



Effectiveness of Population-Based Interventions to Promote Oral Health

Understanding Public Judgment on Science-Intensive Issues: San Diego Dialogues on Community Water Fluoridation

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San Diego Dialogues on Community Water Fluoridation
Viewpoint Learning

Executive Summary

In recent decades, the public has been asked to come to grips with a daunting number of policy issues that involve a strong scientific component. Community water fluoridation (or CWF) is one such issue. Between June 2005 and May 2007, Viewpoint Learning conducted a series of citizen dialogues focused on the question of whether or not the city of San Diego should fluoridate its drinking water. These dialogues were designed to determine which considerations are most important in forming and changing people's views on CWF, as well as to develop insight into how the public processes information, form their attitudes and reach judgment on policy issues with a strong scientific component.

The dialogues were sponsored by Dental Health Foundation of California and the University of California Berkeley. Eight ChoiceDialogue sessions were conducted with randomly selected groups of San Diego residents.¹ A total of 294 respondents participated in the dialogues, each group a representative cross section of the community.

In each session, participants spent the first half of the dialogue crafting a vision for the future of oral health in San Diego, determining their priorities and the tradeoffs they would (and would not) find acceptable. In the second half of each session, participants tested this vision and the common ground they had established by examining a range of advocacy materials – both favoring and opposing CWF – of the type used in public campaigns in recent years. The purpose of this part of the dialogue was to test how the pressures of actual campaigns affect decision-making. Participants were asked to assess these materials in terms of credibility, importance, and any effect they had on their earlier opinions about whether or not to fluoridate. Participants filled out extensive questionnaires, and the sessions were videotaped; these results were analyzed both qualitatively and quantitatively.

The research was conducted in three successive phases, each building on the previous ones.

- Phase 1: Examined information-based “public education” techniques frequently used to engage the public on science-intensive issues
- Phase 2: Tested the effectiveness of social marketing and messaging techniques
- Phase 3: Experimented with a different approach highlighting the common ground shared by supporters and opponents and responding to public concerns in a more balanced way.

¹ The ChoiceDialogue methodology is described in Appendix A of the complete report.

Key findings

In all eight dialogues, participants considered two basic scenarios—to leave San Diego’s water unchanged or to fluoridate. They were asked to consider three major aspects of the issue in particular:

1. Personal choice vs. community responsibility. Should the responsibility for public health and well-being lie primarily with individuals? Or should we take community-wide action to improve everyone’s well-being, even if some individuals object? What sorts of interventions are we willing to accept in the name of the greater public good?
2. Science and the environment. How should scientific data factor into the decision of whether or not to fluoridate? How much reliance should we place on what scientists say? How much should we “tamper with nature” in order to address a specific problem?
3. Cost vs. benefit. What are the costs and benefits of each course of action? What risks and benefits need to be taken into consideration?

Overall participants began favoring CWF by a margin of nearly 2:1, but that support tended to fall off over the course of the dialogue, leaving the two scenarios essentially tied by the end. These shifts closely parallel the results of many real-life campaigns; as such they open a useful window into the process through which the public makes decisions about this issue.

A detailed analysis of how participants’ responses and concerns changed over the course of the dialogue can be found in the main body of the report. In general, we found that as participants worked through the issues their thinking followed a consistent sequence of steps and conclusions:

I. Preserve individual choice wherever possible



II. However, individual choice should take a back seat, IF there is a significant demonstrable benefit to the wider community.



III. Does the scientific evidence indicate that fluoridation offers such a benefit? What was quite striking in these dialogues was the extent to which the issue of trust — or more accurately mistrust — shaped the answer to this question and the outcome of the dialogue overall:

- Participants’ requests for more information were often actually questions about **trust**, and information alone cannot resolve such questions.
- The more participants felt they were being “spun” by experts and advocates — that information was being used tactically not to inform but to sell a pre-determined agenda — the more mistrustful they became and the less open to change.
- Trust also shaped participants’ responses to cost-effectiveness arguments.

Ultimately, many participants remained uncertain about whether fluoridation met the standard of providing a significant demonstrable benefit and as a result opted for the least change (better safe than sorry) option.

The results of the three phases indicate that conventional information-based public education and social marketing approaches are insufficient to bring about public support for change on a science-intensive issue like CWF – and can be counterproductive. Participants tended to view such advocacy strategies as manipulative and one-sided and, when presented with what they saw as “spin vs. spin,” those without strong pre-existing opinions said that they had no good way of assessing which arguments were more credible. They also expressed a great deal of frustration at the barrage of claim and counter-claim, complaining that advocates on both sides seemed to be playing games with the public’s well-being for reasons of their own. Because of the impasse over what information could be trusted, many of these participants concluded that the wisest course was to stick with the status quo.

However, the Phase 3 dialogues indicated that a different approach – one that focuses on common ground and addresses public concerns in a more balanced and responsive way – may lessen the dramatic escalation of mistrust and help reduce the erosion of support for CWF. The sample size in Phase 3 is small, and these findings should be tested with further research.

Conclusions

These dialogues were not designed to create citizen-experts well versed in all the details of water fluoridation. Instead, they were designed to shed light on which factors the public takes into account when making decisions about this kind of issue. These results provide a useful window for decision-makers into how people make up their minds and what matters most when a science-intensive proposal like CWF comes before them.

The research findings reported here suggest a number of points that can help interested decision-makers engage the public more fully around the issue of water fluoridation, and more generally around science intensive issues:

- **Build on common ground.** Despite their differences, participants in every dialogue – supporters and opponents of CWF alike – consistently agreed on a series of key points:
 - *The problem of bad oral health is an urgent community problem that we must work together to address.*
 - *Education is crucial – whether or not we fluoridate the water, we must do a better job of teaching people to take good care of their teeth.*
 - *We need to improve everyone’s access to dental care.*
 - *We shouldn’t put anything in our water unless it offers a significant benefit and very low risk.*
 - *We do not want people to get too much fluoride – over-exposure can cause problems.*

- *Science is not infallible, but it is the best tool we have for understanding the natural world.*
- *We want to preserve individual choice, but individual choice should take a back seat if there is a significant demonstrable benefit to the wider community.*
- **Facts alone will not change minds.** The traditional information-driven campaign by itself is not adequate, especially in a climate of mistrust. Members of the public make up their minds not on the basis of information alone, but also on the basis of deeper concerns that are shaped by values, emotions, and deeply-held beliefs. The public can easily tune out information that counteracts their worldview; this tendency is even stronger when mistrust runs high. Decision-makers need to focus on understanding deeper public concerns and helping citizens to work through the choices and tradeoffs involved.
- **Spin intensifies mistrust.** When people feel they are being spun they become more frustrated and mistrustful, as well as more resistant to change. Excessive claims from either side tended to backfire when presented to those who were not already strong supporters of that viewpoint. Citizens' ability to see through spin, and the damage that the resulting mistrust can cause, should not be underestimated.
- **Transparency about interests is essential.** Participants repeatedly asked for honesty and transparency from experts on both sides of the issue. When assessing an argument, they wanted to know who was making it and why. Advocates' motivations came under constant scrutiny; participants were concerned about whether experts were objective or were marshalling evidence in only one direction.
- **"Common sense" resonates.** Participants showed a consistent and pervasive preference for "common-sense" arguments rather than technical data, and this was particularly true when mistrust ran high. When technical data is potentially tainted by spin, most people turn to information that meshes with their intuitive sense of how the world works.
- **A different approach can help build trust.** These ChoiceDialogues showed the limitations of trying to move the public with a data-driven approach (based on scientific authority) or with social marketing and advocacy techniques, when the fundamental issue is trust. In these circumstances a different approach is needed. Such an approach focuses not on correcting factual misconceptions or emphasizing positive messages, but on understanding public concerns and building on common ground. Experts and advocates need to acknowledge that these concerns exist and to treat them seriously. Simply trying to correct factual misunderstandings without addressing underlying concerns actually *increases* mistrust rather than reducing it.

The ChoiceDialogues showed that maintaining trust is the key to building public support for a public health change like CWF. *To do this, public health experts need to position themselves as trusted advisors on how best to deal with a shared community challenge rather than advocates for one viewpoint or outcome – with CWF as one possible means to that end, rather than an end in itself. In effect they must shift their focus from “how can we win?” to “how can we help the public make up its mind?”*

More generally, scientists can no longer expect the public simply to defer to their expertise when controversial issues are on the table. Even in the face of overwhelming scientific consensus, a handful of rogue studies or misleading results quoted out of context can derail decades of peer-reviewed data. And countering this with a “spin vs. spin” approach actually *undercuts* the authority of science in the public eye. This is especially true in the current climate of mistrust, where public skepticism extends to nearly every social institution: from politics and government to business, academia, religion and science.

Resolving the many science-intensive questions that challenge us today will require finding better ways to understand the public’s values and frameworks, respond more effectively to public concerns, and build on common ground. The dialogue-based approach used in the third phase of this research shows promise and should be tested and developed further.

Understanding Public Judgment on Science-Intensive Issues

San Diego Dialogues on Community Water Fluoridation

Viewpoint Learning

I. INTRODUCTION

In recent decades the public has been asked to come to grips with a daunting number of policy issues with a strong scientific component, ranging from nuclear proliferation and climate change to medical technology and alternative energy. These science-intensive issues are increasing in number and complexity; however, the process by which the public makes up its mind when they are on the table is poorly understood at best. This gap in understanding makes it more difficult for experts and decision-makers to create sustainable policies. To be sustainable in a democracy today, any major policy decision needs to meet at least two tests: it needs to be technically feasible and it needs to reflect the underlying values of the citizenry – where the public stands today, where they are likely to go in the future, what they will be prepared to support and under what conditions. Leaders have excellent ways of determining whether proposed changes are technically feasible. But only citizens – not experts, not special interests – can give leaders the input on values they need to craft sustainable policies.

Community water fluoridation (or CWF) is one of these science-intensive policy issues. Like any other public health measure it raises important questions: How should we as a society balance individual rights with community benefits? How much weight should be given to science and how much to other aspects of the issue? How do we assess costs and benefits in coming to a decision about how to proceed? Yet how the public makes up its mind about questions like these has never been fully explored or understood. The result is an apparent paradox – poll after poll shows that Americans (in fluoridated and non-fluoridated communities alike) favor water fluoridation, yet the same voters often reject CWF proposals when they appear on the ballot.¹

- Public health officials have seen this dynamic in action: In November 2000, 23 ballot measures concerning CWF were up for consideration nationwide. Of 23 measures, 9 passed and 14 failed – and 15 were decided by very narrow margins (56/44 or narrower).²

Methodology

In order to better understand this paradox and what it reveals about the process by which citizens arrive at conclusions about this and other science-intensive issues, Viewpoint Learning conducted a series of innovative citizen dialogues (ChoiceDialogues™) with a representative sample of San Diego residents. This project was sponsored by the Dental Health Foundation of California and the University of California, Berkeley. In these sessions, participants were given the opportunity to work through the pros and cons of fluoridating vs. not fluoridating and then

¹ American Dental Association Survey Center. *1998 Consumers' Opinions Regarding Community Water Fluoridation*. Chicago; June 1998.

² San Francisco Public Utilities Commission. *Fluoridation Feasibility Study. Appendix 6: Fluoridation Status, Surveys, and Election Results in Bay Area, California, United States, and Other Countries*. San Francisco 2002.

to test their conclusions against the kind of advocacy materials they might encounter from both sides in the heat of a public campaign.

The ChoiceDialogue approach differs dramatically from the sort of focus group research that undergirds most public outreach and education campaigns. Too often, experts and advocates assume that the public simply needs more information, presented in the right way. In other words, if you give the public the facts, they will reach sound decisions (and these decisions will be the same ones that experts would make). If the public reaches “wrong” conclusions, the fault lies in the particular combination of facts. This model of opinion formation can result in countless dollars being spent on the search for an informational “magic bullet” that will transform public indifference or resistance into support.

In practice, however, when the public comes to grips with a difficult issue, information is only one component among the many they consider, and often not the most important. Instead, they draw on core values, deeply-held assumptions and life experience. And they do not reach conclusions in isolation, but by engaging in dialogue with family, coworkers, neighbors, and friends. This can be a long and difficult process – people must frequently make painful tradeoffs in which strongly held values come into conflict – and the public can take months or years to reach a conclusion.³

The ChoiceDialogue methodology is designed to compress this process into a single day. In the course of the dialogue, participants confront these difficult tradeoffs, move past their initial top of mind response and work towards a more stable and well-considered judgment – a judgment that takes tradeoffs and consequences into account and meshes with core values. By engaging representative samples of the population in this way, ChoiceDialogues provide unique insight into how people’s views change as they learn, and can be used to identify areas of potential public support where leaders can successfully implement policies consonant with people’s core values. Participant responses are analyzed both quantitatively and qualitatively. All sessions are videotaped and transcribed, and participants complete before-and-after questionnaires designed to measure shifts in views over the course of the dialogue. (For a more complete discussion of ChoiceDialogue methodology, see Appendix A.) In this project, Viewpoint Learning’s quantitative analysis was supplemented with a Bayesian Analysis of the quantitative data, conducted by Dr. William J. Rudman, professor of health information management at the University of Mississippi Medical Center.

³ The research underlying this model of public opinion formation is discussed at length in Viewpoint Learning Chairman Daniel Yankelovich’s book, *Coming to Public Judgment: Making Democracy Work in a Complex World* (Syracuse: Syracuse University Press, 1991).

II. PROJECT OVERVIEW

Between June 2005 and May 2007, Viewpoint Learning carried out six day-long ChoiceDialogues and 2 shorter “micro dialogues,” all conducted with randomly selected representative cross sections of San Diego residents. A total of 294 respondents participated in the dialogues, and each group included a wide range of socio-economic circumstance, ethnic backgrounds, and political leanings.

These dialogues were conducted with several purposes in mind:

- To determine which considerations are most important in forming people’s views on fluoridation, and why their views may change.
- To illuminate how citizens’ interactions with each other shape their decision about whether or not to fluoridate.
- To determine how average citizens receive information, process it, form their attitudes on fluoridation and decide how they intend to vote on the issue.
- To lay the groundwork for future efforts to engage the broader community and educate the public around the issue.
- To develop insight into how the public reaches judgment on policy issues with a strong scientific component – which are becoming increasingly important both nationally and internationally.

As a framework for their discussion, participants used a specially designed workbook, in a tested format, constructed around two distinct values-based scenarios:

The Two Scenarios

<p>1. <u>Leave the Water Supply Unchanged</u></p> <p><i>Rely on personal responsibility and informed choice</i></p> <p>Under this scenario, San Diego will not fluoridate the drinking water. Instead, those who want fluoride will get it on their own, for example from fluoridated toothpaste, fluoride supplements and dentist office treatments. In this scenario we will trust individuals to take the necessary steps to take care of their own teeth.</p> <p>People who support this scenario are concerned about the potential dangers of fluoridation. They are skeptical about the claims of science and experts, and they question the scientific evidence for fluoridation. They fear that adding more chemicals to the water supply tampers with nature and may have long-term consequences that are not yet known. They believe that even if the risks are small it is better to be safe than sorry. They feel that people have the right to make their own choices and that fluoridation is a form of involuntary medication imposed on people whether they want it or not.</p>	<p>2. <u>Fluoridate the Water Supply</u></p> <p><i>Rely on community responsibility and science-based policies</i></p> <p>Under this scenario, San Diego’s drinking water will be fluoridated so that everyone – especially the young, the old and low-income families – receives at least one of the basic components of good dental health. In this scenario we will act as a community to improve dental health for all San Diego residents.</p> <p>People who support this scenario believe that adding fluoride to the community’s drinking water is a cost-effective, scientifically supported and safe way of preventing tooth decay. They trust the scientific evidence in support of fluoridation, and they feel that San Diego should take full advantage of a technology that has improved the lives of millions of Americans over the last 60 years. They feel that the community has the right to make such decisions for the greater good, even if some people object.</p>
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These scenarios were designed to provide a starting point for the day’s dialogue – participants were able to adapt, combine or change them and to add their own ideas. Each scenario included relevant background information and a list of pros and cons articulating the main arguments for and against that approach, in a format allowing participants to quickly absorb key points and compare them with their own attitudes and opinions.

In the first half of the dialogue, participants discussed the scenarios and considered the pros and cons of water fluoridation. In this part of the dialogue, they were asked to consider three major aspects of the issue in particular:

1. Personal choice vs. community responsibility. Should the responsibility for public health and well-being lie primarily with individuals? Or should we take community-wide action to improve everyone’s well-being, even if some individuals object? What sorts of interventions are we willing to accept in the name of the greater public good?
1. Science and the environment. How should scientific data factor into the decision of whether or not to fluoridate? How much reliance should we place on what scientists say? How much should we “tamper with nature” in order to address a specific problem?

2. Cost vs. benefit. What are the costs and benefits of each course of action? What risks and benefits need to be taken into consideration?

As they discussed these three areas, participants crafted a vision for the future of oral health in San Diego, determining their priorities and the tradeoffs they would (and would not) find acceptable. By the end of the morning conversation, participants had established significant common ground on these three issues (these common ground conclusions are laid out in detail on page 33).

In the second half of the dialogue, participants tested this vision and the common ground they had established by examining a range of information-based advocacy materials – both favoring and opposing CWF – of the type that had been used in public campaigns in recent years. The purpose of this part of the dialogue was to test how the pressures of actual campaigns affect decision-making. Participants were asked to assess these materials in terms of credibility, importance, and any effect they had on their earlier opinions about whether or not to fluoridate.

Within this overarching framework each phase of research built on the previous one, testing and deepening the conclusions reached. The three phases were structured as follows:

Phase 1: (June 2005)

Viewpoint Learning conducted the first three ChoiceDialogues in June 2005. A total of 123 individuals participated in the Phase 1 dialogues.

Even with the small sample size, the Phase 1 dialogues very closely mirrored the pattern that is found in public campaigns: initial support for CWF dropped away over the course of the day, leaving participants split on the issue at the close of the dialogue. **The Phase 1 dialogues strongly indicated that the information-based techniques frequently used to engage the public on science-intensive issues are not effective – and can be counter-productive.**

(More detailed findings from all three phases can be found in the following section.)

At the conclusion of Phase 1, Viewpoint Learning and the Dental Health Foundation tested these conclusions with a second phase of research.

Phase 2: (September-October 2006)

The second phase of three ChoiceDialogues was conducted in the fall of 2006. A total of 127 San Diegans participated in the Phase 2 dialogues. The format of this series of dialogues was identical to Phase 1. Participants used the same workbook and scenarios, and were asked to consider the same three issues of choice/community, science/environment and cost/benefit.

In addition, the Phase 2 dialogues were designed to test whether social marketing techniques would prove more effective at engaging the public than the information-driven mode used in the Phase 1 dialogues. To this end, the advocacy materials supporting and opposing CWF were revised to address the most relevant concerns that had surfaced in Phase 1.

- New pro-fluoridation materials were created by a firm specializing in social marketing and advocacy on public health issues. These materials presented positive messages about the value of CWF as a response to California's oral health crisis. In addition, they were

designed to respond to the public's framing of the CWF issue as outlined in Phase 1, as well as emphasizing arguments participants had identified as most important.

- At the same time, the anti-fluoridation advocacy materials were updated to include materials that Phase 1 indicated would be especially effective, and to reflect the most compelling new arguments that had surfaced in the year since the Phase 1 dialogues were conducted.

Phase 2 strongly confirmed the Phase 1 findings with respect to citizen attitudes and priorities regarding CWF. **In addition, they indicated that social marketing techniques are no more effective than information-driven techniques at engaging the public on science-intensive issues, and that marketing and spin can easily increase mistrust.** In the face of such pressures many citizens back away from change and adopt instead a “better safe than sorry” attitude.

Phase 3: (May 2007)

Phases 1 and 2 indicated that there are serious shortcomings in many current efforts to engage the public on science-based policy issues. At the conclusion of Phase 2, sufficient funds remained in the budget to permit a smaller scale experiment to test whether a different approach would be more effective. Accordingly, we embarked on a third phase of research designed to test whether a more “dialogue-based” approach might prove more effective at engaging the public around science-based policy issues like CWF.

Phase 3 participants worked with the same two scenarios used in Phases 1 and 2.⁴ New informational materials were created for the introductory section as well as a new set of advocacy materials built on several key conclusions drawn from Phase 1 and Phase 2. These new materials were designed to:

- Build on the significant common ground shared by supporters and opponents
- Take underlying public concerns seriously, not dismiss them as ignorant or ill-founded

⁴ Minor changes were made in the values statements accompanying each scenario in light of the findings of the first two phases. Specifically, the values statement for Scenario 1 (Leave the water unchanged) was revised to read: *“People who support this approach say that fluoridating the water puts something into our bodies that may harm our health. They note that since fluoride is harmful in large quantities it may be harmful in small quantities as well. They say that we must be very careful about tampering with nature and that water fluoridation may have long-term negative consequences for people or the environment that have not been widely recognized. They believe that even if the risks are small it is better to be safe than sorry. They object to having the decision forced on them whether they want it or not.”*

The values statement for Scenario 2 (Fluoridate the water) was revised to read: *“People who support this approach say that it is a safe, scientifically proven and inexpensive way of reducing tooth decay. They note that water fluoridation has been in place across the country for more than 60 years and they say that the outcome has been overwhelmingly positive – millions of Americans have fewer cavities and scientists have found no evidence that people or the environment have been harmed. They argue that the community has a responsibility to do what it can to improve everyone’s health and well-being.”*

- Use a balanced approach that is straightforward about what is known, what is not known, the relative weight of evidence supporting different positions, and the rationale behind experts' ultimate judgment
- Explicitly recognize the different ways that the public and experts view risk, probability and evidence
- Develop a shared understanding of practical tradeoffs that need to be made
- ***Shift the focus from “how can advocates win?” to “how can experts help the public make up its mind?”***

Phase 3 was conducted with funds left over in the budget after the completion of Phase 2. Because these funds were limited, the sample in Phase 3 was quite small (a total of 44 participants in two 4-hour “micro-dialogues”). The quantitative and qualitative results echoed the key findings of Phases 1 and 2. More important, they provided new insights that should be tested with further research.

III. GENERAL FINDINGS

The following conclusions were consistent across all eight dialogues.

What we observed in the dialogues very closely mirrored the pattern observed in campaigns. In our total sample of 294 San Diegans, 64% initially supported CWF. Over the course of the day that support fell away, leaving 49% supporting CWF at the close of the dialogue.

Looking at participants for whom there is complete survey information:

- **Almost half (48%) could be classified as “consistent supporters” of CWF:** they supported fluoridation at the outset, and continued to do so at the end of the day. **35% could be classified as “consistent opponents.”**⁵
 - Consistent supporters and consistent opponents tended to hold their opinions strongly even at the beginning of the day, before engaging in dialogue with other participants or viewing advocacy materials.⁶
 - In addition, these participants' opinions intensified over the course of the day, moving further toward the extremes of the 10 point rating scale.

⁵ 249 of the 294 participants could be clearly classified as supporters or opponents of CWF in both initial and final questionnaires. “Consistent supporters” supported CWF both at the beginning and the end of the dialogues. “Consistent opponents” opposed CWF at both the beginning and the end of the dialogue. Of the 249 participants with complete information, 119 were classified as consistent supporters, 88 were classified as consistent opponents, 35 switched from support to opposition and 7 switched from opposition to support. *The responses of all these groups except for the 7 respondents who switched from opposition to support were statistically significant (with a P-value of 0.04).*

⁶ In each ChoiceDialogue, participants were surveyed twice, once at the beginning of the day and again at the end. They were asked to rate their response to each scenario independently on a scale of 1 to 10, 1 being totally negative and 10 being totally positive. Consistent supporters' and opponents' ratings of the scenarios tended to cluster at the extremes of the scale. (See Appendix B.)

- **17% switched positions over the course of the day.** These participants were found in each of the 8 groups.
 - Switchers’ initial positions were less strongly held than the positions of consistent supporters or consistent opponents. (See Appendix B.)
 - Of those who switched their opinion, four out of five moved from supporting CWF to opposing it.

An analysis of the respondents who moved from supporting to opposing CWF reveals consistent and statistically significant patterns:

- Switchers were the least educated group (69% have less than a college degree, vs 57% of consistent opponents and 42% of consistent supporters).
- Switchers were more likely to accept the benefits of CWF than consistent opponents:

	Consistent opponents % agree (n = 88)	Support → Oppose % agree (n = 35)	Consistent supporters % agree (n = 119)
Fluoridated water helps prevent tooth decay.	54	77	100
Fluoridation is especially helpful to the young, the old and people without dental care.	50	77	93
Spending a little money now to fluoridate the water will save a lot of money on treating tooth decay	30	51	93

- At the same time switchers were quite concerned about risk – in particular about the risk of getting too much fluoride through CWF (especially because of the amount present in foods). In this they mirrored the consistent opponents.⁷

	Consistent opponents % agree	Support → Oppose % agree	Consistent supporters % agree
If we fluoridate the water, people risk getting too much and could be harmed	92	96	33
Fluoride offers big health benefits with no health risks	11	14	78

⁷ Those who switched were also more likely than any other group to agree strongly with the statement “I am looking for ways to reduce risk – to make everything a little safer for me and my loved ones.” 90% of those who switched agreed strongly, compared to 72% of consistent supporters and 53% of consistent opponents. However, this question was asked in Phase 3 only; because of the small sample size the finding should be confirmed with further research.

- Switchers showed low levels of trust in science and medical authority.

	Consistent opponents % agree	Support → Oppose % agree	Consistent supporters % agree
All major medical and dental organizations support fluoridation: we should trust their judgment.	21	34	88
Scientists and health experts support fluoridation because they have the public's best interests at heart.	32	48	83
Science is often wrong about the risks associated with presumably "safe" treatments	85	83	47

Interestingly, those who changed their views did not do so because they concluded that CWF represents a clear and present danger. Most agreed that fluoridating the water is an effective way of reducing decay, and only a handful (9%, compared with 23% of consistent opponents) strongly agreed that CWF causes serious harm. But many were nonetheless uneasy about the long-term consequences of fluoridating drinking water and the possibility that there were more insidious side effects that were not yet fully understood. Only about 14% of those who switched agreed that CWF “offers big health benefits with no health risks” (compared to 78% of consistent supporters).

It appears that those who shifted did so because their concerns about risk pushed them towards a least change “better safe than sorry” position.

How participants worked through the issues:

In all eight dialogues, participants reached their conclusions by moving through a consistent sequence of interrelated conversations.

Choice/Community. Participants began by considering the issues that fluoridation raises with respect to balancing individual choice and community welfare.

I oppose [CWF] because I feel that it's your own responsibility to take care of your teeth. I don't have dental insurance and I use toothpaste and I floss. There are other options.⁹

Most began by stressing the importance of individual responsibility – people should simply take care of their own teeth. As they worked through the issue, however, many began to recognize the obstacles that can prevent people doing so: poor education, poverty, lack of insurance and simple intransigence (especially among young children). Relying exclusively on individual responsibility would not overcome these obstacles. Accordingly, many participants came to agree that fluoridation would be a valuable tool for helping people at the most risk: by the end of the day a full 82% of participants agreed that “fluoridation is especially helpful to the young, the old, and people without dental care.”

A lot of people don't know how to take care of their teeth. It shouldn't just be a little kid's responsibility to know that they need to floss, they need to get fluoride.

I'm a big fan of personal responsibility and making sure everyone brushes their teeth, but at the same time I see it's not working. We have a high [level] of tooth decay. So I'm not really sure about [CWF], but it's something we have to think about.

At the same time, participants were clear that this did not mean that individuals – even the most disadvantaged – could escape responsibility for their own oral health. Participants agreed that even if community water fluoridation were implemented, San Diego still needed better education and outreach, especially in schools, so that children and their parents have the tools they need to take good care of their teeth.

It needs to be a complete program. It's not just fluoride, it's not just brushing, it's not just flossing. It's also education so that everybody knows to brush, to floss, and about the fluoride. It should all come together – that's how we'd see the maximum benefit from fluoridating the water.

⁸ Participant comments illustrating key points are taken from all eight dialogues.

As participants worked through the issue of who should be responsible for ensuring the community's health, they began to think explicitly about ways in which individuals accept some limitation of choice or convenience in the name of a larger public benefit. A few participants strongly objected to fluoridation on the grounds that it amounts to involuntary medication and as such violates an individual's right to choose what sort of treatments they will or will not accept. However, the majority arrived at a more moderate position. Some participants compared fluoridation to adding Vitamin D to milk and other measures where people accept a certain loss of personal choice in the name of a greater public good.

You have the good of the overall community: ... iodine was added to salt [to get] rid of goiters and we had pasteurization to get rid of other health problems. We add vitamin D to milk.... We've done these things in other areas in our history and it's been extremely effective.

You drive a car, you have to wear a seatbelt you have to have stop lights on your car. If you drive a car you're already saying that you're going to take a drunk driving test. Essentially our entire society is based on that idea [that personal freedom is limited to some degree].

Ultimately, two-thirds (63%) agreed that fluoridation violates individuals' right to choose what kind of treatments they want, but an even larger majority (76%) felt that the community "has the right to make public health decisions, even if some people object."

It might take away choice, but again our democracy is built on the collective good. What's best for the greater good of society and the community, and we felt that even though it may take individual choice away from some people, overall the benefits would far outweigh that cost.

We feel that the community is responsible for the children. There's a lot of kids out there, and that's what we're mostly looking out for; kids and the elderly whose families aren't educated about it, and who can't get their kids the fluoride. It's our responsibility to look out for them.

In the end, the groups reached consistent conclusions across all eight dialogues – people's right to reject an intervention is important, but that right should take a back seat ***if there is a significant demonstrable benefit to the wider community.*** The question they next explored was whether the evidence demonstrated that there was indeed such a benefit and (most important) whether such evidence could be trusted.

Science and the environment. Participants were only willing to accept an intervention like fluoridation if they were sure that it would be effective and safe, and that it would provide a demonstrable benefit to the community. Whether or not fluoridation met this standard was the most contentious point in all eight dialogues, and it surfaced most strongly when people moved from a discussion of choice and community to a discussion of the scientific evidence for fluoridation.

Participants did not doubt the effectiveness of water fluoridation and, for the most part, they were not worried that they would be seriously harmed by it. Four out of five participants (82%) agreed that fluoridated water is an effective means of preventing tooth decay. Most (61%) said that CWF does not cause serious health problems like cancer or osteoporosis; only 10% strongly believed that it does. But many were nonetheless uneasy about the long-term consequences of fluoridating drinking water and the possibility that there were more insidious side effects that were not yet fully understood. Less than half of participants (45%) felt they could agree with the statement that fluoride “offers big health benefits with no health risks.”

Two major themes emerged in participants’ response to the scientific evidence concerning fluoridation: the limits of information and the critical role of trust.

1. **The limits of information.** The dialogues provided considerable insight into the role that information plays in forming public judgment – which is not the one that technical experts might expect. Over and over again, participants said they needed more or better information if they were going to make a decision on water fluoridation. But frequently the information they were given served not to resolve their questions but to raise more. In the course of the dialogue it became clear that most participants’ requests for information were really about more than the technical facts of the issue.

[Some of us] were concerned about whether there has been enough research. Now, I personally would think after 60 years there has. But some of us aren't sure. We don't know what's going to happen if fluoride is added into the water.

There really is no definitive answer that fluoridating is not harmful. There's been a lot of evidence ... today that some people think it might be [harmful], and I've seen no definitive evidence that it's not.

Our group talked about how food that we eat has fluoride in it, but someone's dentist had provided [additional] fluoride for their kid. But maybe the dentist wasn't informed. What if the dentist doesn't know? I'm scared of overexposing my son with too much fluoride. My son eats [a good diet], and I believe that he's getting enough fluoride. How does the dentist who's giving your son fluoride know that he's not getting too much?

How does [the additional fluoride] impact children with cystic fibrosis, people with multiple sclerosis. Does it hinder their health condition? What about older folks taking medications, how does it impact them?

To give only one example: when asked what sort of information they would need in order to reach a decision about fluoridation, participants frequently mentioned wanting to know whether people who drink fluoridated water can overdose on fluoride as a result. Facilitators provided information on this point (which also appeared in participants’ workbooks). Far from settling the issue, however, this information raised even more questions – did researchers take into account people’s fluoride intake from other sources, like food or toothpaste? Were some people (e.g. AIDS patients or those with limited kidney function) at greater risk? Answering each of these questions with technically relevant data did not resolve participants’ concerns, because the basic questions being asked were not about information, but about *trust* – and ***it is not possible to resolve a trust issue by throwing data at it.***

2. **The importance of trust.** This issue of trust – or, more accurately, *mistrust* – proved to be central to participants’ responses across the board. Trust in business, government and other institutions in our society has been tracked for decades, and it currently stands at extremely low levels.⁹ In our work we have found that trust is often a central factor in engaging the public on difficult policy issues, and that a pervasive climate of mistrust can dramatically distort citizens’ willingness to make difficult tradeoffs.¹⁰

There was a lot of skepticism about the scientific studies and research, because everyone felt that the numbers can be skewed or manipulated.

The only [reliable] statistic we got is that [CWF] takes down the amount of tooth decay. What about environmental effects, what about the wastewater, what about the effects on internal organs? Any information at all could be skewed by somebody wanting it to appear a different way.

What was quite striking in these dialogues was the way that advocates’ efforts to “spin” information to support their case exacerbated mistrust, as well as how central mistrust was to the outcome. While participants across the board respected scientific authority they were also powerfully aware of the ways in which scientific information can be used to manipulate and mislead, and they were not inclined to give scientists – or anyone else – the benefit of the doubt.

The more participants felt they were being spun by experts and advocates – that information was being used tactically not to inform but to sell a pre-determined agenda – the more mistrustful they became, *no matter which side seemed to be doing the spinning*. Adding further information in this context served only to intensify the mistrust rather than dissipate it: in effect, participants saw information as ammunition in a debate driven by experts, aimed at influencing the public rather than advancing the public’s best interests. When caught in this kind of crossfire, most ordinary citizens wind up responding in one of two ways:

⁹ Gallup tracking polls show this decline. In 1964, for example, three-quarters of all Americans (76%) believed that “you can trust the federal government to do the right thing all or most of the time.” In 2006, that figure stood at 32%.

¹⁰ See in particular Viewpoint Learning project reports: *Listening to Californians: Bridging the Disconnect* (2005), which discusses Californians’ opinions regarding state governance and finance; *Americans Deliberate Our Nation’s Finances and Future: It’s not about taxes — It’s about trust* (2006), which reports on a nationwide project assessing Americans’ attitudes towards the federal budget and entitlements; and *Listening to the Public: Understanding and Overcoming Barriers to Sustainability* (2006), dealing with environmental sustainability in British Columbia.

- a) Those who are already decided on the question listen only to those arguments that reinforce their position and deny or discount the rest.

I think the most important thing I learned is the amount of fluoride that's already in our foods. There's a tremendous amount. However, that didn't swing my decision. I'm sure there's a reason for putting fluoride in the water in addition to the fluoride in food. [CWF] is recommended by so many of our scientific communities and organizations, and I think we have to put our trust in them.

- b) Those who are undecided become increasingly frustrated and alienated. They may gravitate toward positions that mesh with their existing "common sense" view of how the world works; or they may withdraw and opt for least-change ("better same than sorry") approaches.

From what we've seen from both sides, the statistics do not necessarily agree. I think some of us feel that if they don't agree then what can you believe? The supporting evidence and the opposing evidence don't jibe, so I would say – can we really trust any of this?.

This was also the dynamic observed in these dialogues.

Those who already supported fluoridation, for instance, focused on data showing that CWF has been in place across the nation for 60 years with no apparent ill effects and a significant benefit in lower rates of tooth decay. Others pointed to the large number of organizations on record as supporting fluoridation. Many drew an explicit contrast between the major organizations listed as supporting water fluoridation on the one hand and the smaller and less well known organizations in opposition: the former, they argued, had far greater credibility and were more accountable to the public and other scientific experts.

I think the most important thing that I learned was that there are many U.S. cities that have been doing this for a while – for 60 years. And we see tooth decay goes down and there are no major side-effects. I think it works. I think the trial period is over. I think we can trust it.

We felt the strongest [argument in favor of fluoridating] was that in 50 years there have been no obvious negative side effects from the places that do use it. We figured if something bad happened, an extra eyeball somewhere, unexplained spontaneous combustion, we would have heard about it.

I was mostly surprised that there didn't seem to be a single major name on the opposition. Every single organization that I trust and rely on, including the PTA, is for [CWF]. If you have basically a hundred percent for it, and I couldn't find a single one that I recognized that was against it, I'm going to go with that.

Instead of [government] letting people know you can get [fluoride] from soda, or bread or meat, they're just not telling you. They're saying let's put it in the water but they're not going to tell you that you can get it from drinking a can of soda, they're not going to tell you that you can get from eating a piece of fish. They're hiding things and not giving you all the information that you should know.

I think it's important to note at the top of that page with that long list of people in the [pro-CWF] section – it does not say they endorse it, it says they recognize the benefit of it. That's different than endorsing. I can recognize the benefits in a lot of things, that doesn't mean I support it. So, there's a difference. You can throw your name on there saying you recommend the benefits; it doesn't mean that they're for it.

I guess I'm just so jaded about what all the politicians tell us I just don't believe anything anymore. When I heard that the last 50 years of Surgeon Generals have said we should use fluoride I'm just thinking I don't believe that; somebody got paid off. Just think of all the trillions somebody has made by talking someone into using fluoride in these other 26 big cities. Maybe it has prevented cavities, maybe it hasn't -- but somebody made a hell of a lot of money on those 26 cities.

Those who already opposed fluoridation, however, focused on the arguments that supported their point of view: for instance that toothpaste has been extraordinarily effective at reducing rates of tooth decay, or that fluoride's primary efficacy comes from topical application rather than systemic ingestion. These participants tended to deny or explain away arguments in favor of CWF. Many claimed that evidence of harm caused by fluoridation was being overlooked or actively suppressed by government, industry or scientific experts. Others questioned organizations' motivations for supporting CWF or suggested that these endorsements might be manipulated or taken out of context.

People without strong pre-existing opinions said that they had no good way of assessing which arguments were more credible. They also expressed a great deal of frustration at the barrage of spin and counter-spin, complaining that advocates on both sides seemed to be playing games with the public's well-being for reasons of their own. Because of the impasse over what information could be trusted, many of these participants concluded that the wisest course was to stick with the status quo.

One of the things that really surprised me is that there was so much positive information on one side and so much negative on the other side. So I'm still middle of the road, but leaning towards not supporting CWF..

I was for it when I came in, but after finding out more I'm at a crossroads. I just wish that the government would stop lying to us and lining their pockets. They need to tell us the truth because we have a right to know. It's our lives.

I'd like some information from unbiased person, maybe an actual scientist who hasn't already made up their mind, so I don't feel like I'm being persuaded.

We need a report that is unbiased, that was scientifically done showing before and after effects on various factors, not just tooth decay.

When pressed further about what sort of information they would find useful, participants called repeatedly for transparency and objectivity. They wanted experts on both sides of the issue to deal with them honestly and openly, and to make both the positives and the negatives of fluoridation explicit. Regardless of their position on fluoridation, participants expressed a deep hunger for an honest and impartial analysis, free of spin.

In our work with the public, we have consistently found that citizens are practical and open to considering a wide range of solutions. Once they feel their trust has been abused, however, the reserves of public confidence necessary to approve or implement changes cannot be rebuilt quickly or easily.

There is so much information going both ways, so you really don't know what to believe. You listen to one guy and he's saying "oh, it's bad." Then you listen to another and he's saying, "oh it's good." Who do you believe?

I think the message I would provide to the decision makers is ... give the people that are affected the right information. Make sure it's transparent, make sure it's valid, make sure it's accurate.

Cost/Benefit. The trust issue also shaped participants' response to the issue of cost-effectiveness.

As participants came to realize the extremely low cost of community water fluoridation and the potentially huge savings in dental bills, many of them felt that this was one of the most powerful rationales for fluoridation. ***But this was only the case for those who were already convinced that fluoridation would be both safe and effective – it was not a sufficient rationale on its own.*** Participants' usual formulation was: IF it works, then it's a bargain.

For those of us who believed in the data, the cost-benefit analysis seems to be pretty significant. But for those that didn't ... they said that the costs could be much greater if something was to come out later on down the line that fluoride could actually be harmful to you.

Cost-effectiveness arguments were not sufficient to overcome mistrust among those who not already CWF supporters, and we saw a similar pattern to what we observed in the discussion of science. Several participants raised questions about how the cost-benefit numbers were reached, and some were concerned that the potential financial savings (like the potential health benefits) were being overplayed in the name of advocacy.

I'm more skeptical when someone says [investing] \$1 [will save] \$140. It's so easy to spit out numbers and stuff. Where the hey did that come from?

The cost-effectiveness question also stimulated conversation around San Diego's recent political and economic troubles, which have brought public confidence in decision makers to particularly low ebb. Several participants expressed doubt that San Diego's leaders could be relied on to make a good decision.

I would say the politicians have their own agenda. Otherwise San Diego would have done something 20 or 30 years ago when the majority of the country was fluoridating. If you've lived in San Diego any length of time, you know that there are about five or six families that control everything.

There's breakdowns in processes all the time, especially involving San Diego City infrastructure. Look at our sewer pipes and our police force and fire department. Our infrastructure is broken here. So now we're going to add another thing to it?

Powerful arguments by advocates: In the second half of each dialogue, participants were asked to evaluate campaign-type materials provided by pro- and anti-CWF advocates and to consider which arguments on each side were the most persuasive.¹¹

Participants agreed that the most persuasive arguments against CWF were:

1. **People already get enough fluoride:** This was by far the most commonly cited argument against fluoridation, and participants agreed across the board that it was highly persuasive. A handout from Citizens for Safe Drinking Water (an anti-fluoridation advocacy organization) that listed fluoride levels in a range of foods and drinks was especially powerful for many participants, as it cast doubt on the necessity of community water fluoridation. At the end of the day, 62% of all participants agreed that “people already get enough fluoride from toothpaste and other sources.”

I was surprised about the fluoride content in different foods that we eat on a daily basis. With fluoride being a hazardous material, I wouldn't want more of it in my drinking water, no way.

I had Wheaties last night. I had a Diet Coke today, and I had a café au lait with nonfat milk. From the milk, I got 1.7 grams of fluoride today. So I don't need it in my water.

2. **We shouldn't add unnecessary chemicals to our water:** Participants universally agreed that water should be treated so that it is clean and safe to drink, but many questioned whether fluoride meets the standard of a “necessary” additive. Several expressed concerns about people's high level of exposure to chemicals and felt that it would be unwise to add to it. Overall, many participants felt that since people can get fluoride from other sources, it would be best to err on the side of caution. At the end of the day, 71% of all participants agreed that “we shouldn't add chemicals to our water supply that aren't absolutely necessary.”

Water's water, and we shouldn't mess with it.

We shouldn't tamper with our water. Just keep it as natural as we can because we're tampering with other stuff, and it seems to backfire. We should just leave our water as it is.

My message to the decision-makers would be not to mess with San Diego's water. It's filled with enough chemicals as it is.

¹¹ In their final questionnaires, participants were asked to indicate how strongly they agreed or disagreed with a series of statements about water fluoridation. They were then asked to indicate the three statements that were most important to their conclusions about whether or not San Diego should fluoridate. The statements that supporters and opponents chose in the questionnaire as most important were the same ones identified as persuasive by all participants in the plenary discussion. In other words, CWF supporters and opponents agreed on which arguments on either side were most persuasive.

3. **Fluoridation violates personal choice:** Participants did not agree unanimously that this argument was persuasive, but it did resonate with a significant number of participants in each dialogue – especially those who were already predisposed to oppose CWF. Many participants who found this line of reasoning persuasive pointed to the “Big Brother-ish” aspect of fluoridation, feeling that any proposal that increases government intrusion into people’s lives should be resisted. 63% of all participants agreed that “fluoridating the water violates people’s right to decide for themselves what kind of treatments they want.”

A lot of things are good for all of us and the majority votes, but when it's put in your own body, I object to that. That's what I object to. Not having a choice over something that goes into my body.

I'm pretty much opposed to [CWF]. I don't think government should be involved in giving us stuff like that. [They may say] "Oh, this is for your own good." But I really don't trust them that much.

In sum, the logic of those who favored the “leave the water unchanged” scenario ran something like this:

Yes, we agree that fluoride is good for your teeth, but we feel it is not necessary to add it to our water. We are already getting fluoride from many other sources, and that may be enough. Why add fluoride to our water and run the risk of any negative effects? We shouldn't override personal choice or concerns like these unless we are absolutely sure that it is necessary.

It is worth noting which anti-fluoridation arguments were generally rejected. About half of all participants (52%) rejected the idea that “the fluoride added to the water supply is impure and has toxic chemicals in it.” Only about one-third of respondents believed that there already is evidence that “fluoride can cause serious health problems, such as cancer and brittle bones.”

But participants nonetheless had concerns about the long term effects of fluoridation: as noted earlier, half the participants disagreed with the statement that fluoride has “no health risks.” And citing scientific findings alone can not quell this concern – fully two-thirds (69%) agreed that “science is often wrong about the risks associated with presumably ‘safe’ treatments.”

Participants agreed that the most persuasive arguments in favor of CWF were:

- 1) **Water fluoridation works:** Participants agreed that the argument that fluoridated water is an extremely effective way of preventing tooth decay was both powerful and persuasive. 82% of all participants (including many who opposed fluoridation) agreed that “fluoridated water helps prevent tooth decay.” Many participants noted that decay rates go down in cities that fluoridate.

For us the number one argument was the studies that it prevents tooth decay. All the studies conclusively seem to point that way.

2) Water fluoridation benefits the young, the old, and the medically underserved: Many participants began the day viewing California’s epidemic of tooth decay first and foremost as a problem for other people – low income people, children, immigrants, and migrant workers – but as they came to grips with the issue they began to feel that everyone has a stake in reducing those levels. Across all groups, participants agreed that oral decay is a serious problem that we as a society have a responsibility to address. 77% of all participants agreed that “fluoridation is especially helpful to the young, the old, and people without dental care.”

When [we] realized, for instance, that there are drinking fountains in schools, and [CWF] could make a very good impact, folks said okay, I don't especially need it, but there are many people in the community who do.

I feel that [CWF] is doing the right thing for a lot of people, not just for the rich, but for the poor, and that's what matters.

3) Water fluoridation is cost-effective: The cost savings of reducing San Diego’s high rate of tooth decay was a powerful argument for many participants. Many participants pointed to the \$1 to \$60 ratio as especially persuasive (the idea that every dollar spent on water fluoridation saves up to \$60 in dental care). 65% of all participants agreed that “spending a little money to fluoridate the water will save a lot of money on treating tooth decay.”

I was astounded to hear that the State of California spent \$700 million treating oral diseases a year, that's \$700 million a year. If it's cost-effective and beneficial, we should implement the program to alleviate the state's current financial state and perhaps use the money that we save on other programs.

Our whole group thought that at this moment, [CWF] is the most cost-effective way we have of helping prevent some tooth decay. If we cannot provide dental care for everybody – and we don't know who could afford to do that – it was the most cost-effective way.

In sum, the logic of those who favored the “fluoridate the water” scenario ran something like this:

Fluoridating the water will provide a big benefit for people who need it most – especially children. It has been in use around the country for 60 years with no ill effects and the overwhelming majority of medical and dental professionals support it. If there were a problem with it, we would know. Some people may object, but on the whole the benefits to the community far outweigh the costs.

Several pro-fluoridation arguments carried lesser weight. The “me too” argument that San Diego should follow the example of other cities found only limited support – half disagreed

with this argument. In the course of the discussions, participants were also dismissive of the argument that fluoridation should be embraced because one part per million is such a tiny amount (“equivalent to one inch in 16 miles of roadway,” as one article put it).

Specific findings from the three phases:

Phase 1 and Phase 2:

The dynamic we saw in Phase 1 and Phase 2 was clear and consistent: those with strong pre-existing opinions did not change them. Those with more loosely held preferences tended to become more concerned about risk as a result of the conversation, and were much more likely to move toward the least change option of opposing CWF.

We found only two significant differences in results from Phase 1 and Phase 2:

1. Phase 2 participants started the day with a stronger preference in favor of CWF than was seen in Phase 1. This may have been the result of a change in the introductory materials that emphasized the current epidemic of oral disease in San Diego and presented CWF as one possible response. However, this stronger preference disappeared over the course of the day, and at the end of the day participants showed the same 50/50 split on CWF seen in Phase 1.
2. By the end of the day, Phase 2 participants were more likely to think that fluoridation causes serious health problems (42% agreed, compared to 25% in Phase 1). This was probably the result of revised anti-CWF materials presented in the afternoon.

At the end of Phase 2 it was clear that the **new advocacy materials on both sides had a limited effect on participant responses to specific questions, but ultimately had no significant effect on people’s opinions on whether or not to support CWF.**

In addition, many of the new pro-CWF advocacy materials were still viewed as spin, and many participants (even those supporting CWF) found them offputting.

One woman in particular summed up many participants’ frustration with the pro-CWF advocacy materials, pointing to the way they alienated the very people they were trying to persuade.

There is a tremendous amount of skepticism in this group, and it's because we've been lied to, we've been misinformed, we've been partially informed.

I'm concerned the [advocacy materials] are presented in a way that really polarized the arguments, and the worst offender was the [pro-CWF materials] because they presented an argument for fluoride as though it's clear that is safe and effective and everyone agrees with it except those who believe in Communist plots – the implication being that unless you are insane you agree with us.

I think that really does a disservice to people who have genuine concerns about the safety and effectiveness of a toxin that's being placed in our water system.

So, for the people out there who are putting together these flyers to send to our mailboxes, I am telling you it's going to be more persuasive if you present a reasonable argument that says, it's safe and people who say it is unsafe, this is why they are wrong. Not because they're crazy, maybe it's because ... the studies that say fluoride is a toxin have studied such high concentrations of fluoride that you would never see in the water supply....

So, we need reasonable information, and if there is an argument on the other side that needs to be refuted, refute it. Don't just dismiss the person who is asking the question. Because the effect that had on this audience was that it alienated every single person who felt like that they had a valid concern that was just automatically dismissed. It really polarized the audience [and led them to] take positions that might be really contrary to what they would have concluded if they had been presented with reasonable, rational discussions about what's really going on here.

Phase 3

Phase 3 was designed to test an alternative approach to engaging the public – one that enhances the public's ability to decide a science-based policy issue like CWF on its merits, rather than on the basis of spin and fear. The sample size in Phase 3 is too small for us to draw definitive conclusions. However, the quantitative and qualitative results are very promising and should be confirmed with further research.

The two micro-dialogue sessions produced strikingly different results. Session 7 went overwhelmingly against fluoridation; Session 8 overwhelmingly supported it:

- There were no dramatic demographic differences between the two groups, and the materials were identical in both sessions. Preexisting views were quite similar between the two groups.
- Participants in both micro-dialogues strongly confirmed the common ground established in the 6 full ChoiceDialogues.¹²
- In both sessions, participants were strikingly unable to hear or process information that didn't fit with their existing preconceptions. We had seen this in earlier dialogues, but never so clearly. In at least one case, a participant *literally did not see* information on the page that contradicted her view, even when that information was explicitly pointed out.
- **What differed was the two groups' levels of trust** – in government, science, industry, and fellow citizens. Session 7 showed unusually low levels of trust; session 8 showed unusually high levels. The relationship between trust and support for CWF was consistent with what we observed in the first 6 dialogues, but was especially clear here.

¹² In the more mistrustful group, the statement that “*individual choice should take a back seat if there is a significant demonstrable benefit to the wider community*” generated some controversy during discussion, but 78% ultimately agreed in the final questionnaire.

	Session 7 % agree	Session 8 % agree	Sess 1-6 % agree
All major medical and dental organizations support fluoridation: we should trust their judgment.	34	81	57
Scientists and health experts support fluoridation because they have the public's best interests at heart.	47	85	59

In addition, participants in the two sessions had very different responses when asked if they thought that 43 of the 50 largest cities in the US are knowingly putting toxic waste in their water:

- In session 7 several participants said yes. As one put it, “You never know what government is up to these days.” Some said that the government has lied about other matters (like whether there were WMDs in Iraq), so why should we believe what they say about water fluoridation?
- Session 8 participants doubted that government would deliberately poison a community’s drinking water, and they focused instead on monitoring and implementation as ways of ensuring that the water is safe. “You have to trust your government,” said one participant. “I’m not saying they’re always right ... but they are doing this to help our dental problems. It’s not just for their gain, it’s for ours also.”

This trust was not something that developed in the room; rather its presence (or absence) at the outset was reinforced by the materials and the conversation.

- **The pro-fluoridation materials no longer pushed people away from CWF.**

In earlier sessions, many participants criticized the pro-fluoridation materials as less convincing than they could be, and in some cases even found them counter-productive. One participant in an earlier session said that while she supported CWF, she felt that the materials made it more difficult; another, who opposed CWF, was surprised that “this was the best that [supporters] could come up with.”

In contrast, participants in both of the micro-dialogues found the materials helpful and impartial and appreciated the balanced presentation of risk and benefit. (Several participants were curious to know “whose side” the funders and facilitators were on.)

We did not see the negative effects of “spin-vs-spin” that had been so strongly in evidence in earlier sessions, where spin-vs-spin served to intensify mistrust and push people towards a “do nothing/better safe than sorry” position.

Bayesian Analysis

In addition to the quantitative and qualitative analysis described above, participants' responses on the final questionnaire were analyzed using a full Bayesian Belief Network analysis model. The analysis was conducted by Professor William J. Rudman, of the University of Mississippi Medical Center. The Bayesian Belief Network allows researchers to visually assess how belief structures are related and how they influence attitudes – which attitudes have the closest association, and how attitudes “cluster” into consistent patterns.

The findings of this analysis confirm many of the findings outlined above, and provide interesting insights into the filters individuals use to process information and create their world views.

Most respondents either strongly supported or strongly opposed water fluoridation. In addition, the overall model strongly suggests that individuals' social and personal beliefs are more influential in their ultimate position on CWF than specific technical or scientific evidence – in other words, many of the factors associated with whether an individual supports or opposes CWF are non-rational. (This is not to imply that they are *irrational* – rather, they are emotional or values-based rather than strictly logical or analytical).

A complete discussion of the findings of this analysis can be found in Appendix C.

IV. DISCUSSION

The results of Phase 1 and Phase 2 together indicated that conventional information-based advocacy and social marketing approaches are insufficient to bring about public support for change on a science-intensive issue like CWF – and can be counterproductive. Members of the public tend to view such advocacy strategies as manipulative and one-sided and, when presented with what they see as “spin vs. spin,” those without strong pre-existing opinions retreat to supporting the status quo.

This is especially true in the current climate of mistrust, where public skepticism extends to nearly every social institution: from politics and government to business, academia, religion and science. Scientists and experts cannot count on receiving the benefit of the doubt when controversial issues are on the table – even in the face of overwhelming scientific consensus, a handful of rogue studies or misleading results quoted out of context can derail decades of peer-reviewed data. And countering this with a “spin vs. spin” approach actually *undercuts* the authority of science in the public eye.

The alternative dialogue-based approach tested in Phase 3 shows promise for more effectively engaging the public on CWF and possibly other science-intensive issues and needs to be further developed and tested. Some of the key lessons learned:

- **Build on common ground** Despite the strong disagreements outlined above, participants in all eight dialogues arrived at a striking amount of common ground. This is not unusual in our experience: in our research participants consistently are surprised and impressed at the amount of common ground they find with their fellow participants – often far more than they believed possible at the start of the dialogue. In every dialogue participants across the board – supporters and opponents of CWF alike – consistently agreed on a series of key points:
 - *The problem of bad oral health is urgent and needs to be addressed – this is a community problem that is costing us money and affecting millions of people’s wellbeing. We must work together to address it.*
 - *Education is the first and in many ways the most important step – for kids, parents, caregivers, adults. Whether or not we fluoridate the water, we must do a better job of teaching people to take good care of their teeth.*
 - *We need to improve everyone’s access to dental care.*
 - *We shouldn’t put anything in our water unless it offers a significant benefit and very low risk. We don’t want to cause harm to people or the environment.*
 - *We do not want people to get too much fluoride – over-exposure can cause problems.*
 - *Science is not infallible – sometimes well-meaning experts can be wrong, and the scientific consensus can change over time as new evidence comes in. But even with its limitations, science is the best tool we have for understanding the natural world.*
 - *We want to preserve individual choice wherever possible, but individual choice should take a back seat if there is a significant demonstrable benefit to the wider community.*

These points formed the basis for every group’s vision, and participants’ support for them remained constant throughout the discussion and the presentation of pro and anti CWF advocacy materials. Identifying such areas of common ground at the outset can help to build trust and public support for difficult decisions.

- **Facts alone will not change minds.** The traditional information-driven campaign by itself is not adequate, especially in a climate of mistrust. Members of the public make up their minds not on the basis of information alone, but also on the basis of deeper concerns that are shaped by values, emotions, and deeply-held beliefs. As we have seen, the public can easily tune out information that counteracts their world view; this tendency is even stronger when mistrust runs high. Decision-makers need to focus on understanding deeper public concerns and helping citizens to work through the choices and tradeoffs involved.
- **Spin intensifies mistrust.** When people feel they are being spun they become more frustrated and mistrustful, as well as more resistant to change. Excessive claims from either side tended to backfire when presented to those who were not already strong supporters of that viewpoint. Citizens’ ability to see through spin, and the damage that the resulting mistrust can cause, should not be underestimated.
- **Transparency about interests is essential.** Participants repeatedly asked for honesty and transparency from experts on both sides of the issue. When assessing an argument, they wanted to know who was making it and why. Advocates’ motivations came under constant

scrutiny; participants were concerned about whether experts were objective or were marshalling evidence in only one direction.

- **“Common sense” resonates.** Participants showed a consistent and pervasive preference for “common-sense” arguments rather than technical data, and this was particularly true when mistrust ran high. When technical data is potentially tainted by spin, most people turn to information that meshes with their intuitive sense of how the world works.
- **A different approach is needed to help build trust.** Phases 1 and 2 showed the limitations of trying to move the public with a data-driven approach based on scientific authority or with social marketing and advocacy techniques, when the fundamental issue is trust. In these circumstances a different, more dialogue-based approach is needed. Such an approach focuses not on correcting factual misconceptions or emphasizing positive messages, but on understanding public concerns and building on common ground. Experts and advocates need to acknowledge that these concerns exist and that they are important. Simply trying to correct factual misunderstandings without addressing underlying concerns actually *increases* mistrust rather than reducing it.

Initial testing of this alternative approach in phase 3 led to the following additional conclusions about engaging the public on CWF:

- ***Supporters of CWF start with a significant advantage – a substantial base of public support.*** However, this base alone may not be sufficient to ensure a measure’s success. The greater challenge is to shore up support among “softer” supporters of CWF.
- People with strong negative positions and those with low levels of trust in authority do not change their opinions.
- Those with higher levels of trust are more likely to support CWF.
- Those with higher levels of education (college degree or more) are more likely to support fluoridation. They should be targeted to prevent erosion of the base of consistent CWF supporters. ***They seem especially receptive to arguments that present risk and benefit in a straightforward way.***
- ***It is not necessary to devote enormous energy to convincing people of the benefits of CWF.*** Supporters and opponents both agreed that fluoridated water is effective at preventing cavities (100% of supporters; 82% of opponents), and that it is helpful to the young, the old and the underserved (79% of supporters; 64% of opponents).
- ***It is far more important to address concerns about risk*** – participants were especially concerned about getting too much fluoride from fluoridated water and about whether there might be as yet unknown long-term health consequences. Those with lower levels of education and income are especially sensitive to such concerns.
- ***Outreach materials should respect public concerns and openly address uncertainties.***
 - In particular, outreach materials should address the widespread concern about whether CWF can result in individuals getting too much fluoride.

- The more balanced materials used in phase 3 did not produce the dramatic escalation of mistrust found with “spin vs. spin,” and they appeared to help maintain support among both solid pros and “softer” pros. ***Properly used, such materials can help public health leaders and CWF advocates avoid driving away supporters.***
- Trust can be built up, but only in advance of an actual campaign. In particular:
 - Broad-based education and outreach focusing on the common ground outlined above will be helpful. The best strategy for CWF advocates seems to be an approach that inoculates the public against the key anti-CWF arguments while acknowledging public concerns and treating them directly.
 - In addition, enlisting the support of dental and medical practitioners and encouraging them to discuss CWF with their patients well in advance of any campaign may be helpful. While public health experts cannot rely on public trust in scientific and medical *organizations*, people’s trust in their individual *practitioners* remains significant.¹³
- Once a CWF campaign is underway, little can be done to actively build trust; at this point public health experts’ task is to maintain trust and prevent it from being eroded. An approach based on helping the public understand the issue (rather than pushing a foreordained conclusion) can help at this point.

V. IMPLICATIONS FOR PUBLIC HEALTH EXPERTS

It is always more difficult to bring about public support for change than to maintain the status quo, and this challenge is compounded in a climate of mistrust. The dialogues showed clearly that people holding strong positions do not change their views, and that information-driven and spin-based campaigns do not bring about broad-based support for change. **This has several implications for public health experts who wish to engage the public on a difficult issue like CWF:**

- ***Information alone will not build support for change.*** Information is a key component of how the public engages with public health issues like CWF. But it is not sufficient by itself. Public health experts must focus on presenting accurate information in a way that allows the public to work through key tradeoffs and is responsive to their main concerns.
- ***Experts cannot “sell” a change like CWF as a product*** (e.g. by appealing to positive emotion, promoting positive messages and ignoring or downplaying facts that stimulate public concerns). The ChoiceDialogues showed that it is not difficult to convince people that CWF is effective and beneficial – but that this is not enough. The challenge is to address people’s concern about risk. A positive “spin-based” approach that sidesteps or downplays such concerns is actually counterproductive – it undermines public trust and heightens resistance to change. The more participants feel that information is being used

¹³ In a 2006 Harris Poll Americans were asked which of 11 professionals they trusted to give them professional help or advice: the professionals *trusted completely* by the greatest number of adults were doctors (50%), dentists (47%), and nurses (46%).

tactically not to inform but to sell a pre-determined agenda, the greater their mistrust and the greater their resistance. Citizens' ability to see through spin, and the damage that the resulting mistrust can cause, should not be underestimated.

- ***Nor can experts rely on a “stealth” strategy*** of keeping a low profile, working behind the scenes and not stirring up opponents. As was seen in the dialogues on CWF, the margin of support was narrow and the support of “softer” pros was extremely vulnerable; it takes very little to shift undecideds towards a least-change “better safe than sorry” position. In the case of fluoridation, opponents will make their voices heard, and this will inevitably erode public support. In addition, the public *must* be consulted in the matter: in the current climate of mistrust, anything that is perceived as an attempt to sneak a change like CWF in under the public radar will backfire as soon as it comes to light. Not only would such an attempt heighten mistrust among the undecided, it would also lend apparent credence to the notion that those promoting CWF “have something to hide” and drive some supporters away.
- ***Building on common ground is essential.*** The ChoiceDialogues showed that people with very different positions with respect to CWF share extensive common ground – as well as illustrating how easily this common ground can be obscured in the heat of a campaign. Focusing on wedge issues serves primarily to heighten mistrust and increase polarization; focusing on common ground highlights the goals all parties share and can build on to create better solutions.

The ChoiceDialogues showed that maintaining trust is the key to building public support for a public health change like CWF. To do this, *public health experts need to position themselves as trusted advisors on how best to deal with a shared community challenge rather than advocates for one viewpoint or outcome – with CWF as one possible means to that end, rather than an end in itself. In effect they must shift their focus from “how can we win?” to “how can we help the public make up its mind?”*

The implications of these findings extend far beyond the specific issue of community water fluoridation. Scientists or public health experts who wish to engage the public on many science-intensive issues are likely to find that similar principles apply.

Appendix A

ChoiceDialogue™ Methodology

ChoiceDialogue methodology differs from polls and focus groups in its *purpose, advance preparation, and depth of inquiry.*

- **Purpose.** ChoiceDialogues are designed to do what polls and focus groups cannot do and were never developed to do. While polls and focus groups provide an accurate snapshot of people's current thinking, ChoiceDialogues are designed to predict the future direction of people's views on important issues where they have not completely up their minds, or where changed circumstances create new challenges that need to be recognized and addressed. Under these conditions (which apply to most major issues), people's top-of-mind opinions are highly unstable, and polls and focus groups can be very misleading. ChoiceDialogues enable people to develop their own fully worked-through views on such issues (in dialogue with their peers) even if they previously have not given it much thought. By engaging representative samples of the population in this way, ChoiceDialogues provide unique insight into how people's views change as they learn, and can be used to identify areas of potential public support where leaders can successfully implement policies consonant with people's core values.
- **Advance Preparation.** ChoiceDialogues require highly trained facilitators and (above all) the preparation of special workbooks that brief people on the issues. These workbooks formulate a manageable number of research-based scenarios, which are presented as a series of values-based choices, and they lay out the pros and cons of each scenario in a manner that allows participants to work through how they really think and feel about each one. This tested workbook format enables people to absorb and apply complex information quickly.
- **Depth of Inquiry.** Polls and focus groups avoid changing people's minds, while ChoiceDialogues are designed to explore how and why people's minds change as they learn. While little or no learning on the part of the participants occurs in the course of conducting a poll or focus group, ChoiceDialogues are characterized by a huge amount of learning. ChoiceDialogues are day-long, highly structured dialogues – 24 times as long as the average poll and 4 times as long as the average focus group. Typically, participants spend the morning familiarizing themselves with the scenarios and their pros and cons and developing (in dialogue with each other) their vision of what they would like to have happen in the future. They spend the afternoons testing their preferences against the hard and often painful tradeoffs they would need to make to realize their values. To encourage learning, the ChoiceDialogue methodology is based on dialogue rather than debate – this is how public opinion really forms, by people talking with friends, neighbors and co-workers. These 8-hour sessions allow intense social learning, and both quantitative and qualitative measures are used to determine how and why people's views change as they learn.

Appendix A: ChoiceDialogue Methodology

Steps in a ChoiceDialogue Project

- 1) Archival analysis of polls (or conducting a special one) and other research to provide a baseline reading on what stage of development public opinion has reached;
- 2) The identification of critical choices and choice scenarios on the issue and their most important pros and cons, and the preparation of a workbook built around those scenarios in a tested format for use in the dialogues;
- 3) A series of one-day dialogue sessions with representative cross-sections of the population. Each dialogue involves about 40 participants, lasts one full day and is videotaped. A typical one-day session includes the following:
 - Initial orientation (including the purpose of the dialogue and the use to be made of the results, the nature of dialogue and ground-rules for the session, introduction of the issue and some basic facts about it);
 - Introduction of the choice scenarios on the issue, and a questionnaire to measure participants' initial views;
 - Dialogue among participants (in smaller groups and in plenary) on the likely good and bad results that would occur as a consequence of each choice if it were adopted, and constructing a vision of the future they would prefer to see;
 - A second, more intensive round of dialogue among the participants (again both in smaller groups and in plenary) working through the concrete choices and tradeoffs they would make or support to realize their vision;
 - Concluding comments from each participant on how their views have changed in the course of the day (and why), and a questionnaire designed to measure those changes.
- 4) An analysis of how people's positions evolve during the dialogues. We take before and after readings on how and to what extent people's positions have shifted on each choice as a result of the dialogue. This analysis is both quantitative and qualitative.
- 5) A briefing to leaders to make sense of the results. The briefing summarizes what matters most to people on the issue, how positions are likely to evolve as surface opinion matures into more considered judgment, the underlying assumptions and values that shape that evolution, and the opportunities for leadership this creates.

Appendix B

Quantitative Findings

Except where otherwise noted, the quantitative data in this section combines results from all eight dialogue sessions. A total of 294 participants filled out the questionnaires.

Before and after assessments of the two scenarios

At the beginning of the dialogue, participants were asked to rate each scenario on a scale of 1-10, with 1 being negative and 10 being positive. They were asked to rate the same scenarios again at the end of the day. The initial and final means represent the mean rating for each scenario before and after dialogue.

Assessment of the two scenarios

	initial mean	final mean
Scenario 1: Leave the water unchanged	5.0	5.8
Scenario 2: Fluoridate the water	6.4	5.5

In Phases 2 and 3 (Sessions 4-8) participants were also asked how they would vote if a CWF measure appeared on San Diego's ballot.

If a vote were held tomorrow, would you support or oppose fluoridating San Diego's drinking water?

	Initial	Final
Definitely support	27	30
Probably support	37	19
Probably oppose	23	15
Definitely oppose	12	35

Asked in sessions 4-8 only (n = 171)

Appendix B: Quantitative Findings

Initial and final positions for consistent supporters, consistent opponents, and switchers.

Identifying supporters and opponents:

Support or opposition to CWF in Phase 1 were determined using participants' ratings of the two scenarios on the 1-10 scale:

- A CWF supporter was one who rated Scenario 1 “leave the water unchanged” from 1-5 *and* rated Scenario 2 (“fluoridate the water”) from 6-10.
- A CWF opponent was one who rated Scenario 1 “leave the water unchanged” from 6-10 *and* rated Scenario 2 (“fluoridate the water”) from 1-5.

In Phases 2 and 3, support and opposition were identified by how a participant answered the question “if an election were held tomorrow how would you vote” (definitely support, probably support, probably oppose, definitely oppose). [This question was not asked in phase 1]

- A CWF supporter was one who would “definitely or probably” vote to support water fluoridation.
- A CWF opponent was one who would “definitely or probably” vote to oppose water fluoridation.

Consistent supporters, consistent opponents, switchers:

Consistent supporters supported CWF in both the initial and the final questionnaires. Consistent opponents opposed CWF in both the initial and the final questionnaires. Switchers changed their position over the course of the day.

249 of the 294 participants could be clearly classified as supporters or opponents of CWF in both initial and final questionnaires. Of these, 119 were classified as consistent supporters, 88 were classified as consistent opponents, 35 switched from support to opposition and 7 switched from opposition to support.

Appendix B: Quantitative Findings

- Consistent supporters (Figure 1) and consistent opponents (Figure 2) tended to hold their opinions strongly even before engaging in dialogue or viewing advocacy materials.

Figure 1

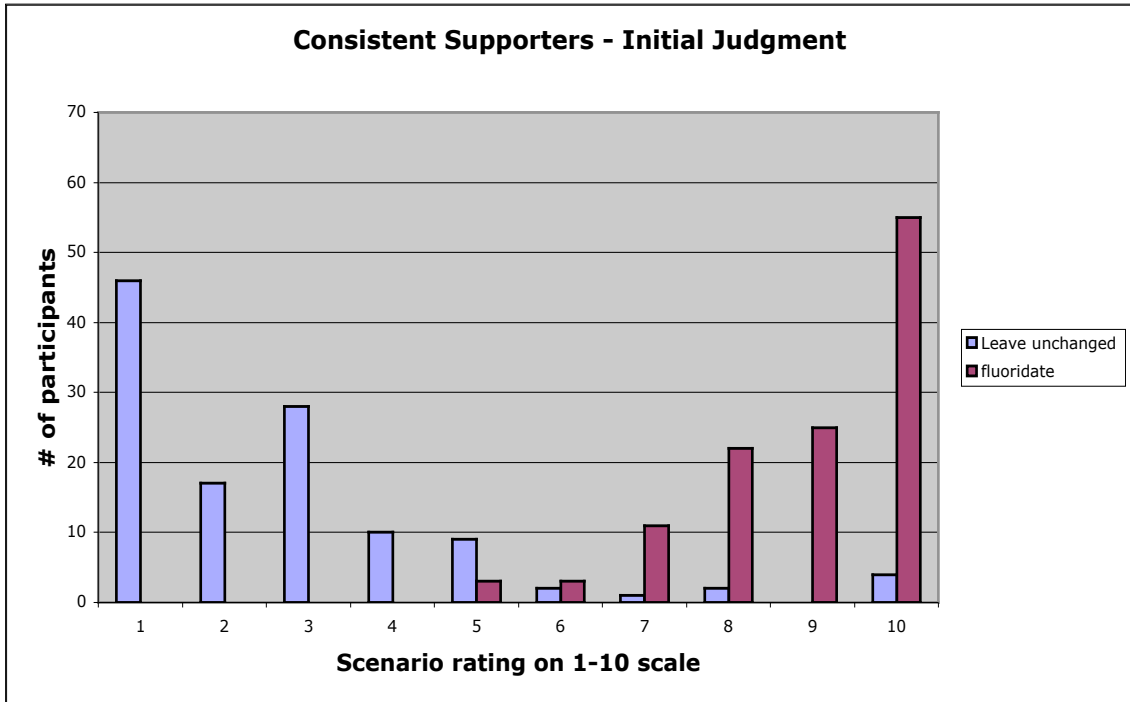
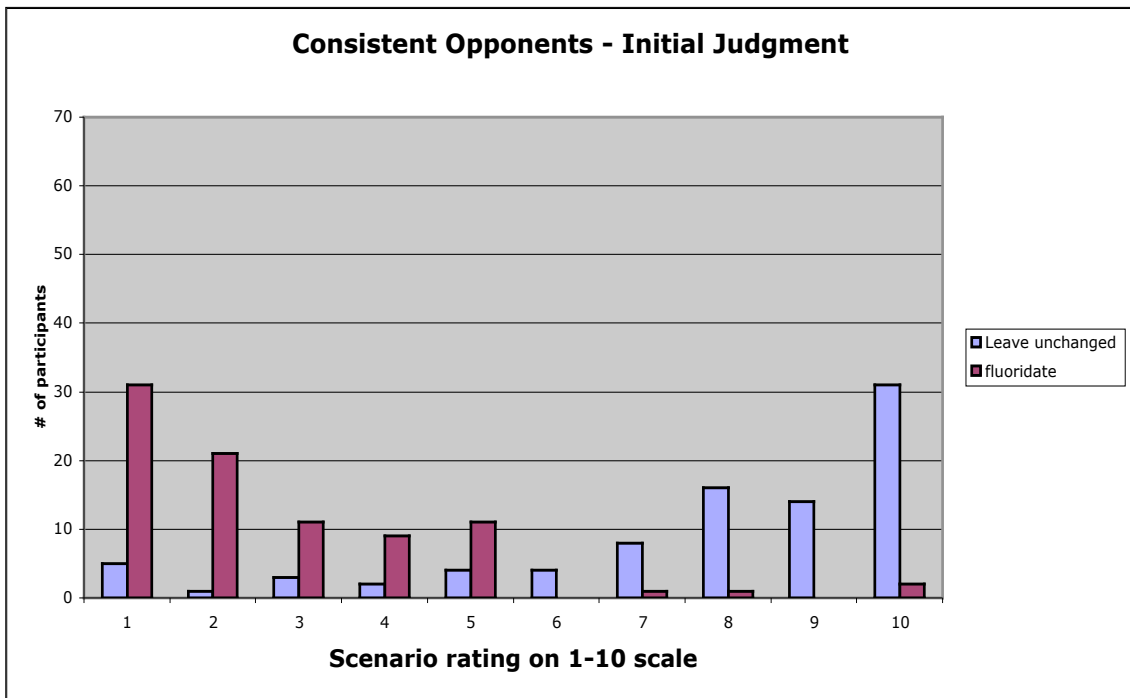


Figure 2



Appendix B: Quantitative Findings

- In addition, consistent supporters' and consistent opponents' opinions intensified over the course of the day, moving further toward the extremes of the 10 point rating scale (See Figures 3 & 4).

Figure 3

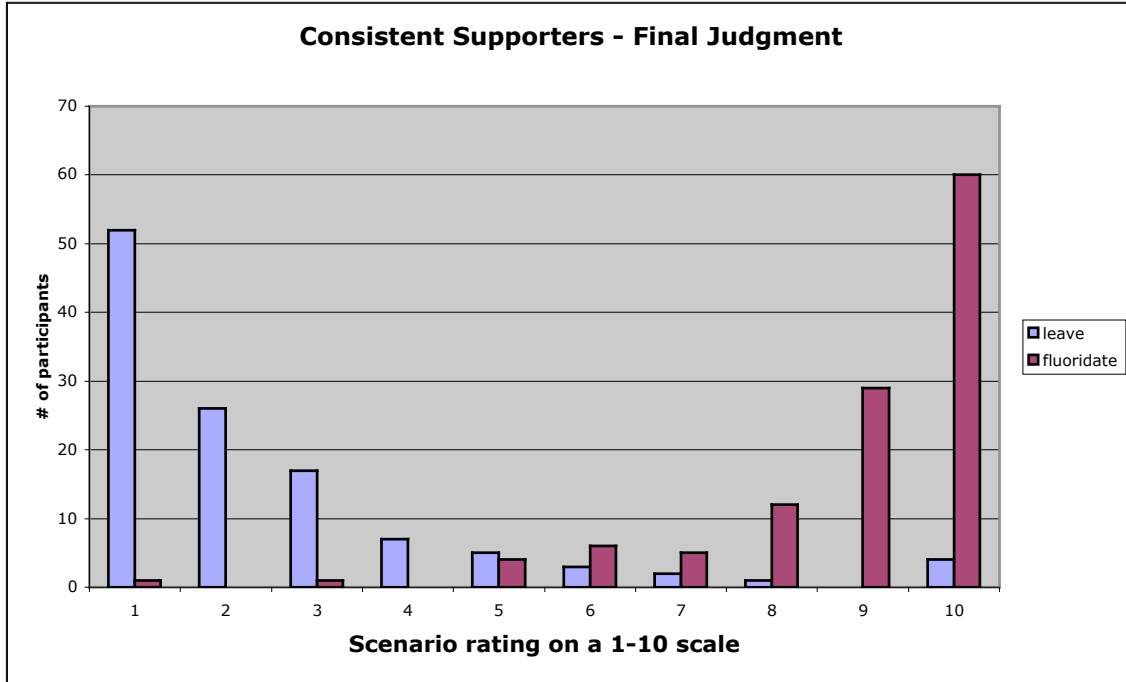
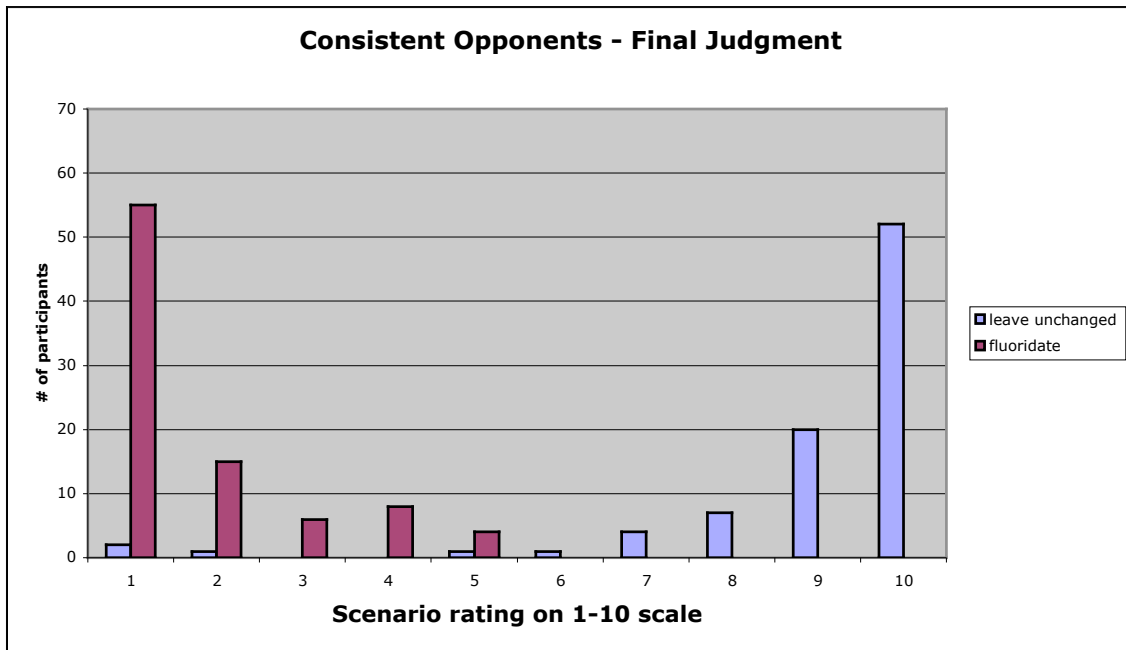


Figure 4



Appendix B: Quantitative Findings

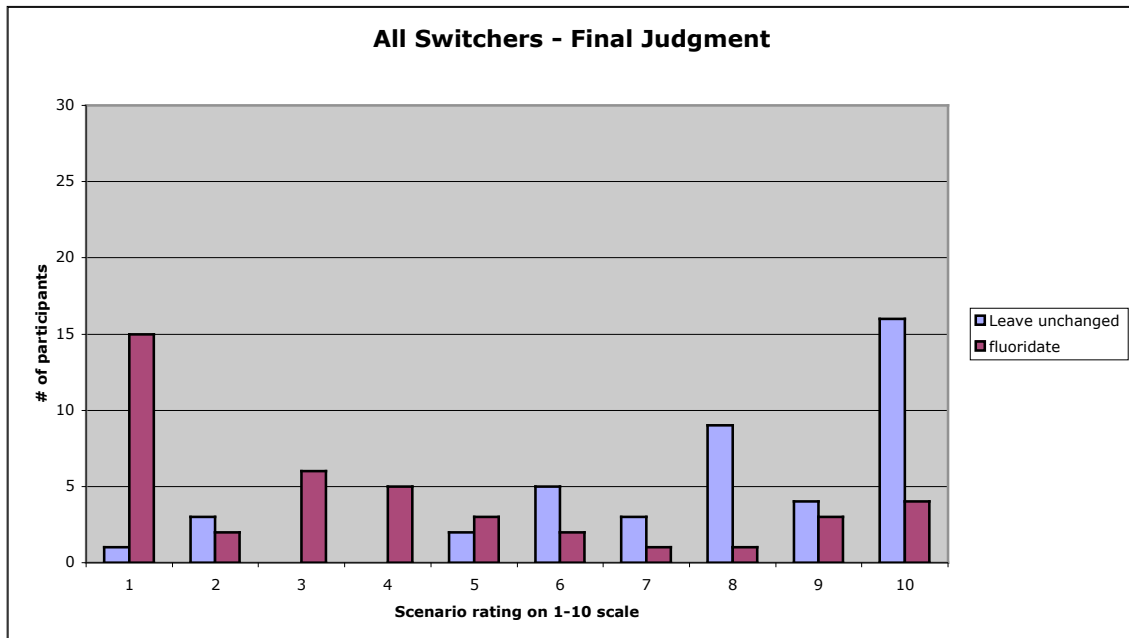
Switchers' initial positions were less strongly held than the positions of consistent supporters or consistent opponents. (See Figure 5)

Figure 5



Almost all of those who switched their opinion moved from supporting CWF to opposing it. (See Figure 6)

Figure 6



Appendix B: Quantitative Findings

Additional questions

At the end of each dialogue, participants were also asked to indicate how strongly they agreed or disagreed with a series of statements about CWF. Except where otherwise noted, the data combines results from all eight dialogue sessions (n = 294).

	Strongly agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Strongly disagree (%)
Fluoridated water helps prevent tooth decay	42	40	13	4
People already get enough fluoride from toothpaste and other sources	29	33	29	9
Fluoridation is especially helpful to the young, the old and people without dental care	42	35	13	8
Fluoride can cause serious health problems, such as cancer and brittle bones.	10	28	32	29
Spending a little money now to fluoridate the water will save a lot of money on treating tooth decay	36	29	23	10
Fluoridating the water violates people's right to decide for themselves what kind of treatments they want	42	21	20	17
Fluoride offers big health benefits with no health risks	13	32	30	24
Fluoridation costs more than San Diego can afford to spend right now	20	22	27	30
All major medical and dental organizations support fluoridation: we should trust their judgment	21	36	25	18
We should not add chemicals to our water supply that are not absolutely necessary	41	30	18	11
The community has the right to make public health decisions even if some people object	44	32	14	10
Science is often wrong about the risks associated with presumably "safe" treatments	26	43	24	7
23 of the 25 largest cities in the U.S. fluoridate their water. San Diego should not be left behind	28	22	23	26
The fluoride that is added to the water supply is impure and has toxic chemicals in it	15	31	32	20
Scientists and health experts support fluoridation because they have the public's best interests at heart <i>(Asked Phase 2-3 only: n = 171)</i>	22	39	23	15
If we fluoridate our drinking water, people risk getting too much and could be harmed <i>(Asked Phase 2-3 only: n = 171)</i>	27	37	25	10
I am looking for ways to reduce risk - to make everything a little safer for me and my loved ones <i>(Asked Phase 3 only: n = 44)</i>	68	30	0	2

Appendix B: Quantitative Findings

Combined Demographic Information

total sample of 294 participants

Gender			Age		
	Sample	San Diego*		Sample	San Diego
	%	%		%	%
male	50	50	18-29	24	28
female	50	50	30-49	37	41
			50-65	25	17
			over 65	14	14

Education level*			Income		
	Sample	San Diego		Sample	San Diego
	%	%		%	%
less than high school	2	17	under 20K	17	20
high school graduate	13	17	20-29K	15	12
some college	38	23	30-49K	30	22
college degree	27	30	50-74K	18	20
graduate study/degree	20	13	75-99K	12	11
			100K or more	6	16
			no answer	2	

*total population age 25 and older

Children under 18 living at home			Seen a dentist in past 12 months	
	Sample	San Diego		%
	%	%		%
yes	41	33	yes	77
no	59	67	no	23

Dental insurance			Ethnicity		
	Sample	San Diego		Sample	San Diego
	%	%		%	%
yes	59	59	Caucasian	55	55
no	41	41	Hispanic	26	21
			Asian	6	14
			African American	9	7
			other	4	3

*City of San Diego Census 2000 Profile Information from SANDAG

Appendix C

Bayesian Analysis

Participants' responses on the final questionnaire in all eight ChoiceDialogues were analyzed using a full Bayesian Belief Network analysis model. The analysis was conducted by Professor William J. Rudman, of the University of Mississippi Medical Center. The Bayesian Belief Network allows researchers to visually assess how belief structures are related and how they influence attitudes – which attitudes have the closest association, and how attitudes “cluster” into consistent patterns. (A complete description of the methodology can be found at the end of this appendix.)

The findings of the Bayesian analysis confirm many of the findings outlined in the main report, and they provide interesting insights into the filters individuals use to process information and create their world views.

In the CWF dialogues respondents either strongly supported (43%) or strongly opposed (37%) CWF.¹ In addition, the overall model strongly suggests that individuals' social and personal beliefs are more influential in their ultimate position on CWF than specific technical or scientific evidence – in other words, **many of the factors associated with whether an individual supports or opposes CWF are non-rational.** (This is not to imply that they are *irrational* – rather, they are emotional or values-based rather than strictly logical or analytical).

Within the data, participant responses on three questions are directly and statistically significantly related to whether that individual strongly supports water fluoridation or strongly opposes it:²

- 1) “People already get enough fluoride from toothpaste and other sources”
- 2) “Spending a little money to fluoridate the water will save a lot of money on treating tooth decay”
- 3) “Fluoridating the water violates people's right to decide for themselves what kind of treatments they want”

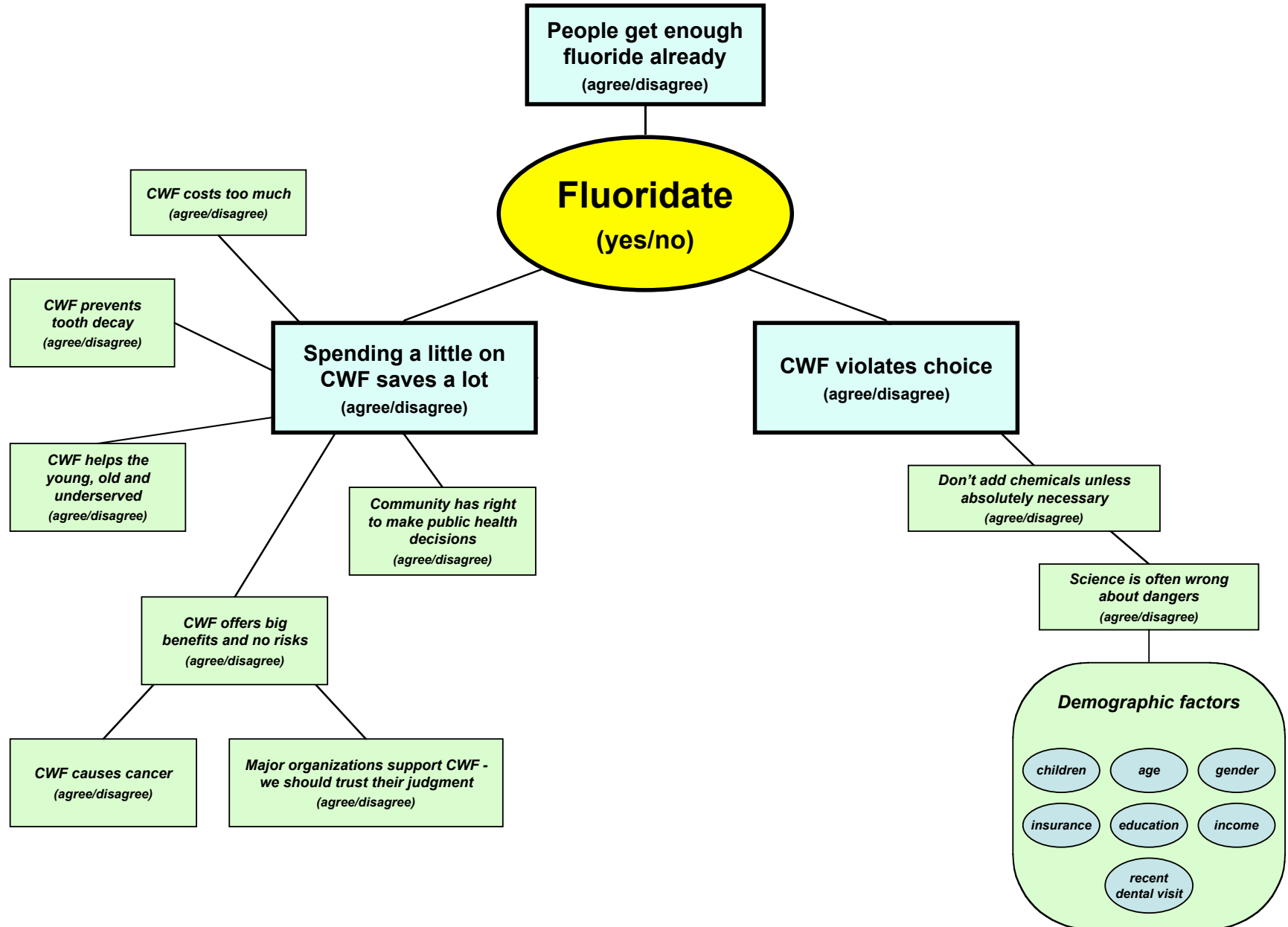
Two of these three key variables are in turn associated with a cluster of related attitudes. These related attitudes are significantly associated with the key variable, though not directly with attitudes toward CWF [See Figure 7].

¹ The measure of “strong” support or opposition was similar though not identical to that used by Viewpoint Learning in its quantitative analysis. As was noted earlier, at the end of each ChoiceDialogue, participants rated the two scenarios (“leave the water unchanged” and “fluoridate the water”) on a scale of 1 – 10 (1 being totally negative and 10 being totally positive). In the Bayesian analysis, the measure of support or opposition to CWF was participants' final rating of the “fluoridate the water” scenario on this 10-point scale. Those who rated the scenario from 1-3 were classified as “strong opponents” of CWF; those who rated it from 4-6 were classified as “moderates” regarding CWF; those who rated it from 7-10 were classified as “strong supporters” of CWF.

² The measure of statistical significance used in the Bayesian analysis was a Minimum Description Length (or MDL) score of 1. This corresponds to a P-value of .02-.03.

Appendix C: Bayesian Analysis

Figure 7: Bayesian Belief Network Model



Appendix C: Bayesian Analysis

It is important to keep in mind that this is not a causal model – the associations mapped out in this model are the same for both supporters and opponents of CWF.

- 1) The first key variable - “People already get enough fluoride from toothpaste and other sources” – stands alone. Responses on this question are statistically significantly related to support or non-support of water fluoridation but are not statistically significantly related to any other variable.
 - Of those who strongly agree that “People already get enough fluoride from toothpaste and other sources”
 - 15% strongly support CWF.
 - 73% strongly oppose CWF
 - Of those who strongly disagree that “People already get enough fluoride from toothpaste and other sources”
 - 70% strongly support CWF
 - 10% strongly oppose CWF.

This indicates that one of the most important single factors influencing attitudes towards CWF is whether or not an individual fears that CWF will lead to fluoride overexposure – the same kind of perception of risk that appeared to motivate participants who changed their views on CWF.

- 2) The second key variable - “Spending a little money to fluoridate the water will save a lot of money on treating tooth decay” – anchors a “cluster” of related attitudes related to the cost and benefits of CWF and to a complex network of other variables. This the most rational and analytical cluster of the three.

Those who believed that “spending a little money to fluoridate the water will save a lot of money on treating tooth decay” also:

- believed that fluoridation offers big benefits with no risks;
 - believed that water fluoridation prevents tooth decay;
 - disagreed that “fluoride can cause serious health problems, such as cancer and brittle bones”;
 - disagreed that water fluoridation costs too much;
 - agreed that fluoride helps the young, old and underserved; and
 - trusted medical and dental organizations.
- 3) The third key variable - “Fluoridating the water violates people's right to decide for themselves what kind of treatments they want” – anchors yet another “cluster” of related attitudes. It is directly related to one other question: “We should not add chemicals to our water supply that are not absolutely necessary.” This variable in

Appendix C: Bayesian Analysis

turn is related to “Science is often wrong about the risks associated with presumably ‘safe’ treatments.” This attitude is in turn to a host of demographic factors including age, gender, income, education and insurance.¹

- Of those who strongly agree that “fluoridating the water violates people's right to decide for themselves what kind of treatments they want”:
 - 8% strongly support CWF.
 - 68% strongly oppose CWF
- Of those who strongly disagree that “fluoridating the water violates people's right to decide for themselves what kind of treatments they want”:
 - 79% strongly support CWF
 - 13% strongly oppose CWF.

Interestingly, the only place in the entire network model where demographic characteristics came into play was responses to whether science is often wrong about risk.

General Observations for this Overall Network Analysis:

1. An individual’s conclusions about matters of scientific fact (i.e. does fluoridation prevent tooth decay, does it cause cancer?) are not directly related to whether or not s/he supports water fluoridation. In addition, beliefs about the credibility of science in general do not directly relate to support or non-support of CWF.

Use of scientific data to influence beliefs seems to be ineffective; however, it is important in helping an individual justify support or non-support of water fluoridation. For example, people who don’t support CWF are more likely to give credence to the argument that people already get enough fluoride from toothpaste and other sources.

2. Demographic characteristics (including age, education, income and insurance status) are not directly related to whether an individual supports water fluoridation. However, they are significantly related to how individuals evaluate scientific evidence and determine whether CWF represents a beneficial public health intervention.

¹ The chain of associations reflected in this attitude cluster shows some interesting parallels with respondents’ discussions in the ChoiceDialogues, where participants followed a similar sequence of steps and conclusions as they worked through the issue:

- Preserving personal choice is important, but personal choice should take a back seat **if** there is a significant benefit to the wider community
- Does CWF meet such a standard; i.e. is it a “necessary” additive?
- Are scientists likely to be correct in their conclusions about its safety?

Appendix C: Bayesian Analysis

3. An individual's belief about whether CWF causes health problems is not directly related to whether he or she supports CWF but is related to the cost-benefit "cluster." The same is true for an individual's trust in major medical and dental organizations. These factors are related to how participants answer the cost-benefit questions, but not directly to whether or not they support CWF.

Support or non-support for CWF is a complex issue that touches upon several dimensions of an individual's belief system. It seems to be a combination of emotive and rational responses. Beliefs about CWF may serve as a proxy for how that individual views other social or cultural issues. In order to better understand an individual's belief about CWF it is important to understand his or her beliefs about the role of the government and personal responsibility toward others.

BAYESIAN ANALYSIS: BACKGROUND AND METHODOLOGY

A Bayesian network encodes the joint probability distribution of all the variables in the domain by building a network of conditional probabilities. It uses conditional independence assumptions to make the representation tractable. The networks are directed networks that incorporate parent-child relationships between nodes. In a network, a node is independent of its non-descendants given its parents. In this respect, the parent acts as a gatekeeper of a change in distribution for the non-descendants. If the value of a parent is known, knowledge of a child will not impact the expected distributions of the grandparents, nor will knowledge of the grandparents affect the expected distribution of the child.

The Bayesian Belief Networks are built by applying a set of heuristics to generate hypothetical models with different conditional independence assumptions. The software generates several networks simultaneously and then continues to generate new hypotheses for each network.

Minimum Description Length (MDL), also known as the Bayesian Information Criterion (BIC), as well as Bayesian Scoring (BDe). Minimum Description Length scoring provides a measure of the quality of a model. It trades off goodness of fit and model complexity. Goodness of fit is measured as the likelihood of the data given the model. Model complexity equals the amount of information required to store the model, subject to an inflator/deflator set by the user. Bayesian Scoring is asymptotically equivalent to MDL scoring. MDL 1.0 ensures that the model structure represents the most likely model, given the data used for learning and the model variations under consideration.

Appendix C: Bayesian Analysis

MINIMUM DESCRIPTION LENGTH (MDL) SCORING

Minimum Description Length (MDL) scoring provides a measure of the quality of a model. It trades off goodness of fit and model complexity.

Model complexity equals the amount of information required to store the model:

$$(1) \quad \frac{\log N}{2} |\Theta|$$

where Θ is the set of parameters of the model, and N is the number of records in the dataset used to learn from, which is a measure of the precision with which the model parameters are known.

Goodness of fit is measured as the likelihood of the data given the model:

$$(2) \quad P(D|\theta)$$

To make both terms comparable we actually use description length of the data given the model:

$$(3) \quad -\log P(D|\theta)$$

Thus MDL scoring minimizes:

$$(4) \quad -\log P(D|\theta) + \frac{\log N}{2} |\theta|$$

For a given network topology the number of parameters $|\Theta|$ is fixed. Thus given a the model complexity (1) is fixed. The optimal parameters can be proven to be equal to the maximum likelihood parameters. Thus for every node we choose a conditional distribution given its parents equal to the distribution of the data:

$$(5) \quad \theta_{x_i, \pi_i} = \frac{N_{x_i, \pi_i}}{N_{x_i}}$$

This result also has the effect that the description length of the data given the model (3) can be decomposed and computed very efficiently:

$$(6) \quad -\log P(D|\theta) = -\sum_i \sum_{x_i, \pi_i} N_{x_i, \pi_i} \log \frac{N_{x_i, \pi_i}}{N_{x_i}}$$

Finally note that MDL is identical to the Bayesian Information Criterion (BIC). Note also that Bayesian Scoring (BDe) is asymptotically equivalent to MDL.

Appendix D

Bibliography

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