5-2018

Water in Worcester A Campaign for Public Fluoridation

Ryan Early
Clark University, rearly@clarku.edu

Xiao Gu
Clark University, xgu@clarku.edu

Yajing Huang
Clark University, yhuange@clarku.edu

Lauren Meininger
Clark University, lmeininger@clarku.edu

Emma Phillips
Clark University, ephillips@clarku.edu

Author
Ryan Early, Xiao Gu, Yajing Huang, Lauren Meininger, Emma Phillips, and Yao Su

Water in Worcester

A Campaign for Public Fluoridation

Ryan Early, Xiao Gu, Yajing Huang, Lauren Meininger,

Emma Philips, & Yao Su

27 April 2018

Table of Contents

List of Tables

List of Figures

Appendix Contents

Executive Summary

Water in Worcester: A Campaign for Public Fluoridation arose as a project from our sponsors, Chris Philbin, Vice President of Government Relations at UMass Memorial Health Care, and Joe O'Brien, former Worcester Mayor, Executive Director of the Environmental League of Massachusetts, and Clark University Adjunct Professor. Our goal has been to produce resources that will support the fight for fluoridation in the City of Worcester. Fluoridation has failed to pass in Worcester on four separate occasions, but Mr. Philbin and Mr. O'Brien believe that the time has come to try again.

In order to fluoridate Worcester's water supply, the municipal Board of Health would have to vote to add it. Opponents would then have the opportunity to collect signatures and make the issue into a referendum question that voters would address in the November, 2018 election. Our goal was to provide persuasive background information that would encourage the Board of Health to institute fluoridation, in addition to resources that could be used to win a referendum campaign, should it come to that.

In our first meeting with Mr. Philbin, Mr. O'Brien, and a number of other local doctors, dentists, and policy leaders, we developed the scope for this project. With a goal of developing information to persuade the Board of Health and voters, we focused our research in three areas that would help us achieve this goal.

The first area is fluoride research. We collected resources discussing the health benefits of water fluoridation, and compiled them into an annotated bibliography and literature review. The purpose of this resource is to serve as a guide for doctors, dentists, and advocates to back up public statements in favor of fluoride.

The second field is political research. This is a multi-faceted section of research. This begins with an exploration of where else in the country water is fluoridated and when it was instituted. We examined data from the Centers for Disease Control and Prevention (CDC) and the Massachusetts Department of Public Health (DPH) and created maps of fluoridation across the United States and within Massachusetts. We also looked at all of the votes on fluoridation in Massachusetts since 2000 using MA DPH data and news articles on fluoridation, compiling the votes by outcome (inclusion or not of fluoride). This section also includes analysis of Worcester's 2001 referendum campaign and election on fluoridation, which was the city's most recent vote on fluoridation. Included here are the election results, the campaign spending breakdown for the pro-fluoride campaign, and a collection of messages used to advocate for and against fluoridation. The final piece of the political research section is an overview of successful messaging that has been used in fluoridation campaigns elsewhere in the country.

The third segment of research is electoral research. This section does not look explicitly at fluoride. Instead, it looks at the changing geographic distribution of voters (by ward) in the City of Worcester between 2001, 2014, and 2016. This section is important for developing a successful campaign strategy for a referendum election, should it be necessary.

The results of all of our data and information collection and analysis have been made into an online resource for our client's use. The fluoride and political research has been collected into a single research document. Part of the political research and all of the electoral research are also presented in the form of dynamic and interactive maps,

tables, and charts through Tableau. These resources can be found using the link in our final deliverables document, which also contains an overview of the information included.

Fluoridation has a strong chance of success in Worcester. The accumulation of this research demonstrates that the trend continues towards fluoridation, in Massachusetts and across the US. The voting segment of the Worcester electorate has changed since 2001. Successful messaging has been fine-tuned through campaigns across the country. Hopefully our sponsors and stakeholders can take this convincing information to the Board of Health and encourage fluoridation.

Acknowledgments

This project would not have been possible without the support of our sponsors and advisors. Our project sponsors were Chris Philbin, Vice President of Government Relations at UMass Memorial Health Care, and Joe O'Brien, Executive Director of the Environmental League of Massachusetts, Clark University Adjunct Professor, and former Mayor of Worcester. Chris Philbin and Joe O'Brien gave us the opportunity to participate in the movement to fluoridate Worcester. This was an amazing capstone experience and we appreciate the chance to work on this issue.

Joe O'Brien was integral to the success of this project. He helped us collect data on Worcester's electorate and provided guidance on how best to analyze it. His commitment to this project and our success was encouraging and inspiring throughout the process.

We would also like to thank all of the fluoride activists in Worcester who are invested in this project. The doctors, dentists, and community leaders who took the time to meet and discuss this with us are passionate and dedicated individuals who have worked tirelessly for this cause.

Finally, we would like to thank Mary Piecewicz, our advisor this semester. We truly could not have accomplished this without her guidance. Mary offered thoughtful comments and insightful advice on how to pursue different parts of the project, and helped ensure that we delivered our best work.

Chapter 1: Introduction

Worcester residents lack access to fluoridated water. The vast majority of Worcester's 184,000 residents are in need of fluoridated water to increase dental health and decrease out of pocket expenses associated with it. Worcester's fluoridation process is simple. The Board of Health would vote to adopt fluoridation. If there is opposition to this, opponents can file for an injunction on adding fluoride to the water supply. The opponents would then collect signatures throughout the summer to put the question of fluoridation on the 2018 ballot as a referendum. The referendum would ask voters if they oppose the Board of Health's decision to add fluoride to Worcester's water supply. If there is no organized opposition to fluoridation, the Board of Health could begin adding fluoride to the water supply.

Voters in Worcester have voted on fluoridation four times before. Most recently Worcester voted on fluoridation in 2001, during the regularly scheduled municipal election. A referendum question on whether or not Worcester should fluoridate its water supply joined the city councilors on the ballot. Worcester failed to fluoridate its water supply in 2001, in an election with approximately 22,000 voters (which is very low turnout). The lessons learned from this election have been formative for those seeking to fluoridate Worcester's water, and constituted an important part of our research.

This capstone project was developed because fluoride advocates in Worcester believe that the time is right to try again. Chris Philbin, Vice President of Government Relations at UMass Memorial Health Care, and Joe O'Brien, former Worcester Mayor, Executive Director of the Environmental League of Massachusetts, and Clark University Adjunct Professor, are our two co-sponsors. Both are active at the intersection of politics and public health, and believe firmly in enhancing the dental health of Worcester residents

through a safe and proven method of preventive community health policy. At the beginning of the semester, our sponsors brought together a group of community stakeholders who have an interest in seeing community water fluoridation succeed. Participants included doctors, dentists, and UMass Memorial Health Care executives. While some of these people were involved with Worcester's 2001 campaign for fluoridation, all are invested in seeing fluoridation succeed in 2018.

Our project has several purposes. We conducted research that our sponsors can use to encourage the Board of Health to pass fluoridation. We also created resources that can be used in a referendum campaign. Our research covered several areas. We created an annotated bibliography and a literature review of scientific research that can provide some of the many resources on the safety of fluoridation for doctors, dentists, or other scientific personnel advocating for the safety of fluoride. We looked at the political context of votes on fluoridation within Massachusetts and across the United States to identify trends in fluoridation in electoral politics. We explored messaging used in other campaigns to see how successful campaigns framed the issue. We examined the 2001 campaign, analyzing campaign finance records and messaging used. Finally, we analyzed the changing electoral context in Worcester between 2001 and 2016 to identify the shift in voting demographics and what segments of the city are likely to be important voting blocs in the upcoming election. The hope is that these resources will be helpful in encouraging the Board of Health that the time is right to fluoridate Worcester's water, and that an ensuing referendum campaign could be successfully waged and won. If Worcester fluoridates its water supply, it will be a victory for dental health and public health in the city.

This paper is broken down into chapters. Chapter 2 is a literature review of existing research on fluoridation. It is by no means an exhaustive survey of scientific research on fluoridation, but it provides background information and an overview of the type of information that can be found on fluoridation. Chapter 3 discusses the methods we used to conduct our research, and is broken down by type of research. Readers can see that our sections are electoral research and political research. Chapter 4 contains the results of our research. Again, this section is broken into electoral research and political research. Much of our research resulted in charts, tables, and graphs depicting trends in Worcester, Massachusetts, and the United States over time. While many of these figures are included in the text, there are also instructions in the appendix on how to view and engage with the interactive versions and additional figures online. Chapter 5 outlines our conclusions and summarizes our key findings. The appendix has additional resources from our research.

Chapter 2: Literature Review

Fluoride is present in the natural environment but can also be reproduced in

community water supplies. Fluoride is a mineral that naturally occurs in water and develops due to the presence of phosphate rock (Fluoride Safety: A Guide for Health Professionals, 2014; Fluoride & Community Water Fluoridation, 2014). Typically, the amount of fluoride that is naturally present in water is not enough to strengthen tooth enamel. Thus, many community water systems supplement fluoride (Fluoride & Community Water Fluoridation, 2014).

Fluoride is also present in consumer products. Fluoride is regularly added to dental care products, including toothpaste and mouth rinses (Fluoride Safety: A Guide for Health Professionals, 2014). Dentists also use fluoride as a preventive measure to improve the health outcomes of children. Topical fluoride treatments are provided at dental cleanings and can be sought out at Worcester Public Schools (Fluoride Safety: A Guide for Health Professionals, 2014). The application of fluoride to teeth through dental care is recognized as an important part of maintaining good dental health.

Communities can choose between several additives when fluoridating water supplies (Fluoride Safety: A Guide for Health Professionals, 2014). The three different additives used in the United States are sodium fluoride, sodium fluorosilicate, and fluorosilicic acid (Fluoride Safety: A Guide for Health Professionals, 2014). The addition of these compounds to water is regulated by the Environmental Protection Agency (EPA) and the United States Public Health Service (PHS) (American Cancer Society; American Dental Association). The PHS recommends optimal levels for water fluoridation, and the EPA sets a legal limit for the amount of fluoride that communities may add to their water supply (American Cancer Society; American Dental Association). Additionally, fluoridated water safety standards are outlined in the Safe Drinking Water Act (Common Questions

About Fluoride, 2014).

Fluoridated water has impressive public health benefits. Fluoride protects against tooth decay by strengthening tooth enamel, making it more resistant to acid (Common Questions About Fluoride, 2014; Fluoridated Water on Tap: Good Oral Health). The strongest benefits from fluoridation are noted among children, though positive oral health outcomes are identified among adults as well (Common Questions About Fluoride, 2014). Additionally, fluoride is safe for infants and fluoridated water can be safely mixed with infant formula (Common Questions About Fluoride, 2014). Fluoride has public health benefits for consumers of all ages.

Communities save money when they fluoridate water supplies. A study commissioned by the Centers for Disease Control and Prevention (CDC) found that each dollar invested in fluoridation saves $38 in dental care spending (Fluoride & Community Water Fluoridation, 2014). Additionally, the amount spent on fluoridation per person per year is significantly less than the cost of one filling (Fluoridated Water on Tap: Good Oral Health). Studies conducted across the United States, from Texas to New York, have noted that community water system fluoridation saves money (Fluoride & Community Water Fluoridation, 2014).

There are, however, pervasive concerns about fluoridation. One is that fluoridated water increases dental fluorosis, which leads to yellow or white spots on teeth (Zimmerman). This can occur in children when the level of fluoride is greater than 2.0 milligrams of fluoride per liter of water (mg/L) (American Cancer Society). The United States Environmental Protection Agency (EPA), however, has guidelines requiring disclosure if fluoride in water exceeds 2.0 mg/L (American Cancer Society). Additionally,

most community water systems maintain optimal levels of fluoride, which are between 0.7 and 1.2 mg/L, according to recommendations set by the United States Public Health Service (PHS) (American Cancer Society; American Dental Association). Another concern is that fluoridation decreases bone density (Zimmerman). This only occurs when there is exposure over a long period of time to water with more than 4.0 mg/L, which is the legal limit set by the EPA (American Cancer Society). There is additional speculation that fluoride can either cause or increase the chances of osteosarcoma, or bone cancer (American Cancer Society). This is challenging to study as it is a rare form of cancer. Several systematic reviews of research studies, however, have concluded either that there is not enough evidence to determine whether or not fluoride is carcinogenic, or that fluoride did not cause osteosarcoma, or any other form of cancer (American Cancer Society). While these concerns and misconceptions continue to spur debate, there is no conclusive evidence that the optimal amount of fluoridation is detrimental to health.

Fluoridation has widespread support in the medical community. The decades of precedence on water fluoridation show that it is a safe and effective tool for strengthening teeth and preventing the need for expensive dental procedures. This has earned fluoridation the support of the American Medical Association, the Centers for Disease Control and Prevention, the American Academy of Pediatrics, the Institute of Medicine, the American Public Health Association, and the American Dental Association (Fluoridated Water on Tap: Good Oral Health). Furthermore, the CDC has named water fluoridation one of the ten great public health achievements of the 20th Century in recognition of its importance to preserving public health (Fluoride & Community Water Fluoridation, 2014).

Chapter 3: Methods

Electoral Research

We used electoral data from 2001, 2014, and 2016 to conduct this analysis. Each of these years was chosen intentionally. The most recent vote on fluoridation in Worcester occurred in 2001; it is critical to understand the voter breakdown from that year to identify who voted in the most recent fluoride referendum election. Next, we chose 2014 because that election is the one that is the most recent and most similar election to 2018. The 2018 election, like 2014, will have a gubernatorial race and a Senate election. Because the same offices are on the ballot, the number of voters who turnout to vote should be similar between the two years. We can therefore identify how many voters will vote, how many voters we need to win, and which wards those voters live in. The reason that we included the 2016 election data is that it will help us determine who is likely still present and voting in Worcester. The least active voters only vote in presidential elections (which 2016 was). The most active voters vote in all elections, including municipal races (which 2001 was). By looking at whether or not the 2001 voters voted in 2014 and 2016, we can determine if they are still alive and living in Worcester. This helps us understand how many of the potential 2018 voters will have voted in the 2001 referendum election.

We obtained the voter data from the years 2001, 2014 and 2016 from the Worcester Election Commission. This data was stored in Excel documents and included the personal information of all those who participated in Worcester’s elections in these three years. Each voter's personal information was subdivided into: Name, Voter ID Number, Address, Ward Number, and Precinct Number. As the voting records must protect voters' privacy, they do not include data on how each person voted. That is to say, we do not know how voters in the 2001 election voted on fluoridation.

Therefore, we used Tableau to analyze the following things using the 2001, 2014, and 2016 election data:

1. Divided Worcester by its 10 wards and created maps based on this. The statistical data and map of each ward were combined into a dynamic table that integrated elections data.
2. Analyzed the number of participants in each ward for each election, and compared participation and growth rate across years.
3. Identified the voters who participated in both the 2001 and 2014 elections, and identified the percentage this was of total voters. Similarly, we found voters who participated in 2001, 2014, and 2016. This information can be used to predict the voter turnout by ward for the 2018 election.
4. Divided the 10 wards according to average income level. Based on information provided by Joe O'Brien, we labeled wards 3, 8, and 10 low income, wards 2, 4, 5, 6, and 7 moderate income, and wards 1 and 9 more affluent. We analyzed what percentage of votes from 2001 came from each of the different income levels, and what the variation was between 2001 and 2014.

We chose Tableau as the tool to process and render this data visualization. As opposed to Excel, Tableau could dynamically link data in the same database and achieve data integration. In addition, Tableau integrated maps and data perfectly. We used Mapbox to draw a dynamic map for Worcester, with the election data excluded in the map. Then, we linked the map data in the Mapbox to the Tableau and connected the map data to the election data in the Excel to achieve the integration of data.

Political Research

Our political research involved several different components, including the details of past fluoridation campaigns in Worcester and understanding how expansive fluoridation is in other parts of Massachusetts.

To begin examining the 2001 fluoridation campaign, we analyzed the campaign finance information, which we obtained from Worcester's Elections Commission. This information was organized by report filing date and is in a PDF file format, so we broke down the expenditures into different categories in an Excel document to clarify the data.The general categories we established were advertising, professional services, printing, staff, public forums, and other. The "other" category contained various expenses that were too small to be their own category. We added up the total expenses from each category and calculated what percentage was spent on each. This information was used to create a pie chart and a histogram demonstrating where money was spent during the 2001 campaign.

When researching the 2001 campaign in Worcester, we also looked into the different arguments that were made for and against fluoridation. This was achieved by examining different sources displaying arguments from the 2001 debate. A dissertation entitled "The Politics of Water Fluoridation from a Problem Definition Perspective" written by Robyn Olson contained many of the arguments that were made in 2001 from both sides of the debate. This document also contained polls which measured how effective certain arguments for fluoridation were.

Another component of the political research was examining what community water systems in Massachusetts currently fluoridate their water supplies. This involved finding

a comprehensive list of all cities and towns in Massachusetts (from the Massachusetts state government website), finding a list of all fluoridated or partially fluoridated community water systems (from the Massachusetts Department of Public Health), and comparing the two. The comparison used Excel spreadsheets to establish the status of each system. We then created a map providing a visual representation of which communities are fully, partially, and not fluoridated.

The examination of fluoridated cities and towns included looking at which communities have voted on fluoridation since 2000. Municipalities that have voted affirmatively on fluoridation were included in data from the Massachusetts Department of Public Health. A survey of local news articles on fluoridation campaigns resulted in the list of towns that have voted against fluoridation since 2000.

Limitations

We faced several limiting factors in our research. The biggest challenges were with electoral research. The City of Worcester does not have a record of the breakdown of the 2001 vote on water fluoridation. The record of the 2001 referendum is limited to the citywide vote total. This limits our analysis because we are unable to identify which parts of the city more strongly supported or opposed fluoridation.

A second challenge we faced was in finding oral health data. There is information from Massachusetts' Department of Health and Human Services on access to oral healthcare across the state, but there is very little community-specific data. This made it challenging to determine the impact that community water fluoridation has had on cities with similar demographics to Worcester. It also means that we are unable to show the

status of Worcester residents' oral health, or how much people here would benefit from fluoridation.

Another limitation we faced was time. This project was limited to a school semester, which is only about four and a half months long, and this may have inhibited our research. For example, because we were restricted for time, we were not able to reach out to many sources, as we did not have time to wait for a response. Additionally, as students, we had other commitments and classes that competed for our time. As a result, we may not have been able to conduct research that was as detailed as we would have preferred, however we still managed to find a lot of useful information.

Ethical Concerns

Because our work revolved around data analysis of primary sources and secondary source research, there were few ethical concerns. The one area of sensitive data that we collected was in relation to voter data; the data is public through the City of Worcester but includes tens of thousands of individuals' personal information. Worcester's Elections Commission provided voter information on all voters from the 2001, 2014, and 2016 elections. This data was used in the aggregate; we examined trends in voter turnout, not individual voters. Because of our concern for the privacy of voters (though this is public information), we kept the data in a password protected GoogleDrive folder.

Chapter 4: Results and Reflection

Electoral Research

Voter Growth and Participation. We received election data for 2001, 2014, and 2016 from the Worcester Election Commission. This data included 21,460 voting records from 2001, 36,148 voting records from 2014, and 63,439 voting records from 2016; this

is a total of 121,047 records from the three years. In order to analyze and compare more thoroughly, we drew the three years of statistical results into a histogram (Figure 1), which shows a significant increase in the total number of voters over the three election years. The number of voters increased by 14,688 from 2001 to 2014, and the growth rate was 68.44%. The 2014 election included the governor's race; the difference between 2001 and 2014 shows how many more voters turn out for gubernatorial years than for municipal elections (which 2001 was). In 2016, there were 27,291 more voters than in 2014, with a growth rate of 75.49%. The presidential election in 2016 dramatically increased turnout. Turnout in 2018 will most closely resemble the 2014 election, as both 2014 and 2018 are gubernatorial election years. The data from 2014, when broken down by ward, is the best predictor of who across the City of Worcester will participate in the 2018 election and a fluoride referendum.

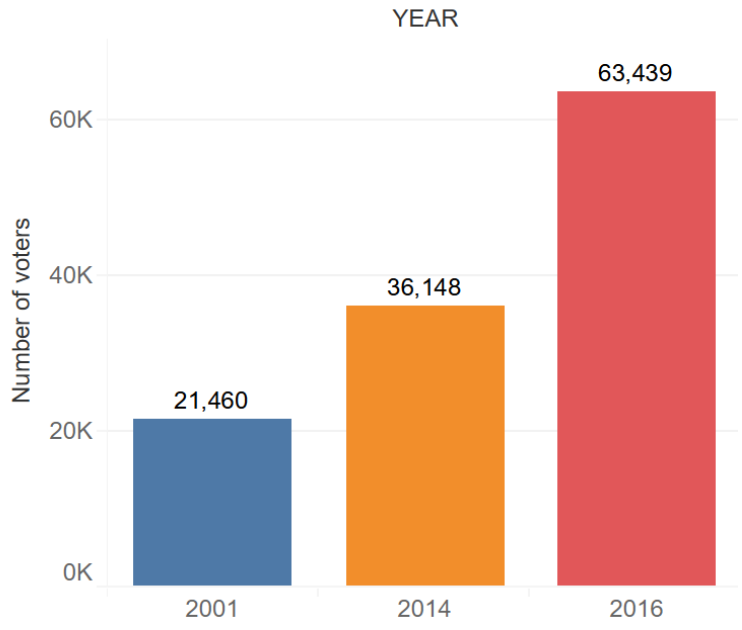


Figure 1. Number of voters in 2001, 2014, and 2016 elections (Data obtained from the Worcester Election Commission, graphic created by Yao Su).

Voter Participation by Ward. We divided the voting data from all three years by the 10 different wards within Worcester. In order to gain a deeper understanding of the statistics, we drew a dynamic map for Worcester in which the city is divided into its 10 wards (Figure 2). In this dynamic map, the user can zoom in or out; when the user zooms in, the area on the map becomes magnified, showing street names and even door numbers. This provides more detail for the user. In the map, users can get the voting data of each ward from each election year by clicking on a ward. By looking at this data, people can easily know the number of voters from each ward in the election years of 2001, 2014, and 2016.

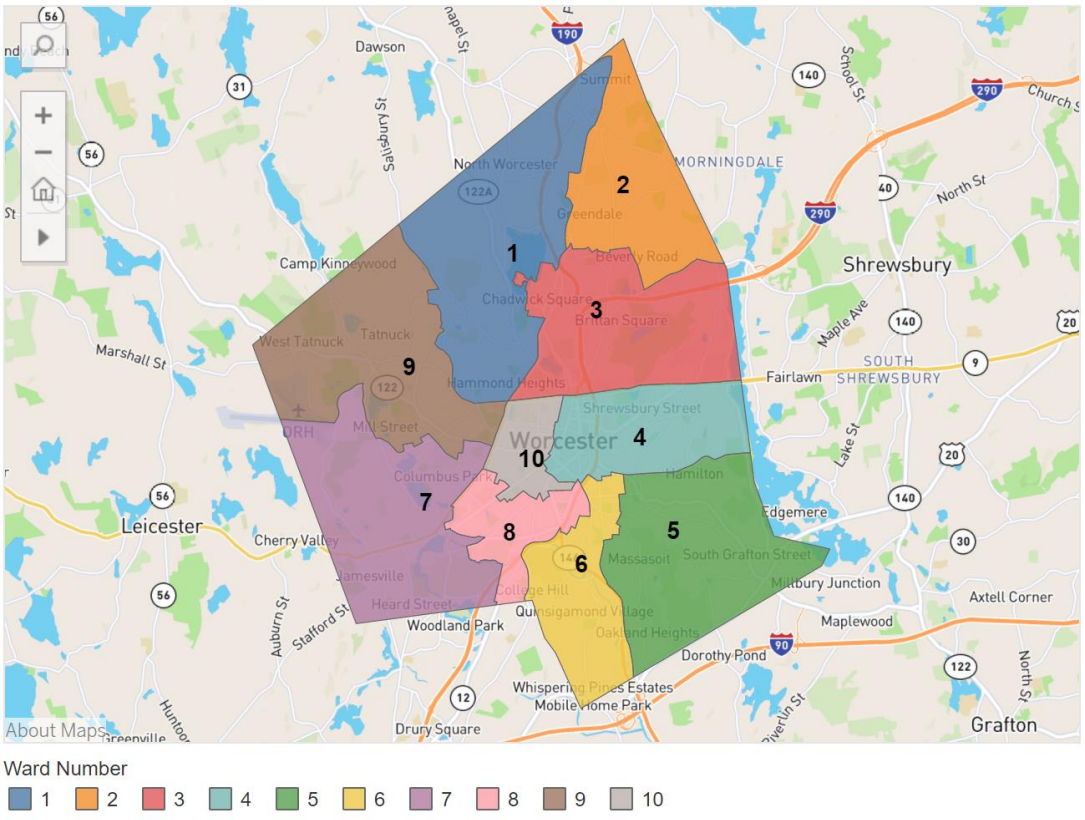


Figure 2. Map of the 10 different wards in Worcester (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

The number of voters in each ward is connected to the map data. We drew

histograms for each election year and broke down the number of voters by ward (Figures 3.1, 3.2, and 3.3). Wards 1, 9, and 2 had the greatest voter turnout across all three election years (Figures 3.1, 3.2, and 3.3). Wards 6, 8, and 10 demonstrated the lowest participation across all three years (Figures 3.1, 3.2, and 3.3).

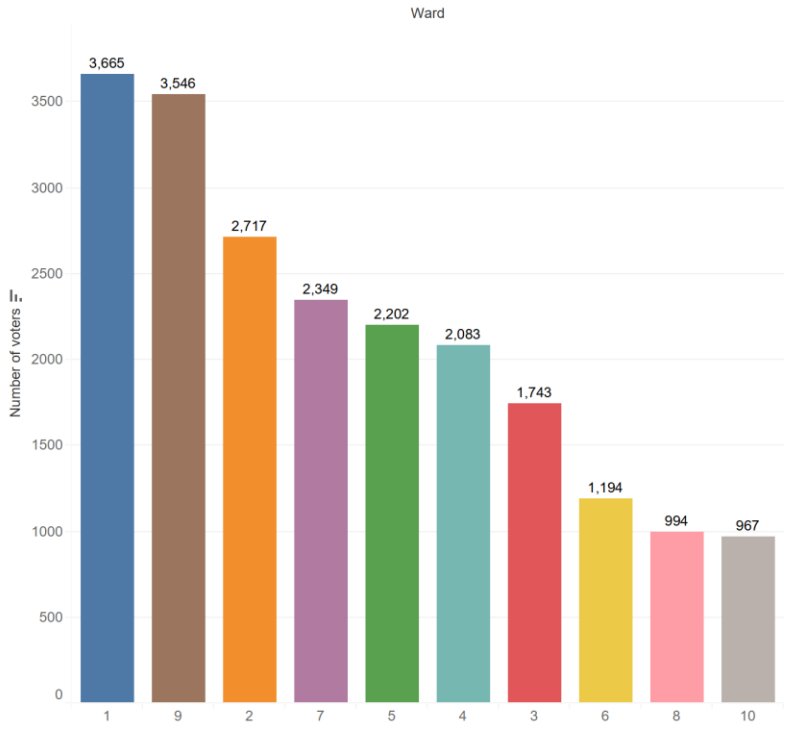


Figure 3.1. Bar graph of 2001 voter participation by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

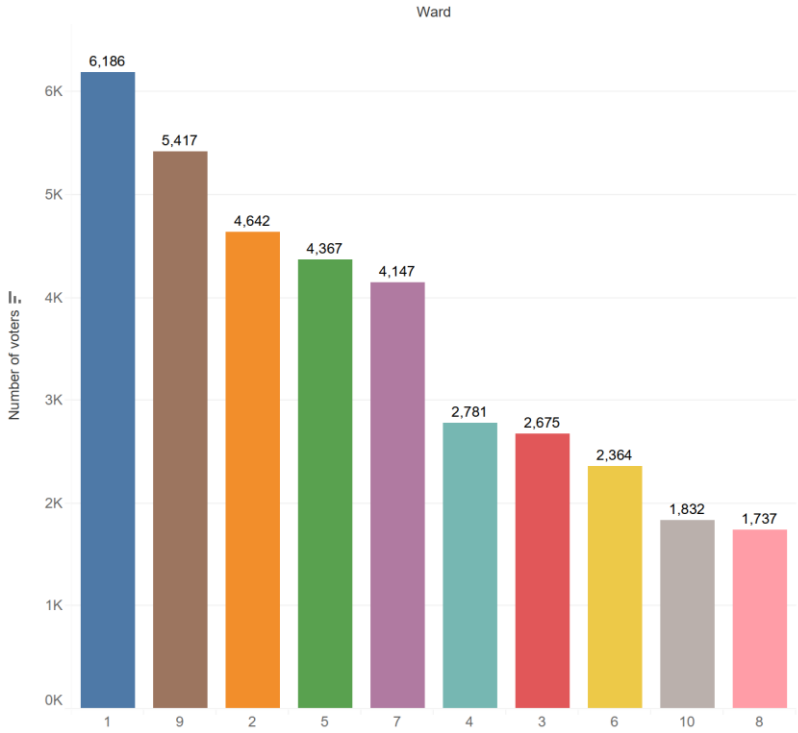


Figure 3.2. Bar graph of 2014 voter participation by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

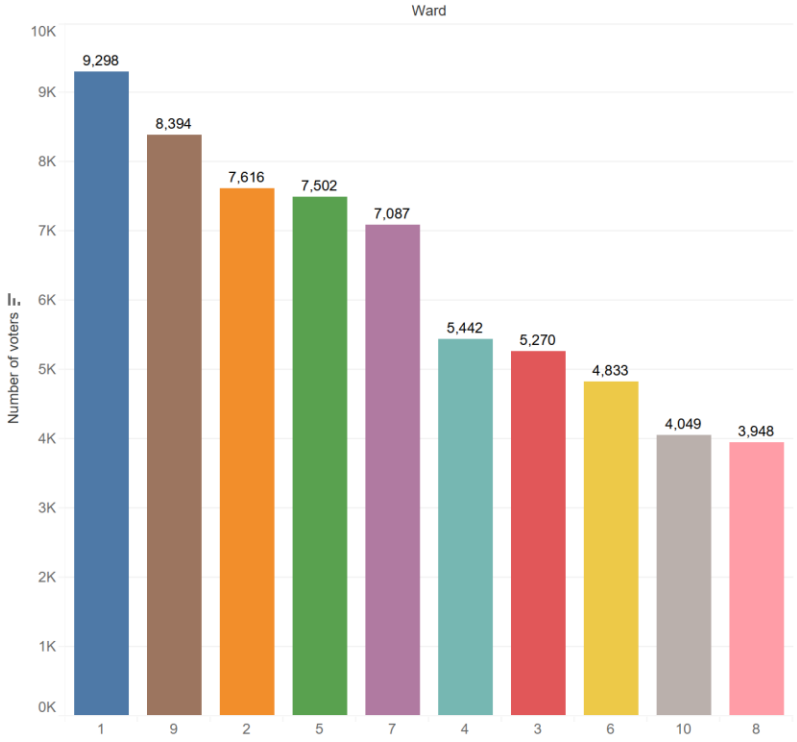


Figure 3.3. Bar graph of 2016 voter participation by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

Growth Rate by Ward. The number of voters in all 10 wards increased with each election year (Table 1). We can see that the growth rate, however, fluctuates differently within each ward. From 2001 to 2014, the net growth rate of Ward 1 was the largest, as the number of voters increased by 2,521 people. The second highest growth was in Ward 5, where 2,165 additional people voted. The least amount of growth occurred in Ward 4, which only increased by 698 people. From 2014 to 2016, the net growth rate of Ward 5 was the largest with an additional 3,135 voters. Next was Ward 1, which increased by 3,112 voters. During this period (2014 to 2016), the growth rate of all wards was relatively large, as each ward saw more than 2,000 additional voters. The smallest growth area in 2016 was Ward 8, which increased by 2,211 voters. In general, from 2001 to 2016, the largest net growth values were found in Wards 1 and 5, which saw increases of 5,633 voters and 5,300 voters, respectively. The lowest net growth values from 2001 to 2016 were in Wards 8 and 10, where the increases in number of voters were only 2,954 and 3,083, respectively. Therefore, for the net growth value, Wards 1 and 5 are demonstrably the fastest growing bases of voters.

Ward number	2001	2014	2016	gap(2001/2014)	gap(2014/2016)	gap(2001/2016)	2001 to 2014	2014 to 2016	2001 to 2016
1	3,665	6,186	9,298	2,521	3,112	5,633	68.79%	50.31%	153.70%
2	2,717	4,642	7,616	1,925	2,974	4,899	70.85%	64.07%	180.31%
3	1,743	2,675	5,270	932	2,595	3,527	53.47%	97.01%	202.35%
4	2,083	2,781	5,442	698	2,661	3,359	33.51%	95.69%	161.26%
5	2,202	4,367	7,502	2,165	3,135	5,300	98.32%	71.79%	240.69%
6	1,194	2,364	4,833	1,170	2,469	3,639	97.99%	104.44%	304.77%
7	2,349	4,147	7,087	1,798	2,940	4,738	76.54%	70.89%	201.70%
8	994	1,737	3,948	743	2,211	2,954	74.75%	127.29%	297.18%
9	3,546	5,417	8,394	1,871	2,977	4,848	52.76%	54.96%	136.72%
10	967	1,832	4,049	865	2,217	3,082	89.45%	121.02%	318.72%

Table 1. 2016 Comparison of voter participation in Worcester's 10 wards from the 2001, 2014, and 2016 elections (Data obtained from the Worcester Election Commission, graphic created by

Yao Su)

Growth rate is an important reference variable that reflects the increase in the number of voters in each ward. There were relatively few voters from some wards in the 2001 election, but they have seen a huge growth rate since. This shows that these wards have great potential for development, and that a large number of the residents do not consistently participate in electoral politics. For this type of ward, we can increase publicity and tap potential voters in a referendum campaign. Therefore, we drew a histogram to compare the growth rates of different wards (Figure 4.1, Figure 4.2, Figure 4.3). From 2001 to 2014, the voter growth rate of Ward 5 was 98.32%, occupying the first position, followed by Ward 6 with a growth rate of 97.99%. The smallest growth was in Ward 4, with a growth rate of only 33.51%. From 2014 to 2016, there are three wards whose total voter growth rate is over 100%. They are Wards 8, 10 and 6. Among them, the growth rate of Ward 8 is the highest, reaching 127.29%. The growth rates are relatively low in Wards 1 and 9, at only 50.31% and 52.76%, respectively. From 2001 to 2016, the growth rate of Wards 10 and 6 are over 300%, making them the two highest growth rates. The growth rate of Ward 8 is 297.18%, which is also a high growth rate. The growth rates of Wards 9 and 1, however, are relatively low at 136.72% and 153.70%, respectively.

Through the analysis of growth rate, we need to pay attention to wards with low net growth value. For example, Wards 6, 8 and 10 are all low net growth value but their voter growth rates are the highest (around 300% between 2001 and 2016). Ward 1, on the other hand, has the highest net growth value, but has the lowest growth rate at only 136.72%. From this data, we can deduce that Ward 1 is very active in voting and has fewer potential voters than lower net growth value wards. Wards 6, 8 and 10, the wards

with the highest growth rates and lowest growth values, have a greater potential for development.

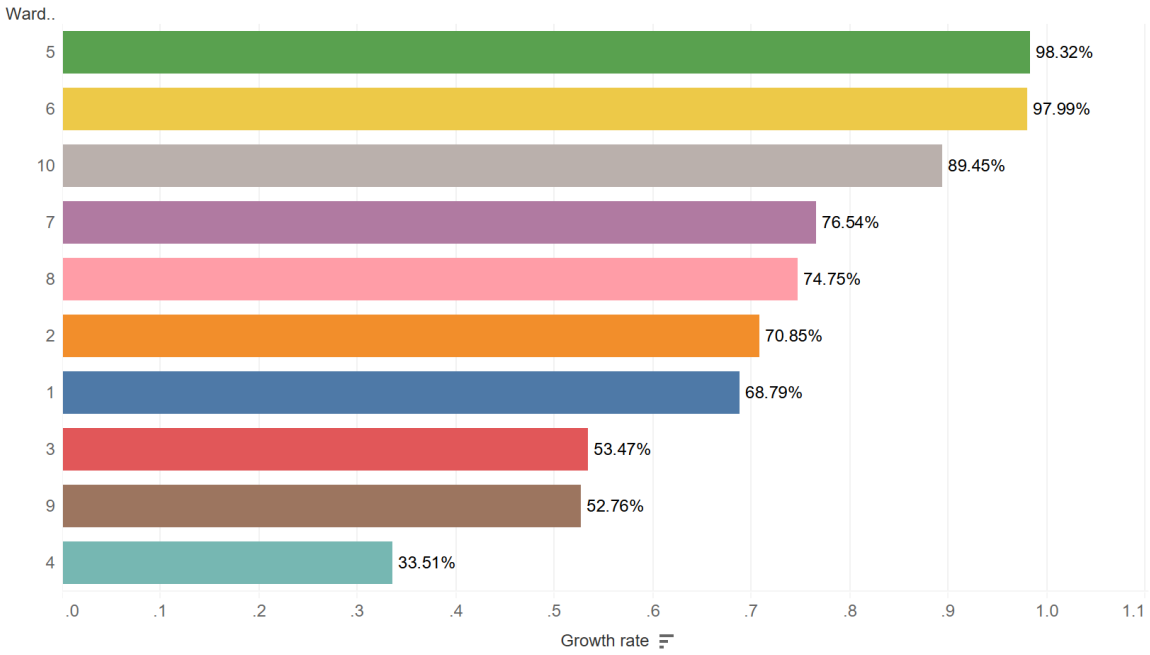


Figure 4.1 The growth rate of voter participation from 2001 to 2014 by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

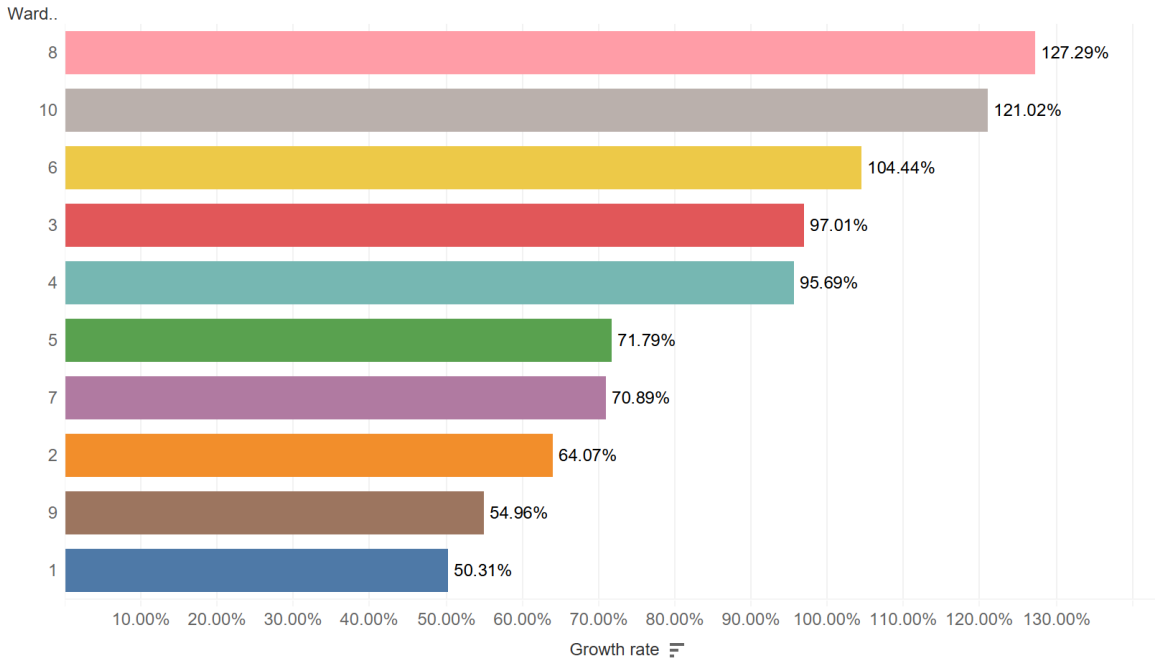


Figure 4.2 The growth rate of voter participation from 2014 to 2016 by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

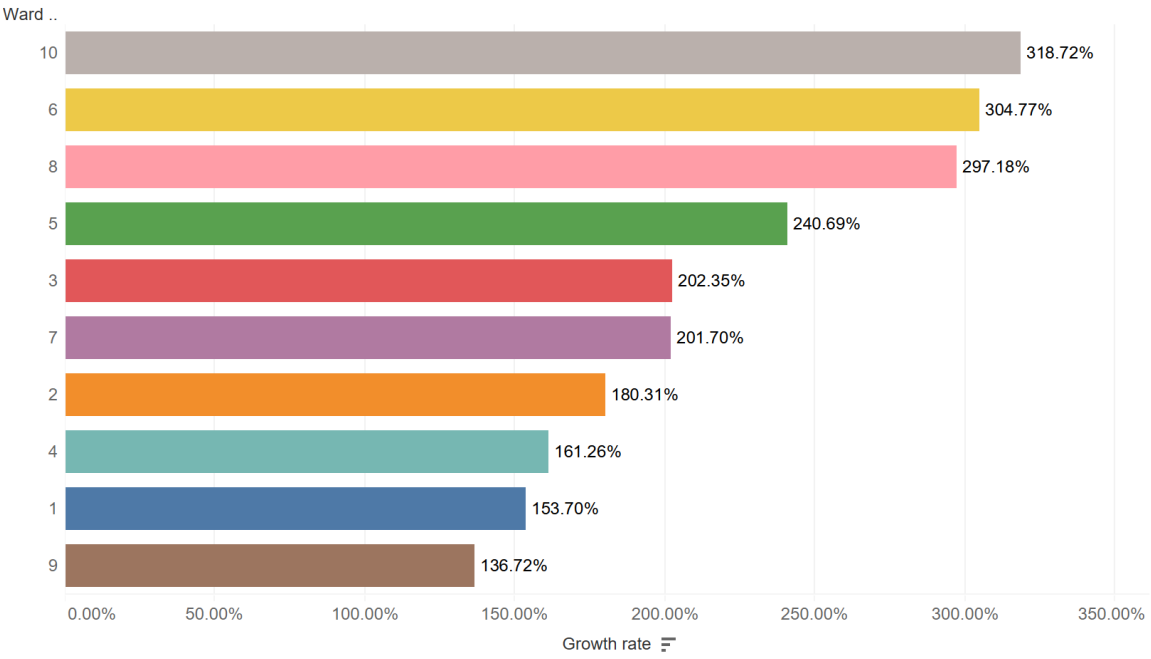


Figure 4.3 The growth rate of voter participation from 2001 to 2016 by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

Income Level by Ward. Based on the information Joe O'Brien provided us with, we divided the wards into three categories according to the residents' income. The group

of low income wards includes Wards 3, 8, and 10. The second category is middle income, and includes Wards 2, 4, 5, 6, and 7. The last category is the relatively wealthy wards, and includes Wards 1 and 9. In order to visually combine the analysis results with map data, we drew maps for Worcester based on income level (Figure 5.1). We also drew the voter participation numbers by income bracket from each of the three elections into pie charts (Figure 5.2). In 2001's election, there were 7,211 voters from the higher income wards, accounting for 33.60% of the total number of voters. Although it only consists of two wards, these wards' voters occupy a large part of the data. In 2001, there were 10,545 voters in the middle-income wards, accounting for 49.14% of the total number of voters. Finally, although there are three low income wards, they only had 3,704 voters, occupying only 17.26% of the total number of voters.

In 2014 and 2016, the highest percentage of voter turnout were voters from the middle income wards, and voters in low income wards had the lowest voter turnout. In order to better analyze the trend of participation of different income groups in these three elections, we summarized the three years of election participation in a line chart (Figure 5.3). From this chart, we can see that there is a slow rise in the number of votes in middle income wards, from 49.14% in 2001 to 50.63% in 2014 and 51.20% in 2016. The percentage of votes in the more affluent wards is decreasing. From 2014 to 2016, the percentage of voters from more affluent wards decreased from 32.10% to 27.86%, a decrease of 4.24%. On the contrary, the number of voters in low-income areas increased rapidly from 2014 to 2016, from 17.27% to 20.92% of the city's voters. Based on this data, we have reason to believe that voters in low income wards will continue to increase in voter turnout. In the 2018 election, we should devote more attention to the voters in low

income wards, which includes Wards 3, 8 and 10. The increase of their participation rate may affect the election results of 2018.

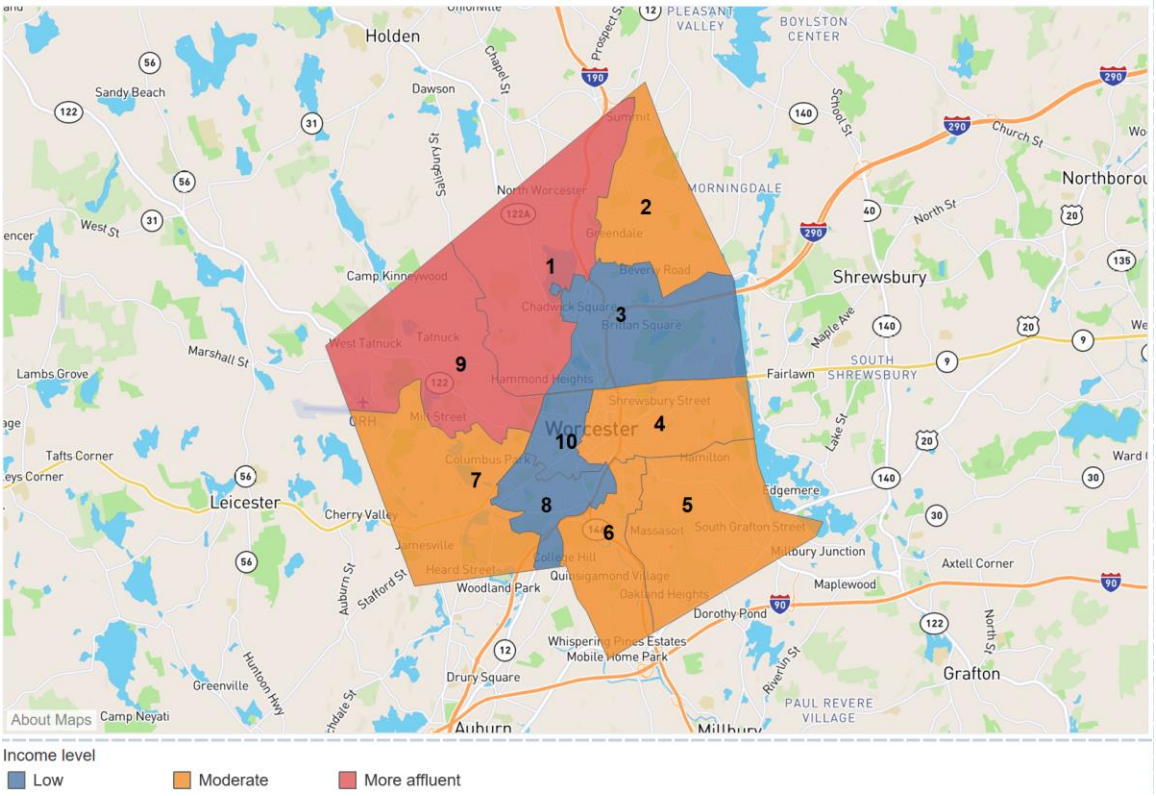


Figure 5.1. Map of different income levels in Worcester (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

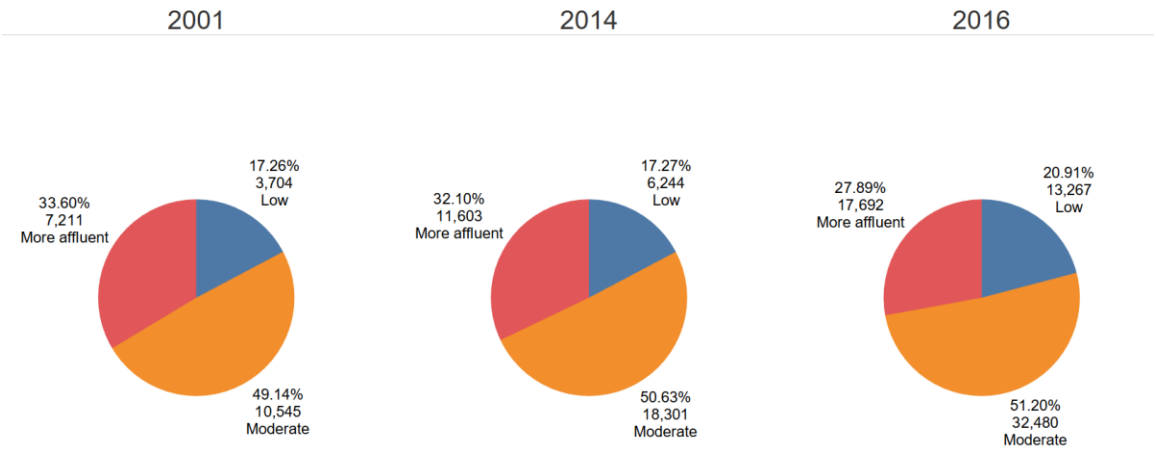


Figure 5.2. Pie charts of the three election years' voter participation by income level (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

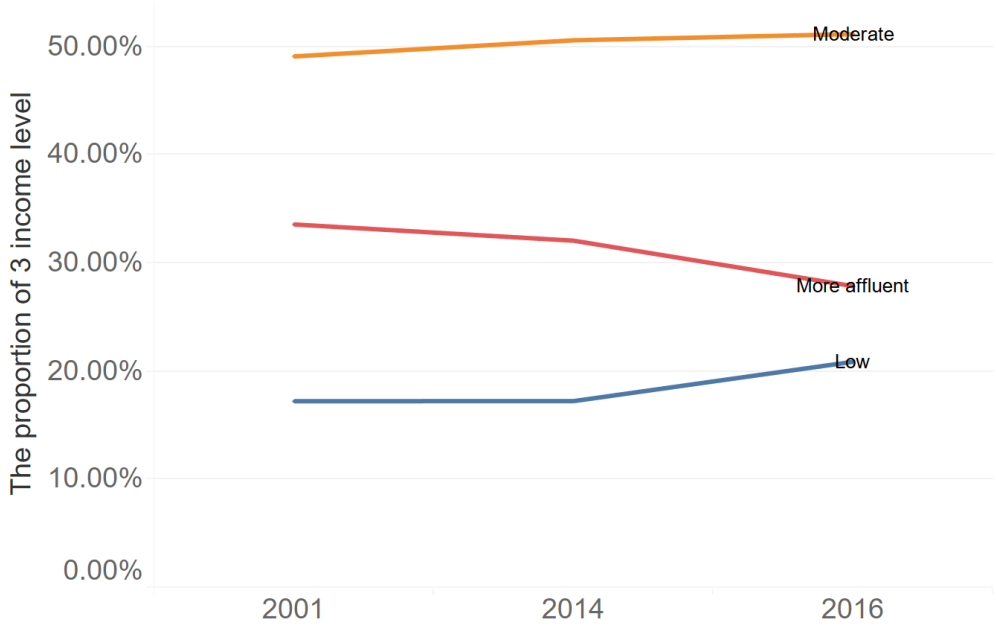


Figure 5.3. Line chart of the three election years' voter participation by income levels (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

Voters from Both 2001 and 2014. We used voter ID numbers to match people with their vote from the 2001 and 2014 elections, and found the ward each person voted in. We did this because we believe that those who participated in both elections are more likely to continue to participate in 2018. This is because we assume that those who voted in a municipal election (2001) will be regular voters in all other elections. Additionally, 2014 was a gubernatorial year, and 2018 will be one as well, therefore we expect to have similar voter turnout.

We drew a pie chart of 2001 and 2014 election participants (Figure 6.1); 11,001 residents participated in both the 2001 and 2014 elections. This part of the population accounts for 30.43% of the total. The other 69.57% of the residents participated in only one election, either 2001 or 2014. Next we broke down the 11,001 residents who participated in both the 2001 and 2014 elections by ward, and drew a histogram (Figure

6.2). Among these residents, people from Wards 1 and 9 represented the plurality, with 20% and 18.75%, respectively. Wards 1 and 9 are comprised of higher income residents, suggesting that higher income voters have more stability in where they live and have higher voter participation rates than lower income Worcester residents. The number of people who participated in Wards 8 and 10 in both the 2001 and 2014 elections was the lowest. Only 347 and 375 people participated in each ward, accounting for 3.15% and 3.41%, respectively. The total number of people who voted in Wards 3, 8, and 10 in both 2001 and 2014 amounted to 1,477 people. This demonstrates that there is less voter participation in lower income areas.

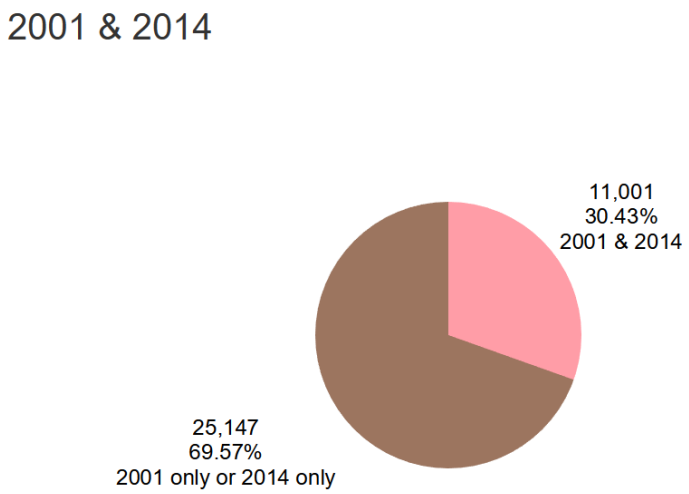


Figure 6.1. Pie chart of 2001 and 2014 voter participation (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

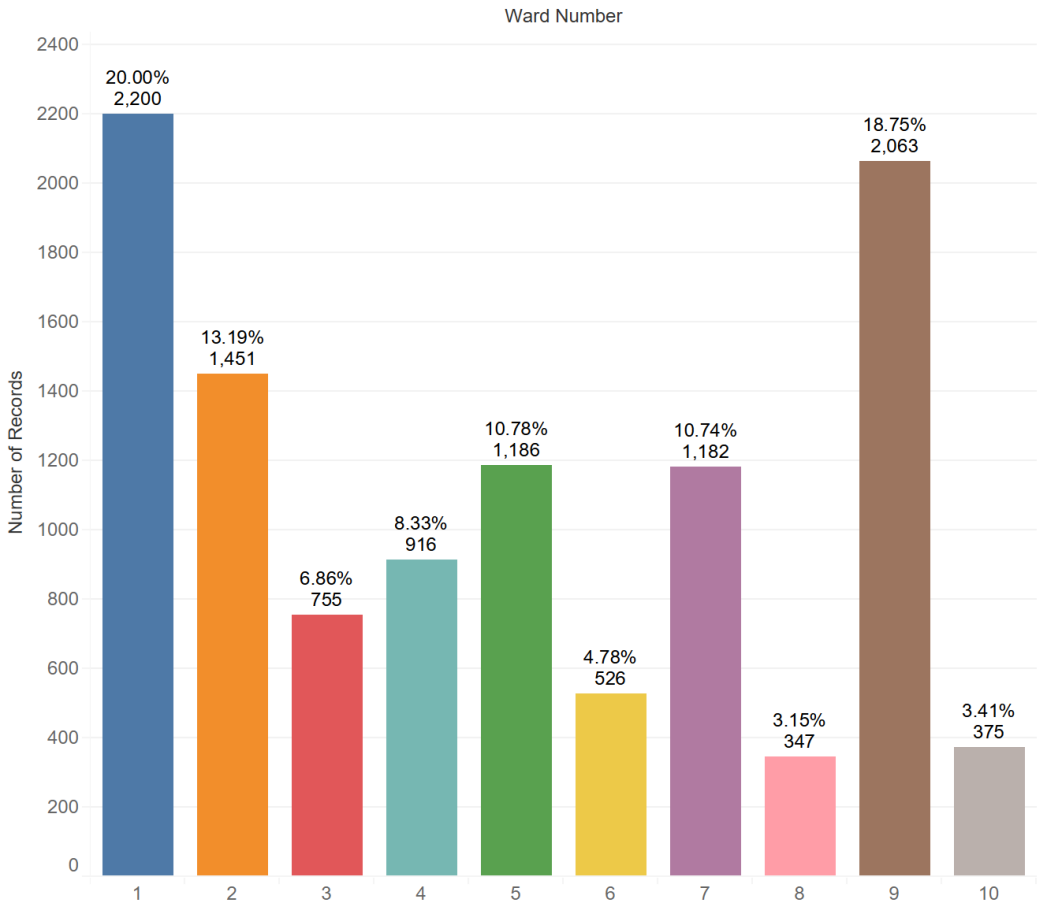


Figure 6.2. Residents who participated in both the 2001 and 2014 elections by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

Voters Across All Three Years (2001, 2014, and 2016). In order to conduct a more comprehensive analysis of the participation of Worcester residents in the three elections, we have created a pie chart. In this picture, we divided the voters into four categories (Figure 7.1):

1. Those who voted in the 2016 election but did not participate in the 2001 and 2014 elections. Statistical analysis reveals that there are 30,083 new voters here, accounting for 47.42% of the total number of 2016 voters. This is the largest category.
2. The voters who participated in all three years (2001, 2014, and 2016). There are

10,045 voters, accounting for 15.83% of the total number of 2016 voters.

3. The voters who participated in the elections in 2001 and 2016 but were absent in 2014. This is relatively few people, only 1,343 people, accounting for 2.12% of the total number of 2016 voters.
4. The voters who did not participate in the 2001 election, but participated in 2014 and 2016. This segment is comprised of 21,968 voters, accounting for 34.63% of the total number of 2016 voters.

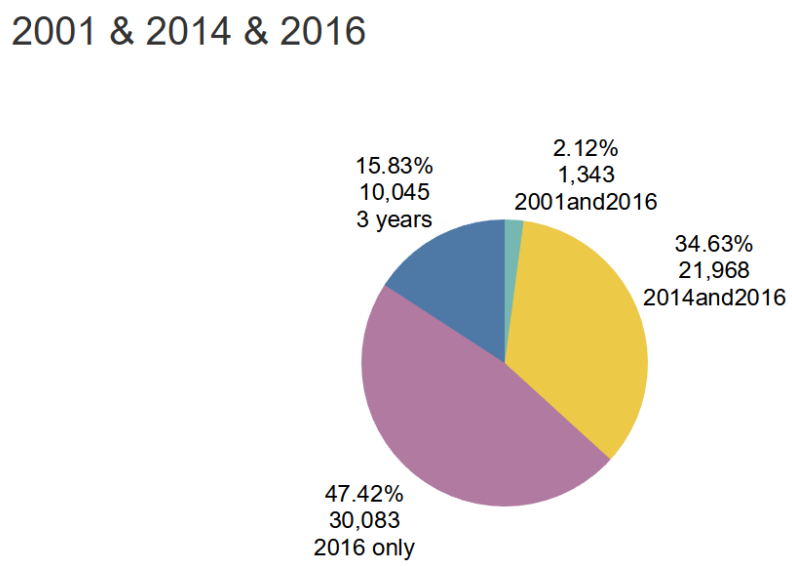


Figure 7.1. Pie chart of 2016 election voters broken down by participation in 2001, 2014 and 2016 elections (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

In order to better understand these voters, we drew bar graphs demonstrating each type of voter, broken down by ward (Figure 7.2 through Figure 7.5). For the group of new voters who only participated in the 2016 election, there was not much difference between the wards (Figure 7.2). The lowest participation was seen in Ward 10, accounting for 8.14% of voters, and the highest participation was in Ward 5, which accounted for 11.53%

of voters. The rest of the wards were concentrated around 9% or 10%. This shows that the distribution of new voters is relatively average. Regardless of income level, people actively participated in the 2016 election.

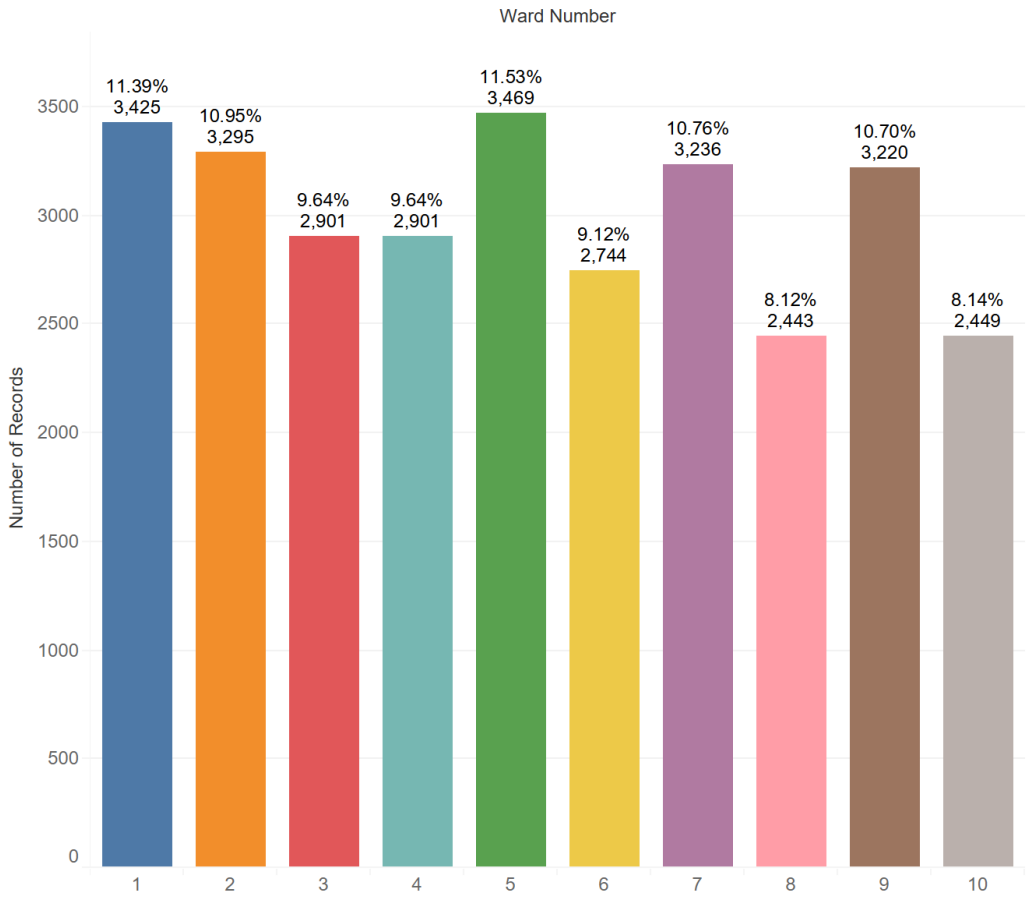


Figure 7.2. Residents who only participated in the 2016 election, by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

The second category of voters is comprised of those who participated in all three elections. The most voters came from Wards 1 and 9, which had 2,053 and 1,934 voters, accounting for 20.44% and 19.25% of the total, respectively (Figure 7.3). These two wards represent higher income residents, and account for about 40% of the voters in this category. There is lower representation from lower income wards. We see that Ward 8

has 307 voters and Ward 10 has 330 voters, accounting for 3.06% and 3.29% of this group, respectively.

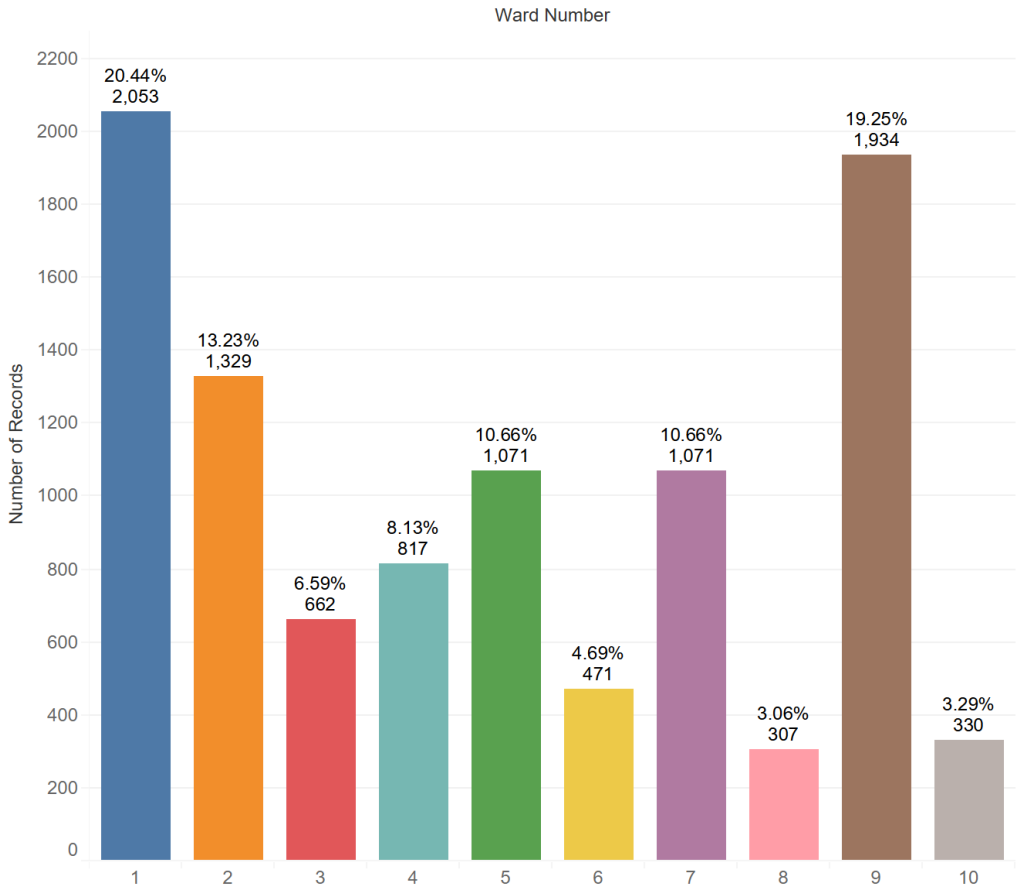


Figure 7.3. Residents who participated in all three elections (2001, 2014, and 2016), by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

The third group of voters, who participated in 2001 and 2016 but were absent from the 2014 election, includes only 1,343 voters. Most of these voters came from more affluent wards; Wards 1 and 9 accounted for 15.93% and 16.83% of the total (Figure 7.4). This, however, is only a small portion of Worcester's voting population.

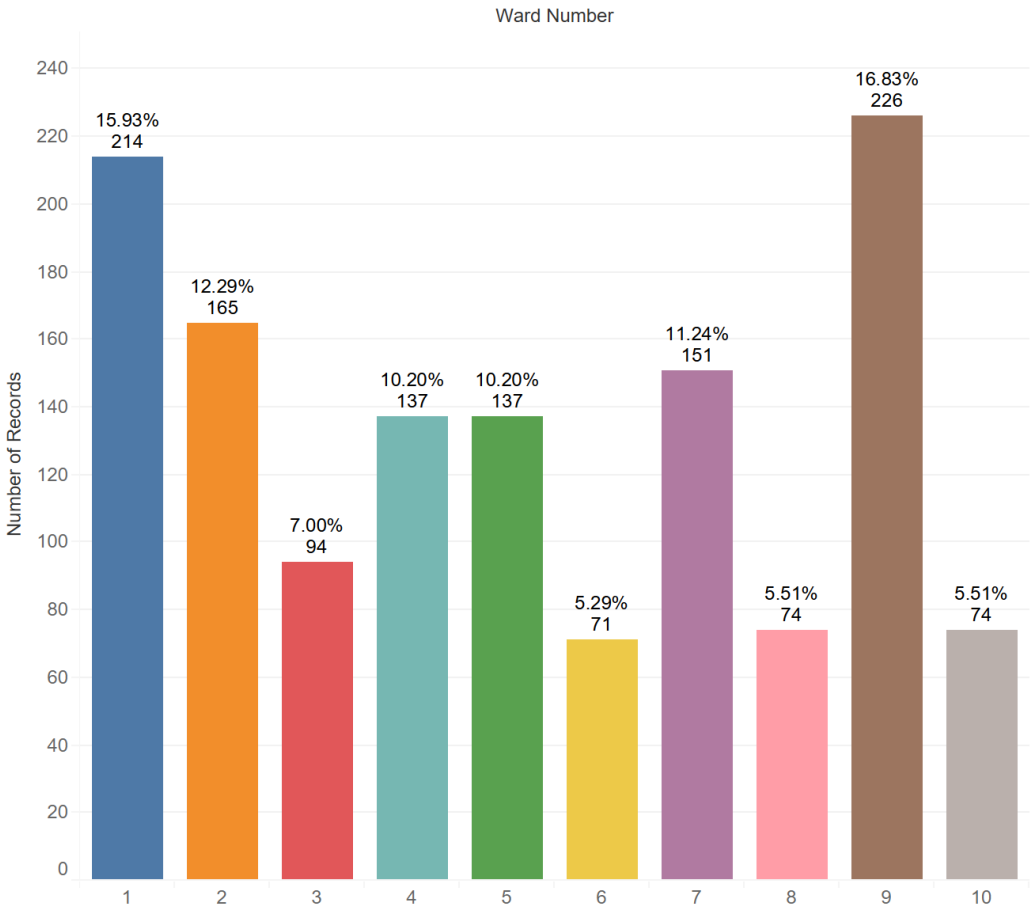


Figure 7.4. Residents who participated in both the 2001 and 2016 elections, by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

The fourth group includes voters who participated in the 2014 and 2016 elections (Figure 7.5). Ward 1 still occupies the largest proportion, accounting for 16.41% of voters. Wards 2, 5, and 7 account for approximately 12% of voters each. Overall, middle income voters account for the largest proportion of the voters in this category, making up 51.96% of the total.

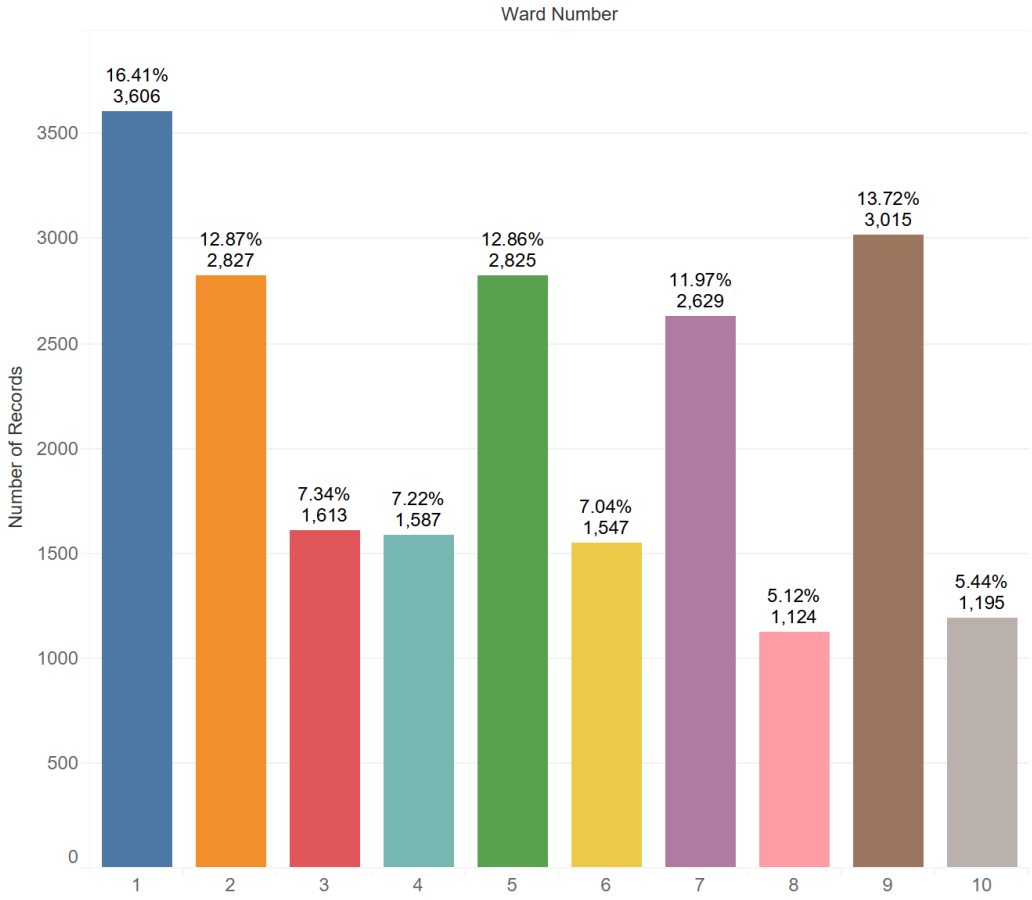


Figure 7.5. Residents who participated in both the 2014 and 2016 elections, by ward (Data obtained from the Worcester Election Commission, graphic created by Yao Su)

Political Research

Trends in Fluoridation. Community water system fluoridation is widespread across the United States. Municipal fluoridation began with Grand Rapids, Michigan in 1945 (National Institute of Dental and Craniofacial Research). This initial test site was used to monitor the effects of widespread fluoridation on tooth decay, primarily among children (National Institute of Dental and Craniofacial Research). In the seventy years since, communities across the country have added, supplemented, and regulated fluoride in water to improve the dental health of their residents. Currently, states run a wide range in fluoridation rates. The most highly fluoridated state is Kentucky, which fluoridates

99.9% of its water supplies. There are a total of 21 states that have 80-100% of the water supply fluoridated.

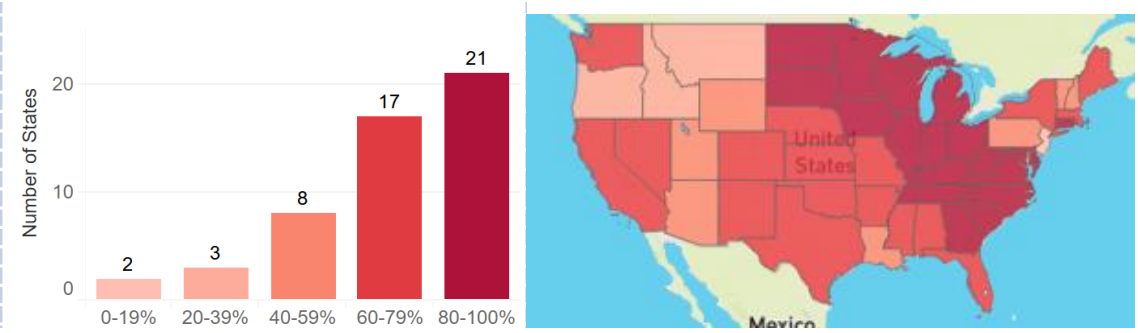


Figure 8.1. This bar graph shows the number of states with each percentage grouping of fluoridation, and provides the color coding for the map of the United States. The darker the shading, the higher the rate of fluoridation that state has. Alaska and Hawaii are not pictured; Washington, DC is included in the ranking (Data obtained from the Centers for Disease Control and Prevention, graphic created by Yao Su)

Massachusetts is ranked 31st among U.S. states for the amount of water it has fluoridated. Within New England, Massachusetts is fourth among the six states for the quantity of the population that receives fluoridated water (Figure 8.2). Inclusion of fluoridation in several communities' water supplies in the early 2000s increased the percentage of people receiving fluoridated water in Massachusetts, but the state remains below the levels found in Connecticut, Rhode Island, and Maine.

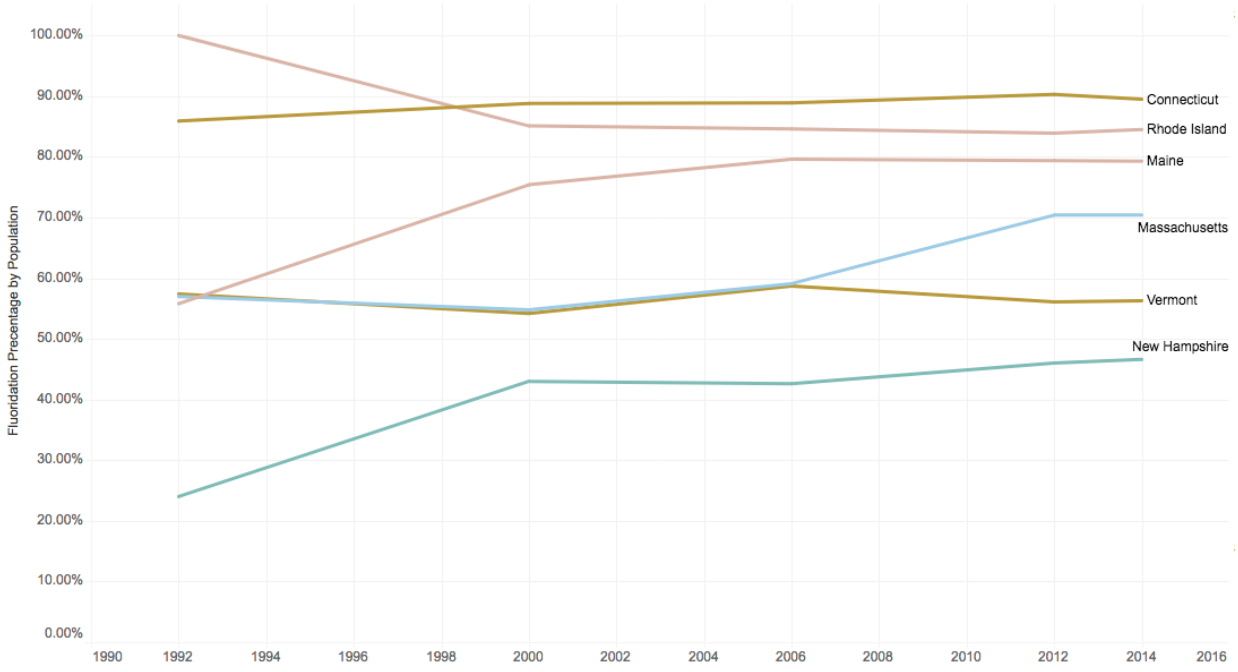


Figure 8.2. The percentage of each New England state's population with fluoridated water, 1992 to 2014 (Data obtained from the Centers for Disease Control and Prevention, graphic created by Yao Su)

In Massachusetts, 70.4% of water is fluoridated. Fluoridated water is concentrated in eastern Massachusetts, but can be found across the Commonwealth. Figure 9 is a map of water fluoridation in Massachusetts.

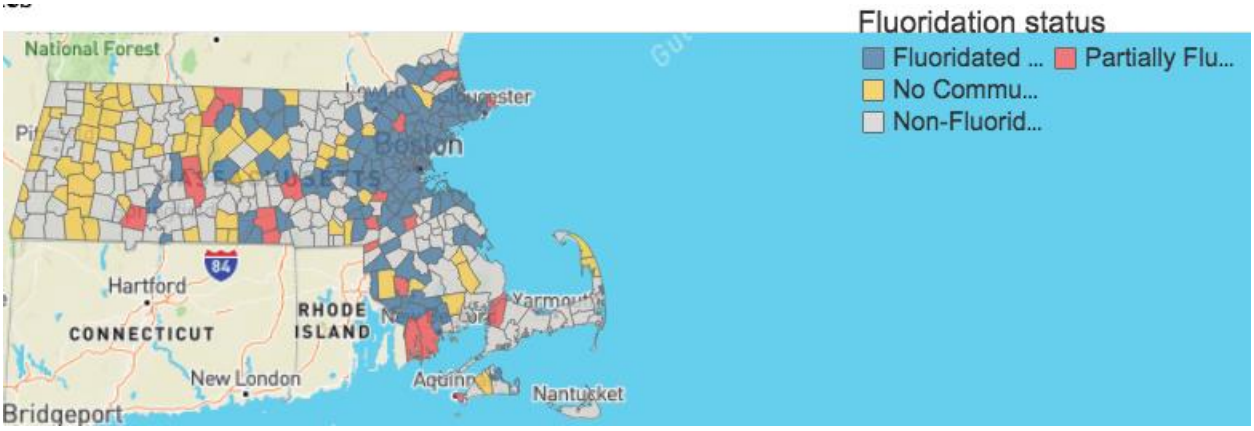


Figure 9. Fluoridation map of Massachusetts; communities are represented as fully fluoridated, partially fluoridated, not fluoridated, or without a community water supply (Data obtained from the MA Department of Public Health, graphic created by Yao Su)

Recent Votes in MA. The vast majority of the largest cities in Massachusetts have fluoridated their water supplies. Of the 20 biggest cities, 16 fluoridate the water (Table 2). The exceptions, the cities that do not fluoridate, are Worcester, Springfield, Brockton, and Chicopee.

City	Population	Fluoridated?
Boston	687,584	Yes
Worcester	184,542	No
Springfield	153,668	No
Cambridge	112,241	Yes
Lowell	110,362	Yes
Brockton	96,236	No
New Bedford	95,146	Yes
Quincy	94,140	Yes
Lynn	92,745	Yes
Newton	89,179	Yes
Fall River	88,738	Yes
Somerville	83,598	Yes
Lawrence	80,309	Yes
Haverhill	63,397	Yes
Waltham	62,962	Yes
Malden	60,586	Yes
Medford	56,973	Yes
Taunton	56,895	Yes
Weymouth	56,212	Yes
Chicopee	55,665	No

Table 2. The 20 largest cities in Massachusetts and their fluoridation status (Data obtained from the MA Department of Public Health, graphic created by Lauren Meininger)

While over two thirds of the state receives fluoridated drinking water, the question is still debated among policy makers and residents. Since 2000, 15 Massachusetts municipalities (other than Worcester) have voted on fluoridation. This does not include the cities or towns that have had debates on the issue but have not taken the question to a referendum. For the towns that have voted on fluoridation, 12 of the 15 votes resulted

in either the continued use of fluoride in the water or a decision to begin adding fluoride to the water. Tables 3 and 4 show the recent votes on fluoridation in Massachusetts. What these votes demonstrate is that, regardless of the vocal minority of people who oppose fluoridation, there is widespread support for the practice. Additionally, once fluoridation has been instituted, the practice is more likely to be maintained by subsequent votes than it is to be ended.

Year	Town	Outcome	Prior Fluoridation
2000	Wayland	Fluoridation	
2001	Northborough	Fluoridation	
2002	North Attleboro	Fluoridation	
2004	Stoughton	Fluoridation	
2007	Acushnet	Fluoridation	
2007	Dartmouth	Fluoridation	
2007	Freetown	Fluoridation	1978 (partial)
2007	New Bedford	Fluoridation	
2008	Woburn	Fluoridation	1978 (partial)
2009	Wilmington	Fluoridation	
2015	Gloucester	Maintain fluoridation	
2015	Rockport	Maintain fluoridation	

Table 3. Municipalities that have voted in favor of fluoridation since 2000 (Data obtained from the MA Department of Public Health, graphic created by Lauren Meininger)

Town	Vote Year	Outcome
Rowley	2000	Reject fluoridation
Methuen	1981, 1997, 2002	Reject fluoridation
Amesbury	1967, 2011	Amesbury fluoridated in 1967; Board of Health discontinued the practice in 2009; voters eliminated fluoride in 2011

Table 4. Municipalities that have voted against fluoridation since 2000 (Data obtained from various news sources, graphic created by Lauren Meininger)

2001 Referendum Election Results. The final vote tally in 2001 was 12,906 votes against fluoridation and 9,980 votes for fluoridation. A significant number of voters did not answer the question. The percentage of voters actually voting in Worcester's election in 2001 was only 27.69% of registered voters.

2001 Campaign Finance Research. Based on the data we gathered, we found that the Health Foundation of Central Massachusetts, the group advocating for fluoridation in the 2001 campaign, spent $331,426.73 on their campaign. We developed a pie chart and a bar graph that show how this money was distributed (by category) in the campaign (Figure 10.1 and Figure 10.2). It is clear that a disproportionate amount of the budget, 72%, was spent on "professional services". Table 5 further breaks down the spending into each of the five categories: advertising, professional services, printing, staff, and other expenses.

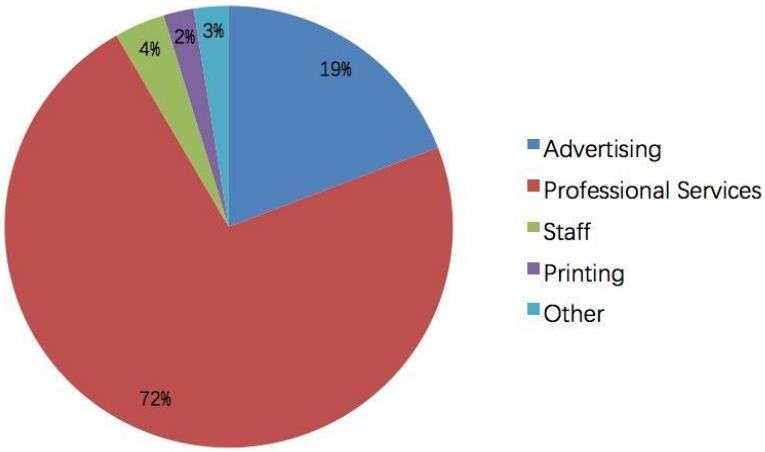


Figure 10.1. Pie chart of 2001 pro-fluoridation campaign expenditures (Data obtained from the Worcester Election Commission, graphic created by Emma Philips)

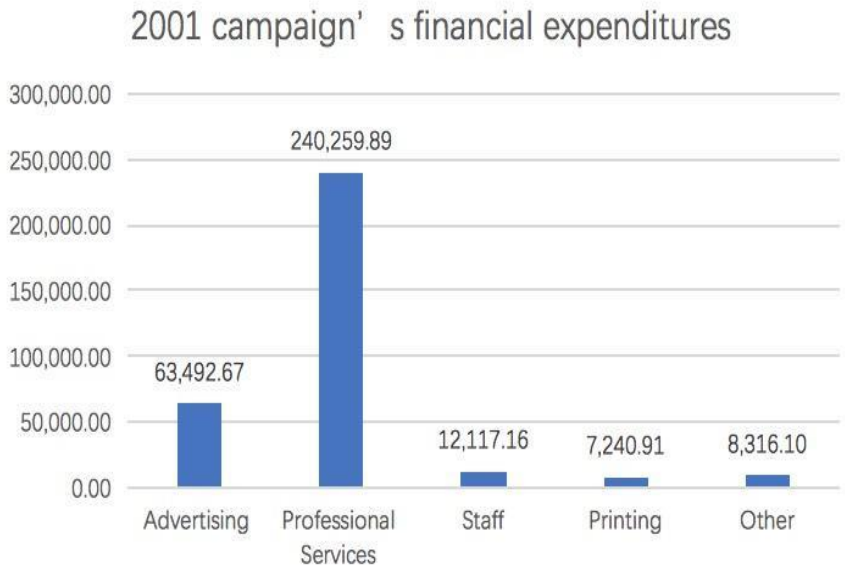


Figure 10.2. Bar graph of 2001 campaign expenditures (Data obtained from the Worcester Election Commission, graphic created by Xiao Gu)

General Purpose	Subcategory	Amount Paid

Advertising		
	Cable	17,421.97
	Print	19,283.2
	Radio	17,615
	Billboard	7,522.5
	Transit bus ads	1650
	TOTAL	**63,492.67**
Professional Services		
	Robertson Associates	71,134.89
	Hock Research	169,125
	TOTAL	**240,259.89**
Printing		
	TOTAL	**7,240.91**
Staff		
	Employee time and effort	11,205.25
	Admin. Asst.	446.4
	Travel expense (Horowitz)	465.51
	TOTAL	**12,117.16**
Public Forum		
	Space rental	420
	Audio visual	5,459
	TOTAL	**5,879**
Other		
	Talent	150
	Garage parking	769
	ADA Fluoridation Facts	217
	Photography	974.75
	Expense reimbursement	46.8
	Catering/meals	279.55
	TOTAL	**2,437.1**
OVERALL TOTAL		**331,426.73**

Table 5. Breakdown of 2001 pro-fluoridation campaign expenditures (Data obtained from the Worcester Election Commission, graphic created by Emma Philips)

Professional services included two consulting organizations, Robertson Associates and Hock Research, which aided the Health Foundation in their campaign.

They assisted in researching and developing all campaign materials, including discussing how the Massachusetts Dental Association and the local Worcester team should work together, and how to educate local dentists and residents to get their support. The next largest expenditure was advertising, which accounted for 19% of spending. The Health Foundation and American Dental Association made a great effort across several multimedia channels. Their mission was to help more residents understand the benefits of fluoridated water and try to expand support. Finally, staff, printing, and other costs (including reimbursements, parking, catering, etc.) accounted for 9% of remaining disbursements. We suggest that future campaigns reduce the proportion spent on professional services and spend more on advertising and media in order to educate people about the benefits of fluoride.

Messaging in 2001 Campaign. When analyzing the different arguments made in 2001, we found several common topics from both sides of the issue. The first point revolved around the issue of safety. Those advocating for fluoridation tried to frame fluoride as a harmless substance. For example, it was emphasized that fluoride is a natural element that already occurs organically in drinking water. A poll conducted in 2001, seen in Table 6, found that only 11% of people said this helped changed their opinion, while 86% said it had no effect on altering their perception, and 3% were unsure

(Olson, 2008). They also argued that there are no adverse health consequences that result from fluoridating the water supply if the proper concentration is used. This argument also had low effectiveness, with the poll revealing that only 13% of people said this helped change their opinion, and 85% said it had no effect (Oslon, 2008).

	Helped Change Opinion	Have No Effect	Don't Know
Fluoridation is an element, which occurs naturally in drinking water.	11%	86%	3%
There have been no adverse health consequences in communities where the naturally occurring fluoride concentration is 2-3 times higher than what is recommended for the best dental health	13%	85%	2%
Fluoride can reduce the amount of cavities in children by 35%	20%	78%	2%
Fluoridation can reduce the amount of cavities in adults by 60%	21%	78%	1%
Over 360 million people in approximately 60 countries worldwide are protected by fluoridation, with over 10,00 communities and 145 million people in the U.S. alone	18%	80%	2%
Forty two of the fifty largest cities in the US including Boston and every community served by the MWRA are supplied with fluoridated water	19%	78%	3%
More than 80 national and international respected organizations support fluoridation including the American Dental Association, the American Medical Association, the American Academy of Pediatrics, the Centers of Disease Control and Prevention, and the U.S. Surgeon general	24%	75%	1%
Water has been fluoridated for more than fifty years	19%	78%	3%
Fluoridation is more cost-effective and practical than other supplements such as tablets, drops or lozenges	22%	76%	2%
Fluoridating a city's water supply can reduce dental disease for Medicaid recipients, which would save tax dollars	25%	73%	2%
One of the leading causes of student absenteeism and loss of work hours for adults is dental decay	11%	89%	
To provide protection from dental decay, the amount of fluoride that needs to be in the water is 1 part per million, comparable to 1 inch in 16 mile	13%	85%	2%
It costs 50 cents per person per year to provide fluoride in water… over a person's lifetime, that's about the same as a cost of one filling	21%	76%	3%

Source: April 2001 report to Corrigan Communications by Louis Di Natale

Table 6. Poll conducted on effectiveness of arguments made in 2001 fluoridation debate (Olson, 2008)

Those arguing against fluoridation made the case that fluoride is actually harmful. The opponents used several sources to support their claim, including research conducted

by Myron Copland and Dr. Norman Manuso from 1997, which pulled together a group of five scientists to analyze fluoride. In this study, four of the five scientists stated that they were opposed to fluoridation because they were unsure whether or not fluoride was helpful. Ultimately, those against fluoridation argued that there was not enough known about fluoridation to justify putting it into our water supply. This can be seen in one of the slogans used by the campaign; “Fluoridation, if there’s any doubt leave it out!” (Olson, 2008). Although the for fluoridation side provided facts proving fluoride’s effectiveness and safety, people still felt unsure as to whether or not fluoride was safe to put in the water.

The pro-fluoridation side of the debate provided facts demonstrating fluoride’s effectiveness and cited official sources which supported fluoride use. For example, they explained how fluoride can be used to reduce cavities in children by 35%, and in adults by 60%. However, this argument only proved to be effective with about 20% of people (Olson, 2008). The pro-fluoridation campaign also argued that fluoride is supported by more than 80 national and international, highly-respected organizations, like the American Dental Association and the CDC. This argument, however, was only effective with 24% of people (Olson, 2008).

Those advocating for fluoridation also advertised the negative impacts of poor dental care. They demonstrated why this issue was important and how it was impacting people's lives. For example, one message was that a leading cause of student absenteeism and loss of work hours for adults was dental decay. This message was only effective for 11% of people (Olson, 2008).

Other arguments revolved around which municipalities and regions fluoridated water. The for fluoride side of the debate argued that fluoridation is an established practice that has been implemented in many other places. For example, they argued that over 360 million people in about 60 countries all over the world are protected by fluoridation. This fact only helped change the opinion of 18% of people polled (Olson, 2008). They also argued that 42 of the 50 largest cities in the US have fluoridation, however this was only effective in changing 19% of the people's opinions (Olson, 2008). The against side countered by saying fluoridation is not used in Europe, and therefore is not needed here.

Another stream of arguments examined costs. The pro-fluoridation side argued that fluoridation lowers health costs by protecting people's teeth and reducing the need for expensive healthcare. For example, they said that it costs 50 cents per person each year to provide fluoride in the water, which, over the course of a lifetime, is the same cost as one filling. This argument only served to change the opinions of 21% of people (Olson, 2008). Other arguments made about cost effectiveness were equally unconvincing to citizens. The opposing side of the argument took a different approach, blaming Worcester dentists for charging too much for care. They argued that only a small number of dentists in Worcester accepted state subsidized dental insurance, and therefore "won't treat poor children" (Olson, 2008). Ultimately, those opposed argued that access and the high cost of healthcare were the real issues.

A final major argument made by those against fluoridation was that putting fluoride in the water supply was an infringement on personal freedoms. They did not want the government to force citizens to consume something against their will. They argued that it should be up to the individual to decide whether or not they wanted to consume fluoride.

Effective Messaging Tactics. In addition to learning from the past campaign for fluoridation in Worcester, we conducted other research into best practices for messaging. An effective argument noted in the literature is explaining how fluoridation is economically practical, providing a return on investment. The CDC conducted a study which found that for every $1 invested in community fluoridation, about $38 are saved because fluoride reduces the need for future care. This has been shown to be an extremely persuasive argument. Emphasizing that fluoridation saves taxpayers' money is an approach that may change how constituents view this issue. This argument was used in the 2001 debate, but could be a more prominent component of a future pro-fluoridation platform.

Another messaging strategy we explored in our research was the use of social media. This is a powerful tool that was not available in Worcester's past campaigns for fluoridation. Social media allows individuals to take a role in creating marketing content, by receiving direct, interactive feedback (Hanna, Rohm, & Crittenden, 2011). Utilizing the interactive features of social media allows individuals to become more engaged and more invested in an issue (Hanna, Rohm, & Crittenden, 2011). Additionally, social media can be used to access a wider range of people; when successfully harnessed, its reach is limitless.

Our research also suggests the use of "kitchen table" language, where the subject is approached in a more polite, non-threatening manner. Messaging campaigns that use this tactic are more likely to be effective in spreading the idea of fluoridation. This will allow an individual to become more involved in the issue.

Reflection

We began this journey with two goals in mind. Our primary goal was to create the deliverables for our client and assist them in their efforts to fluoridate Worcester's water supply. Secondly, this project was a challenge and an opportunity for each of us to grow professionally. The six people on our team come from different majors, include MSIT, MSPC and MPA. Throughout the entire process, MSIT students were responsible for analyzing the data we obtained. We used Tableau and Excel to classify the data skillfully. The members of MSPC were responsible for researching the literature and for providing enough information to demonstrate the benefits of fluoridation policy. The MPA students conducted research on past campaigns, campaign results, finance, and fluoridation distribution. Over the past few months we have learned about the importance of fluoridation and how widespread it is. We compiled evidence to help our clients in their efforts to promote fluoridation and achieve fluoridated water in Worcester. We learned how to work together as a team in a professional setting, maximizing our impact by utilizing all of our different skills and strengths.

Chapter 5: Conclusion

Our research shows that there is general trend towards fluoridation, not only within Massachusetts, but also across the country. As we mentioned previously, 70.4% of Massachusetts is currently fluoridated. Recent votes in MA on the issue of fluoridation

have largely been in favor, suggesting there is an overall trend within the state. The maps we have provided demonstrate how more and more cities and towns are fluoridating their water supply throughout the country and within MA, suggesting this has become a more established and therefore more trusted practice. In the 2001 fluoridation election, people were very unsure as to the validity and safety of fluoridation. Some of the major arguments made against fluoridation in 2001 were centered on the idea that we don't know enough about fluoride, and therefore it could be dangerous. Now that fluoridation is more common and accepted, it is more likely to be accepted in Worcester.

Moreover, our research suggests there will be higher voter turnout in the 2018 election than there was in 2001, because 2018 is a gubernatorial election year. Additionally, there are new voters who will have different views on the issue of fluoridation; many were not part of the vote in 2001 and will not be influenced by the past campaign.

Social media is a powerful advocacy tool that was not available in 2001 and could be used today to raise awareness. Social media platforms are a relatively easy way to share information for a very low cost. The 2001 campaign for fluoridation was very expensive, and perhaps this campaign could save money on advertising.

Additionally, engaging stakeholders in the community, like local dentists, is key to moving this issue forward. There is ample research about the benefits of fluoride, it is now a matter of disseminating this information and raising awareness in the community. Our research suggests that current Worcester residents would be more open to these messages.

References

American Cancer Society. (2015). Water Fluoridation and Cancer Risk. Web.

American Dental Association. (2005). Fluoridation Facts. Web.

Animashaun, A., & Gyurina, C. (2016). Oral Health Community Profile: Worcester. UMass Medical School, Commonwealth Medicine. Web.

Common Questions About Fluoride: A Resource for Parents and Caregivers. (2014). American Academy of Pediatrics. Web.

Fluoridated Water on Tap: Good Oral Health. Maryland Dental Action Coalition. Web.

Fluoride Safety: A Guide for Health Professionals. (2015). American Academy of Pediatrics. Web.

Fluorosis Facts: A Resource for Parents and Caregivers. (2015). American Academy of Pediatrics. Web.

Jacob, M. (2014). Fluoride & Fluoridation. Children's Dental Health Project. Web.

Hanna, R., Rohm, A., & Crittenden, V. L. (2011). We're all connected: The power of the social media ecosystem. Business Horizons, 54(3), 265-273.

Independent critical appraisal of selected studies reporting an association between fluoride in drinking water and IQ (pp. 1-58, Rep. No. 3724527). (2009). London: Bazian.

National Institute of Dental and Craniofacial Research. (2014). *The Story of Fluoridation*. Web.

Olson, R. (2008). The politics of water fluoridation from a problem definition perspective: A dissertation (Unpublished doctoral dissertation). Northeastern University.

One in a million. (2004) The facts about water fluoridation. Birmingham: British Fluoridation Society.

Say This, Not That: Tips for talking about Community Water Fluoridation. (2015). American Academy of Pediatrics. Web.

Zimmerman, J. (2011, November 16). Science fights fluoridation. *Los Angeles Times*. Web.

Appendix

How to Use Tableau

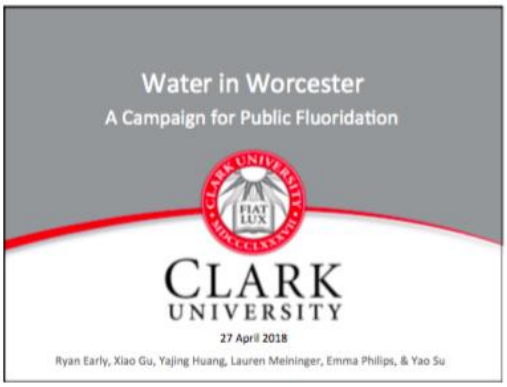
The following link can be used to access these maps, tables, charts, and graphs online:

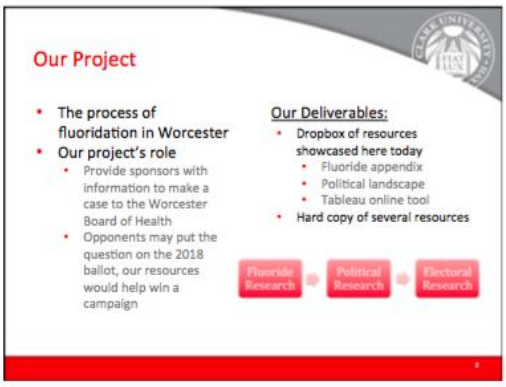
https://public.tableau.com/profile/yao.su#!/

This will take you to Yao Su's profile, you will then click on "Fluoride Project" to reach the data dashboard. Once there, there are several tabs that will lead you to different dashboards which present different maps and charts on different topics. There are nine different tabs:

- **US (map):** Fluoridation levels across the U.S.

- **US (line):** Fluoridation levels across states over time. You have the option of clicking which states you wish to see, allowing for a comparative view of the desired states
- **MA:** Map showing fluoridated communities in MA
- **Recent MA:** Recent votes on fluoridation in MA (negative and positive) showing a trend towards fluoridation in MA
- **Worcester (map):**
    - Provides map of Worcester divided by ward
    - Allows you to see voter turnout for the years 2001, 2014, and 2016 in a histogram-- can select which year you wish to see
    - Divides wards by income level and presents pie chart which shows voter turnout based on income level
- **Growth Rate by Ward:** Shows several graphs which demonstrate how voter participation has grown across 2001, 2014, and 2016
- **Income (3 years):** Presents pie charts which show voter turnout of wards as categorized by income level
- **2001 & 2014:** Compares 2001 and 2014 voter turnout
- **2001, 2014, & 2016:** Uses voter data from all three years, to analyze repeat voters in the 2016 election


Water in Worcester
A Campaign for Public Fluoridation
CLARK UNIVERSITY
27 April 2018
Ryan Early, Xiao Gu, Yajing Huang, Lauren Meininger, Emma Philips, & Yao Su


Our Project
The process of fluoridation in Worcester
Our project's role
Provide sponsors with information to make a case to the Worcester Board of Health
Opponents may put the question on the 2018 ballot, our resources would help win a campaign
Our Deliverables:
Dropbox of resources showcased here today
Fluoride appendix
Political landscape
Tableau online tool
Hard copy of several resources
Fluoride Research
Political Research
Electoral Research


Sponsors
Chris Philbin
Vice President of Government Relations
UMass Memorial Health Care
Joe O'Brien
Executive Director of the Environmental League of Massachusetts
Adjunct Professor at Clark University
Former Mayor of Worcester

Background Fluoride Research

- Fluoride naturally occurs in water
- Fluoride prevents dental decay
- Public fluoridation is one of the 10 great public health achievements of the 20th Century (CDC)
- Communities have been adding fluoride to public water for over 70 years
- Fluoride is safe to mix with infant formula

Fluoridation across the United States

- Fluoridation is widespread in the U.S.
- 75% of the U.S. population have fluoridated water (over 210 million people)
- Massachusetts ranks 31st for fluoridation

Map of United States

Fluoridation in Massachusetts

70.4% of the MA population receives fluoridated water

Recent MA Fluoride Votes

Recent Affirmative Votes

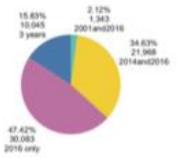
Year	Town	Outcome	Prior Fluoridation
2000	Wayland	Fluoridation	
2001	Northborough	Fluoridation	
2002	North Attleboro	Fluoridation	
2004	Stoughton	Fluoridation	
2007	Acushnet	Fluoridation	
2007	Dartmouth	Fluoridation	
2007	Freetown	Fluoridation	1978 (partial)
2007	New Bedford	Fluoridation	
2008	Woburn	Fluoridation	1978 (partial)
2009	Wilmington	Fluoridation	
2015	Gloucester	Maintain fluoridation	
2015	Rockport	Maintain fluoridation	

Recent Negative Votes

Town	Vote Year	Outcome
Rowley	2000	Reject fluoridation
Methuen	1981, 1987, 2002	Reject fluoridation
Amesbury	1967, 2011	Amesbury fluoridated in 1967; Board of Health discontinued the practice in 2008; voters eliminated fluoride in 2011

Electorate Comparison: 2001, 2014, 2016

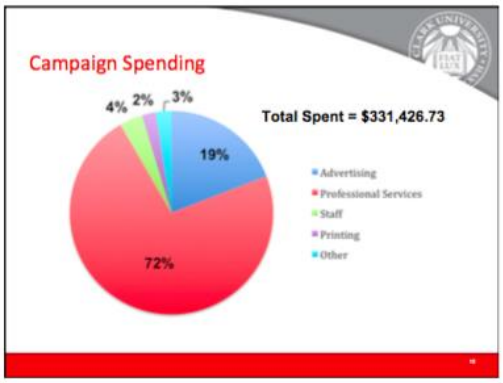
2001 & 2014 & 2016

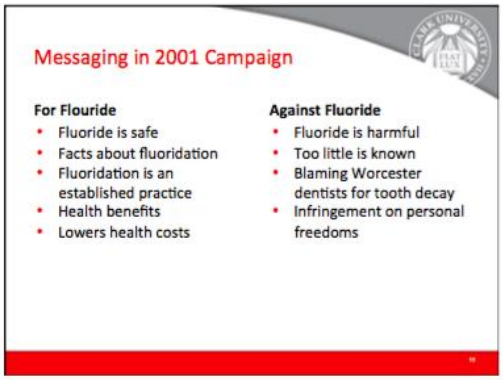


2001 Referendum on Fluoridation

Process and Results

- June 6: The start date
  - Signature gathering
- September
- October
  - Public forums / Advertisements / Brochures
  - Fluoride Education Public Forum
- Final Vote:
  - 12,906 (56%) against fluoridation to 9,980 (44%) support fluoridation
  - Percent of Registered Voters Who Voted: 28%


Campaign Spending
4%
2%
3%
19%
72%
Total Spent = $331,426.73
Advertising
Professional Services
Staff
Printing
Other


Messaging in 2001 Campaign
For Flouride
Fluoride is safe
Facts about fluoridation
Fluoridation is an established practice
Health benefits
Lowers health costs
Against Fluoride
Fluoride is harmful
Too little is known
Blaming Worcester dentists for tooth decay
Infringement on personal freedoms


Successful Messaging:
Simplify Language
Be attentive and avoid using conversation-stoppers
Address the public's concern about the safety of fluoride
Use "kitchen table" language

Successful Messaging: Return on Investment

"For most cities, every $1 invested in water fluoridation saves $38 in dental treatment"

- CDC Study

- Public Fluoridation saves families money
- Oral health influences success
  - An estimated 51 million school hours are lost each year due to dental related illness.

Why Worcester? Why Now?

- Research is largely resolved in favor of fluoride
- National and statewide trend towards fluoridation
- Lessons learned from past campaigns
- Opportunities for social media messaging
- Worcester's electorate has grown and changed

Deliverables

Fluoride Research:
- Appendix of general research reports

Electoral Research:
- Tableau data analysis with dynamic maps, charts, and graphs

Political Research:
- Fluoridation across US and MA Tableau maps
- Recent votes in MA
- 2001 campaign analysis
- Campaign messaging best practices


Acknowledgments
Thank you to our sponsors, Chris Philbin and Joe O'Brien!
Thank you to the Worcester fluoride activists who have supported this project!
Thank you to our advisor, Mary Piecewicz!


Questions?
CLARK UNIVERSITY
CHALLENGE CONVENTION. CHANGE OUR WORLD.

CLARK UNIVERSITY

CHALLENGE CONVENTION.
CHANGE OUR WORLD.

School of Professional Studies

Project Charter

Fluoride Policy

Table of Contents

Glossary of Terms in a Project Charter

This glossary defines key terms used in this document. Although some of the terms will have slightly different definitions outside of this project, this glossary defines the meaning within this initiative.

Assumption – An item taken to be factual even though that fact has not been confirmed. Wherever possible the accuracy of assumptions is validated during the project

Constraint – An unchangeable condition that impacts the project.

Contingency – An activity, budget or time period that is held in reserve in order to minimise the impact that a risk has on the project if that risk is realised

Major Stakeholder – One of the key interested parties and decision makers in the project.

Mitigation – An activity that is undertaken to minimise the impact and /or the likelihood of occurrence of an adverse risk or to maximise the impact and /or the likelihood of occurrence of a positive risk

Project Charter – This document. The document that authorises the project and sets out the framework for what is to be done and how it is to be managed.

Project Manager – The person responsible for the management of the execution of all work items.

Required End State – The definition of what constitutes a completed project.

Risk – An uncertainty that may impact the project in either a positive or negative manner if it occurs.

Scope – The sum of the changes to be made in order to achieve the Required End State.

Steering Committee – The group of people responsible for making major decisions on the project.

1 Project Overview

1.1 Introduction

A group of Worcester's medical and political leaders wants the municipal Board of Health to fluoridate the water supply in the City of Worcester. The group of leaders interested in fluoridation will ask the Board of Health to implement fluoridation in early May, 2018. There will then be a period in which opponents have the opportunity to appeal the decision. That appeal takes the form of a referendum campaign. Opponents would be tasked with collecting the number of signatures that is equal to 10% of the

Worcester population to put the question on the ballot in the November, 2018 election. If they achieve this, there will be a campaign throughout the summer and fall of 2018 to attempt to persuade the electorate.

Our role is to provide research that will support the Board of Health's decision to fluoridate and that can be used in a pro-fluoridation referendum campaign. The final deliverable, a Google Drive with all of our project related research documents, will serve as a resource for the pro-fluoride movement in Worcester.

1.2 Major Stakeholders

- Project Advisors
  - Mary Piecewicz (Capstone Advisor)
  - Joe O'Brien (SPS Faculty)
- School of Professional Studies
- UMass Memorial Medical Center/Medical School
  - Doug Brown, Chief Administrative Officer, UMass Memorial Health Care
  - Cheryl Lapriore, Chief of Staff, UMass Memorial Health Care
  - Monica Lowell, Vice-President of Community Relations & Community Benefit, UMass Memorial Health Care
  - Chris Philbin, Vice-President of Government Relations, UMass Memorial Health Care
  - Lynda Young, MD, Member, Board of Trustees, UMass Memorial Health Care
  - Kolawole Akindele, Senior Director for Government & Community Relations, UMass Medical School
- Worcester Research Bureau
- Worcester Dentists
  - Hugh Silk, MD, MPH, Professor, UMass Medical School, Department of Family Medicine & Community Health
  - Abraham Haddad, DDS, veteran pro-fluoride activist
- Worcester Board of Health
- Worcester Residents
- Worcester Division of Public Health

1.3 Document Purpose

The purpose of this project is to conduct a research project supporting fluoridating the City of Worcester's water supply. We will collect evidence from Worcester, central Massachusetts, and U.S. cities with similar demographics to support our analysis.

2 Project End State and Scope

2.1 Required End State

We will submit our Capstone final report with our analysis and recommendations based on our research about fluoride. This information will be compiled into a Google

Drive folder than can be accessed by the client for future use. We will also present this information in a presentation to major stakeholders.

2.2 Project Scope

Work Area	In Scope	Out of Scope
Scientific Research	-Create a document containing citations of research that demonstrates the health benefits of fluoride	-Conducting original research on Massachusetts oral health
Electoral Research	-Research electoral breakdown and changing demographics in Worcester between 2001 and 2014 -Research why people supported/opposed fluoridation in Worcester in the 2001 election -Research how money was spent in the 2001 fluoride campaign -Research other cities similar in size/demographic/region that have had fluoridation campaigns in the last 5 years and write up lessons learned and marketing strategies -Research recent fluoride votes in MA -Research and include polls that have been conducted on the question of fluoridation in the US	-Prove that fluoride is good -Demographic data not related to Worcester (2001-2014) -Non-U.S. cities
Advocacy Research	-Research participation in Swish Day in Worcester -Research demographics for Worcester Public Schools using 2015 Census data	-Implementation of social media and marketing campaign -Research on participation data for any other Worcester school-related programs

2.2.1 Change Management

Our ultimate change management initiative is to influence the Board of Health's stance on fluoridation. Our research is going to support the Board of Health's efforts to change the status of Worcester's water by giving them the evidence to demonstrate that it is necessary and that fluoridation should happen now.

3 Assumptions

- Fluoridated water is good

- Worcester should fluoridate its water
- The municipal Board of Health is open to hearing a case for fluoridation
- Fluoridation will require convincing the Board of Health to take action and persuading the public it is worthwhile (should it become a referendum campaign)
- We can find data on each of the research questions
- The client will respond to questions about scope/helpful contacts
- Mary and Joe are supportive of our efforts
- This project can be completed by April 23rd, 2018
- Every team member will contribute equally to the capstone project

4 Constraints

- Time:
    - We must finish by April 23rd as the Client wants to present to the Worcester Board of Health in May, 2018
    - Competing priorities, including other classes and work schedules
- Money: No funds have been allocated for this effort
- Database: There is a lot of data to handle and we will have to calculate the most relevant data to support our analysis.
- Analytics tools

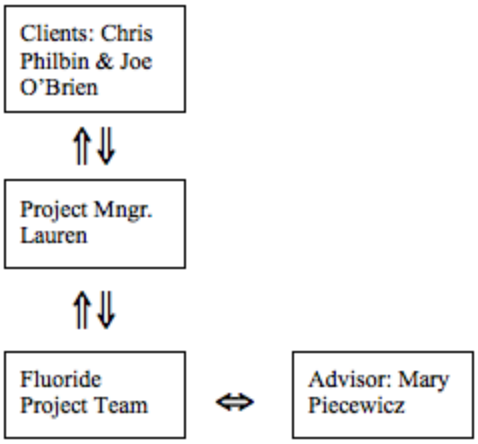
5 Risks

- Negative Risks:
    - Inability to identify pertinent pieces of data, limiting our ability to answer one or more of the research questions
    - Our client/sponsors/other contacts availability for rapid response to inquiries
    - Project scope exceeds the time available to complete the project
- Positive Risks:
    - Team members can list a public advocacy project on their CV/resume
    - Establishment of network with thought leaders at UMass Memorial Medical Center and in the City of Worcester government

6 Communication Strategy

- Internal Communications: Our group communicates with each other via a group text message
- Communications with Advisor: Communicate with Mary Piecewicz via email and in person, weekly meetings
- Communications with Sponsors: Communicate with Chris Philbin and Joe O’Brien via email and meet/hold conference calls as needed

7 Project Structure



8 Steering Committee and Stakeholder Commitments

8.1 Steering Committee

Not Applicable

8.2 Stakeholder Commitments

- Respond to requests from project manager Lauren Meininger within three business days (if possible)
- Put us in contact with the people that could serve as useful resources
- Help us access information we may not be able to obtain
- Attend final presentation

9 Roles & Responsibilities/RASCI Chart

	Roles / Responsibilities					
	Yao	*Xiao*	*Yajing*	*Emma*	*Lauren*	*Ryan*
Project charter including end state and scope	R	R	R	R	R	R
Project management and control	C	C	C	C	R	C
Project communication	R	R	R	R	R	R

Project planning	R	R	R	R	R	R
Research	R	R	R	R	R	R
Presentation	R	R	R	R	R	R

C= Contributing
R= Responsible

10 Measures of Success

Project Performance Dimensions by Project Success Factor	
Project Outcomes	**Measure of Success**
Report for Client/Resource List	Client Satisfaction
Presentation	A in class; win first place
Final Paper	A in class; win first place
Professional Development	Successful project on CV

11 Stakeholder Sign-off

This project charter has been signed off by the following stakeholder:

_____	_____	_____
Name	Title	Date

Project Teams Members:

Emma Philips	Team member	02/23/2018
_____	_____	_____

Lauren Meininger	Team lead	02/23/2018
Yao Su	Team member	02/23/2018
Yajing Huang	Team member	02/23/2018
Xiao Gu	Team member	02/23/2018
Ryan Early	Team member	02/23/2018

Fluoride Research

Annotated Bibliography of Reports on Water Fluoridation

Bazian Ltd. (2009). Independent critical appraisal of selected studies reporting an association between fluoride in drinking water and IQ. 1-58.
A report for South Central Strategic Health Authority
“The primary studies reviewed were conducted in China, Mexico, Iran and India. They sought to investigate whether high environmental exposure to fluoride or arsenic or low exposure to iodine, was associated with lower IQ and used observational (cross sectional and ecological) methods.”

Common Questions About Fluoride: A Resource for Parents and Caregivers. (2014). American Academy of Pediatrics. Web. Retrieved from https://14703-presscdn-0-93-pagely.netdna-ssl.com/wp-content/uploads/2014/10/CommonQuestionsAboutFluorde.pdf
Basic answers about fluoride: why children need fluoride, it is safe to mix infant formula with fluoridated water, and fluoride does not affect IQ.

Fluoridated Water on Tap: Good Oral Health. Maryland Dental Action Coalition. Web.
"The implication of fluoridated water for Maryland. Communities in Maryland have been fluoridating their water. Everyone benefits from fluoridation. Healthier teeth improve learning. Healthier teeth help people in the job market. Fluoridation builds on the benefits of toothpaste. Solid evidence proves it's safe and effective. Fluoridation is backed by the leading health and medical organizations."

Fluoride Safety: A Guide for Health Professionals. (2015). American Academy of Pediatrics. Web. Retrieved from https://ilikemyteeth.org/wp-content/uploads/2014/10/FluorideSafetyforHealthProfessionals.pdf
"Fluoride is a mineral that is mined from phosphate rock. In its naturally occurring form, fluoride dissolves into water and is found in environmental sources throughout the world. Much like iron and calcium, fluoride is also present in a wide variety of consumer products. Some of these include toothpaste, cosmetics, and ceramics. It is one of many minerals our bodies need for optimal health."

Fluorosis Facts: A Resource for Parents and Caregivers. (2015). American Academy of Pediatrics. Web. Retrieved from https://14703-presscdn-0-93-pagely.netdna-ssl.com/wp-content/uploads/2014/10/FluorosisFactsForFamilies.pdf
Introduction to dental fluorosis, the sources of fluoride, and three guidelines for protecting children's teeth without causing fluorosis.

Jacob, M. (2014). Fluoride & Fluoridation. Children's Dental Health Project. Web. Retrieved from https://www.cdhp.org/resources/309-fluoride-fluoridation
Q&A: The Benefits and Safety of Community Water Fluoridation
This article looks at the need for, benefits from, and safety of water fluoridation. It also discusses misinformation around fluoridation.

Say This, Not That: Tips for talking about Community Water Fluoridation. (2015). American Academy of Pediatrics. Web.
Retrieved from https://ilikemyteeth.org/wp-content/uploads/2014/10/SayThisNotThat.pdf
"When talking about water fluoridation, it is important to use words and phrases that don't add to confusion or fear."

Primary Source Documents to Follow

Primary sources include:

A. MA Fluoridated Towns and Cities (MA Department of Public Health)

B. 2001 Election Results (Worcester Elections Commission)

C. 2001 Campaign Expenditure Report (Worcester Elections Commission)