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Water consumption beliefs and practices in a rural Latino community: Implications for fluoridation

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Abstract

Objective—Adequate fluoride exposure is especially important for those experiencing disproportionately high prevalence of dental caries, such as rural Latino farmworkers and their children. Water is an important source of fluoride. This qualitative study examined water consumption beliefs and practices among Latino parents of young children in a rural community.

Methods—Focus groups and open-ended in-depth interviews explored parents' beliefs about tapwater, beverage preferences and knowledge of fluoride. A questionnaire documented socio-demographic characteristics and water consumption practices. Qualitative analysis revealed how water-related beliefs, social and cultural context, and local environment shaped participants' water consumption.

Results—The vast majority of participants (N=46) avoided drinking unfiltered tap water based on perceptions that it had poor taste, smell and color, bolstered by a historically justified and collectively transmitted belief that the public water supply is unsafe. Water quality reports are not accessible to many community residents, all of whom use commercially bottled or filtered water for domestic consumption. Most participants had little knowledge of fluoride beyond a general sense it was beneficial. While most participants expressed willingness to drink fluoridated water, many emphatically stated that they would do so only if it tasted, looked, and smelled better and was demonstrated to be safe.

Conclusions—Perceptions about water quality and safety have important implications for adequate fluoride exposure. For vulnerable populations, technical reports of water safety have not only to be believed and trusted but matched or superceded by experience before meaningful change will occur in people's water consumption habits.

Keywords

Hispanic Americans; rural population; dental caries; water; culture

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INTRODUCTION

Adequate fluoride exposure is especially important for populations experiencing disproportionately high prevalence of dental caries, such as rural Latino farmworkers and their children [1–6]. While community water fluoridation has reached about 70% of the U.S. population served by public water supplies, multiple barriers persist to adequate fluoride exposure. Along with public resistance and very vocal opposition from some community members, technical issues make fluoridation difficult and financially prohibitive for small communities. While nearly two-thirds of large municipal areas fluoridate their water supply, many smaller communities, especially in rural locations, do not. For example, California law exempts water districts with fewer than 10,000 service connections from having to fluoridate [7].

A poorly investigated barrier to adequate fluoride exposure concerns community perceptions of water quality and how these perceptions influence water consumption. Research documents a notable increase in bottled water usage and tap water avoidance in the U.S. in the last decade [8–13] and this trend may be particularly pronounced among urban Latinos [14–17]. Most bottled water does not contain optimal amounts of fluoride [5, 8, 10, 13]. Less is known, however, about rural Latinos' water consumption. Since low-income Latinos, especially farmworkers and their families, experience very poor oral health status, including early childhood caries (ECC), the confluence of consumption preferences and multiple barriers have substantial implications for oral health.

Few studies have specifically evaluated the connections between bottled water usage and beliefs about municipal water quality, or explored how cultural beliefs and experiences shape water consumption decisions and practices. In order to address barriers to adequate relationships between rural Latinos' perceptions of water quality and their water consumption, we undertook this qualitative study of Latino parents of young (1–5 years old) children in one rural community in California’s Central Valley.

California, a major agricultural state with high proportions of Latino migrant and non-migrant farmworkers in the population, serves as a good place in which to situate the study. The chosen study site in the Central Valley is representative of other rural communities in the region. Study findings about community beliefs and behaviors, and the implications of these for adequate fluoride exposure, therefore may be applicable to other vulnerable populations, beyond the local context.

METHODS

The Site

The community’s permanent resident population of around 9,000 is 95 percent Latino-origin, comprising mainly recent and a few second-generation immigrants from Mexico and other Latin American countries. Non-livestock agriculture is the main economic enterprise. Approximately 40% of the 1,825 households are at or below federal poverty level, currently defined (2009) as an annual income of $US40,793 for a family of four. The city hosts a Federally Qualified Health Center providing primary care, basic medical emergency services and dental care. In addition, there are two other private general dentists in this city, and more than a dozen dentists in neighboring communities. As is common in Central Valley communities, there are several free standing self-service filtered water vending outlets, including machines located in grocery store parking lots that charge $US1.00 per gallon. These machines are often referred to as "water mills" because they are constructed to resemble Dutch windmills. The community is non-fluoridated in the sense that it does not

have a controlled and monitored amount of fluoride added to its water supply specifically as a caries preventive. The natural fluoride level of the water, however, averaged 0.6ppm in 2006 [18], slightly below the optimal range (0.7ppm – 1.2ppm) [19].

Procedures

Both focus groups and in-depth qualitative interviews were conducted with adults who self-identified as Latino, and as a parent or primary caregiver to a child aged 1–5 years. Focus \groups are a particularly effective method for developing a deeper understanding of the reasons behind poorly-understood beliefs or behaviors, such as tap water avoidance [20, 21]. Moreover, their interactive group format encourages a more relaxed discussion among marginalized populations such as farmworkers or recent immigrants who may feel less comfortable expressing their views on sensitive topics, such as their beliefs about water contamination, to outside researchers. In-depth qualitative interviews with key informants (e.g., water vendors, store managers, civic leaders, local dentists, WIC officials), and community participants (a few of whom might also have participated in the focus groups) explored in further depth those topics which emerged as important during the focus group sessions. Brief focused ethnographic observations provided a broader understanding of the context of water purchase and consumption behaviors.

Each focus group session or interview lasted between 1½ and 2 hours. Participants received a $20 gift certificate upon completion of this activity. Interviewers were bilingual local residents who were trained for and experienced at conducting both survey and interview-based health research. Each session or interview was audio-taped, translated from Spanish and professionally transcribed by a native Spanish speaker. Transcription was checked by study staff who back-translated, and compared the audiotapes to the translated and transcribed text, noting any difficult to translate segments. The semi-structured interviews comprised open-ended questions followed by probes, with topic areas and questions derived from the literature and prior work. Major questions focused on beliefs about the quality of the tap water and other local water sources, including beliefs about water safety, and water consumption practices, including water use for drinking, infant formula mixture, and cooking. Other questions explored beverage preferences and consumption; knowledge of and beliefs regarding fluoride including acceptability of water-based fluoride delivery mechanisms such as fluoride drops/tablets, fluoridation of filtered water stations, or fluoridated bottled water purchased at additional expense. Participants also completed a brief questionnaire about socio-demographic characteristics, evaluation of overall health and oral health status for themselves and their children, and water consumption practices.

Analysis of how participants gave meaning to their experiences, developed water-related beliefs, and how cultural context and local environment shaped water-related practices was guided by a broadly social constructivist theoretical approach that underpinned this study. This approach relies on data collection and constant comparison of themes presented by participants to develop a conceptual model of participants' ideas as these emerge directly from the observational and text data [22, 23]. This qualitative approach has been successfully used to explain other empirical including health-related phenomena that are otherwise poorly-understood. It yields a rich understanding of tap water avoidance/bottled water use that complements quantitative descriptive accounts. Two researchers independently applied codes that were developed, from the existing literature and from themes emerging from the transcripts. Codes were iteratively applied to the text using, when appropriate, a qualitative software program (NVivo® 7.0) to assist with the tracking, storage and retrieval of coded text. In addition, when reviewing the text, the ways participants responded to questions were enumerated (e.g., knowledge about fluoride). Where appropriate, descriptive statistics were generated using SPSS to provide a more detailed profile of participants and their water usage, a profile that complements and expands the

thematic analysis. Illustrative quotations, typical comments made by respondents, are included in supplemental material accompanying the online article.

RESULTS

Participants

Overall, 46 individuals participated. A total of four focus groups (with five to six participants in each) and 22 individual interviews were conducted. Participants were predominantly Latina mothers of children age five or younger, of low educational attainment and low–income, mostly farmworkers (n=31). A profile of participants is presented in Table 1. Most (76%) participants had lived in the study location for six or more years. Over two-thirds of participants (69%) had between 1–3 children; most (74%) of those with at least 2 children reported that the youngest or middle child was aged 5 or younger (data not shown). The sample also included five current or former city officials or health and educational professionals, eight individuals in skilled or commercial occupations, and two persons not in the workforce.

Table 1 also details participants' health-related characteristics such as insurance coverage and dental services utilization. Nearly all children of respondents had medical and dental insurance coverage, predominantly public insurance such as Medicaid (known in California as Denti-Cal). Among respondents with young children, 68% reported a dentist visit for their child less than six months ago. Twenty-two percent reported that their child had never been to a dentist, or had last been seen by an oral health professional three or more years ago. The profile of this small convenience sample is similar to that reported elsewhere for this community and matches descriptions of other rural Latino populations and their utilization of dental services, as well as research done with a larger, population-based representative sample [24] (Mejia et al., 2009, unpublished observations)

Beliefs about tap water quality

The vast majority of residents who participated in the study did not drink the municipal water, and felt strongly that it was unsafe to drink unfiltered tap water based on its taste, appearance, and smell. They described the tap water as tasting salty or strongly of chlorine, appearing brown or yellow especially when first used in the morning, frequently smelling likethat the water caused stomach aches, nausea and vomiting in adults and children who drank it unfiltered, as well as skin irritations or lesions and hair loss. Many said that the water was especially troublesome for children as they were still developing physically and therefore were more vulnerable than were adults to any harmful effects.

Participants also claimed the tap water corroded the plumbing pipes in their home and their air conditioning system. Some participants attributed the poor water quality to faulty infrastructure, old plumbing, and contamination (including from agriculture). The collective belief that the water was unsafe was also informed by the study site's documented history of poor quality water more than five years ago. Longtime residents still believed the water was of poor quality, and warned new residents about it.

In contrast, a small minority of individuals (primarily city officials) stated that the municipal water was safe to drink and had substantially improved in quality since 2002 when the city government used federal and state funds to upgrade the water system. These informants told interviewers that the community's water supply is monitored monthly by an independent company to ensure it meets federal water quality regulations, and asserted that problems with discoloration and foul smell are caused not by the water itself, but by old pipes in the homes. They spoke of a "stigma" being attached to the current water supply based on a

history of poor quality, which has resulted in the widespread public belief that the current water supply is unsafe.

The majority of city residents who participated in this study indicated that they were unaware of the existence of, let alone the content of, the annual water quality reports produced by the city government. Many residents stated that they would be convinced of the water's safety if they saw evidence from a reputable source that tested the water and was independent of the city government.

Water and other beverage consumption practices

For drinking at home, most participants consumed bottled water, water filtered through a home filter, or water purchased in bulk from the water mills. Domestic consumption for children mostly involved bottled water. When not at home, both adult participants and their children mainly drank bottled water. For cooking, however, about half the participants used tap water, explaining that it would be rendered safe because it would boil a long time. The few informants who believed the water was safe distinguished safety from taste, and admitted to frequently drinking bottled water or water from the water mills rather than the tap water because of taste preferences.

While most informants expressed that water is the healthiest beverage, especially for children, they reported regularly drinking alternatives to tap water such as sodas, Gatorade®, fruit juice, or "flavored water" if filtered or bottled water was not available. The majority of parents, if no filtered or bottled water was available, gave their children Gatorade® or juice rather than tap water.

Knowledge of and beliefs regarding fluoride

As noted in Table 2, most participants had little knowledge of fluoride despite a general familiarity with it as something beneficial for "teeth." Participants thought fluoride was most typically disseminated in the U.S. through toothpaste or by a dentist. Most participants reported that they used "fluoride toothpaste" and approximately one-third said that their children had been prescribed fluoride drops, tablets, or mentioned that they had given consent for their children's teeth to have fluoride varnish applied. Few participants, however, reported knowing what fluoride was, or the reason for fluoride exposure.

After receiving from the interviewer an explanation about fluoride and a commentary on its beneficial effects as a preventive method for caries, the majority of participants expressed willingness for their children to get access to fluoride additional to that in toothpaste. Participants routinely expressed this as "if it's safe and would benefit my children's oral health, then…" Some parents had concerns about using drops or tablets because of the difficulty of remembering to give the drops on a regular schedule, anxiety about getting the dosage correct but mainly because of children's behavior based on the taste of these products. Children were reported to resist the drops' bitter taste, or to enjoy the sweet-tasting tablets so much they treated them like candy. The idea of fluoride being added to the water supply was generally acceptable, was not seen as compromising or reducing water safety. A number of participants explicitly said they would prefer to get fluoride through the water supply, especially if the water would be "healthier" due to the fluoride.

Acceptability of water-based fluoride delivery mechanisms

When asked if they would be more or less likely to drink tap water, water mill water, or bottled water if each was fluoridated, most participants stated they would be more likely to consume the fluoridated versus non-fluoridated water from all sources. Considerations about cost, water quality and safety informed participants' responses. While most (90%) also said

they would be willing to pay more for fluoridated water from the water mill or bottled water, a number of individuals, especially those employed as farmworkers, indicated that more than 10 or 20 cents extra for a gallon of water that currently costs $1.00 from vendors would pose a financial hardship. Some participants noted that when they lacked money to purchase water, they limited their fluid intake (a potentially dangerous practice for farm field hands during the very hot summer months) or reserved the purchased water for their children. Participants noted that if the tap water improved, there would be no reason to purchase water alternatives. While the vast majority of participants (90%) said they would be more inclined to drink tap water if fluoride was added, at least half emphatically stated that they would drink fluoridated tap water only if it tasted, looked, and smelled better – and was shown to not make people sick. A commonly- voiced sentiment was that only if it was demonstrably safe would tap water consumption increase, regardless of whether it was fluoridated or not

DISCUSSION

People in this rural Latino community use bottled or commercially filtered water in preference to the much cheaper, more easily accessible municipal tap water. This is largely because the poor organoleptic qualities of the tap water (i.e., bad taste, cloudy appearance, unpleasant smell) established and maintained basic beliefs in the lack of safety of the water supply.

These water consumption patterns reflect previous research on oral health topics in this rural community and beyond. For example, during interviews with 47 primary caregivers of children under age 5, participants consistently commented that their children consumed bottled or commercially filtered water [24]. Many of these caregivers also expressed a belief that the local municipal water supply was unsafe. A population-based epidemiologic survey of adult and child oral health status (Mejia et al., 2009, unpublished observations) also revealed a high level of consumption of water from commercial filtration sites or water mills. When asked what kind of water was given to their children to drink, virtually all (99%) of the 178 adults in the 134 households surveyed reported that they purchased filtered water or water from water mills. Ironically, these mills treat the municipal water using reverse osmosis, so any naturally occurring or added fluoride in the water is removed. The remaining one percent of adults reported using bottled water.

Similar findings regarding aversion to consumption of bad tasting, cloudy water have been widely reported in the literature for the population at large [10–12] and specifically for Latinos [9, 15, 16]. Beliefs about water making consumers sick, especially children who are said to be more vulnerable than adults, have also been previously reported [14]. The same study found that Latino parents were less likely to give tap water to their children than non-Latino parents and more likely to believe tap water would make their children sick [14].

Lack of trust in the public water has important implications for adequate fluoride exposure, especially for populations who experience high rates of dental caries. In this study, the majority of residents avoided drinking unfiltered tap water because of a historically justified and collectively transmitted belief that the public water supply is of poor quality. At the same time, they believed that water is the best beverage to drink, so they turned to bottled water. However the bottled or commercially filtered water available in this and many other communities generally lacked an optimal level of fluoride [8, 12].

Foul-tasting water does not necessarily indicate water that is unsafe to drink; nor does clear water with a pleasant taste necessarily indicate that it is safe [12]. Beside the taste, color or odor of the water supply, however, people in this and other communities generally have few other experiential or easily understood or accessible resources to indicate water safety. Nor

do they necessarily trust official reports or interpretations of water quality data, especially when these appear to reach conclusions opposite to their experiences [1, 10]. The Environmental Protection Agency, which regulates water quality in the U.S., has a primary list of 93 chemical and 11 microbiologic factors that are known to affect public water safety and that must be tested for, with results reported annually [12]. Organoleptic and other qualities that do not affect safety of municipal water supplies, however, are on a list of secondary qualities that are not mandatory to either test for or report.

Printed reports on water safety and quality in this community were easily available only to homeowners but not renters. Reports are available publicly in both English and Spanish on the city's official website. Few local residents, however, have access to computers. Moreover, even if these reports were more widely disseminated among the populace, the findings would remain inaccessible to many local residents most of whom have less than a high school education and are either basically literate only in Spanish or unable to read.

Despite the region's naturally high fluoride level in the water, it was challenging for the population to achieve adequate fluoride exposure from this source. Most study participants said they would be willing to increase their children's fluoride intake if needed, but several individuals Said the use of fluoride drops or tablets were problematic. People preferred fluoride to be available through a cheap, easily accessible, improved municipal water supply rather than other means. In this location and similar communities, however, the community's deep concern about the safety of tap water informed their water consumption practices and their willingness to drink fluoridated tap water.

Findings from this study indicate that building trust in the municipal water supply – within the study community and in similar communities elsewhere [14, 16] – needs to focus on effective ways of disseminating information, taking into account the ways the population will be most likely to receive and understand this information. For example, in many rural and urban communities with large Spanish-speaking populations, there could be wide distribution of official reports about water quality in the Spanish language on a regular basis – e.g., mailings to every household in the city, public service announcements on Spanish-language radio or television, and news items in Spanish-language newspapers.

Limitations of this study are its single location, small convenience sample and lack of diversity in terms of socioeconomic status, occupational background of participants, and history of water quality deficits. Moreover, its focus is on rural Latinos, just one of several minority populations experiencing disproportionately high rates of caries compared to the U.S. general population. Conducting this study in urban areas or in different regions, with other minority or other Latino sub-populations, or in locations with a different history of water quality issues could produce different results.

Nonetheless, these findings are consistent with previous research in this population group and others in the U.S. as well as in other countries [10, 11, 14, 16]. Generally, findings point clearly to the ways in which people's beliefs and perceptions shape their subsequent behaviors. By documenting the connections between bottled water usage and beliefs about water quality, and showing how beliefs and experiences shape water consumption practices, the findings indicate issues and implications for oral health that extend beyond the study. of ensuring optimal fluoride exposure will not suffice, especially in vulnerable and low-income communities whose members may trust direct experience more than technical information they cannot access or understand. Characteristics of the water supply that are secondary in terms of ensuring its official safety but that are primary in establishing its acceptability and consumption by the populace – i.e., water's organoleptic qualities – must be addressed. In vulnerable populations, abstract, technical reports of water safety have not only to be

believed and trusted but matched or superseded by experience before meaningful change will occur in people's water consumption habits.

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Table 1

Characteristics of participants (N=46)

Demographic characteristics	
Female	65%
Mean age (± sd)	36.6 years (±11.1)
Self-identify as Latino/a or Hispanic	98%
Education	
11 years or less	71%
Mean years of education (±sd)	8.2 years (±5.1)
Born outside USA	87%
Mean years lived in USA (±sd)	13.5 (±9.1)
Years lived in study site location	
1–5 years	24%
6–10 years	38%
11+ years	38%
Care for child(ren) < 18 years old	89%
Mean number children < 18 years old (±sd)	2.8 (±1.5)
Youngest child < 5 years old	95%
Respondent and spouse's pre-tax income in previous year is < $30,000	82%
Occupation	
Farmworker	67%
Skilled/semi-professional/business	17%
Current/former city official or professional	11%
Health-related characteristics	
Respondent covered by medical insurance	42%
Respondent covered by dental insurance	40%
Respondent's child closest to 5 years old covered by medical insurance	98%
Respondent's child closest to 5 years old covered by dental insurance	98%
Respondent has cavity that needs treatment	62%
Last dentist visit of respondent's child closest to 5 years old (self-reported)	
<6 months ago	68%
6 months – 2 years ago	7%
3+ years ago/Never been	22%

sd= standard deviation

Table 2

Participants' knowledge of and experiences with fluoride (N=46)

Knowledge about fluoride	
Has *not* heard of fluoride	26%
Heard of fluoride – unclear about purpose and benefits	56%
Knows fluoride's purpose and benefits	17%
Respondent's child(ren)'s toothpaste contains fluoride	77%
Respondent's child(ren) prescribed fluoride varnish, drops, or tablets	30%
Willing to give children fluoride drops or tablets if needed	81%