalent among children in Bauxite but not in a town located five miles away (NIH, 2014b).

Dr. McKay and Dr. Kempf's investigation made it to Pennsylvania where it caught the attention of ALOCA's chief chemist, Dr. H. V. Churchill. Dr. Churchill had spent time over the past couple of years refuting claims that their cookware was poisonous. To mitigate any potential problems from the report, Dr. Churchill decided to conduct his tests which included a photospectrographic analysis; a more sophisticated test than the tests previously run by Dr. McKay (Pierre Fauchard Academy, 2016). Eventually, Dr. Churchill's analyses concluded that the water sample from Bauxite, Arkansas had high levels of fluoride. In January 1931, Dr. Churchill composed a five-page letter about his tests and subsequent discovery and sent it to Dr. McKay. Shortly after receiving the letter, Dr. McKay again retrieved samples from Colorado Springs and Oakley and confirmed an answer to his 30-year investigation: high levels of fluoride caused discoloration of tooth enamel (NIH, 2014b).

The First Municipality to Fluoridate

The resolution of Dr. McKay's 30-year quest was not the finality of the issue; however, it only sparked new inquiries by the PHS. Dr. H. Trendley Dean the head of the Dental Hygiene Unit at the National Institute of Health (NIH), was the leader of these new investigations which sought to discover the relationship between fluoride and tooth enamel. One of Dr. Dean's primary research concerns was the epidemiology of fluorosis which he began investigating in 1931 (NIH, 2014b).

Dr. Dean wanted to determine at what point did fluoride levels in water start to cause fluorosis. Dr. Dean sought the help of Dr. Elias Elvove, who was a senior chemist at the NIH. Dr. Elvove was taken to task to develop a system of measuring fluoride levels more accurately (NIH, 2014b). The method developed by Dr. Elvove was successful and could accurately measure fluoride levels within .1 ppm of accuracy. Dr. Dean led his team of researchers in comparing fluoride levels from communities all across the United States and concluded that fluoride levels of up to 1.0 ppm in community drinking water did not cause fluorosis in most people, and mild fluorosis in a small percentage of the population (NIH, 2014b).

Dr. Dean then took these findings in a different direction, tying the second discovery of Dr. McKay and Dr. Black's original report from 1915, that the children's mottled teeth were particularly resistant to decay, to his findings (Northwestern University Library, 2016). Dr. Dean then worked towards testing his hypothesis that adding fluoride to drinking water at 1.0 ppm, (which he had determined to be the physically and cosmetically safe level) would help fight tooth decay (NIH, 2014b).

In 1944, after many discussions with the Michigan Department of Health, PHS researchers, and other public health organizations, Dr. Dean convinced the City Commission of Grand Rapids to test his hypothesis by adopting a policy to add fluoride to the water supply at the 1.0 ppm level. In 1945, Grand Rapids, Michigan became the first city in the United States (and the world) to fluoridate its public water supply (Lennon, 2006).

Shortly thereafter, Grand Rapids began a 15-year water fluoridation study that was originally sponsored by the U.S. Surgeon General. In 1948 the National Institute of Dental Research (NIDR) took over the study upon its inception. During the span of the study, researchers monitored 30,000 schoolchildren's rate of tooth decay. By the conclusion of the

survey, Dr. Dean who was then director of the NIDR announced his finding that there was a 60% drop in the tooth decay rate among children who were born after they began adding fluoride to their water supply (Arnold, 1957). The findings were considered revolutionary in respect to dental care. For the first time in history tooth decay was now considered a largely preventable disease (NIH, 2014b).

Research Purpose

The purpose of this research was to design and execute a study that describes the attitudes of San Marcos, Texas residents affected by the new public policy that ends fluoridation of municipal water supplies. Furthermore, the study assesses resident knowledge of the fluoridation policy. This descriptive study primarily employed a survey of citizens of the municipalities affected by Proposition 1, which resulted in the new water fluoridation policy. The survey results are augmented by interviews with public servants, and activists who engaged in the controversy from both sides. The study is also bolstered by research and reporting of relevant studies concerning fluoride to clarify and calm the controversy that surrounds water fluoridation into an academic context.

Chapter II: Policy History

Chapter II Purpose

This chapter covers a broad range of topics that are pertinent to the evolution of water fluoridation policy since its inception in the 1945 Grand Rapid, Michigan case (Arnold, 1957). The Safe Drink Water Act of 1974 answered fundamental questions of what government entity regulates water fluoridation: Environmental Protection Agency (EPA) and by what standard: Maximum Contaminant Level (MCL) (EPA, 2016a). By 1981, controversy over fluoride's MCL had begun with the state of South Carolina questioning, then petitioning the EPA's regulation of fluoride in 1981 with the support of the American Dental Association (ADA) (EPA, 1979). South Carolina and the ADA's opposition led to the EPA reviewing fluoride's MCL and eventually upholding their regulation of fluoride, but raising the MCL, which was also highly controversial (Pincus, 1981).

The new fluoride MCL of 4 parts per million (ppm) was implemented in October of 1985 followed by a lawsuit from the Natural Resource Defense Council (NRDC) in 1986 (NRDC, 1986). In February of 1987, the United States Court of Appeals for the District of Columbia ruled in favor of the EPA and upheld their 4 ppm fluoride MCL (United States Court of Appeals for the District of Columbia Circuit, 1987). This ruling was then followed by the EPA's request, in August of 2003, to the National Research Council (NRC) to review their fluoride MCL and any potential safety concerns with fluoride (Hileman, 2003). The NDRC completed and published its report in March 2006 titled "Fluoride in Drinking Water: A Scientific Review of EPA's Standards" (NRC, 2006). The NRC concluded that severe dental fluorosis was an adverse health effect and the EPA's 4 ppm fluoride standard is unsafe. These findings directly contradict

the ruling in favor of the EPA in the NRDC's lawsuit, and the statute the EPA codified in 1985 (EPA Professional Union, 2006).

The chapter then shifted gears to discuss silicofluorides which most are commonly used for municipal water fluoridation (CDC, 2014). Specifically, the discussion focuses on the EPA's regulation of the phosphate industry (EPA, 2016b). During the first half of the 20th Century, there was little regulation of the phosphate industry releasing silicofluorides through the air, streams, and rivers. The lack of regulation led to a great deal of environmental degradation and many costly lawsuits against the phosphate industry (Streater, 2002). The phosphate introduced methods of capturing these silicofluorides but were left with an uneconomical waste by-product (EPA, 2016b). The EPA saw silicofluorides as an "ideal solution" both for the phosphate industry and for drinking water fluoridation (EPA, 1983). This policy is also a highly controversial issue.

This chapter again changes focus to examine the Food and Drug Administration's (FDA) regulation of fluoride; specifically, under the Federal Food, Drug, and Cosmetic Act (FD&C) (Cornell University Law School, 2016). Fluoride, as regulated under the FD&C, is considered a drug in products such as toothpaste and mouth rinse. Further discussion of the FDA's rejection of fluoride supplements and the FDA's disclosure of that information to Congress concludes the subsection titled "Food and Drug Administration (FDA) Regulation."

The final four subsections of this chapter discuss the overall momentum that has been building for the removal of fluoride from municipal water sources all over the world, most notably in the United States, since 2010 (FAN, 2016a). Israel's decision to end fluoridation is discussed in detail, and other large cities from North America who have discontinued their fluoridation policy are listed (Siegel-Itzkovich, 2014). This discussion leads to the completion of

this chapter and the municipality that is the primary case relevant to this overall research, San Marcos, Texas.

In discussing the case of San Marcos, Texas, there is a detailed account told of the primary activist group responsible for the change in San Marcos' fluoridation policy named "Communities for Thriving Water: Fluoride Free San Marcos" (CTW). Then the research covers the legal battle that went on between the members of CTW and the local government, including but not limited, to the City Council of San Marcos (District Court of Hays County Texas, 2015). Further discussion covers Proposition 1 which was the proposition that dealt directly with the water fluoridation policy in San Marcos, and Proposition 2 that dealt with the legal means that CTW utilized to get a fluoride proposition on the ballot during the November 2015 general election in San Marcos, Texas.

The Safe Drinking Water Act (SDWA) of 1974

In 1974, the United States Congress passed the SDWA requiring the EPA to set federally enforceable standards of contaminants in drinking water (EPA, 2016a). These standards are guidelines which are enforced by the EPA; however, each municipality has their own autonomy in respect to a decision of whether or not to fluoridate their municipal water supply. The SDWA is intended to have a preventative purpose embodying Congress' intent to maximize the public benefit by protecting their health. In order to exercise this precaution, the EPA is required to prescribe drinking water regulations for contaminants which may be a threat to public health. Originally the EPA set a Maximum Contaminant Level (MCL) of 1.4 ppm to 2.4 ppm, (FAN, 2016b) echoing the PHS' recommended guidelines set forth in 1962; to protect against moderate to severe dental fluorosis (EPA, 2016a).

The American Dental Association (ADA) announced its opposition to the EPA regulations of fluoride in water during March of 1980 (ADA, 1980). According to then-ADA President, Dr. I. Lawrence Kerr, “at this point, there is no evidence implicating naturally occurring fluorides as a health hazard even at eight times the optimum level set by the EPA.” Dr. Kerr further cited concerns that labeling excessive fluoride levels would undermine the efforts in promoting fluoridation for communities with naturally lower levels of fluoride (ADA, 1980).

South Carolina petitions the Environmental Protection Agency (EPA)

The South Carolina Department of Health and Environmental Control filed a petition to the EPA requesting removal of fluoride from the federally enforceable standards in 1981 (Pincus, 1981). Their petition followed inquiries from Senator Strom Thurmond in 1979 whether fluoride could be removed from the federally-enforceable standards. On April 17, 1979, the EPA sent a formal letter in response to Senator Thurmond’s request “It is not appropriate to remove fluoride from the primary standard because it can cause adverse health effects (moderate to severe dental fluorosis) at levels found in some drinking water.” (EPA, 1979). According to a story published in the Washington Post on December 10, 1981, South Carolina studied water samples from 43 different communities finding naturally-occurring fluoride levels above the MCL enforced by the EPA. South Carolina concluded, “that costs of fluoride reduction would make compliance with the current regulations economically burdensome” (Pincus, 1981).

In February 1987, the Academy of General Dentistry (AGD) published an article written by Zev Ramba, which criticizes the political pressure of pro-fluoride advocates on the EPA (Ramba, 1987). Ramba explained her view that organized dentistry was losing its objectivity, thus reducing their effectiveness in the fluoride debate. Specifically, the article referenced South Carolina’s Department of Health and Environmental Control 1981 petition to the EPA. Ramba

criticized South Carolina and the ADA's position for ignoring the issue of dosage. Ramba contends that fluoride, at optimal levels, reduces decay without harmful effects. The higher fluoride levels deregulation would permit, Ramba warns, could lead to harmful effects of high levels of fluoride (Ramba, 1987).

Ramba's article also reports several interesting statistics, while maintaining a well-balanced stance in favor of fluoridation. According to the article, of the 2000 referendums held in the United States on fluoridation from 1950-1987, close to 60% have been voted down. The article further reported that a 1985 poll by the ADA found that 36% of the 255 fluoridation programs they surveyed had been canceled, while another 14% had been delayed or cut back (Ramba, 1987). The article concludes with Ramba stating, "Fluoride is too effective a public health measure to be held back by political gamesmanship" (Ramba, 1987).

Review of Fluoride Maximum Contaminant Level (MCL)

In 1981, the EPA asked the Surgeon General to advise them on the health aspects of dental fluorosis. The Surgeon General assembled a medical committee that advised the EPA on "Non-Dental Health Effects of Fluoride". On April 18 and 19, 1983, the majority opinion of the panel came to the conclusion that moderate to severe fluorosis are both adverse health effects that should be prevented through proper use of the enforceable drinking water contaminant level of 1.4 to 2.4 ppm of fluoride. At the end of the hearing, the panel voted 12-2 to maintain the 1.4-2.4 MCL (NIH, 1983).

The Final Report of the Surgeon General's ad hoc committee was submitted on September 26, 1983. The original conclusion of moderate to severe dental fluorosis as an adverse health effect had been altered to describe it as "uncosmetic" (Shapiro, 1983). Investigative

journalist Daniel Gossman reported in December 1990, that the majority of the members of the committee were never informed of the changes made to the Final Report (Grossman, 1990).

On May 14, 1985, the EPA announced its proposal of a new MCL for fluoride of 4 ppm with a secondary MCL of 2 ppm in the Federal Register (EPA, 1985). The secondary standard is a goal that water systems should attempt to reach, but the municipality can only be fined by the EPA for failure to meet the primary MCL standard. According to Dr. Joyce M. Donohue, a toxicologist in the EPA's Office of Water, the enforceable MCL of 4 ppm was set to protect against skeletal fluorosis, while the "nonenforceable" MCL of 2 ppm was set to prevent dental fluorosis (Hileman, 2003).

Dr. Donohue explained how the EPA calculated their MCL. First, the EPA assumed that all fluoride exposure comes from drinking water. Secondly, the EPA understood that if an individual consumed 20 milligrams (mg) of fluoride daily for 20 years they would be at serious risk of developing severe skeletal fluorosis. 20 mg divided by 2 liters which is the average daily water intake to get 10 mg per liter, which was then divided by a 2.5 safety factor. Safety factors are used to establish a margin of safety to account for individual and species variability when using data from animal and human research. Dr. Donohue further explained that she was unaware of how the EPA decided on a 2.5 safety factor given that they now use safety factors of 1, 3, and 10 (Hileman, 2003).

The new fluoride MCL proposal was then officially adopted on October 31, 1985. On that same day an EPA scientist, Paul Price, who was responsible for writing the new standard circulated an internal mock press release lambasting the new standard. The mock press release referenced a lack of new evidence in support of the new standard and concludes by stating, "EPA

selected this level based on a cost-effectiveness study which showed that it is cheaper for people to keep their mouth shut than to remove fluoride.” (Price, 1985).

Price’s frustrations stem from what he views as “a clash of two different cultures.” In Price’s view the PHS. was guided by a 1950s-era attitude that health problems are solved with medication and that the doctors know best; therefore, anyone questioning their authority is unjustified (Grossman, 1990). The EPA scientists, in Price’s opinion, instead work on the precautionary principle, that no substance should be allowed in drinking water unless it is proven beyond any doubt to be safe (Kreibel et. al., 2001).

David Chandler of the Boston Globe wrote an article on the controversy at the EPA on November 25, 1985. In the article, Chandler spoke with an EPA scientist in the toxic substances division named Dr. Robert Carton. Dr. Carton claimed in the article that their study showed evidence that the new regulation of 4 ppm of fluoride could cause “crippling skeletal fluorosis”. Dr. Carton would further state that “this whole thing is politics, you’re not talking science at all.” Dr. Carton’s contention is that the more lenient standard prevented the EPA’s reputation from being damaged (Chandler, 1985).

Natural Resources Defense Council’s (NRDC) Lawsuit

In April of 1986, the Natural Resources Defense Council (NRDC) filed their first legal brief as part of their lawsuit against the EPA for the alteration of the MCL of fluoride. The NRDC’s primary complaint was that the EPA’s new standard did not protect the public health. Another key issue for the NRDC was that the new regulations passed by the EPA required jurisdictions to warn their constituents that if their fluoride levels were higher than 2 ppm, that children under the age of 9 years old should not drink the water. The NRDC further contended

that the new MCL for fluoride was not low enough to even prevent skeletal fluorosis (NRDC, 1986).

The Atlantic Magazine published an article in August of 1986, quoting the NRDC's attorney Jacqueline M. Warren, "This is the first time in the history of the EPA that permanent regulations are in place to tell people not to drink the water." Ms. Warren went on to say that, "By calling [dental] fluorosis a cosmetic effect, they are simply attempting to define the problem out of existence." (Shell, 1986).

The NRDC was not the only group to openly criticize the EPA's decision. The EPA's union of scientists and professionals voted to join the NRDC in their lawsuit against the EPA. In an unprecedented move, the EPA's professional union led by President Dr. Carton attempted to join the NRDC's lawsuit. Dr. Carton, speaking on behalf of the EPA's professional union was quoted in the Washington Post saying, "Our responsibility to defend EPA professionals' reputations and to protect public health in this situation requires us to put loyalty to the public interest and to moral principles above loyalty to persons or to [a] government department." (Williams, 1985).

In September of 1986, the EPA's professional union filed an amicus curiae brief to express their interest in joining the NRDC's lawsuit against the EPA administration. The EPA union's primary contention in joining the suit was their view that the SDWA's legislative history clarifies that "the administration must decide whether any adverse effects can be reasonably anticipated, even though not proved to exist" (EPA Professional Union, 1986). The United States Court of Appeals for the District of Columbia which presided over the NRDC's lawsuit did not allow the EPA professional union to join the lawsuit as a party (United States Court of Appeals for the District of Columbia Circuit, 1987).

After several months of hearings and other legal proceedings, the United States Court of Appeals for the District of Columbia upheld the 4 ppm MCL for fluoride on February 22, 1987. Their ruling further upheld the EPA's contention that an adverse health effect is an effect that results in functional impairment of body or mind. The NRDC's suit featured a psychiatric panel report about the potential psychological effects of dental fluorosis. The panel identified psychological problems posed by dental fluorosis such as loss of self-confidence and dissatisfaction with personal appearance (United States Court of Appeals for the District of Columbia Circuit, 1987).

The EPA successfully defended against the psychological panel's assertions by defining the psychological effects of dental fluorosis as welfare effects, but not necessarily health effects as stated in the SWDA. Though the court and EPA acknowledged dental fluorosis manifests staining and pitting of teeth, the EPA successfully defended their stance that dental fluorosis is a cosmetic effect. Thus, the EPA was not required to consider the prevention of dental fluorosis in the setting of fluoride's enforceable MCL (United States Court of Appeals for the District of Columbia Circuit, 1987).

National Research Council's (NRC) 2006 Review

In August of 2003, the EPA requested the NRC conduct a review of the adequacy and safety of the EPA's fluoride standards. The NRC Board on Environmental Studies & Toxicology had previously reviewed the EPA's standards in 1993. After reviewing the fluoride MCL standards, the NRC deemed the EPA's standards to be acceptable. However, the 1993 NRC report pointed out inconsistencies in the fluoride database with gaps in knowledge. The NRC recommended further research be conducted specifically on fluoride intake, dental fluorosis,

fluoride-related bone fractures, and carcinogenicity. The NRC also advised that EPA standards undergo review when the results of the new research became available (Hileman, 2003).

The formal challenge the EPA issued to the NRC was to review epidemiological, toxicological, clinical and exposure data published about fluoride since 1993. The NRC conducted their fluoride research over a span of three years from 2003-2006, and released its 450-page review on March 22, 2006. The NRC's report titled "Fluoride in Drinking Water: A Scientific Review of EPA's Standards" concluded that 4 ppm is unsafe for bones and teeth; but the most relevant conclusion was that severe dental fluorosis is an adverse health effect. According to the NRC's report, "One of the functions of tooth enamel is to protect the dentin and, ultimately, the pulp from decay and infection...The damage to teeth caused by severe enamel fluorosis is a toxic effect that is consistent with prevailing risk assessment definitions of adverse health effects." (NRC, 2006). The NRC's findings directly contradicted the standards codified by the EPA in 1985 (EPA, 1985).

The day after the NRC's report was released, the EPA's professional union issued a press release which detailed their view of the NRC's report. The EPA professional union viewed the NRC's report as vindication of their concerns about fluoride toxicity on multiple levels including the stance EPA's professional union had held since 1986 on the EPA's fluoride MCL, that severe dental fluorosis is an adverse health effect. The NRC's report that severe dental fluorosis is an adverse health effect implies a violation of the SDWA on behalf of the EPA (EPA Professional Union, 2006). In March 2010, as a result of the second Six-Year Review of Drinking Water Standards, the EPA indicated that the Office of Water was in the process of developing its health and exposure assessments to address the NRC's recommendations (EPA, 2015). The EPA finalized their risk exposure assessments of fluoride in January of 2011 in the Federal Register.

“EPA concluded that severe dental fluorosis is an adverse effect due to the fact that the pitting it causes in the permanent teeth is a structural defect to the teeth” (EPA, 2011). As of February 2016, the EPA still has not revised their MCL regarding fluoride (EPA, 2016a).

The NRC’s 2006 report goes beyond implying a legal violation of the SDWA by the EPA, to making recommendations that would constitute a revolution in fluoride research. The NRC’s report included a laundry list of recommended studies. Among the recommendations were studies on brain effects of fluoride concerning a possible link between fluoride consumption and Intelligence Quotient (IQ) and dementia. Further recommendations include fluoride endocrine effects on the thyroid gland, pineal gland, and metabolic processes. Kidney disease, fertility effects, musculoskeletal effects and bladder cancer were also key areas of fluoride study the NRC recommended (NRC, 2006).

Further recommendations on biomonitoring surveys including fluoride were included in the NRC report. Disclosure of fluoride content in commercial food and beverage was another important recommendation by the NRC’s report. Another extremely relevant recommendation the NRC made in their report was to research “the possibility of biological effect of SiF₆, [Hexafluorosilicic acid] as opposed to free fluoride ion, should be examined.” (NRC, 2006). The relevance of this recommendation is that fluorides added to the water supply are silicofluorides (CDC, 2014), not sodium fluoride used in dental products (MedicineNet, 2016). Silicofluorides generally come from the phosphate production industry (Specht, 1960). The city of San Marcos, Texas, in particular, has used hydrofluorosilicic acid for its fluoride treatment to water in the past. Hydrofluorosilicic acid is one of many different types of silicofluoride compounds that include but are not limited to hexafluorosilicic acid and sodium silicofluoride (City of San Marcos, 2013).

EPA Regulation of Silicofluorides

In 1997, the EPA Union of Professionals voted to oppose water fluoridation. In June 2000, Dr. William Hirzy, who at the time was serving his sixth term as the Senior Vice President of the Union; testified to the United States Senate Committee on Environment and Public Works. Dr. Hirzy's presentation titled, "Why EPA's Union of Professional Opposes Fluoridation" outlined the Union's objections to water fluoridation. One of the primary complaints Dr. Hirzy discussed during his testimony involved the EPA's regulation of airborne fluorides concerning the various industries, most notably phosphate manufacturing (US Senate, 2000).

During the early parts of the 20th century, there was little regulation of the phosphate industry in their emissions of fluoride containing vapors, such as hydrogen fluoride. These fluoride emissions quickly started taking a toll on the surrounding environments. For example, Polk County, Florida created many phosphate plants in the 1940s. A study conducted in 1970 estimated that fluoride contamination caused the cattle population to drop by 30,000 head in Polk County between 1953 and 1960 (Linton, 1970). Fluoride emissions quickly became one of the biggest environmental liabilities of the phosphate industry (ATSDR, 2000).

In 1983, Dr. Leonard Weinstein of Cornell University, echoing the sentiment of various studies before him, stated, "there has been more litigation on alleged damage to agriculture by fluoride than all other pollutants combined." (Weinstein, 1983). The primary motivation for the fluoride litigation was "the painful, economically disastrous, debilitating disease" that fluoride was causing to livestock (Hodge & Smith, 1977). Responding to litigation and stringent regulation by the EPA, the phosphate industry introduced what they term "scrubbers," which strip particulate and gaseous components from the waste gas and produce waste products known as silicofluorides (Glasser, 1998).

Some fluoride compounds such as calcium fluoride are in demand for industrial purposes; however, silicofluorides are not among the group of industrially useful fluoride compounds. Therefore, the phosphate industry would have to refine their silicofluorides, to render their byproduct industrially useful. To this point there has not been an economically-viable process of refining silicofluorides, thus leaving these industries with large quantities of an unusable fluoride byproduct for industrial purposes (Tampa Tribune, 1993).

EPA representative, Rebecca Hanmer, who was the Deputy Assistant Administrator for Water, responded to a letter from Dr. Leslie A. Russell about fluoridation of drinking water on March 30, 1983. In the letter, Ms. Hanmer discussed the use of fluosilicic acid (a form of silicofluorides) as a water treatment chemical. The letter described the use of fluosilicic acid as “an ideal environmental solution to a long-standing problem. By recovering by-product fluosilicic acid from fertilizer manufacturing, water and air pollution are minimized, and water utilities have a low-cost source of fluoride available to them.” (EPA, 1983).

Dr. Hirzy, on behalf of the EPA Union, had a very different view on the relationship between the fertilizer industry and water fluoridation. During his testimony, Dr. Hirzy explained “if this stuff [silicofluorides] gets out into the air, it’s a pollutant, if it gets into the river, it’s a pollutant; if it gets into the lake it’s a pollutant; but if it goes right into your drinking water system, it’s not a pollutant.” (US Senate, 2000). Dr. Hirzy further points out that the EPA’s body of evidence supporting water fluoridation based on research performed on sodium fluoride, and not silicofluorides (EPA, 2000).

The EPA officially refutes Dr. Hirzy’s claims by pointing out that fluorides in drinking water are still classified as contaminants and thus subject to MCL regulation (EPA, 2016a). The EPA and other fluoride supporting agencies such as the U.S. Center for Disease Control (CDC),

further respond to the lack of silicofluorides-based research with a well-supported theoretical calculation. The theory states that when silicofluorides dilute into water, the compound dissociates into free fluoride ions, and thus the treated water will not have silicofluorides compounds in it when consumed (Urbansky & Schock, 2000). However, there is evidence to refute the dissociation theory used by the EPA and CDC in the case of silicofluorides (Westendorf, 1975).

Food and Drug Administration (FDA) Regulations

The Food and Drug Administration (FDA) regulates fluoride under the Federal Food, Drug, and Cosmetic Act (FD&C). Under the FD&C fluoride is regulated in food products, such as bottled water, dental products such as toothpaste and mouth rinses, and supplements (FDA, 2015). The FDA on several occasions dating back to 1963 has made their classification of fluoride clear, “Sodium fluoride used for therapeutic effect would be a drug, not a mineral nutrient. Fluoride has not been determined essential to human health.” Since the previous statement made in 1963, the FDA has confirmed their stance on three separate occasions, in 1967, 1990 and 2000 (FDA, 1963) (FDA, 1967) (FDA, 1990) (FDA, 2000).

The FDA’s statement in 2000 was the clearest and most concise statement, especially regarding the use of fluoride to prevent dental caries. “Fluoride, when used in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or animal, is a drug that is subject to Food and Drug Administration (FDA) regulation.” (FDA, 2000). Therefore, according to the FDA, fluorides are considered drugs. Further confirmation of that status is made in a pragmatic way by observing the back of a product using fluoride such as fluoridated toothpaste (see Figure 2.1 below).

The image in Figure 2.1 clearly shows packaging for a fluoride toothpaste called “OraLine.” On the back of this product is disclaimer information required by the FDA. Included in the disclaimer is one section titled “Drug Facts”, another section titled “Active Ingredient”, and a “Purpose” title. Therefore, Sodium Fluoride listed under both “Drug Facts” and “Active Ingredient” implies that sodium fluoride is a drug that actively works for anticavity purposes. It is also worth pointing out the ADA seal of acceptance and their quote on the “OraLine” packaging stating “The ADA Council on Scientific Affairs’ Acceptance of OraLine Fluoride Mint Toothpaste is based on its finding that the product is effective in helping to prevent and reduce tooth decay, when used as directed.”

Figure 2.1

ADA Accepted
American Dental Association

OraLine

No animal based ingredients.
Mint Flavor

Net Wt. 3 oz. (85g)

FLUORIDE TOOTHPASTE

The ADA Council on Scientific Affairs' Acceptance of OraLine Fluoride Mint Toothpaste is based on its finding that the product is effective in helping to prevent and reduce tooth decay, when used as directed.
— Council on Scientific Affairs, American Dental Association

Drug Facts		Drug Facts (continued)
Active Ingredient Sodium Fluoride 0.24% w/w (0.15% w/v Fluoride Ion)	Purpose Anticavity toothpaste	Directions ■ Adults and children 2 years of age and older: Brush teeth thoroughly, preferably after each meal or at least twice a day, or as directed by a dentist or doctor. ■ Children under 6 years of age: use a pea-sized amount and instruct in good brushing and rinsing habits to reduce swallowing. ■ Supervise children as necessary until capable of using without supervision. ■ Children under 2 years of age: Consult a dentist or doctor.
Use Helps protect against cavities		Inactive Ingredients: Sorbitol, Hydrated Silica, DI Water, Glycerin, PEG 12, Sodium Lauryl Sulfate, Cellulose Gum, Titanium Dioxide, Flavor, Sodium Benzoate, Disodium Phosphate, Sodium Saccharin, FD&C Blue #1.
Warnings Keep out of the reach of children under 6 years of age. If you accidentally swallow more than used for brushing, get medical help or contact a Poison Control Center right away.		

J.M. Murray Center Inc. “Oraline.” <http://www.drugs.com/otc/105974/oralline-secure.html>
(Accessed April 22, 2016).

Possibly the most controversial topic within the FDA's regulation of fluoride pertains to the subject of fluoride supplementation. Fluoride supplements were designed to provide children living in non-fluoridated areas with the daily equivalent of a daily allowance of fluoridated water of 1 milligram per day. There have been school programs dating back to the 1970s that have provided students with fluoride through various avenues, most notably through mouth rinse and fluoride tablets (ASTDD, 2011).

The controversy specifically with these school programs stems from the lack of approval of a fluoride supplement due to definitional and scientific problems (FDA, 2005). If fluoride is a drug, as the FDA has acknowledged previously, it could not be a dietary supplement because there are no biological systems or processes that are required or enhanced by fluoride (FDA, 1990). There also has been controversy over information the FDA gave to Congress in 2000 about fluoride supplements (FDA, 2000).

In the 1960s and 1970s, the FDA rejected two different New Drug Applications (NDA) for fluoride supplements. The first NDA was applied for in 1966. This NDA was a supplement to be taken by expectant mothers as a prenatal treatment to strengthen the teeth of their child. James L. Goodard, who at the time was FDA commissioner, explained the rejection of the prenatal fluoride supplement as so, "A number of vitamin-mineral preparations containing fluoride have been promised to as preventing tooth decay in children when the drugs are taken by expectant mothers. There is insufficient evidence to support that claim." (Drug News Weekly, 1966). In June of 1975, the medical journal "Drug Therapy" published a short release announcing the withdrawal of the NDA for a lozenge supplement called "Enziflur." The statement says the NDA was withdrawn because "there is no substantial evidence of drug effectiveness as prescribed, recommended, or suggested in its labeling" (FDA, 1975).

Since the rejection of the 1966 and 1975 fluoride supplement NDAs, the FDA has repeatedly confirmed that there have been no new NDAs approved for fluoride supplements. On five separate occasions, twice in 1993, once in 1997, once in 2000, and the last time in 2005, the FDA has confirmed a lack of approved fluoride supplements (FDA, 1993a) (FDA, 1993b) (FDA, 1997) (FDA, 2000) (FDA, 2005). In 2005, the FDA replied to questions about fluoride supplements approval “No. To date, FDA has approved no fluoride-containing supplement as prescription or over-the-counter drugs. Dietary supplements do not require premarket approval by FDA.” (FDA, 2005).

Rejection of the 1966 and 1975 fluoride NDAs directly contradicts information the FDA provided in a letter to Ken Calvert, the Chairman of the U.S. House of Representatives Committee on Science and Subcommittee on Energy and Environment on December 21, 2000. The letter which was originally sent by Mr. Calvert to the FDA on May 8, 2000, included four different questions on fluoride regulation. The second question asked the FDA if they had any NDAs on file that had been either approved or rejected that contain fluoride for dental health. The question further inquired if there were any approved or rejected NDAs, on what grounds was that decision made (FDA, 2005). The FDA, in response to Congressman Calvert’s questions, failed to mention the 1966 prenatal fluoride NDA or the 1975 Enziflur NDA (Drug News Weekly, 1966) (FDA, 1975).

Fluoride Rejection Since 2010

Fluoridation, since its inception in 1945, has always been a highly controversial issue. Proponents of fluoridation have lauded the practice as a contribution to the eradication of tooth decay and the beginning of dentistry as a leader in preventative medicine. The CDC recognized water fluoridation as one of the “Ten Great Public Health Achievements” during the 20th century

(CDC, 2013b). Skeptics have deplored fluoridation claiming links to cancer, hypothyroidism, down syndrome, lowered intelligence quotients (IQs) and a nationwide increase in dental fluorosis among other health complications (FAN, 2015). In recent years, the issue of fluoridation has reached a fever pitch.

Since 2010, over 150 communities, ranging from small municipalities to entire countries, have decided to end their water fluoridation policy (FAN, 2016a). Included among that group of cities are large jurisdictions such as: Calgary, Alberta, Canada, population of 1,096,833 as of 2011 (UN, 2011); Bucks County, Pennsylvania, a population of 626,685 as of July 2014; Portland, Oregon, a population of 619,360 as of July 2014; Albuquerque, New Mexico, a population of 557,169 as of July 2014; Wichita, Kansas, a population of 388,413 as of July 2014 (US Census Bureau, 2014); Windsor, Ontario, Canada; population 210,890 as of 2011 (UN, 2011). Other cities such as Austin, Texas, population 912,791 as of July 2014 (US Census Bureau, 2014), have had strong activist pushes to end fluoridation, but to this point have been unsuccessful (FFA, 2015).

In 2014, the entire country of Israel (population 8,215,300 as of 2014) decided to end their water fluoridation policy. Israel began their fluoridation policy in 1970, specifically for any jurisdictions with over 5,000 residents. Before the discontinuation of their fluoride policy in 2014, 70% of Israelis received fluoridated water. Unlike many other places such as Portland, Oregon or San Marcos, Texas that ended water fluoridation by referendum, Israel has ended their water fluoridation policy essentially by executive decision of Israeli Health Minister, Yael German. German based her decision on research by The Adin Committee. They recommended that fluoridation not be mandatory but rather be optional. The Adin Committee further recommended that Israeli officials fluoridate desalinated water (Siegel-Itzkovich, 2014).

Professor Arnon Afek, who is German's director-general and an expert in pathology and medical administration supported German's decision and discussed the matter with Judy Siegel-Itzkovich of the Jerusalem Post. "Mandatory fluoridation is medical treatment. Individuals have the right to decide if they want it or not. The question is not if fluoride is beneficial but how it should be delivered. We cannot force people." (Siegel-Itzkovich, 2014).

German's decision to end fluoridation has been met with fierce criticisms from local public health officials and dentistry associations such as the Israel Dental Association. Before the cancellation of fluoridation policy was put into effect, a group of public health officials and dentists wrote a letter to German expressing their concern as a last ditch effort to save the fluoridation policy. Professor Ted Tulchinsky, a former senior Health Ministry expert in public health, charged German with completely ignoring the Adin Committee's recommendation to fluoridate desalinated water. Professor Tulchinsky further described, "The minister's decision is amateurish and liable to cause long-term damage to Israeli children and adults, making their health situation poorer, especially on the economically and educationally disadvantaged." The efforts of Professor Tulchinsky and his colleagues were unsuccessful, and Israel officially ended its water fluoridation policy on August 26, 2014 (Siegel-Itzkovich, 2014).

Dr. Hardy Limeback, Professor Emeritus and Former Head of Preventative Dentistry at the University of Toronto, served three and a half years on the US Nation Academies of Science (NAS) Subcommittee on Fluoride in Drinking Water. This NAS subcommittee was responsible for the NRC's 2006 publication on fluoride toxicity. In a letter Dr. Limeback wrote to German on August 15, 2014, he lauded German's decision to end fluoridation saying "parents would save on costly dental bills treating dental fluorosis, dental decay rates would remain the same or even

continue to decline...and the health of city residents would improve when industrial waste products are no longer added to the drinking water.” (Limeback, 2014).

Communities for Thriving Water Fluoride-Free San Marcos (CTW)

The culmination of this controversy has resulted in municipalities from all around the country voting on fluoride-related propositions. The City of San Marcos, Texas, who has fluoridated their drinking water since 1987, is one of the municipalities that has found itself embroiled in this controversy. An activist group named “Hays County Constitutional Republicans” (HCCR) initially became aware of the issue of fluoridation in 2013. Within three months of becoming aware and subsequently researching fluoride, HCCR took an internal vote on the matter, which resulted in a resounding vote against water fluoridation (Brannon, 2016).

The HCCR gave birth to another organization known as Communities for Thriving Water Fluoride-Free San Marcos (CTW). CTW began attending city council meetings and actively raising awareness of the issue; the group then put together binders to give each council member, the city manager, and director of Public Utilities. Shortly after, CTW then got a sit-down conversation with the city manager and director of Public Utilities (Brannon, 2016).

After the conversation with the city manager and director of Public Works of San Marcos, CTW did not feel their concerns had been adequately addressed. CTW again started attending council meetings expressing their desire for a public hearing in city council chambers on the issue. For CTW, the ideal situation would be that the city would present their argument for water fluoridation and CTW would be able to cross-examine their case in council chambers. The council sent the case to the Citizen Utility Advisory Board (CUAB) where CTW presented its case. The board brought in Austin-based Dr. Stanley Wang to defend the city’s water

fluoridation policy. After eight months, the recommendation of the board was for continuing the fluoridation policy (Brannon, 2016).

At the end of 2014 in October, after seeking legal counsel, CTW decided to change their tactics in favor of pursuing a City Charter Amendment petition pursuant to Section 12.11 of the San Marcos City Charter. CTW immediately began petitioning from October 2014-March 2015. The petition that CTW circulated targeted individuals registered to vote in the City of San Marcos and sought to add a section to the city charter to read as follows:

“The City of San Marcos including its departments, agents, and contractors, shall not fluoridate the public water supply or accept any fluoridated water for use in the San Marcos water system including but not limited to the addition of Hydrofluorosilicic Acid, Hexafluorosilicic Acid, Sodium Silicofluoride, or any other fluoride derivative. The City of San Marcos shall not purchase, install or allow the installation of fluoridation equipment to be used in relation to the San Marcos municipal water supply or its distribution system.” (CTW, 2015b)

CTW presented 1,634 signatures to Jamie Lee Pettijohn, the City Clerk of San Marcos, on April 2, 2015 (CTW, 2015a). Ms. Pettijohn declared the petition invalid at a City Council meeting on May 5, 2015, stating “None of the petition papers contains an oath or affirmation that each signature was the genuine signature of the person who signed it. Therefore, none of the signatures may be counted.” (Rollins, 2015). Pettijohn cited precedent stated in San Marcos’ city charter, that has been in place since 1967, that amendment petitions must be accompanied by an oath or affirmation, according to Section 6.03:

“Before signatures on any petition paper may be counted, one of the signers of such petition paper, a qualified voter, shall make oath or affirmation before the city clerk or any other officer competent to administer oaths or affirmations, that the statements made therein are true, that each signature to the paper appended is the genuine signature of the person whose name purports to be signed thereto, and that such signatures were placed thereon in that person's presence.” (City of San Marcos, 2016b).

On May 18, 2015, Brad Rockwell of Frederick, Perales, Allmon & Rockwell, P.C. Attorneys At Law, filed a letter on behalf of CTW to Ms. Pettijohn, Mayor Daniel Guerrero and the City Council demanding they fulfill their nondiscretionary duties under Section 12.11. Section 12.11 states that the city must acknowledge and count the signatures, and Texas Local Government Code Section 9.004(a) nullifies the verified signature precedent asserted by Ms. Pettijohn. Texas Local Government Section 9.004 further states the Council must approve the measure to be put on the ballot for the November 2015 general election (FPAR, 2015b). Nearly a month later on June 16, 2015, Rockwell filed a second letter to the city with the same demands concluding: “Your continued refusal to comply with your duties and deprive the people of San Marcos the opportunity to vote on the question as to whether their public water should be fluoride-free will leave my client only with the unpleasant option of filing a lawsuit.” (FPAR, 2015a).

The following day, June 17, 2015; the City of San Marcos filed suit in district court against Communities for Thriving Water-Fluoride Free San Marcos naming Sam Brannon, Kathleen O’Connell, and Morgan Knecht as the primary defendants. The city sought to have the petition declared void for failure to comply with state and municipal law; have their municipal laws ruled constitutional and thus the City Council would not have to put the Proposition on the ballot. In addition to a declarative decision, the city was seeking to receive payment from the defendants for “reasonable attorney’s fees”. (District Court of Hays County Texas, 2015).

On August 14, 2015, Judge Bruce Boyer presiding over the 22nd District Court of the State of Texas ruled for CTW, ordering the city to count the signatures and put the measure on the ballot if the petition met numerical requirements (Anderson, 2015).

Proposition 1

For any charter amendment to be on the ballot for the November 2015 election, the City Council had to approve the measure by August 25, 2015. The Council decided to propose their version of a fluoride-related City Charter Amendment. The wording approved by City Council was: “The City of San Marcos shall not add, or direct or require its agents to add fluoride in the form of hydrofluorosilicic acid, hexafluorosilicic acid, or sodium silicofluoride to the San Marcos municipal water supply.” This amendment was considered, approved, and adopted on August 18, 2015 (City of San Marcos, 2015b).

CTW was initially hesitant to support this proposed charter amendment which would eventually become Proposition 1. CTW viewed the proposed language in the Council’s charter amendment as providing the City a loophole because it excluded their original wording about not accepting already fluoridated water. Eventually, CTW decided it was in their best interest to support Proposition 1 and began campaigning in favor of Proposition 1 (Brannon, 2016).

CTW’s decision to support Proposition 1 was made from a pragmatic point of view. Though the wording was not exactly what had been on their petition, CTW could see that their time was running short and that their appeal likely would not be resolved by the August 25 deadline. Therefore, CTW saw Proposition 1 as a foot in the door, and that a campaign in favor of Proposition 1 could lay the foundation for their future plans (Brannon, 2016).

When results from all 19 precincts were accounted for, Proposition 1 passed with 60.73% (1,814 votes) in favor, compared to 39.27% (1,173 votes) opposed. Proposition 1 went into effect on November 12, 2015. Proposition 1 also affected other municipalities along the I-35 corridor

including Kyle, Buda, Sunfield, Goforth S.U.D., and Monarch, because the San Marcos Water Treatment Plant supplies water to those communities (Bien, 2015).

Proposition 2

At the same hearing on August 18, 2015, when the City Council decided to propose the wording for Proposition 1, the Council also proposed another city charter amendment which would later become Proposition 2 on the November 2015 general elections. Proposition 2, according to the City documents from the proceedings, was on amending Section 12.11 of the city charter concerning charter amendments. Proposition 2 sought to include a cross-reference to the requirements for verification of signatures on any petition according to Section 6.03 of the San Marcos City Charter. The exact wording of the amendment is as follows; (underlined parts denote the clarifying language):

“Amendments to this charter may be framed and submitted to the voters of the city in a manner provided by state law and in compliance with the provisions of this charter pertaining to the holding of elections, including the requirements in Section 6.03 for verification of signature on any petition paper that have been continuously in effect since the adoption of the original city charter on February 24, 1967.” (City of San Marcos, 2015b)

When results from all 19 precincts were accounted for, Proposition 2 passed with 55.20% (1,565 votes) in favor, compared to 44.80% (1,270 votes) opposed (City of San Marcos, 2015a). Proposition 2, according to City of San Marcos’ official website is intended to provide clarity regarding the process for citizen-initiated charter amendments on the ballot by requiring verification of signatures (City of San Marcos, 2015b). In an interview with Sam Brannon, the primary person named in the city’s lawsuit against CTW, Brannon expressed his frustrations with the Council’s tactics. Brannon views the addition of Proposition 2 during the August 18

council hearing, as an attempt to undermine CTW's efforts to petition the city and to undermine petition efforts in general. Brannon disclosed CTW's plans to eventually challenge the legality of Proposition 2 and further expressed confidence in the legal basis of their contention on Proposition 2 (Brannon, 2016).

Chapter III: Literature Review

Chapter III Purpose

The purpose of this third chapter titled “Literature Review” is to formally discuss and solidify key concepts in relation to water fluoridation. By discussing and solidifying these concepts, it substantiates the relevance of the issues at hand and provides the basis for the ensuing operationalization of these concepts into the formal survey and interview processes. The survey and interview analyses are the subject of Chapter 5: Results, which thus informs Chapter 6: Conclusions.

This chapter is designed to formally outline each important area which has been identified through research and go item-by-item in order to prove the validity of each overarching and constituent concept. The end of this chapter formally presents the Conceptual Framework (Table 3.1).

Demographics

Demographic information is highly relevant to fluoride research, in general, and in this particular research. Proponents of fluoridation have lauded the policy as being highly cost effective, thus saving money and benefitting all people and minorities in particular. Research published by the CDC demonstrated that the annual per person cost savings resulting from fluoridation ranged from \$15.95 in small communities to \$18.62 in large communities (Griffin et. al., 2001).

In November of 2010, the CDC acknowledged that infant formula mixed with fluoridated water on a regular basis could increase the chance of a child developing dental fluorosis (CDC, 2015a). The CDC further published a National Immunization Survey (NIS) in 2012. The survey shows that minority groups, especially Blacks, are less likely to breastfeed their infants (CDC,

2012). Breast milk is naturally extremely low in fluoride content at four parts per billion (ppb) (Sener et. al., 2007). If an infant were to drink formula with fluoridated water at .7 parts per million (ppm), they would receive 175 times the fluoride dose of an infant that is breastfed.

According to a national survey conducted by the CDC published in 2005. Black children, being more likely to have been fed infant formula, have significantly higher rates of dental fluorosis than either white or Hispanic children. The CDC did not provide a conclusive reason for Black children's higher rates suggesting it could be a result of "biologic susceptibility or greater fluoride intake" (Beltran-Aguilar et al., 2005). Earlier studies had likewise confirmed the CDC's findings, most notably for this study, a fluorosis survey in various Texas communities. That study, published in 1985, showed that Black children had a higher prevalence of dental fluorosis, being 2.3 times as likely to show signs of dental fluorosis. According to the 2010 US Census, 5.5% of the citizens of San Marcos are Black (US Census Bureau, 2010).

Many prominent Black rights activists and citizens have publicly stated their stance against water fluoridation including but not limited to: Andrew Young, former Atlanta mayor and U.N. ambassador under President Bill Clinton (Young, 2011), Dr. Gerald Durley, an environmentalist and clinical psychologist (Durley, 2011); Reverend William Owens, President of the Coalition of African American Pastors (Owens, 2010); and Cheryl Carter and Clifford Walker of the Portland NAACP (Mesh, 2013). Reverend Bernice King, the daughter of Dr. Martin Luther King Jr., who also works as an attorney, stated "Water fluoridation needs to end. It is good that organizations are lending their support to help push this outdated and harmful practice of fluoridation toward collapse. This is wonderful news" (King B., 2011). Dr. Alveda King, the niece of Dr. Martin Luther King Jr., echoed Bernice King's sentiment when she expressed her disapproval of fluoridation policy in a blog post on June 22, 2011, as such:

“The Fluoridegate scandal continues to unravel. All water fluoridation legislation should be repealed in all states that enact fluoridation. Generally people with built-in biases in support of fluoridation have been controlling the discussion about harm from fluorides. The Center for Disease Control has clearly been trying to preserve fluoridation at all costs, but the facts about fluoride harm are coming out anyway.

This is a civil rights issue. No one should be subjected to drinking fluoride in their water, especially sensitive groups like kidney patients and diabetics, babies in their milk formula, or poor families that cannot afford to purchase unfluoridated water. Black and Latino families are being disproportionately harmed.” (King A., 2011).

In 2011, the League of United Latin American Citizens (LULAC) published an official resolution titled “Civil Rights Violation Regarding Forced Medication”. The LULAC resolution officially denounced the practice of water fluoridation describing it as “forced medication” which they view as a violation of their civil rights (LULAC, 2011). This resolution by LULAC, which is the oldest and largest Latino organization in the United States, founded and still headquartered in Corpus Christi, Texas, is highly relevant to this study given the large Latino population in the City of San Marcos. According to the 2010 US Census, 37.8% of the citizens of San Marcos are Latino (US Census Bureau, 2010).

Residential History

Residential history is another important type of information for the purposes of this study because of the varying fluoride policies from country to country, state to state, city to city and now before and after the passage of Proposition 1 in San Marcos, Texas. It is possible that these differing water fluoridation policies belie exposure to different information or different methods of treating perceived problems from different cultures. For example, as previously noted during the “Policy History” portion of this research, there are now over 200 different jurisdictions that have ended their water fluoridation policy (FAN, 2015).

The country of Israel was specifically discussed during the “Policy History” section, but Israel is just one of many countries that do not actively fluoridate their water supply. In 2012,

there were only 25 countries that actively pursued water fluoridation policies (BFS, 2012). In 2014, Israel effectively ended their water fluoridation program country-wide dropping the number of countries that fluoridate to 24 (Siegel-Itzkovich, 2014). 11 out of those 24 countries have less than 20% of their population consuming fluoride and another 10 out of those 24 countries have more than 50% of their population drinking fluoridated water. In 2012, an estimated 369,656,000 people in 25 countries in the world drank fluoridated water, which is only 5% of the world's population. Over half of those people are United States citizens (BFS, 2012).

Countries in the European Union by and large have rejected fluoridation. Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, and Switzerland all fluoridate 0% of their municipal water supplies (Belgium, 2000) (Finland, 2000) (France, 2000) (Germany, 1999) (Luxembourg, 2000) (Netherlands, 2000) (Northern Ireland, 2000) (Norway, 2000) (Sweden, 2000) (Czech Republic, 1999) (Austria, 2000) (Denmark, 1999). Only the Irish Republic at 73% (an estimated 3,250,000 people) Spain at 11% (an estimated 4,250,000 people), and the United Kingdom at 11% (an estimated 5,797,000 people) fluoridate any of their drinking water. In total only an estimated 13,297,000 people in Western Europe drink fluoridated water of the estimated 412,841,357 total populations which constitutes 3% of the population (BFS, 2012).

In 1999 and 2000, many of the Western European countries that fluoridate 0% of their water supply replied to inquiries from fluoride researchers in the United States. Austria for example, replied emphatically that “toxic fluoride have never been added to the water in Austria.” (Eisenhut, 2000). Other countries such as Netherlands replied in a more diplomatic tone acknowledging during the 1960s they had fluoridated their drinking water but after the Hoge Raad (Netherlands' supreme court) ruled that there was no legal basis for their fluoridation program in 1973, the issue never came up again. Wilfred Reinhold, legal advisor for the

Directorate Drinking water in Netherlands, further explained Netherlands's stance on water fluoridation by concluding his letter with "The main reason for opposition against fluoridation of drinking water (and against amendment of the law) was that fluoridation was seen as putting a medical additive into drinking water by the government 'for the benefit of the society'." (Reinhold, 2000).

Proposition 1

Proposition 1 began as a petition by the fluoride activist group Communities for Thriving Water Fluoride Free San Marcos (CTW). The original wording that CTW circulated on their petition and received 1,634 signatures which were submitted to the City Council of San Marcos on April 2, 2015, was:

"The City of San Marcos including its departments, agents and contractors shall not fluoridate the public water supply or accept any fluoridated water for use in the San Marcos water system, including but not limited to the addition of Hydrofluorosilicic Acid, Hexafluorosilicic Acid, Sodium Silicofluoride, or any other fluoride derivative. The City of San Marcos shall not purchase, install, or allow the installation of fluoridation equipment to be used in relation to the San Marcos municipal water supply or its distribution system." (CTW, 2015b).

The petition further cited the Local Government Code of Texas, specifically Section 9.004(a) which states:

"The governing body of a municipality on its own motion may submit a proposed charter amendment to the municipality's qualified voters for their approval at an election. The governing body shall submit a proposed charter amendment to the voters for their approval at an election if the submission is supported by a petition signed by a number of qualified voters of the municipality equal to at least five percent of the number of qualified voters of the municipality or 20,000, whichever number is the smaller." (State of Texas, 2016b).

CTW further cited Section 277.0024 of the Texas Election Code in their April 2, 2015, letter. According to Section 277.0024:

“If the minimum number of signatures required for a petition is determined by a computation applied to the number of registered voters of a particular territory, voters whose names appear on the list of registered voters with the notation “S”, or similar notation, shall be excluded from the computation.”. (States of Texas, 2016a).

For the 2015 San Marcos election, there were 29,307 registered voters as of October 6, 2014 and 10,039 “S” voters following Section 277.0024. You subtract the “S” voter amount from the registered voters total, which gives a total of 18,998 voters for the purposes of figuring the 5% of voters’ signatures needed for the petition. Applying 5% to the 18,998 voters gives a total of 964 signatures required for the petition to reach the ballot (CTW, 2015a).

Given that CTW submitted 1,634 signed petitions, above the 5% minimum required to reach the ballot, CTW requested the City of San Marcos include their wording on the November 2015 ballot citing Local Government Code 9.004(b) which states:

“The ordinance ordering the election shall provide for the election to be held on the first authorized uniform election date prescribed by the Election Code or on the earlier of the date of the next municipal general election or presidential general election. The election date must allow sufficient time to comply with other requirements of law and must occur on or after the 30th day after the date the ordinance is adopted.” (State of Texas, 2016b).

After CTW submitted their letter on April 2, 2015, the attorney for CTW, Brad Rockwell, sent two different letters on May 18, 2015 and June 16, 2015. The letters requested City Council to abide by the aforementioned codes cited in CTW’s April 2 letter. The letter sent by Rockwell on June 16, 2015 concluded with the language, “Your continued refusal to comply with your duties and deprive the people of San Marcos the opportunity to vote on the question as to whether their public water should be fluoride-free will leave my client only with the unpleasant option of filing a lawsuit.” (FPAR, 2015a).

The following day, the City of San Marcos, Texas filed suit against CTW naming Sam Brannon as the primary defendant. The City of San Marcos cited Section 6.03 of their city charter which states:

“Before signatures on any petition paper may be counted, one of the signers of such petition papers, a qualified voter, shall make oath or affirmation before the city clerk or any other officer competent to administer oaths or affirmation, that each signature to the paper appended is the genuine signature of the person whose name purports to be signed thereto, and that such signatures were placed thereon in that person’s presence.” (City of San Marcos, 2016).

On August 14, 2015 Judge Bruce Boyer ruled in favor of CTW issuing the following order:

“the Court will require the City of San Marcos, through its appropriate official, to review the submitted petition to ascertain if it contains the original signatures of the percentage of qualified voters required by Section 9.004(a) of the Local Government Code. The Codes do not require or prescribe a particular form of verification or affirmation, only that signatures not be copies or reproductions.” (Anderson, 2015).

The City of San Marcos immediately appealed the decision and their appeal still sits in the 3rd District Court of Appeals of the State of Texas. The City Council of San Marcos held a meeting on August 18, 2015 where they proposed Proposition 1 with their own wording stating: “The City of San Marcos shall not add, or direct or require its agents to add fluoride in the form of hydrofluorosilicic acid, hexafluorosilicic, or sodium silicofluoride to the San Marcos municipal water supply” (City of San Marcos, 2015).

The wording of Proposition 1 had a noteworthy omission of language from the original wording proposed by CTW about the city buying already fluoridated water from other sources. CTW originally was hesitant to support Proposition but eventually decided to support the measure (Brannon, 2016). On November 3rd, 2015 Proposition 1 passed with 60.73% (1,814 votes) of the vote. Proposition 1 went into effect on November 12th, 2015 (Bien, 2015).

Classification

There are various questions asked to respondents under the subsection “Classification”. The first questionnaire item in the “Classification” subsection states that most westernized countries in the world fluoridate their water supply. As previously mentioned, this is not a true statement given that only 24 countries in the world have a fluoride program of any type. Furthermore, the term “westernized” often refers to European Union countries (Siegel-Itzkovich, 2014) (BFS, 2012).

Germany, for example, does not fluoridate their water supply, and in a 1999 letter to fluoride researchers they stated: “The argumentation of the Federal Ministry of Health against a general permission of fluoridation of drinking water is problematic nature of compulsion medication and the problem of fluoride containing waste water as more than 99% of the used fluorides will get into the water.” German law, however, does permit cities to apply for an exception and use a referendum to pass a possible fluoride policy; to this point all of Germany remains non-fluoridated (Hankel-Khan, 1999).

France, also considered a “western” country, does not fluoridate their water either. In 2000, Louis Sanchez, Director of the Protection de l’Environnement agency in France, wrote in a letter to fluoride researchers stating the relevant statute and their reason for excluding fluoride. “Circulaire n 2000/166 du 28 Mars 2000” related to chemicals and other compounds used for drinking water treatments process. Fluoride chemicals are not included in the list. This is due to ethical as well as medical considerations.” (Sanchez, 2000).

As of 2012, the only country in Western Europe to fluoridate most of its water supply was the Irish Republic who fluoridated 73% of their water supply. There are only two other European Union countries that fluoridate at all, and they are the United Kingdom and Spain who

both fluoridate about 11% of their water supply. Between Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Irish Republic, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom, an estimated 13,297,000 people drank fluoridated water in 2012 out of a total population of 412,841,357 between those 18 countries. The implication is that only 3% of the population of those 18 countries drank fluoridated water in 2012, which is an extreme minority (Belgium, 2000) (Finland, 2000) (France, 2000) (Germany, 1999) (Luxembourg, 2000) (Netherlands, 2000) (Northern Ireland, 2000) (Norway, 2000) (Sweden, 2000) (Czech Republic, 1999) (Austria, 2000) (Denmark, 1999) (BFS, 2012).

The next questionnaire item in “Classification” is about the way the FDA classifies fluoride. The FDA has officially stated at least four times that they regulate fluoride compounds as drugs when they are in food and cosmetic products such as toothpaste. Most recently in 2000, the FDA replied to an inquiry from Congressman Ken Calvert, chairman of the Committee on Science and Subcommittee on Energy and Environment, “Fluoride, when used in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or animal, is a drug that is subject to Food and Drug Administration (FDA) regulation.” (FDA, 2000). If the intent of water fluoridation is to diagnose, cure, mitigate, treat or prevent dental caries for the population, then by the definition provided to Congressman Calvert by the FDA, fluoride would be subject to regulation as a drug by the FDA under the Federal Food Drug and Cosmetic Act (FDA, 2015). The FDA had made three previous statements in 1990, 1967, and 1963 which echoed their 2000 statement to Congressman Calvert. In a 1990 letter to Senator John Heinz of Pennsylvania, the FDA stated “contradictory results did not justify a classification of fluorine as an essential element, according to accepted standards. Nonetheless, because of its valuable effects on dental health, fluorine is a beneficial element for humans. In summary, FDA does not list fluoride as an essential nutrient.” (FDA, 1990).

In a short reply letter in March of 1967, the FDA replied to a question regarding fluoride. “Your question: ‘The United States Food and Drug Administration says that sodium fluoride is necessary for health. Correct?’ The answer is ‘No.’” (FDA, 1967). In 1963, FDA made possibly their most clear declaration on fluoride regulation, in reply to questions about sodium fluoride.

- “1. Sodium fluoride used for therapeutic effect would be a drug, not a mineral nutrient.
2. Fluoride has not been determined essential to human nutrition.
3. A minimum daily requirement for sodium fluoride has not been established.
4. There can be dangers in the use of almost any substance, even water or table salt.
5. Above 2 milligrams per day of total intake of fluorides can cause tooth mottling in sensitive persons. It would be impossible to state a safe amount for supplementation by an individual without knowledge of the amount of fluorides already being consumed by him from such sources as drinking water and food grown in soils that are rich in fluorides.” (FDA, 1963).

The third questionnaire item of the “Classification” subsection is about expert opinions of fluoridation and whether experts agree in regard to benefits and risks of water fluoridation. The 2006 report by the National Research Council (NRC) was a significant report which shows there has been quite a bit of disagreement among health experts. The NRC’s 450-page report covered a wide range of fluoride-related topics including brain effects, endocrine system effects, thyroid gland effects, pineal gland effects, reproductive system effects, immune system, among many others (NRC, 2006).

On the topic of brain effects, the NRC’s report on page 222 stated “On the basis of information largely derived from histological, chemical and molecular studies, it is apparent that fluorides have the ability to interfere with the functions of the brain and the body by direct and indirect means.”. The NRC further made statements about a gland found in the middle of the brain known as the pineal gland. “The single animal study of pineal function indicates that fluoride exposure results in altered melatonin production and altered timing of sexual maturity

(Table 8-1). Whether fluoride affects pineal function in humans remains to be demonstrated.” (NRC, 2006).

The NRC further commented on endocrine studies that had been conducted from 1993-2003 stating their interpretation of the evidence of fluoride’s relation to the endocrine system on page 266 of their report.

“In summary, evidence of several types indicates that fluoride affects normal endocrine function or response; the effects of the fluoride-induced changes vary in degree and kind in different individuals. Fluoride is therefore an endocrine disruptor in the broad sense of altering normal endocrine function or response, although probably not in the sense of mimicking a normal hormone.” (NRC, 2006).

One of the most important glands in the endocrine system is the thyroid gland which regulates the body’s metabolism among other important functions of the thyroid. The NRC’s report expressed concern that fluoride could potentially have negative effects on the thyroid gland, especially if iodine intake was insufficient. On page 262-263 of their report “In humans, effects on thyroid function were associated with fluoride exposures of .05-.013 mg/kg/day when iodine intake was adequate and .01-.03 mg/kg/day when iodine intake was inadequate.” (NRC, 2006).

In page 303 of the NRC’s report, the scientists expressed concerns on the effects of fluoride on the immune system specifically of individuals who have an already compromised immune system. “In addition, studies could be conducted to determine what percentage of immunocompromised subjects have adverse reactions when exposed to fluoride in the range of 1-4 mg/L in drinking water.”. Very early in the report, on page 8, the scientist also express concern on the effects fluoride could potentially have on the reproductive system. “A few human studies suggested that high concentrations of fluoride exposure might be associated with

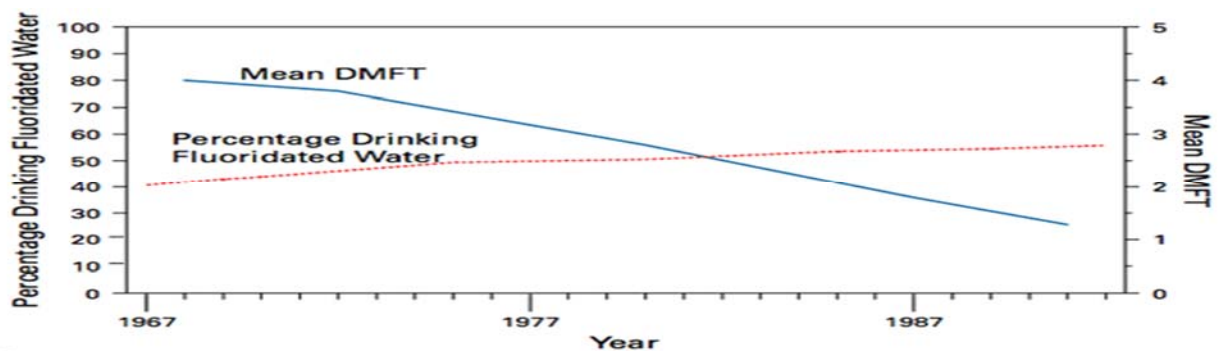
alteration in reproductive hormones, effects on fertility, and development outcomes, but design limitations make those studies insufficient for risk evaluation.” (NRC, 2006).

Benefits

In 1999, the CDC acclaimed water fluoridation as one of the ten great public health achievements of the 20th century. According to the CDC, early studies reported that tooth decay reduction attributed to water fluoridation ranged from 50% to 70%. By the mid-1980s, the tooth decay rate decrease was 18% lower than individuals living in communities without water fluoridation (see Figure 3.1). A review of studies on the effectiveness of water fluoridation conducted from 1979-1989 in the United States found that tooth decay decline was 8%-37% with a mean of 26.5% among adolescents. The CDC further states that water fluoridation reduces tooth decay by 20%-40% among adults (CDC, 1999).

Figure 3.1

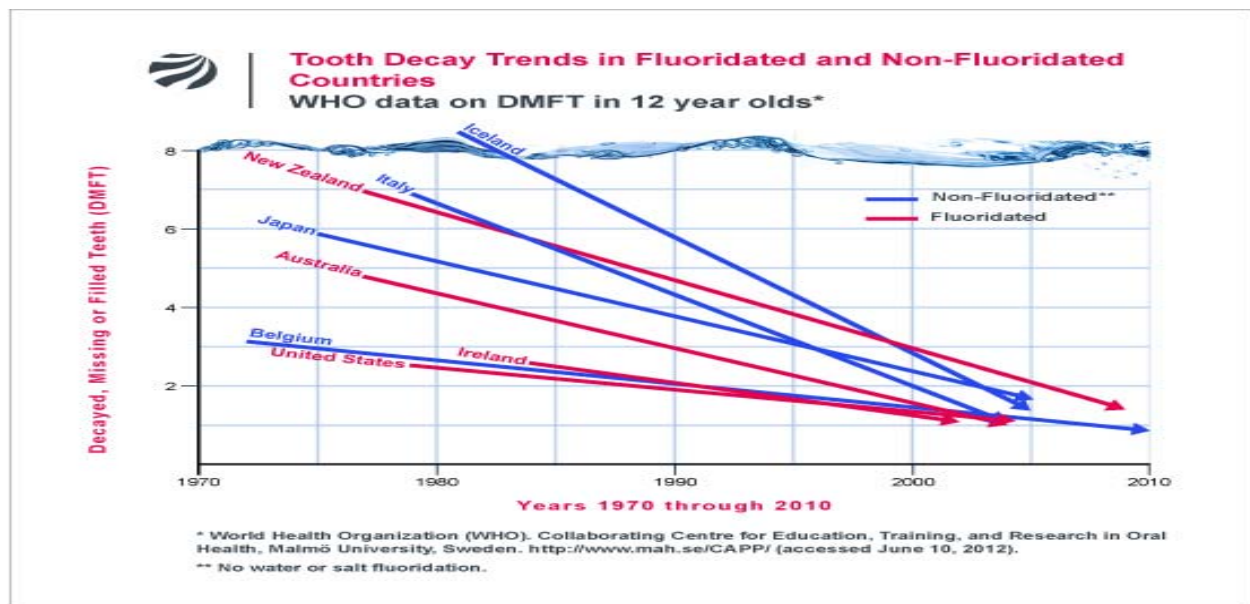
SOURCE: Centers for Disease Control. 1999. Achievements in Public Health, 1900-1999: Fluoridation of Drinking Water to Prevent Dental Caries. MMWR 48:933-40.
http://www.fluoridealert.org/uploads/cdc1999_figure.gif



Critics of water fluoridation refute the CDC's claims by citing research by the World Health Organization (WHO) that shows tooth decay rates from countries all around the world have declining rates of tooth decay including countries that do not fluoridate any of their water supply such as Iceland (see Figure 3.2).

Figure 3.2

Fluoride Action Network (FAN). 2012b. "Tooth Decay". <http://fluoridealert.org/issues/caries/who-data/>



Water fluoridation, when it began in the 1940s, was believed by dentists to be primarily beneficial when swallowed during childhood. When swallowed by children before their adult teeth erupted, dentists believed fluoride would build up in the internal matrix of the teeth, incorporating fluoride and then making the teeth permanently more resistant to cavities and all forms of tooth decay. In 2004, Danish scientist Ole Fejerskov posited his hypothesis as such:

“The hypothesis was that increased intake of fluoride during tooth formation raises the fluoride concentration in enamel and hence increases acid resistance. As a consequence fluoride had to be taken systemically and artificial fluoridation of drinking water became the ‘optimal’ solution.”. (Fejerskov, 2004).

In 1999, when the CDC released water fluoridation as part of their ten greatest public health achievements in the 20th century, the CDC acknowledged that “laboratory and epidemiologic research suggests that fluoride prevents dental caries predominately after eruption of the tooth into the mouth, and its actions primarily are topical for both adults and children.”. The CDC further acknowledged three primary mechanisms of topical fluoride application including, preventing demineralization, inhibition of bacterial activity in dental plaque, and enhancement of remineralization (CDC, 1999). It is worth noting that all of those mechanisms of benefit can be achieved without swallowing fluoride systemically. The CDC reaffirmed their position on fluoride benefits being topical in 2001 stating “fluoride’s predominant effect is posteruptive and topical” (CDC, 2001).

Dr. Arvid Carlsson, winner of the Nobel Prize in Medicine or Physiology (Nobel Media, 2014a), in an October 2005 interview, stated that fluorides have the ability to protect against tooth decay but states the effects is local or topical. A "local or topical" effect means that fluoride is effective in preventing tooth decay by applying to the teeth then spitting it out. “Fluoride has a protecting action against caries but this is a local effect...If you drink it, you are running the risk of all kinds of toxic actions.” Dr. Carlsson later in the interview stated, “I see no reason at all for giving it in any other way than locally – topically, if you wish.” (Carlsson, 2005).

Risks

Critics of water fluoridation cite various risks associated with the systemic consumption as a result of water fluoridation. The key for this subsection is to review the literature to assess if these concerns are rooted in the scholarly literature, then to compare the literature with the results of the survey to see if residents of San Marcos are adequately aware of any possible risk associated with water fluoridation. One of the primary concerns critics of water fluoridation reference is reduced Intelligence Quotient (IQ) among children.

Since 1991, there have been 50 different studies that have shown a negative association between fluoride exposure and IQs of children (FAN, 2016c). In March of 2016 a study was published titled, “Dental fluorosis and urinary fluoride concentration as a reflection of fluoride exposure and its impact on IQ level and BMI of children of Laxmisagar, Simlapal Block of Bankura District, W.B., India.”. The results of this study concluded:

“Children residing in areas with higher than normal water fluoride level demonstrated more impaired development of intelligence and moderate [dental fluorosis]. Millions of children including adults around the world are affected by higher level of fluoride concentration through their drinking water and are therefore potentially at risk. It is concluded that for the benefit of the future generation, urgent attention should be paid on this substantial public health problem.” (Das & Mondal, 2016).

This particular study is highly relevant to water fluoridation in the United States given that the average fluoride levels of the study were 2.1 ppm which is much less than the 4 ppm that the EPA has regulated as the MCL for fluoride since 1985 (EPA, 1985).

Other IQ studies since 1991 have reached similar conclusions as the study conducted by Dr. Das (FAN, 2016c). Other studies such as the study conducted by Phillipe Grandjean and Anna Choi in 2012 summarizing the finding of 27 different fluoride studies dealing with the IQ

and found that all but one of the 27 studies showed an IQ deficit associated with increased fluoride research (Grandjean et al., 2012). This study, originally published by Harvard University, has received intense criticisms from water fluoridation promoters. Criticisms have included the difference in location and difference in fluoride levels in water. On September 11, 2012, Grandjean released a statement about the study; they acknowledged the limitations of their meta-analysis stating:

“These results do not allow us to make any judgment regarding possible levels of risk at levels of exposure typical for water fluoridation in the U.S. On the other hand, neither can it be concluded that no risk is present. We therefore recommend further research to clarify what role fluoride exposure levels may play in possible adverse effects on brain development, so that future risk assessments can properly take into regard this possible hazard.” (Grandjean et. al., 2012).

The researchers refused to completely dismiss their findings asserting that further research was warranted and that the level of intake needed to be the primary measure of fluoride exposure.

It is possible that a contributing factor to the results in the 50 IQ studies could have to do with fluoride's impact on the pineal gland. The pineal gland is found in the center of the brain between the two brain hemispheres (Bowen, 2003). Philosopher Rene Descartes called the pineal gland the “seat of the soul” (SEP, 2013). The pineal gland is further responsible for the synthesis and secretion of melatonin into the brain and body (Macchi & Bruce, 2004).

In 1997, researcher Jennifer Luke, found that fluoride reduced melatonin levels and shortened the time for research animals to reach puberty (Luke, 1997). In 2006, the NRC corroborated Luke’s findings stating on page 256 of their report that “fluoride is likely to cause

decreased melatonin production and to have other effects on normal pineal function, which in turn could contribute to a variety of effects in humans” (NRC, 2006).

In 2001, further research conducted by Luke concluded that fluoride accumulates at its highest rates in the pineal gland at a highly statistically significant rate ($p < .001$) as compared to muscle fluoride calcification. Luke presented her conclusion as such:

“In conclusion, this study presented evidence that fluoride readily accumulates in the aged pineal. Fluoride may also accumulate in a child’s pineal because significant amounts of calcification have been demonstrated in the pineals from young children [Cooper, 1932; Wurtman, 1968; Kerényi and Sarkar, 1968; Tapp and Huxley, 1971; Daskal, 1984].” (Luke, 2001).

In 2006, when the NRC made their recommendations on water fluoridations one of the areas they discussed was in regard to diabetes. “The conclusion from the available studies is that sufficient fluoride exposure appears to bring about increases in blood glucose or impaired glucose tolerance in some individuals and to increase the severity of some types of diabetes.” (NRC, 2006). If fluoride does cause difficulty with the body’s ability to synthesize glucose, these difficulties can contribute to a variety of health effects including kidney damage (Triplitt, 2012).

A study from China published in 2000, and translated into English in 2011, found high rates of glucose intolerance and diabetes among individuals living in a high-fluoride (8 ppm) area (Xie & Du, 2011). Furthermore, diabetics are more likely to consume more water therefore they are considered to be a “sensitive subpopulation”. Furthermore, research has found that diabetics have a reduced capacity to clear fluoride from the body, (Hanhijarvi, 1975) which may be a result of the kidney damage that can accompany diabetes. As noted in one review, “subjects with nephropathic diabetes can exhibit a polydipsia-polyurea syndrome that results in increased

intake of fluoride, along with greater-than-normal retention of a given fluoride dosage.” (Rose & Marier, 1977).

As with diabetes mellitus (type 2), those with uncontrolled diabetes insipidus (type 1) drink excessive amounts of water (NIH, 2015). Researchers have observed moderate and severe dental fluorosis in people with hereditary diabetes insipidus (type 1), a result of drinking “optimally” fluoridated water (1 ppm) during tooth development (Seow & Thomsett, 1994). Thus far, no studies have been conducted to determine if diabetics have an elevated risk for dental fluorosis.

Over the last century exposure to fluoride compounds has also been shown in animal studies and human studies of high fluoride exposure human studies to disproportionately affect the kidney (Varner et al., 1998). In 2006, a study was done by an endocrinologist in Bangalore, Dr. C.V. Harinarayan. The study titled “Fluorotoxic metabolic bone disease: an osteo-renal syndrome caused by excess fluoride ingestion in the tropics” concluded that:

“Evidence of chronic fluoride intoxication, associated with renal tubular dysfunction in the group of FMBD patients, brings to focus the possibility that fluoride toxicity may be responsible for both bone and kidney disease in FMBD... Evidence is available in the literature to support our observation of fluoride-induced renal damage.” (Harinarayan et al., 2006)

The kidney has been a focus of fluoride research since it has been the highest soft-tissue organ aside from the pineal gland where fluoride concentration has been shown to accumulate at the highest rates. Since 1937, there have been 21 different studies that have linked kidney impairment with fluoride (FAN, 2012a).

The last risk associated with water fluoridation that is a topic of discussion in this research is the association or lack thereof, between fluoride and Osteosarcoma, a rare type of

bone cancer. Osteosarcoma is a type of bone cancer that disproportionately affects males in certain windows of development during younger ages (NIH, 2016). Research on the relationship between Osteosarcoma and fluoride exposure dates back to 1977 when the National Toxicology Program (NTP) conducted animal research at the behest of the U.S. Congress titled “Drinking Water and Health”. The report found that there was 13.5% incidence rate of bone defects in fluoridated communities as compared to 7.5% rate of bone defects in non-fluoridated communities (NTP, 1977).

In 2001, Harvard University student Elise Bassin, completed a doctoral thesis which analyzed information that was originally released in 1995 (McGuire et al., 1995). Bassin’s analysis found a statistically significant relationship between consumption of fluoridated water during the mid-childhood growth spurt (6-8 years old) and Osteosarcoma among the group most likely to be diagnosed with Osteosarcoma, boys under the age of 20 years old. “For males, the odds ratio for the high exposure group was 7.20 at 7 years of age with a 95 percent confidence interval of 1.73 to 30.01... All of our models are remarkably robust in showing this effect during the mid-childhood growth spurt, which, for boys, occurs at ages seven and eight years.” (Bassin et. al., 2006).

Dr. Bassin’s study quickly found itself ensnared in an intense controversy which is discussed in detail in the subsection titled “Information Disclosure”. After the controversy had come to a close, the medical journal titled “Cancer Causes & Control” published a study based on Dr. Bassin’s research titled “Age-specific fluoride exposure in drinking water and osteosarcoma (United States).” The publication concluded with:

“We observed that for males diagnosed before the age of 20 years, fluoride level in drinking water during growth was associated with an increased risk of osteosarcoma, demonstrating a peak in the odds ratios from 6 to 8 years of age. All of our models were

remarkably robust in showing this effect, which coincides with the mid-childhood growth spurt.” (Bassin et. al., 2006).

In the same publication, Dr. Chester Douglass published a letter titled “Caution needed in fluoride osteosarcoma study.” The letter warns readers not to take the implications of Dr. Bassin's study too far and further adds his intentions to conduct further research which will disprove the analysis provided by Dr. Bassin.

“A parallel analysis of age-specific exposure to fluoride, especially during growth periods, is also being pursued by our study team in the second set of cases of our study. Accordingly, readers are cautioned not to generalize and over-interpret the results of the Bassin et al. paper and to await the publications from the full study, before making conclusions, and especially before influencing any related policy decisions.” (Douglass & Joshipura, 2006).

In 2011, Dr. Douglass published the study he had promised in the 2006 letter which accompanied Dr. Bassin’s publication in “Cancer Causes & Control”. In July of 2011, a PDF was published online by Des Moines Water Works, which directly answered some of the questions which surrounded Dr. Douglass 2011 study. The final question of the PDF concluded by asking “...why should we take this new study seriously?” The reply to the above question concludes by saying “...The sound design of this study and quality of the analysis speaks for themselves.”. (Des Moines Water Works, 2011).

Incidentally the primary detractors of the 2011 Douglass’ study titled “An Assessment of Bone Fluoride and Osteosarcoma” are the questionable design restrictions inherent in the study (Kim et al., 2011). Dr. Douglass’ 2011 study only had 20 subjects under the age of 30 years old which was only of a fifth of the subjects under 30 in Dr. Bassin’s study. Given that the most noteworthy finding in Dr. Bassin’s was the windows of opportunity for Osteosarcoma

being between ages 6-8 and 14-16 years old (Bassin et al., 2006). Dr. Douglass' 2011 results do little to either contribute or refute those particular findings by Dr. Bassin's analysis.

Furthermore, Dr. Douglass chose to use patients with other forms of bone cancer as the control group in his analysis, if fluoride were to also be a cause of those other forms of bone cancer it could offset any results or differences between the study and control group. The final major weakness of Dr. Douglass' is that the cases were severely mismatched concerning age. The median age of the control group was 41 years compared to 18 years old for the study cases (Kim et al., 2011). Again, Dr. Bassin's most significant finding was the window of opportunity associated with Osteosarcoma (Bassin et al., 2006).

Given that it is known that fluoride accumulates in the bone over years of exposure (Bassin et al., 2006), it is highly questionable to use a control group that is twice the age. It is possible that the control group would have twice the fluoride exposure and accumulation in their bone as compared to the study group. Dr. Douglass and his colleagues who authored the study admitted to the statistically significant difference in age ($p < .001$) of the control group as compared to study group (Kim et al., 2011), as well as the possibility of flaws with their measure of fluoride exposure being lifetime exposure as opposed to focusing on specific windows of opportunity as was recommended by Dr. Bassin's study (Bassin et al., 2006).

Medical Ethics

The subsection "Medical Ethics" has four different questionnaire items. These items are designed to gauge respondent's perception of water fluoridation policy; specifically, regarding their personal rights in receiving fluoridated drinking water, how much they consume daily and whether fluoride affects people equally (Sandman, 1989). The questionnaire items posted in the

operationalization table were informed by past studies which focused on the ethical issues concerning water fluoridation (Armfield, 2009).

The official reason for water fluoridation put forth by the Center for Disease Control (CDC) is that fluoride reduces and prevents tooth decay while promoting overall dental health and saving money for families and the health care system overall. On June 8, 2015, the CDC released a formal statement in support of water fluoridation. “Tooth decay and its complications are preventable, and several preventive and early treatment options are safe, effective, and economical. The CDC leads national efforts to improve oral health by using proven strategies such as community water fluoridation and school-based dental sealant programs that prevent oral diseases.” In a separate part of the statement, the CDC stated: “In 2012, more than 210 million people, or 74.6% of the U.S. population served by public water supplies, drank water with optimal fluoride levels to prevent tooth decay.” (CDC, 2015b).

The American College of Preventive Medicine defines preventive medicine. “Preventive Medicine focuses on the health of individuals, communities, and defined populations. Its goal is to protect, promote, and maintain health and well-being and to prevent disease disability, and death.” (ACPM, 2016). Given that it has been established that the FDA considers fluoride compounds to be drugs (FDA, 2000), combined with The American College of Preventive Medicine’s definition of preventive medicine and the CDC’s description of water fluoridation (CDC, 2015b); by deduction, it logically follows that fluoridation of public water supplies is a form of preventative medicine.

Water fluoridation by definition being preventive medicine it then logically follows that the practice is subject to standard pharmacological practice such as informed consent. Informed consent is defined by the National Institutes of Health as:

- “You are informed: you have received information about your health condition and treatment options.
- You understand your health condition and treatment options.
- You are able to decide what health care treatment you want to receive and give your consent to receive it.

To obtain your informed consent, your health care provider may talk with you about the treatment. Then you will read a description of it and sign a form. This is written informed consent.

Or, your health care provider may explain a treatment to you. They will ask if you agree to have the treatment. Not all medical treatments require written informed consent.” (NIH, 2014a).

It could be argued, however, that water fluoridation does not merit a written informed consent waiver in all cases. However, for individuals that are particularly sensitive to fluoride exposure such as dialysis patients and infants, some form of informed consent whether written or oral would be necessary, as is the case with fluoridated toothpaste (see Figure 2.1). Water fluoridation hits a major problem with informed consent when one considers the fact that these policies are put forth by politicians, by definition, politicians are unable to provide anyone informed consent unless they are licensed health care providers. Informed consent is a major legal issue regarding medical treatment, and the failure to provide informed consent leads to many lawsuits on a yearly basis (NIH, 2014a).

On October 5, 2005, Dr. Arvid Carlsson, winner of the 2000 Nobel Prize in Medicine or Physiology, spoke in an interview about water fluoridation. Dr. Carlsson was a major force behind the Swedish decision not to pass a country-wide fluoridation policy. Speaking of the ethics underpinning water fluoridation policy Dr. Carlsson said, “this is against all principles of modern pharmacology. It’s really obsolete, I mean, I think those nations that are using it should feel ashamed of themselves. It’s against science.”. Another important excerpt of the interview with Dr. Carlsson, which informs the rest of the discussion on medical ethics regarding water fluoridation.

“In modern pharmacology it’s so clear that even if you have a fixed dose of drug, the individuals respond very differently to one and the same dose. Now, in this case, you have it in the water and people are drinking different amounts of water. So you have huge variations in the consumption of this drug. So it’s against all modern principles of pharmacology. It’s obsolete...” (Carlsson, 2005).

Dr. Carlsson’s comments on fixed dose and variation in consumption are highly relevant to this discussion of medical ethics. One of the primary reasons for the importance of people receiving informed consent for medical treatment is it allows a licensed professional to evaluate the individual’s state of health. By assessing the individual’s health and physical attributes such as weight, the physician can then determine their possible need for a medication to correct the individual's medical condition (NIH, 2014a). These considerations weighed into the optimal range recommendation made by the EPA of .7-1.2 ppm of fluoride. They recommended .7 ppm for places that have hotter weather under the assumption that people in those locations would be more likely to drink larger quantities of water, thus by accumulation possibly consuming more fluoride in an average day.

The recommendations by the EPA still fail to meet pharmacological practice because there will be differences from person to person on the amount of water they will drink on a given day, regardless of where they live. Furthermore, weight is a significant factor regarding dosage; in fact, the standard for dosage is milligrams per kilogram per day (mg/kg/day). Therefore, if a 6’ 9” 136.2-kg man drank 32-ounces of fluoridated water at .7 ppm and a 5’00” 45.4-kg woman also drank 32-ounces of fluoridated water at .7 ppm; both individuals would receive the same amount of fluoride measured in milligrams. However, in term of mg/kg/day, the woman would be given a dosage three times higher than the much larger man (NIH, 2014a).

In 1993, Dr. Bruce Spittle published a study titled, “Allergy and Hypersensitivity to Fluoride” Dr. Spittle reviewed four different fluoride allergen reports. The reports had previously found that the evidence of fluoride being an allergen was unconvincing. After consideration of the reports, Dr. Spittle interpreted the results as: “It is concluded that the four reviews were seriously incomplete in their coverage of the literature and that when a more complete examination is made there are reasonable grounds for concluding that there are individuals in whom allergy or hypersensitivity to fluoride has been demonstrated. The sources of fluoride included those used in fluoridation of community water supplies.” (Spittle, 1993).

Many individuals would take exception to this study and suggest that people are having a psychosomatacal response to fluoride (Patient, 2016). Regardless, if there are people who are diagnosable as fluoride hypersensitive or allergic to fluoride; it is well established that there is always individual variability in response to any drug or medication. Therefore, the precautionary principle would likely come into play; the precautionary principle in regards to this situation would suggest that fluoride has to be proven safe for all people regardless of their individual health condition (Geiser, 1999).

Information Disclosure

Information disclosure is an important topic concerning water fluoridation. Many skeptics of water fluoridation policy claim that government agencies have either refused to acknowledge or obscured studies which contradict government agency’s stance on water fluoridation. The result of one study which lends itself to skeptics’ claim is a study performed by the National Toxicology Program (NTP) in 1990 (NTP, 1990).

The results of NTP’s study were released in full, and in the literature, the results were discussed in detail. The problem arises in the way public health officials marginalized the results

of the study. The results of NTP's study showed "equivocal evidence of carcinogenic activity" of sodium fluoride in a subsection of young male rats. Their "equivocal evidence" means that results were uncertain (NTP, 1990). However, the form of cancer they were researching, known as Osteosarcoma, is a very rare form of bone cancer (NIH, 2016). Furthermore, Osteosarcoma is a kind of cancer known to disproportionately affect males, specifically young males, during growth spurts (Bassin et al., 2006). Given that information, the results of NTP's research become much more significant and worthy of further investigation and consideration from public health officials.

Another instance of suppression of fluoride research relates to the aforementioned research conducted by Dr. Elise Bassin for her doctoral thesis in 2001. The National Institute of Environmental Health Sciences (NIEHS) funded \$1,300,000 to the original data collection efforts of Dr. Bassin's research (Thompson, 2006). In 2005, The Washington Post published a story titled "Professor at Harvard is being Investigated". The story focused on Dr. Chester Douglass who supervised Dr. Bassin's research. Dr. Douglass reported to federal officials no significant correlation between fluoridated water and Osteosarcoma. Dr. Douglass's report directly contradicted the results that Dr. Bassin had reported in her thesis, that boys exposed to fluoridated water at a young age and during a specific time in development were more likely to be diagnosed with Osteosarcoma (Eilperin, 2005).

The controversy takes on further implication given that Dr. Douglass served at the time of his report as the editor-in-chief for the industry-funded Colgate Oral Care Report, who produces fluoridated products such as toothpaste and mouth rinses. The Environmental Working Group (EWG), urged federal officials in June 2005 to explore whether Dr. Douglass had skewed his 2004 report to NIEHS to downplay possible risks of water fluoridation (Eilperin, 2005). The

EWG further stated that Dr. Douglass' role as editor of the Colgate Oral Care Report "creates the appearance of a conflict of interest." (EWG, 2005).

In August of 2006, The Harvard Medical School and School of Dental Medicine (HSDM) released their review of Dr. Douglass. HSDM concluded that Dr. Douglass "did not intentionally omit, misrepresent, or suppress research findings of a graduate student surrounding federal grant work looking at potential links between fluoride in drinking water and osteosarcoma." Furthermore, the HSDM "found that Douglass's editorship of the newsletter did not constitute a conflict of interest under school and federal guidelines." (HMSOPA, 2006). A group of alumni later sent a letter to HSDM on August 22, 2006, asking the HSDM to explain further how they reached their conclusions on the investigation of Dr. Douglass (Burgstahler, 2006). HSDM replied on September 16, 2006, declining to go into further detail, "as set forth in our detailed procedures, reviews of allegations of scientific misconduct are confidential, and thus I cannot share further details with you." (Bok, 2006).

In respect to the City of San Marcos, when they were fluoridating drinking water, they provided a PDF on their website (which can still be found with a search engine) titled "City of San Marcos Fluoride Facts." The PDF contains relevant information such as what type of fluoride the city used (hydrofluorosilicic acid), the fluoride level (.7 ppm), price estimations, benefits, endorsements, and risks. The PDF also directed to other sources of fluoride information such as the CDC, American Dental Association (ADA), and the Texas Health Services website for their views on fluoridation policy (City of San Marcos, 2013).

Government Responsiveness

Government responsiveness is another highly important issue in regard to water fluoridation policy. This question has the potential to give city officials of San Marcos feedback

in terms of the perception of their engagement with the city since the discontinuation of adding fluoride to the municipal water. The results of this questionnaire item can inform the city on how to engage the public in the future (Armfield, 2009).

On June 22, 2011, Dr. Alveda King, Dr. Martin Luther King Jr.'s niece, wrote in a post on her blog her overall disapproval of fluoridation policy. One key point she made during her post concerned the CDC's handling of fluoridation policy. "The Centers for Disease Control has clearly been trying to preserve fluoridation at all costs, but the facts about fluoride harm are coming out anyway." (King A. 2011). In defense of the CDC, they do have multiple web pages dedicated to disclosing fluoridation information, including information about dental fluorosis and potential dangers posed by fluoridation (CDC, 2014).

The San Antonio Water System (SAWS) for example, has a whole page dedicated to answering frequently asked questions about fluoride. The website titled "Fluoride" answers eight different questions about fluoride policy in San Antonio. The questions are: Does everyone in San Antonio receive fluoridate water?; When did fluoridation of San Antonio's water supply begin?; What form of fluoride is added to our water?; How is fluoride added to the water?; What is the concentration of fluoride?; How much does it cost to fluoridate our water?; How can I be sure that the level of fluoride in my water is safe?; If I don't want fluoride in my water, how can I remove it? The author of the website goes on to answer each question in detail (SAWS, 2016).

Given the legal battle the City of San Marcos engaged CTW in during their efforts to get their original charter amendment onto the ballot; it is safe to assume CTW does not see the responsiveness of the San Marcos government in a positive manner (District Court of Hays County, 2015). Sam Brannon, who was the primary defendant named in the city's lawsuit, described working with the city on the fluoridation in an article ran by the Texas State University

Star newspaper. “The city’s behavior so far has been one of resistance.” (De Leon, 2015). Frank Arredondo, who is the former Mayor of San Marcos and was running for Place 5 on the City Council in the November 2015 election, spoke with the University Star before the election. Arredondo expressed his expectations that the fluoride proposition would fail (Arguello, 2015). Arredondo did not win election to Place 5 on the San Marcos City Council, losing to Scott Gregson who received 62.59% of the vote (City of San Marcos, 2015a).

Since Proposition 1, passed the City of San Marcos has actively informed citizens of the changes of policy. The city officially acknowledged that water fluoridation ceased on November 12, 2015, through multiple outlets including their website. At the beginning of February 2016 which they consider “Children’s Dental Health Month,” the city posted on their website information on their website again acknowledging the changes in water fluoridation policy. The primary intent of the notification was to promote the use of fluoride toothpaste to promote children’s dental health (City of San Marcos, 2016a). CTW recommends the city go beyond acknowledging the cessation of adding fluoride to actively promote San Marcos as a “clean water city” (Brannon, 2016). The complete conceptual framework table (Table 3.1) is presented on the following two pages.

Conceptual Framework

Table 3.1: Conceptual Framework	
<p>Title: <i>Fluorosis Neurosis: Describing the Attitudes of Residents of San Marcos on the New Water Fluoridation Policy.</i></p> <p>Purpose: This study will describe the perceptions of San Marcos residents, regarding the newly developed water fluoridation policy in the City of San Marcos.</p>	
Category	Supporting Literature
1. Personal Background Characteristics	
1.1 Demographics	United States Census Bureau, 2015; LULAC 2011; Dr. Alveda King, 2011; Griffin et. al., 2001; Center for Disease Control, 2015a; Center for Disease Control, 2012; Sener et. al., 2007; Beltram-Aguilar et. al., 2005; United States Census Bureau, 2010; King B., 2011; Mesh, 2013; Durley, 2011; Owens, 2010; Young, 2011
1.2 Residential History	Fluoride Action Network, 2015; British Fluoridation Society, 2012; Siegel-Itzkovich, 2014; Eisenhut, 2000; Reinhold, 2000 Belgium, 2000; Finland, 2000; France, 2000; Germany, 1999; Luxembourg, 2000; Netherlands, 2000; Northern Ireland, 2000; Norway, 2000; Sweden, 2000; Czech Republic, 1999; Austria, 2000; Denmark, 1999
2. Policy/Procedural Awareness	
2.1 Proposition 1	<i>Communities for Thriving Water Fluoride Free San Marcos, 2015b; Communities for Thriving Water Fluoride Free San Marcos, 2015a; State of Texas, 2016a; State of Texas, 2016b; Frederick, Perales, Allmon & Rockwell, P.C. Attorneys at Law; City of San Marcos, Texas Proposition 1, 2015; Brannon, 2016; Bien, 2015</i>
2.2 Classification	Siegel-Itzkovich, 2014; Hankel-Khan, 1999; Sanchez 2000; British Fluoridation Society, 2012; U.S. Food and Drug Administration 1990; U.S. Food and Drug Administration, 2000; U.S. Food and Drug Administration 2015; U.S. Food and Drug Administration 1967; U.S. Food and Drug Administration, 1963; National Research Council, 2006; Belgium, 2000; Finland, 2000; France, 2000; Germany, 1999; Luxembourg, 2000; Netherlands, 2000; Northern Ireland, 2000; Norway, 2000; Sweden, 2000; Czech Republic, 1999; Austria, 2000; Denmark, 1999

3. Health Perceptions	
3.1 Benefits	Center for Disease Control, 1999; Fluoride Action Network, 2012b; Fejerskov, 2004; Center for Disease Control, 2001; Nobel Media, 2014a; Carlsson, 2005
3.2 Risks	Fluoride Action Network, 2016c; Das & Mondal, 2016; Environmental Protection Agency, 1985; Grandjean et. al., 2012; Bowen, 2003; Stanford Encyclopedia of Philosophy, 2013; Macchi & Bruce, 2004; Luke, 1997; National Research Council, 2006; Luke, 2001; Triplitt, 2012; Xie & Du, 2011; Hanhijarvi, 1975; Rose & Marier, 1977; National Institutes of Health, 2015; Seoy & Thomsett, 1994; Varner et. al., 1998; Harinarayan et. al., 2006; Fluoride Action Network, 2012a; National Institutes of Health, 2016; National Toxicology Program, 1977, McGuire et. al., 1995; Bassin et. al., 2006; Douglass & Joshipura, 2006; Des Moines Water Works, 2011; Kim et. al., 2011
4. Pharmacological Practice	
4.1 Medical Ethics	Armfield, 2009; Center for Disease Control, 2015b; American College of Preventive Medicine, 2016; Food and Drug Administration, 2000; Center for Disease Control, 2015b; National Institutes of Health, 2014a; National Institutes of Health, 2014a; Carlsson, 2005; Spittle, 1993; Geiser, 1999
5. Transparency	
5.1 Information Disclosure	NTP, 1990; Bassin, 2006; National Institutes of Health 2016; Bassin et. al., 2006; Thompson, 2006; Eilperin, 2005; Environmental Working Group, 2005; Harvard Medical School Office of Public Affairs, 2006; Burgstahler, 2006; Bok, 2006; City of San Marcos, 2013
5.2 Government Responsiveness	Armfield, 2009; Brannon, 2016; King A., 2011; SAWS, 2016; Center for Disease Control, 2014; City of San Marcos, 2016a; City of San Marcos, 2015a; Arguello, 2015; De Leon, 2015

Chapter IV: Methods

Chapter IV Purpose

This chapter discusses details associated with design and methods used in this research. This study used a multi-method approach, i.e. surveys and interviews, to collect data from different stakeholders related to water fluoridation in San Marcos, Texas. This chapter is organized such that details related to the survey method are presented first, followed by details related to the interview method. This chapter concludes with a discussion of Institutional Review Board exemption and human subject protection.

Survey Research Setting and Participants

The primary objective of this study was to describe the perceptions of different stakeholders associated with water fluoridation in San Marcos, Texas. Since students of Texas State University are important constituents of the city, a survey was administered to a sample of students. The survey was formulated to elicit their opinion on various aspects of the water fluoridation issue such as implementation and effects of the new water fluoridation policy in San Marcos. Some items for the survey were drawn from existing literature (see for example, Q22). Other items were formulated by the researcher.

The survey was then disseminated to a random sample of 3,800 Texas State University students which consisted of full-time undergraduate and graduate students attending classes at the San Marcos, and Round Rock campuses or online classes in Spring 2017. The survey was distributed to a sample of the constituent population abiding by Texas State University's policy which governs large-scale survey activity. Texas State's administrative survey policy prohibits researchers from sending survey invitations to the entire student body or a significant portion of the students without review and approval by the University Survey Committee (Texas State

University, 2017). Therefore, this study uses the guidelines of the administrative survey policy to limit the sample size to be less than 10% of the enrolled student population. As of Fall 2016, the enrollment of Texas State University was 38,808. Applying the 10% policy guideline resulted in a sample of 3,800 students. Access to this roster of students was obtained from the Texas State University Office for Institutional Research. The faculty advisor accessed the Texas State University Email List Management application to obtain the Excel sheets which contain e-mail addresses, and other information about potential survey participants. After receiving the email lists, the faculty advisor removed all information except the email addresses and used the “random between” function in Excel to randomly select 3,800 Texas State University e-mail addresses to constitute the population of the survey. Once the final list of survey recipients was determined, Qualtrics web survey platform was used to administer the survey to them since access to this platform is free for Texas State faculty, staff and students. An e-mail requesting completion of the survey was crafted with a description of the study, estimated time for completion, and an anonymous link to the survey. The survey recruitment e-mail is provided in Appendix A. Table 4.1 provides the complete survey instrument. The web survey was first administered to students on March 22, 2017. Three reminder emails were sent to non-respondents on March 27, 2017, March 29, 2017, and March 31, 2017. The survey was closed on April 1, 2017.

Operationalizing the Conceptual Framework into a Survey

The conceptual framework was operationalized by a close examination of surveys from scholars who have conducted research on the perceptions of fluoridation of municipal water supplies. This section reviews how the concepts in the conceptual framework were operationalized. As shown in Table 4.1, the first category is titled “Personal Background

Characteristics” and the first subsection is titled “Demographics” which includes questions about gender, age, race, and income among others. These questions have been deemed relevant based on a review of multiple studies including results from a 2005 national survey released by the Center for Disease Control (CDC), which found that Black children are disproportionately impacted by dental fluorosis (Beltran-Aguilar et. al., 2005). The CDC did not conclude why Black children are more susceptible but did suggest it could be a result of “biologic susceptibility or greater fluoride intake.” Since 1962, there have been several other studies which have likewise noted the higher rate of dental fluorosis among Black children. (Russell, 1962) (Butler et. al., 1985) (Williams et. al., 1990) (Kumar et. al., 1999) (Kumar et. al., 2000) (Beltran-Aguilar et. al., 2005) (Martinez-Mier, 2010). Particularly important to the City of San Marcos is the League of United Latin American Citizens’ (LULAC) resolution opposing water fluoridation in 2011 (LULAC, 2011). Given that 37.8% of the population of San Marcos was Hispanic or Latino and 5.5% was Black in the 2010 Census, gathering demographic information is relevant to the study overall (US Census Bureau, 2015).

The second subsection of “Personal Background Characteristics” titled “Residential History,” is designed to gauge the respondent’s residential history. “Residential History” is relevant to the overall study in that roughly 5% of the world’s population receives artificially fluoridated water according to the British Fluoridation Society (BFS, 2012). The questions in this portion of the survey are one of three types: yes, no, prefer not to say answers, or a response to a multiple choice type question where the options are 0-5 years, 5-10 years, 10-15 years, 15-20 years, or not applicable. The 6-point scale only applies to Q14, which asked if the respondents have lived in a foreign country, what country? This question has two options either “yes, fill-in-blank” where they then write in the name of the country or “not applicable”. These questions

provide many subsections of the population and useful measures for evaluating responses such as if different races feel differently about the issues.

The second category of the survey is titled “Policy/Procedural Awareness” and includes sections titled “Proposition 1” and “Classification.” The “Proposition 1” section is designed to measure respondent’s knowledge of Proposition 1 during the 2015 election in San Marcos which was the fluoride initiative. Q15 and Q16 were designed to measure awareness of Proposition 1. See Table 4.1 for the exact wording of the questions.

The section titled “Classification” includes four different questions. One question, which is unique to this survey, asked respondents whether they believe the majority of “western” countries such as France, and England fluoridate their water. Given that these countries are the ones most often compared to the United States and the overwhelming majority of Western Europe has rejected water fluoridation (BFS, 2012), Q18 provides a basis of the respondent’s knowledge of water fluoridation policy in Western Europe. Another question unique to this survey is Q20 which asked how the Food and Drug Administration (FDA) classifies fluoride. As previously substantiated in Chapter III, the FDA has stated and reconfirmed their position many times that fluoride is considered a “drug” (FDA, 1963) (FDA, 1967) (FDA, 1990) (FDA, 2000). Given fluoride’s “drug” classification by the FDA, the interest is to see if respondents were aware of this classification, by providing them five options (“nutrient”, “vitamin”, “mineral”, “drug” or “other”). Q21 and Q22 are informed by previous studies which have asked respondents their view of expert opinions of water fluoridation and their view of fluoridation as a natural process. Both of these questions are on a 7-point Likert type scale (Armfield, 2009; Sandman, 1990).

Categories 3 and 4 of the survey instrument titled “Health Perceptions” and “Pharmacological Practices” were informed through past studies and utilized the same wording based on the recommendation of Sue & Ritter (2012). These survey questions/items have been pre-tested in studies by Sandman (1990) and Armfield (2009) and therefore meet the criteria of validity and reliability.

The final category of the survey instrument is titled “Fluoride Transparency.” These two sections utilize two newly developed questions that were based on the controversy which surrounded the fluoridation policy in San Marcos in particular. Given that this is the first study designed specifically around the fluoridation policy in San Marcos, the wording of the questions reflects the new policy and aims to measure respondent’s views of how well public officials have disclosed information related to fluoridation policy and how responsive they have been to water fluoridation concerns.

Strengths of Survey Technique

A variety of steps have been taken to increase the reliability and validity of the survey while decreasing error in the results. Sue & Ritter (2012) recommend using survey questions from past scholars as a guide to designing questions. This survey has been crafted using this technique where possible, in an attempt to develop a pre-validated set of questions for the survey. Sue & Ritter’s (2012) recommendations have been applied for categories 1, 3, 4 and 5 of the conceptual framework.

Categories 3 and 4 have been partially created using Sue & Ritter’s (2012) technique; other questions in those sections have been developed for the first time. Bhattacharjee (2012) states various recommendations to increase the reliability of research: (1) using questionnaires decreases the subjectivity of data collected; (2) asking questions pertaining to topics respondents

care about; (3) avoiding the use of ambiguous terms; and (4) using simplistic syntax and dictation in questions. By conducting this study on a relatively new public policy which directly affects all individuals in the City of San Marcos, this study is hoping to gather the views of as many stakeholders as possible to increase the validity and reliability of results.

18 of the 35 questions on the survey feature the standard 7-point Likert type scale from “strongly disagree” to “strongly agree.” The rest of the questions on the survey still feature fully labeled responses, with four of those questions also featuring a fill-in-the-blank “other, please specify” type of labeled response. Scales that feature fully labeled responses have been found to be more reliable and easier for respondents to answer (Sue & Ritter, 2012).

On a positive note, coverage error is minimal in this study. Coverage error occurs when parts of the population are not included in the sampling method, leading to different data being gathered from the sample (Sue & Ritter, 2012). The survey was distributed to email addresses in an academic environment where internet use is frequent among students. Sue and Ritter (2012) state in university or workplace settings “Coverage error poses less of a problem” due to constant access to the internet. Also, this survey has been developed with Qualtrics software which also creates a smartphone version of the survey for those who may access the email solicitation on their phone and wish to take the survey on their mobile device.

Weaknesses of Survey Technique

There are several weaknesses of the survey method. Previous research has expressed concern for surveying how people view water fluoridation and the possible effects both negative and positive. This survey has taken these questions a step further by looking to measure the constituent’s knowledge of the policy and their view of the ethical implications of water fluoridation policy. This study used a newly developed survey instrument (parts of category 3,

and 4) to attempt to answer research recommendations from scholars found in the literature review (Armfield, 2009). The survey method creates further weaknesses in the methodology and validity of this study.

For example, questions may not accurately measure the anticipated construct and likely have room for improvement by other scholars. Sources of error are likely to affect the findings of the survey negatively. Nonresponse error occurs when respondents choose not to partake in the survey or skip particular questions. The issue with nonresponse is that participators may have different opinions than those who choose not to participate (Sue & Ritter, 2012). A 2012 study conducted on non-response bias comparing a classroom survey sample to a web-based survey sample; found that the classroom sample was more representative of the university population (Wells et. al., 2012). Wells et. al. (2012) concluded that students responding to the web-based survey “expressed more extreme opinions and behavioral responses to a proposed policy.” This non-response bias creates significant limitations in estimating perceptions of the population, as an increased proportion of respondents with extreme opinions may be inclined to respond to this survey.

The response rate also creates limitations regarding the representativeness of survey respondents. Also, as discussed in the “Survey Research Settings and Participants” section of this chapter, the survey was only distributed to 10% of the student population (approximately 3,800 students). This restriction on student population sampling is likely to reduce the number of respondents to the survey significantly, further reducing representativeness of survey constituents.

Survey Data Analysis

Qualtrics software recorded the responses of individuals who answered the entire survey and partial responders alike. Therefore, there are some discrepancies in the number of responses from question to question on the survey. Perceptions of respondents concerning water fluoridation are reported using a variety of descriptive statistics. Frequency distribution tables were used to assess counts and percentages of respondent attitudes towards water fluoridation. Cross-tabulation analyses were also conducted to analyze the patterns among responses to two survey questions at the same time.

Survey IRB Exemption/Human Subject Protection

This research study was approved and exempt by the Institutional Review Board (IRB) on March 16, 2017, under application number 2017475. To protect the identity of human subjects responding to the survey, anonymous data were collected during the survey by using the Qualtrics Anonymous link. Qualtrics' website states that "no identifying information such as name or email address is collected unless you specifically ask for it in the survey" (Qualtrics, 2017). Therefore, this survey did not collect any personally identifiable information from the respondents. The preliminary email message sent to respondents stated that "all answers to the survey are completely anonymous, and participation is entirely voluntary giving respondents the option to skip questions or quit the survey at any point." The same statement was posted on the opening page of the Qualtrics survey. The IRB approval/exemption message for this study is listed in Appendix A. Table 4.1 shows the operationalization of the survey. A copy of the actual survey and the order of questions is listed in Appendix A.

Operationalization Table 4.1

Table 4.1: Survey Operationalization Table	
Category	Questionnaire Item
1. Personal Background Characteristics	
1.1 Demographics	1. What is your gender? (Male, Female) 2. What is your age? (>18, 18-21, 22-25, 26-36, 37-50, 51-70, 70+) 3. What is your race/ethnicity? (White, Black, Hispanic, Asian, Pacific Islander, Native American, Other) 4. What is your political affiliation? (Democrat, Republican, Independent, Other, please specify, or Prefer not to say) 5. What is your classification by Texas State University? (Freshman, Sophomore, Junior, Senior, Grad Student)
1.2 Residential History	6. Have you lived in San Marcos your whole life? (Yes, No, Prefer not to say) 7. How many years have you lived in San Marcos? (0-5 years, 5-10 years, 10-15 years, 15-20 years, 20+ years, Not applicable) 8. Have you lived in Texas your whole life? (Yes, No, Prefer not to say) 9. How many years have you lived in Texas? (0-5 years, 5-10 years, 10-15 years, 15-20 years, 20+ years, Not applicable) 10. Have you lived in the United States your whole life? (Yes, No, Prefer not to say) 11. How many years have you lived in the United States? (0-5 years, 5-10 years, 10-15 years, 15-20 years, 20+ years, Not applicable) 12. Have you ever lived in a foreign country? (Yes, No, Prefer not to say) 13. If yes, what foreign country? (Open ended, or not applicable) 14. How many years did you live in that foreign country? (0-5 years, 5-10 years, 10-15 years, 15-20 years, 20+ years, Not applicable)
2. Policy/Procedural Awareness	
2.1 Proposition 1	15. Proposition 1 in the 2015 San Marcos elections had to do with what topic? (Petitioning, Texting and Driving, Water Fluoridation, Minimum Wage or Other, please specify) 16. Was Proposition 1 passed into law? (Yes, No) 17. I support fluoridation of municipal water supplies. (Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree)
2.2 Classification	18. The majority of “westernized” countries in the world fluoridate their water supplies. (Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree) 19. How does the Food and Drug Administration (FDA) classify fluoride compounds? (nutrient, vitamin, mineral, drug, other, please specify) 20. Experts agree over the benefits and risks of water fluoridation. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree) 21. I see the addition of fluoride to water supplies as a natural process. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)

3. Health Perceptions	
3.1 Benefits	<p>22. I believe water fluoridation is beneficial to oral health. ((Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>23. I believe water fluoridation is beneficial to overall health. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>24. I believe I can personally control the effects of water fluoridation. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p>
3.2 Risks	<p>25. I am anxious regarding possible health risks from water fluoridation. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>26. I believe my family, to be at risk as a result of water fluoridation. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>27. I believe children, in particular, are put at risk from water fluoridation. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>28. I believe health effects associated with water fluoridation are reversible. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>29. I believe water fluoridation has catastrophic potential, capable of contributing to many deaths or illnesses. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p>
4. Pharmacological Practices	
4.1 Medical Ethics	<p>30. I see water fluoridation as an issue relating to personal rights or freedoms. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>31. I know how much fluoride I consume every day. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>32. I am entitled to signing an informed consent waiver before using fluoridated water. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p> <p>33. I believe water fluoridation affects people equally. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p>
5. Fluoride Transparency	
5.1 Information Disclosure	<p>34. I believe the government has disclosed all information relating to water fluoridation. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)</p>

5.2 Government Responsiveness	35. I believe the government's attitude is responsive to the public's concerns over water fluoridation. (Strongly disagree, Disagree, Somewhat disagree, Neither agree nor disagree, Somewhat agree, Agree, Strongly agree)
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Interview Research Setting and Participants

The interview process is the secondary method of this research. Interviews were conducted with prominent individuals who were directly involved in formulating new water fluoridation policy in the City of San Marcos. The interviews took place on March 30, 2017, and March 31, 2017, with Mr. Sam Brannon, head of CTW, and Mr. John Thomaides the newly elected mayor and former councilman of the City of San Marcos, respectively. The selection of interviewees is based on the individual's expertise and perception of the implementation of the new water fluoridation policy in the City of San Marcos. The interview with Mr. Brannon took place on the Texas State campus in the Political Science Department, on the third floor of the Undergraduate Academic Center, in room UAC 321. Mr. Brannon's interview lasted from approximately 2:00-3:00 PM on Thursday, March 30, 2017. The interview with Mr. Thomaides took place over the phone from approximately 9:30-10:00 AM on Friday, March 31, 2017.

Recruitment of Interview Participants

The interview instrument targets two individuals who were directly involved in the policy formulation and election process which resulted in San Marcos' new water fluoridation policy. The interview process employed three key documents: 1) the interview questions (Table 4.1 & 4.2), 2) the request for interview e-mail, and 3) the interview script. The e-mail included much of the same details as the survey e-mail, including a description of the study and an estimation of the time commitment. The e-mail also included the questions that I asked during the interview session and a suggested time and place for the interview session. Mr. Brannon's email address was obtained through prior contact with him. Mr. Thomaides email was publicly available on the City of San Marcos' website. The recruitment e-mail and the subsequent replies, along with the

interview script are attached in Appendix A. A copy of the interviews is attached at the bottom of this chapter as Table 4.2 and 4.3.

Operationalizing the Conceptual Framework into Interviews

The interview portion of the study mirrors the survey portion of the study because they tap into the same categories of questions. However, the interview phase elicited qualitative responses from the interviewees given their expertise on the subject of water fluoridation and their ability to provide in-depth answers on the issue while the survey elicited quantitative responses. Therefore, the interviews also feature a subsection titled “Personal Background Characteristics” including demographic and residential questions very similar to the survey instrument. However, for the interviews, these questions are directed towards open-ended conversation and avoid obvious, irrelevant, or private questions such as race, gender, or income.

The “Personal Background Characteristics” section of the interviews also has a personalized set of questions in Section 1.2 which concern the organizations that each man founded. This information has been deemed relevant to the study given the nature of the organization’s relation to the issue of fluoridation. For Mr. Brannon, there are questions designed to gather information about the organization he founded named “Communities for Thriving Water: Fluoride-Free San Marcos” (CTW). CTW is the organization that petitioned to end water fluoridation in the City of San Marcos. For Mr. Thomaides, questions in Section 1.2 were designed to gather information about the organization he founded named “Alpha Pure Water”, which is an organization which sells high-quality water filters.

Category 2, “Policy/Procedural Awareness” also has discrepancies between the interviewees. Given that the two men were on different sides of the issue, it follows logically that there was a desire for both sides of the story. However, the questions touch on many of the same

issues, such as how Proposition 1 made it to the ballot. Questions also probe into the ensuing legal battle between the City of San Marcos and CTW, and the relationship between Proposition 1 which had to do with fluoridation and Proposition 2 which had to do with petitioning and were adopted as ballot measures at the same council meeting.

Categories 3, 4, and 5 ask both interviewees the same questions and again are designed to reflect the survey items of Categories 3, 4, and 5. However, through the interview process, the goal was to create a qualitative response to compare to the quantitative responses of the survey. Therefore, questions in Categories 3 and 4 of the interviews are adaptations of the questions asked by Sandman (1990) and Armfield (2009) in their survey methods, and Category 5 questions are an adaptation of the questions posed in the Fluoride Transparency category of the survey.

Strengths of Interview Technique

The interview process augments the survey in that it allows the study to become much more in-depth and qualitative in converse to the more quantitative data of the survey. The type of questions asked during the interviews reflects the qualitative nature of this aspect of the study. The interviews provided an open-ended, in-depth dialogue with individuals who were directly involved in the policy, which has the potential to help clarify the policy further for residents and provide a projection of the policy into the future.

Many of the questions asked during the interview are very similar to questions asked to the survey respondents, but given the respondent's opposition on the issue during the Proposition 1 election process, it is very likely that the responses are from two different angles on the issue. Adding these two distinct perspectives on the issue to the survey respondents provides two

separate expert opinions as pillars to compare to the survey respondents in an attempt to triangulate the views of Texas State students as compared to the expert opinions.

Weaknesses of Interview Technique

The interview process also presents limitations to this study. First and foremost, the fact that interviews present qualitative data and not quantitative data makes the study much more subjective. The issue with the qualitative and thus subjective study is that it is much more likely to be influenced by personal biases and idiosyncrasies. Also, the direct presence of the researcher during data gathering, which in this case is unavoidable, could potentially affect the interviewees' responses. This issue ties into the issue of anonymity and confidentiality, which likewise could have an impact on respondent's answers given that they are both public political figures.

A separate threat to the validity of the interview is that the qualitative research is more rigorous due to the sheer volume of data. For example, the survey is estimated to take respondents about 6 minutes to complete, whereas the interviews took between thirty minutes to an hour. The significant time disparity between these two types of methods ensures that the interview process is more time consuming and subject to the researcher's ability to focus and evaluate information of a qualitative nature. Also, this qualitative information is much harder to characterize in a visual way and findings cannot be generalized to a larger population given the individual expertise of the interviewees.

The interview method, like the survey method, is also subject to a type nonresponse error. The particular nonresponse error that is likely to occur with the interview method is interviewees electing to skip questions and/or end the interview early due to time constraints. Mr. Thomaides stated in response to the interview request that he would not be able to commit more than thirty

minutes to the project. Thus the list of questions asked to Mr. Thomaides was shortened significantly. The shortening of Mr. Thomaides interview leaves holes in the results which the interview operationalization tables sought to answer. Another threat to validity that the interviews share with the survey are the newly developed questions. Questions in the interview may not accurately measure the anticipated construct and likely have room for improvement by other scholars.

Interview Data Collection

For the interview process, the interviews were recorded on the “Voice Memos” application on an iPhone 7. Mr. Thomaides’ interview was conducted via telephone, therefore a work phone at Texas State University was used. The “Handsfree” setting of the phone was employed then the iPhone 7 was placed close to the speaker in order to clearly record the interview. Before either of the interviews began, the interviewees were read an IRB approved script which acknowledged that their responses would be recorded for accurate reporting. Both interviewees consented to the recording, the interview script is attached in Appendix A. Also a copy of the recruitment email for the interviews and the responses from the interviewees has been attached in Appendix A.

Interview Data Analysis

Interviews yielded qualitative data. Data from the two interviews were thoroughly analyzed to account for potential similarities and differences in responses to the questions. Given the interviewees stood in opposition on the water fluoridation issue during the election process, it was expected that they have opposing views on the questions they were presented with during the interview process. By collecting and scrutinizing these two opposing positions, it provides two expert opinions which act as opposing pillars to compare their views, not only to each

other's opinions, but also to the views of the survey constituents. These expert opinions can also be compared to the literature presented in Chapter III to compare their responses to the literature on fluoridation.

Interview IRB Exemption/Human Subject Protection

For the interview process, the interviewee's anonymity is not presupposed given that both interviewees held very public stances on the issue. Both individuals have previously attended public meetings of the City Council of San Marcos where they both publicly espoused their view on the subject of water fluoridation. However, the interviewees were given the same freedom as survey respondents to skip questions or end the interview at any point. This research study was approved and exempt by the Institutional Review Board (IRB) on March 16, 2017, under application number 2017475. The IRB approval/exemption message for this study is listed in Appendix A. Tables 4.2 and 4.3 below show the interviews as they were presented to Mr. Brannon and Mr. Thomaides, respectively.

Operationalization Tables 4.2 and 4.3

Table 4.2: Interview with Sam Brannon Operationalization Table	
Category	Interview Questions
1. Personal Background Characteristics	
1.1 Demographics and Residential History	1. Do you live in San Marcos? (Yes, No) 2. If so, for how long do or did you live in San Marcos? (Open Ended) 3. Have you lived in Texas your whole life? (Yes, No) 4. If not, how long have you lived in Texas? (Open Ended) 5. Have you lived in the United States your whole life? (Yes, No) 6. If not, what foreign countries have you lived in? (Open Ended) 7. Do you affiliate with a specific political party? (Yes, No) 8. If so, which political party do you affiliate with? (Open Ended)
1.2 Fluoride-Free San Marcos (FFSM)	9. When did CTW begin to organize? (Open Ended) 10. How many members are there in CTW? (Open Ended) 11. Is CTW connected to other fluoride-free organizations such as the groups in Austin, or Portland? (Open Ended) 12. Was the petition that led to Proposition 1 the first organized petition by CTW? (Open Ended)
2. Policy/Procedural Awareness	
2.1 Proposition 1	13. Do you view water fluoridation as a partisan issue? (Yes, No) 14. Why or why not? (Open Ended) 15. Do you view water fluoridation as a political issue? (Yes, No) 16. Why or why not? (Open Ended) 17. How many signatures did you receive for the Proposition 1 petition? (Open Ended) 18. How many hours did you estimate you personally dedicated to collecting signatures? (Open Ended) 19. Did you receive any financial benefits from gathering signatures for Proposition 1? (Yes, No) 20. If so, how much and how does that process work? (Open Ended) 21. Why was FFSM originally hesitant to support Proposition 1? (Open Ended) 22. Is FFSM still in a legal battle with the City of San Marcos? (Open Ended) 23. What court is presiding over the case? (Open Ended) 24. Are there plans to get a follow-up proposition on the 2017 ballot? (Open Ended)
2.2 Proposition 2	25. How does Proposition 1 relate to Proposition 2? (Open Ended) 26. How did Proposition 2 make it on the ballot? (Open Ended) 27. Do you see the passage of Proposition 2 as undermining FFSM future ballot measures? (Open Ended)

3. Health Perceptions	
3.1 Benefits	<p>28. Do you believe there are positive effects of water fluoridation? (Yes, No)</p> <p>29. If so, what do you believe are the most important positive effects of water fluoridation? (Open Ended)</p>
3.2 Risks	<p>30. Do you believe there are negative effects of water fluoridation? (Yes, No)</p> <p>31. If so, what do you believe are the most important negative effects of water fluoridation? (Open Ended)</p>
4. Pharmacological Practices	
4.1 Medical Ethics	<p>32. Do you agree with the FDA's classification of fluoride compounds as a drug? (Yes, No)</p> <p>33. Do you believe individuals are entitled to sign an informed consent disclosure before fluoridation of municipal water supplies? (Yes, No)</p> <p>34. Why or why not? (Open Ended)</p> <p>35. Do you believe municipalities should apply the precautionary principle when deciding on water fluoridation policy? (Yes, No)</p> <p>36. Why or why not? (Open Ended)</p>
5. Fluoride Transparency	
5.1 Information Disclosure	<p>37. Do you know when San Marcos began fluoridation? (Yes, No)</p> <p>38. If so, when did San Marcos begin water fluoridation? (Open Ended)</p> <p>39. How would you describe the government's disclosure of information regarding fluoridation, in general? (Open Ended)</p> <p>40. How would you describe the City of San Marcos' disclosure of information regarding fluoridation? (Open Ended)</p>
5.2 Government Responsiveness	<p>41. How would you describe the government's responsiveness to fluoride concerns? (Open Ended)</p> <p>42. How would you describe the City of San Marcos' responsiveness to fluoride concerns? (Open Ended)</p>

Table 4.3: Interview with John Thomaides Operationalization Table	
Category	Interview Questions
1. Personal Background Characteristics	
1.1 Demographics and Residential History	1. Do you live in San Marcos? (Yes, No) 2. If so, for how long do or did you live in San Marcos? (Open Ended) 3. Have you lived in Texas your whole life? (Yes, No) 4. If not, how long have you lived in Texas? (Open Ended) 5. Have you lived in the United States your whole life? (Yes, No) 6. If not, what foreign countries have you lived in? (Open Ended) 7. Do you affiliate with a specific political party? (Yes, No) 8. If so, which political party do you affiliate with? (Open Ended)
1.2 Alpha Pure Water (APW)	9. When did APW first begin business? (Open Ended) 10. How many employees are there in APW? (Open Ended) 11. Do any of the products sold by APW remove fluoride? (Yes, No)
2. Policy/Procedural Awareness	
2.1 Proposition 1	12. Do you view water fluoridation as a partisan issue? (Yes, No) 13. Why or why not? (Open Ended) 14. Do you view water fluoridation as a political issue? (Yes, No) 15. Why or why not? (Open Ended) 16. In your position as councilmen at the time, did you support or dissent to the fluoride petition? (Support, Dissent) 17. What was your rationale on your stance for or against the fluoride petition? (Open Ended) 18. Why did the City of San Marcos decide to sue Fluoride Free San Marcos (FFSM)? (Open Ended) 19. Is the City of San Marcos still in a legal battle with FFSM? (Open Ended) 20. What court is presiding over the case? (Open Ended) 21. Why did the Council decide to adopt their own version of the FFSM petition? (Open Ended) 22. What was the Council's reasoning for the discrepancy in wording from the original petition? (Open Ended) 23. Are there plans for any future water fluoridation related propositions? (Yes, No) 24. If so, when and for what purposes? (Open Ended)
2.2 Proposition 2	25. Does Proposition 2 relate to Proposition 1? (Yes, No) 26. If so, how? (Open Ended) 27. How did Proposition 2 make it on the ballot? (Open Ended) 28. How does Proposition 2 affect future petitioning efforts? (Open Ended)
3. Health Perceptions	
3.1 Benefits	29. Do you believe there are positive effects of water fluoridation? (Yes, No) 30. If so, what do you believe are the most important positive effects of water fluoridation? (Open Ended)

3.2 Risks	<p>31. Do you believe there are negative effects of water fluoridation? (Yes, No)</p> <p>32. If so, what do you believe are the most important negative effects of water fluoridation? (Open Ended)</p>
4. Pharmacological Practices	
4.1 Medical Ethics	<p>33. Do you agree with the FDA's classification of fluoride compounds as a drug? (Yes, No)</p> <p>34. Do you believe individuals are entitled to sign an informed consent disclosure before fluoridation of municipal water supplies? (Yes, No)</p> <p>35. Why or why not? (Open Ended)</p> <p>36. Do you believe municipalities should apply the precautionary principle when deciding on water fluoridation policy? (Yes, No)</p> <p>37. Why or why not? (Open Ended)</p>
5. Fluoride Transparency	
5.1 Information Disclosure	<p>38. Do you know when San Marcos began fluoridation? (Yes, No)</p> <p>39. If so, when did San Marcos begin water fluoridation? (Open Ended)</p> <p>40. How would you describe the government's disclosure of information regarding fluoridation, in general? (Open Ended)</p> <p>41. How would you describe the City of San Marcos' disclosure of information regarding fluoridation? (Open Ended)</p>
5.2 Government Responsiveness	<p>42. How would you describe the government's responsiveness to fluoride concerns? (Open Ended)</p> <p>43. How would you describe the City of San Marcos' responsiveness to fluoride concerns? (Open Ended)</p>

Chapter V: Results

Chapter V Purpose

The purpose of this chapter is to present results from the survey and interviews. This chapter is organized such that results from the survey are presented first followed by results from the interviews. Since the conceptual framework consists of 5 broad categories, survey and interview results pertaining to these five major categories are presented in detail.

Survey Response Rate

As indicated in Chapter III, the survey was administered to 3800 students. One email bounced back, and as a result, the survey was administered to a total of 3,799 potential respondents. A total of 189 students responded to the full survey resulting in a response rate of approximately 5%¹. Some questions gathered more respondents up to 225 people responded to at least part of the survey the number of respondents for each question is reported in the tables below. The following sections of this chapter provide details of results obtained from the survey.

Category 1: Personal Background Characteristics of Survey Respondents

The first category as listed on the Operationalization Table 4.1 and Conceptual Framework Table 3.1 is “Personal Background Characteristics.” The goal of this set of questions was to gather information about the respondents to see if demographic variables are tied to perceptions about water fluoridation. Descriptive statistics are provided.

The “Personal Background Characteristics” section describes the demographic and residential characteristic of the respondents which was the first major category identified through the literature review process. First, as shown in Table 5.1A, 96.86% of survey respondents have

¹ Rigorous social science research conventions require that results be reported only from fully completed responses. Since the researcher did not compute inferential statistics and is only reporting descriptive statistics, information from all responses gathered are reported in this study.

not lived their whole life in San Marcos, yet 59.69% of survey respondents acknowledged living their whole life in Texas, and 84.82% have lived their whole life in the United States.

Table 5.1A: Respondents Residential History

Personal Background Characteristics: Residential History	Yes	No	Prefer not to say
Have you lived in San Marcos your whole life? N=191 (Frequency)	3.14% (6)	96.86% (185)	0.00% (0)
Have you lived in Texas your whole life? N=191 (Frequency)	59.69% (114)	40.31% (77)	0.00% (0)
Have you lived in the United States your whole life? N=191 (Frequency)	84.82% (162)	15.18% (29)	0.00% (0)
Have you ever lived in a foreign country? N=191 (Frequency)	21.47% (41)	78.01% (149)	0.52% (1)

Out of a total of 36 respondents who indicated that they lived in a foreign country, slightly more than half of them indicated that they had lived either in Germany or Mexico. Table 5.1B shows that Germany and Mexico had 9 and 8 survey respondents respectively identify that they had lived in those countries.

Table 5.1B: List of Countries Where Respondents have Resided

Personal Background Characteristics: Residential History	
Name of Countries	N=36 Frequency
Germany	9
Mexico	8
South Kora	3
Argentina	2
Canada	2
England	2
Iraq	2
Italy	2
Spain	2

Afghanistan	1
Austria	1
Azores	1
Belgium	1
Benin	1
Brazil	1
China	1
Colombia	1
Costa Rica	1
Cuba	1
Czech Republic	1
Democratic Republic of the Congo	1
Dubai	1
France	1
Ghana	1
Hungary	1
India	1
Ireland	1
Jamaica	1
Japan	1
Kuwait	1
Kyrgyzstan	1
Netherlands	1
Nigeria	1
Qatar	1
Russia	1
Singapore	1
Switzerland	1
Thailand	1
Trinidad and Tobago	1
Turkey	1
Venezuela	1

Table 5.1C shows that there were more female respondents than male respondents, 66.84% of the survey respondents identified as “Female.” Therefore, over two out of every three survey respondents identified as a “Female.”

Table 5.1C: Respondents Gender Identification

Personal Background Characteristics: Demographics	Male	Female
What is your gender? N=190 (Frequency)	33.16% (63)	66.84% (127)

Furthermore, Table 5.1D shows of 63.49% of survey respondents identified their race/ethnicity as “White” with the next closest racial/ethnic representative being “Hispanic” at 19.58%.

Table 5.1D: Respondents Racial/Ethnic Identification

Personal Background Characteristics: Demographics	White	Black	Hispanic	American Indian or Alaska Native	Asian	Native Hawaiian or Pacific Islander	Other
What is your race/ethnicity? N=189 (Frequency)	63.49% (120)	5.82% (11)	19.58% (37)	0.53% (1)	3.70% (7)	0.53% (1)	6.35% (12)

A cross-tabulation analysis as shown in Table 5.1E of Gender and Racial/Ethnic identification has revealed that the largest racial/ethnic-gender group to respond to the survey was those who identified as “White Females.” Of those who answered both questions, 43.39% identified as “White Females” with the next highest being “White Males” at 20.10%. “Hispanic Females” were third and “Hispanic Males” fourth at 12.70% and 6.88%, respectively.

Table 5.1E: Cross-tabulation of Gender and Racial/Ethnic Identification

		What is your gender? N=189 (Frequency)		
Personal Background Characteristics: Residential History		Male	Female	Total
What is your race/ethnicity? N=189 (Frequency)	White	20.10% (38)	43.39% (82)	63.49% (120)
	Black or African American	2.65% (5)	3.17% (6)	5.82% (11)
	Hispanic	6.88% (13)	12.70% (24)	19.58% (37)
	American Indian or Alaska Native	0.00% (0)	0.53% (1)	0.53% (1)
	Asian	1.59% (3)	2.11% (4)	3.70% (7)
	Native Hawaiian or Pacific Islander	0.00% (0)	0.53% (1)	0.53% (1)
	Other	2.11% (4)	4.23% (8)	6.34% (12)

Table 5.1F presents a depiction of the political affiliation of survey respondents given five options of “Democrat,” “Republican,” “Independent,” “Other, please specify,” and “Prefer not to say.” 38.38% of survey respondents identified as “Democrat”, then 27.03% identified as “Independent,” and 15.13% identified as “Republican.” Many of the respondents who chose the “Other, please specify” option identified as “Libertarian” and expressed a sense of disillusionment with the political party system.

Table 5.1F: Respondents Political Party Identification

Personal Background Characteristics: Demographics	Democrat	Republican	Independent	Other, please specify	Prefer not to say
What is your political affiliation? N=185 (Frequency)	38.38% (71)	15.13% (28)	27.03% (50)	8.11% (15)	11.35% (21)

Further demographic questions of the survey in Table 5.1G show that 52.91% of survey respondents identified as “Graduate” students, and the percent lowered as classification lowered. “Seniors” were the second highest representatives at 18.52%, and “Freshman” were the lowest at 4.76%.

Table 5.1G: Classification of Respondents by Texas State University

Personal Background Characteristics: Demographics	Freshman	Sophomore	Junior	Senior	Graduate
What is your classification by Texas State University? N=189 (Frequency)	4.76% (9)	8.47% (16)	15.34% (29)	18.52% (35)	52.91% (100)

As illustrated in Table 5.1H, 32.63% of survey respondents indicated that they were in the “22-25” year category, and 28.95% identified as “18-21”. A combined 61.58% of survey respondents identified as 25 years of age or younger. 13.69% of survey respondents identified as over 37 years of age.

Table 5.1H: Age of Respondents in Years

Personal Background Characteristics: Demographics	>18	18-21	22-25	26-36	37-50	51-70	70+
What is your age? N=190 (Frequency)	0.00% (0)	28.95% (55)	32.63% (62)	24.74% (47)	10.52% (20)	3.16% (6)	0.00% (0)

Category 2: Policy/Procedural Awareness of Survey Respondents

Descriptive analyses were likewise conducted on the second category of the survey titled “Policy/Procedural Awareness.” The aim of this category was first to see if survey respondents knew what the topic of Proposition 1 was during the 2015 San Marcos election and whether it

passed into law. The second subsection of questions in the “Policy/Procedural Awareness” were designed to gather survey respondents’ awareness of various aspects of water fluoridation.

As shown in Table 5.2A, 43.06% of survey respondents knew that Proposition 1 during the 2015 San Marcos election was about “Water Fluoridation.” 26.85% of survey respondents thought Proposition 1 was about “Texting and Driving.” It is also worth noting that “Other, please specify” received 18.98% of the responses. Many of the “Other, please specify” wrote in some variation of “I don’t know,” but 28.2% of the “Other, please specify” respondents wrote in a response which has to do with the May 2017 San Marcos bond election.

Table 5.2A: Knowledge of the Topic of Proposition 1

Policy/Procedural Awareness: Proposition 1	Petitioning	Texting and Driving	Water Fluoridation	Minimum Wage	Other, please specify
Proposition 1 in the 2015 San Marcos Election had to do with what topic? N=216 (Frequency)	4.63% (10)	26.85% (58)	43.06% (93)	6.48% (14)	18.98% (41)

The second question relating to Proposition 1 asked respondents if Proposition 1 was passed into law, and 75.50% of survey respondents answered “yes” to this question as shown in Table 5.2B.

Table 5.2B: Knowledge of the Approval of Proposition 1

Policy/Procedural Awareness: Proposition 1	Yes	No
Was Proposition 1 passed into law? N= 200 (Frequency)	75.50% (151)	24.50% (49)

However, many who chose “yes” as shown in Table 5.2B were not aware that Proposition 1 dealt with water fluoridation policy. To figure out how many people knew that Proposition 1 was about water fluoridation, and knew that it passed into law, a cross-tabulation analysis was

conducted. The cross-tabulation revealed that of the total responses to both Proposition 1 related questions 34.34% of respondents knew Proposition 1 was about water fluoridation and that it passed into law. Further results of the cross-tabulation can be seen in Table 5.2C.

Table 5.2C: Cross-tabulation of Knowledge of Proposition 1 Topic and Approval		Was Proposition 1 passed into law? N=198 (Frequency)		
Policy/Procedural Awareness: Proposition 1		Yes	No	Total
Proposition 1 in the 2015 San Marcos elections had to do with what topic? N=198 (Frequency)	Petitioning	2.02% (4)	2.53% (5)	4.55% (9)
	Texting & Driving	26.77% (53)	2.52% (5)	29.29% (58)
	Water Fluoridation	34.34% (68)	12.12% (24)	46.46% (92)
	Minimum Wage	4.04% (8)	2.53% (5)	6.57% (13)
	Other, please specify	8.08% (16)	5.05% (10)	13.13% (26)

The second subsection of Category 2 questions titled “Classification” are reported in Table 5.2D. First, 42.22% support the fluoridation of municipal water supplies, and 29.78% do not support water fluoridation. 44.18% of survey respondents do not believe that experts agree over the benefits and risks of water fluoridation while 37.86% believe experts do agree on the risks and benefits of water fluoridation. 61.39% of survey respondents believe that most “westernized” countries fluoridate their water supplies. Also, 54.90% of survey respondents do not see the addition of fluoride to water as a “natural” process.

Table 5.2D: Perceptions of Water Fluoridation

Policy/Procedural Awareness: Classification	% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I support fluoridation of municipal water supplies. N= 225 (Frequency)	29.78% (67)	28.00% (63)	42.22% (95)
The majority of “westernized” countries in the world fluoridate their water supplies. N= 215 (Frequency)	15.35% (33)	23.26% (50)	61.39% (132)
Experts agree over the benefits and risks of water fluoridation. N= 206 (Frequency)	44.18% (91)	17.96% (37)	37.86% (78)
I see the addition of fluoride to water as a “natural” process. N= 207 (Frequency)	54.90% (114)	22.06% (45)	23.04% (48)

As shown in Table 5.2E, 61.84% of respondents believe fluorides are classified as a “Mineral” by the FDA. 13.05% of respondents correctly chose “Drug” from the list “Nutrient,” “Vitamin,” “Mineral,” “Drug,” or “Other, please specify.” As has been previously substantiated the FDA classifies fluoride compounds as a “drug” (FDA, 1963) (FDA, 1967) (FDA, 1990) (FDA, 2000). 6.76% of respondents chose “Other, please specify” and four of the “Other, please specify” respondents wrote-in an answer to the effect of “medical treatment.” The “medical treatment” respondents constitute an extra 1.93% of the total responses for the question.

Table 5.2E: Awareness of FDA Fluoride Classification

Policy/Procedural Awareness: Classification	Nutrient	Vitamin	Mineral	Drug	Other, please specify
How does the Food and Drug Administration (FDA) classify fluoride compounds? N=207 (Frequency)	11.59% (24)	6.76% (14)	61.84% (128)	13.05% (27)	6.76% (14)

Cross-tabulations were conducted to analyze respondents’ answers of the FDA’s classification question further. The first cross-tabulation analysis specifically focused on the 13.05% of the respondents who answered “Drug” on the FDA classification question presented in Table 5.2E. Table 5.2F shows the FDA classification question cross-tabulated with the

question of whether or not the respondents support the fluoridation of municipal water supplies. The results of the first cross-tabulation indicate that 44.44% of those who believe that fluoride is a drug support water fluoridation, whereas 37.04% do not support water fluoridation.

Table 5.2F: Drug Classification Versus Support of Water Fluoridation		How does the Food and Drug Administration classify fluoride compounds? N=27 (Frequency)
Policy/Procedural Awareness: Classification		Drug
I support fluoridation of municipal water supplies. N=27 (Frequency)	% Disagree: 1-3	37.04% (10)
	% Neither agree nor disagree: 4	18.52% (5)
	% Agree: 5-7	44.44% (12)

For the second cross-tabulation, the responses to the effect of “medical treatment” were included with those who chose “Drug” which then bumped the percent of respondents who correctly answered up to 14.98%. With the “medical treatment” responses added, the cross-tabulation in Table 5.2G shows a shift to 41.94% of survey respondents who answered the FDA classification question correctly not supporting water fluoridation, compared to 38.71% who support water fluoridation.

Table 5.2G: Drug or Medical Treatment Classification Versus Support of Water Fluoridation		How does the Food and Drug Administration classify fluoride compounds? N=31 (Frequency)
Policy/Procedural Awareness: Classification		Drug or “Medical Treatment”
I support fluoridation of municipal water	% Disagree: 1-3	41.94% (13)

Table 5.2G: Drug or Medical Treatment Classification Versus Support of Water Fluoridation

Policy/Procedural Awareness: Classification		How does the Food and Drug Administration classify fluoride compounds? N=31 (Frequency)
supplies. N=31 (Frequency)	% Neither agree nor disagree: 4	19.35% (6)
	% Agree: 5-7	38.71% (12)

Survey Category 3: Health Perceptions

The goal of the third category overall was to gather the perceptions of respondents on the relationship between water fluoridation and their health. The first subset of questions titled “Benefits” asked respondents about their perception of the health benefits of water fluoridation. The second subset of questions titled “Risks” asked respondents their perception of the health risks of water fluoridation. The results of both subsets of questions are reported in the following tables and paragraphs as descriptive statistics.

In the “Benefits” subset of questions, two of the three questions received a majority opinion. 66.34% of survey respondents believe water fluoridation is beneficial to oral health, and 20.79% do not believe fluoridation is beneficial to oral health. 52.48% of survey respondents believe they can control the effects of water fluoridation, and 13.86% believe they can control the effects of water fluoridation. 40.80% of survey respondents believe water fluoridation is beneficial to overall health, while 33.33% believe water fluoridation is not beneficial to overall health. Table 5.3A displays the results of the “Benefits” questions.

Table 5.3A: Perceptions of Fluoride Benefits

Health Perceptions: Benefits	% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I believe water fluoridation is beneficial to oral health. N=202 (Frequency)	20.79% (42)	12.87% (26)	66.34% (134)
I believe water fluoridation is beneficial to overall health. N=201 (Frequency)	33.33% (67)	25.87% (52)	40.80% (82)
I believe I can personally control the effects of water fluoridation. N=202 (Frequency)	52.48% (106)	33.66% (68)	13.86% (28)

The “Risks” subset of questions showed that 54.31% of survey respondents disagreed with the statement, “I believe my family to be at risk as a result of water fluoridation” compared to 24.37% who agreed. 46.35% of survey respondents disagreed with the statement, “I believe water fluoridation has catastrophic potential, capable of contributing to many deaths or illnesses” compared to 23.44% who agreed.

43.88% of survey respondents do not agree that children, in particular, are put at risk from water fluoridation; and 38.26% agree that children, in particular, are put at risk from water fluoridation. 42.71% of survey respondents also do not feel anxious regarding possible health risks from water fluoridation, compared to the 38.19% who do feel anxious from possible health risks from water fluoridation. 54.45% of survey respondents selected to neither agree nor disagree with the statement that the health effects from water fluoridation are reversible, comparably 24.08% disagreed and 21.47% agreed that health effects from water fluoridation are reversible. Results of the “Risks” questions are listed in Table 5.3B.

Table 5.3B: Perceptions of Fluoride Risks

Health Perceptions: Risks	% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I am anxious regarding possible health risks from water fluoridation. N=199 (Frequency)	42.71% (85)	19.10% (38)	38.19% (78)
I believe my family to be at risk as a result of water fluoridation. N=197 (Frequency)	54.31% (107)	21.32% (42)	24.37% (48)
I believe children, in particular, are put at risk from water fluoridation. N=196 (Frequency)	43.88% (86)	17.86% (35)	38.26% (75)
I believe health effects associated with water fluoridation are reversible. N=191 (Frequency)	24.08% (46)	54.45% (104)	21.47% (41)
I believe water fluoridation has catastrophic potential, capable of contributing to many deaths or illnesses. N=192 (Frequency)	46.35% (89)	30.21% (58)	23.44% (45)

Survey Category 4: Pharmacological Practices

The fourth category “Pharmacological Practices” has only one section of survey items titled “Medical Ethics.” “Pharmacological Practices” is designed to gather survey respondent’s perception of the ethical issues which surround water fluoridation. Descriptive analyses were conducted on this category namely distribution charts and cross-tabulation tables. “Medical Ethics” survey items are designed to see if respondents believe water fluoridation should be subject to standard medical ethics such as informed consent and controlled dosage.

One of the survey items states “I know how much fluoride I consume every day.”, 82.29% of survey respondents disagreed with that statement compared to 5.21% who agreed. Furthermore, 47.92% agreed that they are entitled to sign an informed consent waiver before using fluoridated water, compared to 25.00% who disagreed. 44.79% of survey respondents disagreed with the statement that “I believe water fluoridation affects people equally” compared to 25.52% of survey respondents who agreed. The final survey item in the “Medical Ethics”

section states “I see water fluoridation as an issue relating to personal rights or freedoms”

41.15% of survey respondents agreed while 38.54% of survey respondents disagreed with the statement. Table 5.4A shows the results of the “Pharmacological Practices” survey items.

Table 5.4A: Perceptions of Fluoridation Ethics

Pharmacological Practices: Medical Ethics	% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I see water fluoridation as an issue relating to personal rights or freedoms. N=192 (Frequency)	38.54% (74)	20.31% (39)	41.15% (79)
I know how much fluoride I consume every day. N=192 (Frequency)	82.29% (158)	12.50% (24)	5.21% (10)
I am entitled to signing an informed consent waiver before using fluoridated water. N=192 (Frequency)	25.00% (48)	27.08% (52)	47.92% (92)
I believe water fluoridation affects people equally. N=192 (Frequency)	44.79% (86)	29.69% (57)	25.52% (49)

Given that 82.29% of survey respondents did not agree with the statement “I know how much fluoride I consume every day,” the fluoride consumption survey item was selected to perform cross-tabulation analyses with the other questions in the “Pharmacological Practices” category. The first cross-tabulation compared the answers to the fluoride consumption survey item and the informed consent survey item. The cross-tabulation analysis showed that 41.67% of the respondents who answered both questions agreed that they are entitled to sign an informed consent waiver before using fluoridated water and do not know how much fluoride they consume on a daily basis. The second highest response to both items was 21.35% of respondents who do not know how much fluoride they consume daily and do not believe they are entitled to sign an informed consent before using fluoridated water. The results of this cross-tabulation are listed in Table 5.4B.

Table 5.4B: Informed Consent Versus Daily Fluoride Consumption

Pharmacological Practices: Medical Ethics		I know how much fluoride I consume every day. N=192 (Frequency)		
		% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I am entitled to signing an informed consent waiver before using fluoridated water. N=192 (Frequency)	% Disagree: 1-3	21.35% (41)	2.60% (4)	1.04% (2)
	% Neither agree nor disagree: 4	19.27% (37)	6.77% (13)	1.04% (2)
	% Agree: 5-7	41.67% (80)	3.13% (6)	3.13% (6)

Table 5.4C features a cross-tabulation between the fluoride consumption survey item and the survey item which states “I see water fluoridation as an issue relation to personal rights or freedoms.” The cross-tabulation analysis showed 36.98% of respondents to both survey items believed that water fluoridation is an issue which relates to their personal rights and that they do not know how much fluoride they consume daily. The second highest response percent was 32.81% of respondents who do not know how much fluoride they consume daily but do not believe that water fluoridation is an issue relating to their personal rights.

Table 5.4C: Personal Rights Versus Daily Fluoride Consumption

		I know how much fluoride I consume every day. N=192 (Frequency)		
Pharmacological Practices: Medical Ethics		% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I see water fluoridation as an issue relating to personal rights or freedoms. N=192 (Frequency)	% Disagree: 1-3	32.81% (63)	4.17% (8)	1.56% (3)
	% Neither agree nor disagree: 4	12.50% (24)	6.77% (13)	1.04% (2)
	% Agree: 5-7	36.98% (71)	1.56% (3)	2.61% (5)

The last cross-tabulation of Category 4 compares the answers to the fluoride consumption survey item with the survey item which states “I believe water fluoridation affects people equally.” This cross-tabulation showed that 40.32% of survey respondents who did not believe they know how much fluoride they consume daily while also disagreeing with the statement that water fluoridation affects people equally. 21.47% of respondents who answered both survey items do not know how much fluoride they consume daily but also believe that fluoride affects people equally. The complete results to this cross-tabulation are reported in Table 5.4D.

Table 5.4D: Equal Effects Versus Daily Fluoride Consumption

Pharmacological Practices: Medical Ethics		I know how much fluoride I consume every day. N=191 (Frequency)		
		% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I believe water fluoridation affects people equally. N=191 (Frequency)	% Disagree: 1-3	40.32% (80)	2.09% (4)	2.62% (5)
	% Neither agree nor disagree: 4	20.42% (39)	8.90% (17)	0.52% (1)
	% Agree: 5-7	21.47% (41)	1.57% (3)	2.09% (4)

Survey Category 5: Fluoride Transparency

The fifth and final category titled “Fluoride Transparency” features two subsections titled “Information Disclosure” and Government Responsiveness.” Descriptive statistics have been utilized to describe the survey respondent’s answers.

The first statement which seeks to address the respondent’s perception of the government’s “Information Disclosure” states “I believe the government has disclosed all information relating to water fluoridation.” 56.02% of survey respondents disagree and believe the government has not disclosed all information relating to water fluoridation, compared to 25.65% of survey respondents who agreed. Table 5.5A depicts the responses.

Table 5.5A: Perceptions of Information Disclosure by Government

Fluoride Transparency: Information Disclosure	% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I believe the government has disclosed all information relating to water fluoridation. N=191 (Frequency)	56.02% (107)	18.33% (35)	25.65% (49)

Table 5.5B depicts the respondent's perception of the government's responsiveness to fluoridation concerns. 43.46% of survey respondents disagreed with the statement "I believe the government's attitude is responsive to the public's concerns over water fluoridation." 21.99% of survey respondents agreed that the government has a responsive attitude toward the public's fluoride concerns.

Table 5.5B: Perceptions of Government Responsiveness to Fluoridation Concerns

Fluoride Transparency: Government Responsiveness	% Disagree: 1-3	% Neither agree nor disagree: 4	% Agree: 5-7
I believe the government's attitude is responsive to the public's concerns over water fluoridation. N=191 (Frequency)	43.46% (83)	34.55% (66)	21.99% (42)

Interview Responses

As previously discussed in the 'Methods' chapter, due to time constraints Mr. John Thomaides was not able to answer all questions in Table 4.3. But Thomaides was able to answer questions from Category 2, 3, and 4. Mr. Sam Brannon was able to complete the full interview. However, to present both sides of the issue, this interview analysis only discusses the question which both interviewees answered. Therefore, the following interview analysis focuses on Category 2, 3 and 4 of Table 4.2 and 4.3.

Category 2: Policy/Procedural Awareness of Interviewees

Category 2 “Policy/Procedural Awareness” was the first category discussed in each interview. In response to Q17 and Q18 of Table 4.3, Mr. John Thomaides stated that his stance was twofold in the fluoridation debate. First, was when the fluoride matter came up to council discussion Thomaides recused him from the discussion. Thomaides’ decision to recuse himself was to avoid any appearance of a conflict of interest given the nature of the organization he founded named “Alpha Pure Water” (APW), which sells water purification systems. Thomaides further clarified that APW does not have any contracts with the City of San Marcos and though some of his systems do remove fluoride that he does not actively advertise his purification systems as removing fluoride. Thomaides further suggested he has likely lost more business than he has gained through the sale of purification systems which remove fluoride. Secondly, Mr. Thomaides stance was in support of water fluoridation (Thomaides, 2017).

Mr. Sam Brannon founder of “Communities for Thriving Water: Fluoride-Free San Marcos” (CTW) stood in opposition to Thomaides and did not support the fluoridation of municipal water supplies. Furthermore, as head of CTW, Brannon actively campaigned against water fluoridation.

The next questions posed to Thomaides were Q22 and Q23. Q22 asked Thomaides why the City Council of San Marcos decided to adopt their own version of CTW’s petition after filing a lawsuit against CTW over the original petition. Q23 asked why there was a discrepancy in the wording of Council’s version of the original CTW petition. Thomaides’ response to Q22 began with stating that the way CTW executed the petitioning process was flawed, that not all the signatures gathered were properly witnessed by petitioners. This flaw in the petitioning process led to the city’s decision to file suit against CTW. Thomaides further explained that the way

CTW had originally worded the petition would have cost the City of San Marcos to spend \$90,000,000 to comply with new treatment equipment which they did not see as economically feasible. Thomaides further stated that despite the discrepancy in wording CTW decided to support Proposition 1 (Brannon, 2017).

In the interview with Brannon he stated through the petition process, CTW had obtained roughly 3,500 signatures. But in an attempt to avoid controversy CTW decided only to present the signatures they felt unquestionably complied with state law governing the petition process. CTW eventually won the legal battle with the City of San Marcos; on August 15, 2015, the 22nd State District of Texas Judge Bruce Boyer concluded: “If the petition qualifies, the City of San Marcos shall be required to follow the ministerial duty of calling for an election on the issue.” (Rollins, 2015). After the city had adopted their own version of the petition, Brannon was initially frustrated. Brannon and CTW decided to support Proposition 1 despite their view of Proposition 1 as a compromise. Overall, CTW believed Proposition 1 was an incremental step in their interest of ending water fluoridation in the City of San Marcos (Brannon, 2017).

Category 3: Health Perceptions of Interviewees

The next set of questions Q30 and Q31 on Table 4.3 described Thomaides’ perception of the health benefits associated with water fluoridation. Thomaides stated that when the issue of water fluoridation first came to his awareness, he was contacted by dentists. The dentists presented studies which he believed credible and substantiated Thomaides’ belief that water fluoridation presented a public health benefit to oral health. Furthermore, Thomaides stated that the studies further substantiated that there was a correlation between oral health and overall health. Therefore, Thomaides believes water fluoridation also provides an overall public health benefit which satisfied his duty as a public servant (Thomaides, 2017).

Conversely, Brannon expressed his belief that water fluoridation provides little to no benefits to the city or those who reside in San Marcos. The only possible benefit Brannon acknowledged is the “topical effect” as described by the EPA (2015). Brannon then posed the caveat that the “topical effect” would only be beneficial if San Martians were gargling the fluoridated water and spitting it out (Brannon, 2017).

Q32 and Q33 of Table 4.3 were then asked to Thomaides. Thomaides thought back to when water fluoridation originally became an issue and expressed his opinion that many of the claims of fluoride risks were outlandish. To put the risks into perspective Thomaides compared water fluoridation policy to water chlorination policy. Thomaides acknowledged that fluoridation and chlorination both could potentially present risks but that the overall benefits of both chlorination and fluoridation outweigh the potential risks (Thomaides, 2017).

Brannon expressed concern that fluoride presents a bevy of risks not only to the citizens but also the city. For citizens, Brannon believes fluoride presents a risk factor with a variety of conditions and diseases. Conditions and diseases such as hypothyroidism (Peckham et. al., 2015), increased risk of bone cancer specifically Osteosarcoma among young boys (Bassin et. al. 2006), and a disproportionate effect on low-income citizens (Beltram-Aguilar et. al., 2005). For the City of San Marcos, Brannon expressed concern that fluoride corrodes pipes and can also leach other substances out of the pipes such as lead or arsenic which causes a whole different set of health risks to the citizens (Brannon, 2017).

Category 4: Medical Ethics of Interviewees

The final set of questions addressed in the interview with Thomaides answered questions which dealt with the topic of medical ethics in relationship to water fluoridation policy. Specifically, Q37 and Q38 of Table 4.3 asked Thomaides about the role of the “precautionary principle” in deciding on water fluoridation policy. Thomaides stated that the question was beyond his expertise, but believed a preponderance of evidence was on the side of water fluoridation. Thomaides again related the discussion to chlorination of water. While Thomaides acknowledged that fluoridation directly seeks to treat the people who receive it, whereas chlorination treats the water, he stated that the two policies share common ground in the interest of providing public health benefits (Thomaides, 2017).

Brannon’s stance was not in agreement with Thomaides’ stance on the medical ethics of water fluoridation policy. Brannon believes there is a great significance in the difference between fluoridation treating the people and chlorination treating the water. Furthermore, Brannon expressed strong criticism of the ethical implications of water fluoridation (Brannon, 2017).

First, Brannon stated that despite the controlled level of water fluoridation at 0.7 ppm; one cannot assume a controlled dose of fluoride, as people naturally vary on the amount of water they drink in a given day. Second, individual sensitivity is not being taken into account; as there is likely to be wide variability in the fluoride sensitivity from the least fluoride sensitive to most fluoride sensitive citizen in the City of San Marcos (Brannon, 2017). Third, Brannon stated that the lack a randomized control trial on fluoridation invalidates the entire water fluoridation argument because it has never met the standard of a widely accepted tool for clinical research (George Washington University, 2011).

Chapter VI: Conclusions

Chapter VI Purpose

The purpose of this chapter is to review and summarize the research presented in this study. Results from the survey and interview analyses are discussed. This chapter also discusses the contributions and the limitations of this research. After a thorough summarization of the findings and examination of the contributions and limitations, recommendations for future research and suggestions for the area of focus for potential research are presented.

Research Summary

This applied research project described the opinions and knowledge of Texas State students and two prominent members of the San Marcos community regarding the newly formulated water fluoridation policy. The research was first conducted to give a detailed introduction to what fluoride is on an elemental level, and how it was first synthesized and isolated. Then a discussion about how fluoride was discovered to be in water and fluoride's association with lower cavity rates, and the first trial city to implement water fluoridation as a public policy. Further discussion focused on how water fluoridation policy became commonplace in the United States.

Following the introductory chapter, a detailed policy history was examined specifically the role that the EPA played in regulating fluoridation policy with such as acts as the 1974 Safe Drinking Water Act. The policy history chapter also covered relevant lawsuits relating to water fluoridation and full-scale reviews and adjustments of the regulation of water fluoridation policy. Most importantly, the "Policy History" chapter gave a thorough report of how water fluoridation became an issue in the City of San Marcos.

Chapter III: Literature Review took a comprehensive approach to existing literature to develop a conceptual framework that organized various important aspects of fluoridation policy

through experts such as the EPA, FDA, and independent researchers, among many others. The purpose achieved through the literature review was to solidify key concepts about water fluoridation to create the conceptual framework (Shields & Rangarajan, 2013). The conceptual framework was then used as a guide to operationalize questions into a survey and interview format with five categories. Answers to these questions then were used to describe the views of individuals who are affected by the new water fluoridation policy in San Marcos, Texas.

The process of operationalization is detailed at length in Chapter IV: Methods. The methodology chapter also highlights the strengths and weaknesses of the analysis methods for the sake of accurately interpreting the results of the analyses and acknowledging the contributions and limitations inherent in the analyses.

Chapter V: Results is for providing the data both qualitative (interviews) and quantitative (survey) for each category in the operationalization tables (Tables 4.1, 4.2, & 4.3). By providing this information in analytical tables and analyzing the qualitative data, it sets the stage for this final chapter which interprets the results and provides a table which summarizes the findings. Chapter VI: Conclusions then continues to discuss contributions, limitations, future recommendations and the final conclusions that can be taken from this analysis.

Summary of Findings

Analysis of results from both methods of research shows that there is an ideological split in between two fundamental notions of governance. On one side there is the ideology of democracy and the collective will of the people, compared to the other side being the ideology of representativeness and individual rights.

For example, Table 6.1 shows that 42.22% of survey respondents support fluoridation of municipal water supplies. However, Table 6.1 also shows an extreme majority of 82.29% of respondents disagree with the statement “I know how much fluoride I consume every day.”

compared to 5.21% of respondents who believe they know how much fluoride they consume daily. 47.92% of survey respondents believed that they were entitled to sign an informed consent waiver before using fluoridated water. Furthermore, Table 6.1 also shows that 41.67% of individuals who did not believe they knew how much fluoride they consumed daily also agreed with the statement “I am entitled to signing an informed consent waiver before using fluoridated water.”

The interview analysis showed a similar dichotomy of ideology. Mr. Thomaides focused on what he saw in water fluoridation as a general benefit to the community of the City of San Marcos. Whereas Mr. Brannon, on the other hand, focused on what he saw as the lack of representation for those who are put at most risk by potential hazards of water fluoridation. Furthermore, the presentation of scientific arguments can be made from both sides and effectively cancel each other out. However, the ethical implications of water fluoridation as a treatment for citizens in both analyses were rather clearly against water fluoridation.

Though survey respondents generally viewed water fluoridation risks and benefits favorably where 66.34% believe water fluoridation is beneficial to oral health; while 54.31% do not believe their family is at risk from water fluoridation; it is important to note the ignorance of how fluorides are viewed by the rest of the world and by the Food and Drug Administration (FDA). 61.84% of survey respondents believed that the FDA classified fluorides as a “mineral” whereas only 13.05% of respondents were aware that the FDA classifies fluorides as a “drug” (FDA, 1963) (FDA, 1967) (FDA, 1990) (FDA, 2000). Furthermore, 61.39% of respondents believed that other “westernized” countries fluoridate their water. To the contrary, 97% of Western Europe has rejected water fluoridation (BFS, 2012).

As further evidence of the general ignorance of the water fluoridation, while 75.50% of survey respondents believed Proposition 1 passed into law, 43.06% believed Proposition 1 had to do with water fluoridation. Further analysis as reported in Table 6.1 shows that 34.34% of survey respondents correctly answered both awareness questions that Proposition 1 had to do with water fluoridation and passed into law.

The general ignorance of the nature of fluoride as a drug is a strong argument against a democratic ideology being applied to water fluoridation policy. But the most powerful argument against the democratic ideology is that individual medical choices such as prescription medications are not subject to majority opinion. If an individual wants to initiate a medical procedure or begin a medication regimen, they have a right to accept or decline an invitation into that protocol willingly. Water fluoridation's lack of compliance with standard pharmacological protocols such as informed consent and controlled dosage; leads this research to the conclusion that from the perspective of a public policy researcher to continue to pursue a continuance of the newly adopted water fluoridation policy in the City of San Marcos.

Table 6.1: Summary of Key Survey Findings

Survey Category	Key Findings
Personal Background Characteristics	<ul style="list-style-type: none"> • 66.84% identified as “female” • 63.49% identified as “white” • 43.39% identified as both “white” and “female” • 52.91% identified as “graduate” students
Policy/Procedural Awareness	<ul style="list-style-type: none"> • 43.06% knew that Proposition 1 had to do with water fluoridation • 75.50% knew that Proposition 1 passed into law • 34.34% knew Proposition 1 was passed into law and that it was about water fluoridation • 42.22% support water fluoridation • 61.39% believe other “westernized” countries fluoridate their municipal water • 61.84% believe the FDA classifies fluorides as a “mineral” • 13.05% believe the FDA classifies fluorides as a “drug”
Health Perceptions	<ul style="list-style-type: none"> • 66.34% believe water fluoridation is beneficial to oral health • 40.80% believe water fluoridation is beneficial to overall health • 54.31% do not believe their family is at risk from water fluoridation • 43.88% do not believe children, in particular, are put at risk from water fluoridation
Pharmacological Practices	<ul style="list-style-type: none"> • 82.29% do not know how much fluoride they consume daily • 47.92% believe they are entitled to sign an informed consent waiver • 41.67% do not know how much fluoride they consume daily and believe they are entitled to sign an informed consent waiver
Fluoride Transparency	<ul style="list-style-type: none"> • 56.02% believe the government has disclosed all information relating to water fluoridation • 43.46% believe the government is responsive to the public’s concerns over water fluoridation

Contributions

The survey contributes to the overall research of water fluoridation by being the first survey on the new water fluoridation policy in the City of San Marcos. This research provides feedback for elected officials of San Marcos to consider if they intend to enact any further water fluoridation legislation based upon the views of residents of San Marcos.

This study provides a general framework to study perceptions and awareness of water fluoridation policy in the future. Also by formulating new questions, the survey adds to the literature vetted questions which can be used in further research both in the City of San Marcos and in other municipalities where the issue of water fluoridation has come to the forefront.

The interviews contribute to the literature by providing two perspectives of water fluoridation by two individuals who were intimately involved in the policy formulation process of San Marcos' water fluoridation policy. The interviews provide expert points of views from both sides of the argument and could provide separate methods for formulating water fluoridation policy.

Limitations

This research has been conducted with limited resources that create various limitations to the reliability of results. First and foremost, the greatest limitation of this research has been time. Given that the analysis had to be approved by the IRB, conducted and concluded all within a single semester poses many challenges to the reliability of the results. Ideally, the survey would have been sent out to the citizens of San Marcos to get their feedback on the new fluoridation policy. For the sake of convenience, it was decided instead to use Texas State students as the constituent population for the survey. The response of students is less likely to be a reliable measure of the opinion of the average San Martian because of the distinct possibility that they are not from San Marcos and/or do not plan to stay in San Marcos after graduation. The average student's opinion on fluoridation policy, given their lack of investment in the community, may not be representative of the average San Martians view on water fluoridation policy.

The results of this survey have to be interpreted with caution due to a low response rate. Furthermore, the unverifiable possibility of non-response bias due to it being conducted as a web-based survey is present in the results. A further threat to validity and reliability is due to the

disproportionate number of female respondents. As shown in Table 6.1 over two-thirds of respondents have identified as “Female” which both exemplifies the non-response bias and poses a threat to reliability in the possibility that males have different views on water fluoridation policy than females. Also, 61.58% of respondents identified as between the ages of 18-25 which is a significant disparity compared to the average age of a San Martian.

A separate limitation to the reliability of the survey is that the questions from Category 2 and parts of Category 3 and 4 have been created for the first time. These newly formulated questions present an issue regarding the reliability of the measurement of the intended variable by those questions. Furthermore, regarding the interview process the questions have been formulated to reflect the questions asked in the survey, and if the survey questions are of questionable reliability, then it is likely to imply a less reliable set of interview questions. Also due to time constraints in his schedule Mayor John Thomaides had to skip a majority of the questions originally planned for his interview therefore not all interview questions were answered from both sides of the debate.

Given the researchers past diagnosis of Osteosarcoma and its connection to fluoride, there is the possibility that the results and overall tone of this research to be biased against water fluoridation.

Future Research Recommendations

This study can be extended in many different ways in the future. Future researchers should seek to administer the survey to the citizens of the municipality as opposed to a floating population of students. Citizens are more likely to be affected by water fluoridation policy, more knowledgeable of the policy and more likely to vote. Future researchers should also seek to involve as many stakeholders in the water fluoridation policy as possible, from experts and elected officials to longtime citizens and younger demographics.

Moreover, future research may find that the conceptual framework does not include all important elements of perceptions and awareness of water fluoridation policy. Therefore, future researchers may seek to expand or retract the scope of the study, specifically the survey. Further research should try to expound on the wording of the newly formulated questions from Category 2, 3, and 4.

The final recommendation for future research is for researchers to utilize as much time as possible to gather a response rate which sufficiently represents the population that is affected by water fluoridation policy.

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Appendix A

Survey Recruitment Email

This email message is an approved request for participation in research that has been approved or declared exempt by the Texas State Institutional Review Board (IRB).

The following research survey is intended to help describe citizen's perception of recent legislation passed in the city of San Marcos. Your participation will help further the understanding of this policy and how it affects residents of the City of San Marcos. This survey will only take about 10-20 minutes of your time; all answers to the survey are completely anonymous and participation is entirely voluntary giving respondents the option to quit the survey at any point. If you are interested in participating in the survey, please click the link below.

To participate in this research or ask questions about this research please contact Nicholas Marks njm34@txstate.edu or 512-245-6616.

This project 2017475 was approved by the Texas State IRB on 03/10/17.

Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser 512-245-3413 – (lasser@txstate.edu) or to Monica Gonzales, IRB administrator 512-245-2314 - (meg201@txstate.edu).

Interview Recruitment Email

This email message is an approved request for participation in research that has been approved or declared exempt by the Texas State Institutional Review Board (IRB).

You are receiving this e-mail due to your involvement and expertise in respect to the newly formulated water fluoridation policy. This e-mail is designed to recruit you to be part of an interview process which is intended to help describe citizen's perception of recent legislation passed in the city of San Marcos. Your participation will help further the understanding of this policy and how it affects residents of the City of San Marcos. This interview will take about 1-2 hours of your time if you accept the interview, please provide a date and time that would be most convenient for you; participation is entirely voluntary giving interviewees the option to skip questions or end the interview at any point.

An example of a question you will be asked are "Do you believe there are positive effects of water fluoridation?" and "If so, what do you believe are the most important positive effects of water fluoridation?" If and when you agree to the interview I will forward you the entire list of questions that will be asked during the interview, and you are free to skip questions or end the interview at any point.

To participate in this research or ask questions about this research please contact Nicholas Marks at njm34@txstate.edu or 832-718-8462.

This project 2017475 was approved by the Texas State IRB on 03/10/17. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser 512-245-3413 – (lasser@txstate.edu) or to Monica Gonzales, IRB administrator 512-245-2314 - (meg201@txstate.edu).

Interview Script

“Thank you for agreeing to speak with me today.”

“The purpose of this interview is to get your feedback about how the new water fluoridation policy came about and your involvement in the process. Specifically, we want to understand your role in the process and your view of the policy and controversy which surrounds the policy. We want to understand the legal process which led to the fluoride proposition, and your view of the policy both in the City of San Marcos and in general as a public policy.

“The underlying assumption that we are working with is that you sought to further the best interest of the residents of the City of San Marcos by advocating either for or against the water fluoridation policy. Given your direct involvement in the issue we further assume you have an intimate knowledge of the process which brought about this water fluoridation policy in the City of San Marcos. That is why we are speaking with you. We want to hear from you what you believe to be in the best interest of the residents of San Marcos regarding water fluoridation policy.”

“The interview will last one to two hours and we will audiotape the discussion to make sure that it is recorded accurately.”

“Do you have any questions for us before we begin?”

IRB Approval Message

In future correspondence please refer to 2017475

March 16, 2017

Nicholas Marks Texas State University 601 University Drive. San Marcos, TX
78666

Dear Mr. Marks:

Your IRB application 2017475 titled “Fluorosis Neurosis: Describing the Attitudes of people affected by the San Marcos Water Fluoridation Policy.” was reviewed and approved by the Texas State University IRB. It has been determined that risks to subjects are: (1) minimized and reasonable; and that (2) research procedures are consistent with a sound research design and do not expose the subjects to unnecessary risk. Reviewers determined that: (1) benefits to subjects are considered along with the importance of the topic and that outcomes are reasonable; (2) selection of subjects is equitable; and (3) the purposes of the research and the research setting is amenable to subjects’ welfare and producing desired outcomes; that indications of coercion or prejudice are absent, and that participation is clearly voluntary.

1. In addition, the IRB found that you need to orient participants as follows: (1) informed consent is required; (2) Provision is made for collecting, using and storing data in a manner that protects the safety and privacy of the subjects and the confidentiality of the data; (3) Appropriate safeguards are included to protect the rights and welfare of the subjects. This project is therefore approved at the Exempt Review Level 2. Please note that the institution is not responsible for any actions regarding this protocol before approval. If you expand the project at a later date to use other instruments please re-apply. Copies of your request for human subjects review, your application, and this approval, are maintained in the Office of Research Integrity and Compliance. Please report any changes to this approved protocol to this office.

Sincerely,

Monica Gonzales IRB Regulatory Manager Office of Research Integrity and
Compliance

CC: Dr. Nandhini Rangarajan

Qualtrics Survey

Dear Respondent,

My name is Nicholas Jay Marks. I am working towards a Masters in Public Administration Degree at Texas State University. My Applied Research Project has the purpose of describing students' perceptions of a public policy issue in San Marcos. I request you to participate in this survey because you are a member of Texas State University and are likely to be affected by this. Your participation will help evaluate this policy and its effects on San Marcos residents. This survey is estimated to take about 6 minutes to complete; all answers to the survey are completely anonymous and participation is entirely voluntary giving respondents the option to skip questions or quit the survey at any point.

This research IRB #2017475 has been approved by the Texas State Institutional Review Board (IRB). If you have any questions or need any clarifications about this research please contact me at njm34@txstate.edu or 512-245-6616. This project IRB #2017475 was approved by the Texas State IRB on 03/16/17.

Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser 512-245-3413 - (lasser@txstate.edu) or to Monica Gonzales, IRB administrator 512-245-2314 (meg201@txstate.edu).

Thank you for taking the time out to fill out this survey!

Sincerely,
Nicholas Jay Marks

Proposition 1 in the 2015 San Marcos elections had to do with what topic?

Petitioning

Texting & Driving

Water Fluoridation

Minimum Wage

Other, please specify _____

Was proposition 1 passed into law?

Yes

No

I support fluoridation of municipal water supplies.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

The majority of "westernized" countries in the world fluoridate their water supplies.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

How does the Food and Drug Administration classify fluoride compounds?

Nutrient

Vitamin

Mineral

Drug

Other, please specify _____

Experts agree over the benefits and risks of water fluoridation.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I see the addition of fluoride to water supplies as a natural process.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe water fluoridation is beneficial to oral health.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe water fluoridation is beneficial to overall health.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe I can personally control the effects of water fluoridation.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I am anxious regarding possible health risks from water fluoridation.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe my family, to be at risk as a result of water fluoridation.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe children, in particular, are put at risk from water fluoridation.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe health effects associated with water fluoridation are reversible.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe water fluoridation has catastrophic potential, capable of contributing to many deaths or illnesses.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I see water fluoridation as an issue relating to personal rights or freedoms.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I know how much fluoride I consume every day.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I am entitled to signing an informed consent waiver before using fluoridated water.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe water fluoridation affects people equally.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe the government has disclosed all information relating to water fluoridation.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

I believe the government's attitude is responsive to the public's concerns over water fluoridation.

Strongly disagree

Disagree

Somewhat disagree

Neither agree nor disagree

Somewhat disagree

Agree

What is your gender

Male

Female

What is your age?

>18

18-21

22-25

26-36

37-50

51-70

70+

What is your race/ethnicity?

White

Black or African American

Hispanic

American Indian or Alaska Native

Asian

Native Hawaiian or Pacific Islander

Other

What is your political affiliation?

Democrat

Republican

Independent

Other, please specify _____

What is your classification by Texas State University?

Freshman

Sophomore

Junior

Senior

Graduate

Have you lived in San Marcos your whole life?

Yes

No

Prefer not to say

How many years have you lived in San Marcos?

0-5 years

5-10 years

10-15 years

15-20 years

20+ years

Not applicable

Have you lived in Texas your whole life?

Yes

No

Prefer not to say

How many years have you lived in Texas?

0-5 years

5-10 years

10-15 years

15-20 years

20+ years

Not applicable

Have you lived in the United States your whole life?

Yes

No

Prefer not to say

How many years have you lived in the United States?

0-5 years

5-10 years

10-15 years

15-20 years

20+ years

Not applicable

Have you ever lived in a foreign country?

Yes

No

Prefer not to say

If yes what foreign country?

Yes, fill-in blank _____

Not applicable