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Urban Mexican-American mothers' beliefs about caries etiology in children

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Abstract

Objectives—Caries is a severe condition which disproportionately affects Latino children in the U.S. This study sought contextual understanding of urban, low-income Mexican-American mothers' beliefs, perceptions, knowledge and behavior surrounding causes of caries.

Methods—In urban San José, CA, a qualitative study was conducted with a convenience sample of Mexican-American mothers of young children about their beliefs and knowledge about the causes of caries. Audio-taped in-depth interviews with open-ended questions, primarily in Spanish, were translated to English and then transcribed verbatim. Texts were independently read and thematically analyzed by two researchers.

Results—Even while expressing uncertainty, all 48 mothers mentioned specific causes of caries, most frequently citing candy or juice consumption (85%), poor oral hygiene (65%) and use of the bottle (52%). Mothers rarely recognized cariogenic foods beyond candy, did not know or perform recommended oral hygiene routines, and demonstrated confusion and uncertainty about exactly how baby bottles are detrimental to teeth. Nearly half of these mothers also mentioned secondary cavity causes, such as genetics, lack of calcium, not going to the dentist, or lack of fluoride. Mothers did not mention the role of bacteria. While mothers recognize that oral hygiene can counteract the detrimental effects of candy consumption, they did not recognize its beneficial effects in other contexts. Nor did they know about other preventive activities.

Conclusions—Mothers recognized the three major important factors causing caries: sugar consumption, poor oral hygiene, and bottle use. However, their knowledge is limited in depth and specificity which restricts development of caries prevention behaviors. More comprehensive education is needed, including on caries prevention (oral hygiene) behaviors, which could lead to an increased sense of self-efficacy with respect to their children's oral health.

Keywords

Caries; Caries etiology; Mothers' beliefs and knowledge; Mexican-American children; Qualitative research

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Introduction

Caries is the most prevalent infectious disease affecting children in the United States (U.S.) (1). Caries does not affect the population equally, as children living in poverty are twice as likely as those living above poverty level to be affected (1). Latino children (2), particularly Mexican-Americans (3), are one of the populations most affected by caries even when controlling for economic status, insurance coverage status, and parental attitudes toward preventive care (1, 4, 5). *Healthy People 2010* reported that nationally, 43% of Hispanic children aged 6 to 8 years have untreated caries, compared with 36% of non-Hispanic black children and 26% of non-Hispanic white children (6). Findings from the 2005 California Health Interview Survey, a random-sample survey including all 58 counties and designed to be statistically representative of the state, found that 32% of Latino children aged 0–11 years have untreated tooth decay (7, 8).

Caries is a complex and potentially serious health problem. Severe untreated caries, especially in early childhood, can lead to infections, speech and communication problems, school absence, chewing difficulties and malnutrition (1, 9). Risk factors for caries include bacteria, diet (especially at-will exposure to sweet foods and liquids), delayed weaning practices especially from the bottle, and poor oral hygiene (10–14). Fluoride exposure has been well-established as a protective factor (15–17). Insurance coverage, access to care and other social structural level factors, such as availability and access to pediatric oral health care specialty services and cultural perceptions of need for care, also influence children's oral health (1, 18–20).

While clinicians understand the complexity of caries etiology, lay people may not be aware of, believe in, or understand the mechanisms involved in caries etiology. Individual knowledge, attitudes, and beliefs are linked to behaviors (21–24), and to caries status (25). Therefore, it is important to explore what at-risk populations such as low-income Latinos know, believe, and understand about caries and how these factors influence oral health-related behaviors.

While most research studies on caregivers of young children of any ethnicity measure oral health-related behaviors, few include measures of oral health-related knowledge, and even fewer examine knowledge of caries etiology or its link with behavior. Only a handful of studies have looked at parental knowledge of caries etiology. Three of these relevant studies, one conducted over a decade ago, used survey research approaches and were conducted internationally (26–28). Only two studies, one conducted in the U. S. and one in Canada, investigated qualitatively the meanings parents give to caries and its causes (29, 30). In general, these studies have found that most parents are aware of the role of sugar consumption and poor oral hygiene in causing caries (26–30). Studies that asked follow-up questions, however, found limited depth of knowledge of those topics, (26, 27, 29) and studies that examined actual related practices found that despite high knowledge, parents reported low practice of ideal oral hygiene behaviors (27, 28, 30). In particular, while parents knew poor oral hygiene leads to poor oral health, few knew to use fluoridated toothpaste (26, 27), the amount of dentifrice to use or the quantity of fluoride that should be in toothpaste, and few parents assisted their young children with brushing or had children who brushed twice a day (27, 28). Additionally, while most parents knew that sugary foods were detrimental to oral health, few could identify the primary sources of sugar in their child's diet or were aware of "hidden sugars" in food (26–29, 31). Amin and Harrison report that parents recognized that they had control over children's behaviors, such as sugary food consumption and tooth brushing, but encountered many challenges, such as the child having multiple caregivers and the child's temperament, that limited their control over those factors (30).

Two recent studies looked at parental knowledge of the role of bottle use in caries etiology. Horton and Barker's qualitative study with rural Latino mothers of young children in the United States found a majority (61%) of mothers were aware of the role of the baby bottle in putting children at risk for early childhood caries, a particular serious form of caries affecting children under age six (29). These authors also describe maternal confusion about how the bottle affects teeth, with many caregivers believing characteristics of the bottle's nipple, rather than prolonged exposure to its sweet contents were detrimental (29). Gussy and colleagues in rural Australia report that only 5.5% of mothers in their study were aware of the bottle's effect in caries formation (26).

While bacteria's link with caries has been well-established in the clinical literature (10, 11, 17, 32) only two caregiver studies focused on bacteria's role in caries etiology. Gussy and colleagues note that 10% of their sample listed bacteria as the "most important cause of tooth decay" (26), whereas Amin and Harrison found that only the Chinese parents in their multi-ethnic sample mentioned bacteria as a risk factor for caries (30).

The only other qualitative U.S.-based study looking at Latino parents' knowledge of caries etiology was conducted over two decades ago. Woolfolk and colleagues investigated rural migrant Mexican-American workers and their children in Michigan. They found that brushing was reported by parents (60%) and children (69%) as the best preventive measure against caries (33). Fluoride was rarely mentioned, however, by only 10% of mothers and <2% of children aged 5 to 12 years. In general, participants were described as having "weak knowledge" about the relation between a sweet diet and caries (33).

Thus, there is very limited prior research conducted on mothers' knowledge and beliefs surrounding caries etiology in the United States, and none with urban Mexican-American populations, a group particularly at risk for the disease. While basic knowledge does not always translate to in-depth understanding or beneficial behaviors (27, 28, 30, 34, 35), it is nevertheless an important foundation, a necessary base for the comprehension of prevention messages. Further research into the nuances of caries etiology and its connections to behaviors of parents of at-risk Mexican-American children is warranted. The purpose of this study, then, is to explore and describe low-income, urban Mexican-American mothers' beliefs and behaviors surrounding their perceptions of the causes of caries.

Materials and Methods

A qualitative approach was used to gain an understanding of urban Mexican-American mothers' beliefs, knowledge and behaviors surrounding their children's oral health. The theoretical underpinning for this study is broadly social constructionist. That is, it is based on the view that people make sense of their world by ascribing meaning to the symbolic, historical and material environments or contexts in which they live, meaning developed through the social interactions they have with others in their group (36–40). Everyday knowledge and actions come from repeated interactions and verbal expressions that help create a sense of meaning or social reality. Using this framework, we explore low-income urban Mexican-American mothers' knowledge (beliefs) and practices about their children's oral health. Our study approach consisted of in-depth interviews with mothers about their habits and beliefs surrounding the risk factors for caries and their young children's tooth brushing and other oral hygiene practices. This project is part of a larger study detailed elsewhere (18, 41).

The study was conducted in one neighborhood in San José, a large, urban city in Santa Clara county in Northern California. The focal neighborhood primarily consists of low-income Latino families. The county had been previously recognized as high risk for early childhood

caries and is unusual in that it provides health and dental insurance for all children, including migrants, regardless of documentation (citizenship) status (42, 43).

Participants were: primary caregivers of children aged 10 years or less, with an aim that the participant's youngest child would be aged five years or less; first- or second- generation immigrant caregivers from Mexico. The convenience sample was drawn from multiple sources in the community, including a migrant parents' support group, various preschools, low-income dental clinics, community festivals, and referrals from other participants. Screening specifically for children who had experience with dental caries was not undertaken. Interested participants were screened for eligibility, and recruited into the study by a bilingual interview staff member who obtained informed consent.

All face-to-face interviews relied on open-ended questions contained in a semi-structured guide reviewed and approved by the ethics review board of the University of California, San Francisco. Interviews were conducted by a bilingual female researcher over a period of 6 months. Interviews were conducted in participants' homes or in preschool classrooms after school hours. Questions were derived from previous studies of Latino immigrant and low-income populations' conceptions of oral disease and experiences with the oral health care system and in consultation with a team of specialists in Latino children's oral health (44–49). Answers to three basic questions – “Why do you think [your] child has caries?”, “What caused those problems [caries]?” and “Why do you think your child does not have caries?” – provided the data for this analysis of mothers' conceptions of their children's oral health and disease and associated oral health-related behaviors. The most commonly-used Spanish term for tooth decay is *caries*. As interviews were conducted in Spanish, the actual word “*caries*” occurred often in the interviews. This colloquially common term was understood by participants. All data are self-reported; no data come from medical or dental records. No caries status of children was obtained by the researcher, nor was self-reported caries status linked to findings about caries knowledge or practices. Data discuss beliefs and behaviors only, and do not make causal links between caregiver beliefs about caries etiology and the actual caries status of their children.

Interviews were digitally recorded, translated from Spanish to English when necessary, and transcribed verbatim. QSR International's NVivo 7® software package (QSR International, Doncaster, Victoria, Australia) was used to assist with data analysis. Following standard qualitative procedures, a short list of codes related to the causes of caries was developed from the existing literature (50, 51). After application of these codes to the text, transcripts were re-read and these initial codes were refined and applied, and new themes identified and coded as they emerged while reading transcripts and field notes about the interviews. Two researchers independently read through and coded the mothers' responses, then compared findings and reached consensus on any discrepant categorizations through discussion with all three researchers.

Because a parent could mention multiple causes for caries and because each cause mentioned was separately coded and counted, the denominator for the percentages reported is the number of reasons given, not the number of parents interviewed. Throughout this report, typical quotes from participants are used to illustrate the points being made.

Results

SAMPLE

Forty-eight Mexican-American mothers of young children were interviewed for this study, 43 in the Spanish language, five in English. The mothers were a mean age of 31 ± 5.6 years, had on average between 2 and 3 children per family, and reported low educational

achievement (see Table 1). Most of these mothers lived in households with an annual income at or below federal poverty level and the majority (89%) participated in the federally funded Women Infant and Children (WIC) nutrition supplementation program (see Table 1) (52). The majority (60%) of their children was under 5 years of age, and mothers reported that nearly two-thirds of these children had caries experience (see Table 2). Almost all (97%) of the children had some form of dental insurance, mostly public insurance.

ETIOLOGY OF CARIES: MAIN CAUSES

It is important to note that 40% of caregivers' response to being asked their thoughts about the causes of caries, said "I don't know" or "I'm not sure." The following illustrates this common state of ambivalence and uncertainty:

"...They [children] just have too much sugar, I don't know. Or maybe it's in the family, I don't know. Or too much bottle feeding at night and they left the bottle inside [the mouth]... Juice and baby bottle, and I think that's why. I don't know..."

Despite this uncertainty, all caregivers continued on to give other possible reasons why caries develop. We categorize and analyze here all the reasons offered, whether they are a tentative suggestion or a more confident assertion.

Thus, most parents listed multiple causes for caries. The mean number of reasons each participant mentioned was 2.9 ± 1.3 . All caregivers mentioned at least one of three main reasons. In order of frequency of mention, these main reasons are: candy or juice consumption (85%), poor oral hygiene (65%), and bottle use (52%). Another seven ideas about caries etiology offered by less than half the participants were classed as minor causes of caries. Five caregivers gave only one reason for caries etiology: of those, four mentioned "candy" specifically. Around one-fourth of all caregivers (14 of 48, 29%) mentioned all three primary reasons, with half of those caregivers going on to include additional "other" reasons. This mother, for example, was classed as listing the three primary causes and one "other" etiological factor (genetics):

"...I think they [parents] must give them [children] milk with Nesquik ® or give them a bottle a lot. I don't know. And a lot of them are just born like that, with really bad teeth... maybe they don't brush, or maybe it's from sleeping with their juice..."

1. Candy or Juice Consumption—Candy or juice consumption was the most often-mentioned cause of caries (85%). Two quotes illustrate the types of comments caregivers generally made:

"...I think [child] got cavities because of candies. She likes to eat a lot of candies..."

"...I think [decay] happened to their teeth because of the sugar in the juices they drank..."

A few mothers mentioned sugar or sweets in general, but most mentioned candy specifically as the cause for caries. Lollipops, chocolates, chewy toffees, and candy bars were all listed as examples of candy. Caregivers rarely mentioned other cariogenic foods, however, such as baked goods, ice cream, or starchy foods. Just over one-third (35%) of mothers recognized the role of fruit juice specifically in causing caries and tried to limit their child's juice consumption by diluting it with water. Most of these low-income mothers reported learning about the risk of juice as a cause of dental caries, well as how to dilute it, from the WIC nutrition centers they attended.

Mothers talked about various attempts to reduce their child's at-home candy consumption and barriers to doing so. Mothers often tried not buying candy very often and limiting access. Many mothers said they didn't want to deprive their child of sweets entirely, but tried to place limits on candy consumption by reducing frequency and/or quantity. "We do give him candies because we aren't going to limit everything, but that's only once in a while."

Most mothers, however, expressed frustration with how ubiquitous and easy to find candy was: Relatives, children's birthday parties, Halloween, and *piñatas** were all candy sources for their child beyond the mothers' control. This mother explains:

"...I've always tried to avoid candies but you know that they sometimes go to parties. They are given candies or people give them candies. Sometimes other people offer them candies. It's inevitable but I'm always trying to not give them sugar..."

Mothers also mentioned that the child's desire for the candy often overrode parental restrictions, as this mother noted with respect to her 10 year old son:

"I tell him that he can't eat candies because his teeth will decay, but he doesn't pay attention."

This emphasis on candy sometimes caused mothers to overlook other sources of sugars their child might be consuming, as the following reveals:

"...he was eating a lot of candy, but I took him off that. I only give him ice cream bars now. I don't want him to eat candy, but when I took him back [to the dentist] he had more caries. I don't know why. Who knows why? I was asking myself, 'How he could have more?'..."

This mother did not realize that by replacing candy with ice cream bars, she was not reducing her child's exposure to sweet substances and thus his caries risk. Similarly, other mothers emphasized their efforts to reduce their child's candy consumption, but talked about frequently still giving their child sweetened yogurts, sports drinks and similar substances—believing these were nutritious foods that were good for their children but not recognizing their cariogenic content. This mother explains,

"There was a time when he drank a lot of Gatorade® [a sugared sports drink]. He hardly drank any water, just Gatorade® and more Gatorade®. When I'd go to the doctor when he had diarrhea or vomiting, the doctor would tell me to give Gatorade® to [my son], so I thought it was good for him... I would give it to him and give it to him and give it to him. I think that's why [he had caries] ... Then I went to the dentist and they found all those caries, so I stopped [giving him Gatorade®]... Sometimes you do things that you don't even know are bad."

Non-recognition of where in the diet sugars actually appear is particularly evident in the following case. A mother was getting distraught over her child's continually deteriorating oral health. Her three year old daughter had already had multiple teeth extracted due to extreme decay, but at every visit the dentist found yet more carious decay. This mother didn't think caries could develop in a matter of months, especially since she was increasing efforts to limit her child's exposure to candy and soda:

"... these last months I haven't given her soda. We don't drink much soda at home anyways. They [the children] did eat candies, not in excess, but she would eat them once in a while."

* *Piñatas* are paper containers filled with candy and toys, common at birthday parties and holidays

Now, from the last time I had her teeth checked I stopped giving her candies... I don't know what happened to them [her carious teeth.]” At this point in the interview, however, the grandmother who lived with the family chimed in to give her opinion – that cookies (*galletas*) were the culprit. To this, the mother replied that they weren't sweet cookies (*galletas*), but rather crackers (*galletas saladas*) that she gave the child and therefore should not be bad for the child's teeth. During this interchange and, in fact, during most of the hour-long interview, the three-year-old child was walking around the house drinking a chocolate milkshake. What this observation clearly reveals is that children's source of sweet substances is wider than recognized or discussed by their parent or grandparent caregivers.

2. Poor Oral Hygiene—Poor oral hygiene was the second most mentioned cause for caries given by mothers (65%) in this study. Mothers mentioned absent, infrequent, or low-quality brushing as the problem, as exemplified in the following quotes.

“I wasn't brushing his teeth a lot. That's why he had cavities”

“Not brushing your teeth properly [causes caries]”

Mothers mentioned multiple barriers to good oral hygiene practices. Most barriers were behavioral issues on the part of her child. Just two of the 48 mothers mentioned their own lack of effort as the sole or major reason for their children's poor oral hygiene. For very young children, examples of the barriers mothers pointed to include that the child didn't like his or her mouth to be touched, would fight a mother's efforts to brush his teeth, or would gag.

“My daughter has had problems because she wouldn't let me brush her teeth. It was very hard for me to clean them and brush them from when she was a baby... because she was a baby who wouldn't let me touch her mouth”

For older children, mothers blamed the child's own lack of responsibility to remember to brush, or lack of care and time allowed for brushing. This mother of a five-year-old and 10-year-old said of her children:

“They don't brush when I tell them, ‘Go brush your teeth.’ Sometimes I have to say, ‘Come on you, guys, everybody in the bathroom, let's all brush our teeth!’ Because they say they'll do it, and then they don't.”

When asked why she thinks her child has had cavities, another mother explained,

“Well, I think he ate a lot of candy, and he's a little lazier and he doesn't brush his teeth... Because he's always by himself, he doesn't clean his teeth. At night he does because then I'm here. But he's lazy.”

3. Use of the bottle—Half of the sample (52%) mentioned bottle use as a cause for caries: “I started to see that her teeth were yellow and decayed. That was because of the bottle...”

Despite so many people mentioning the bottle as an etiological factor, there was little agreement among participants on exactly how or why the bottle was a problem for teeth. As Table 3 shows, mothers mentioned seven very different reasons for why the bottle caused caries.. Four of those reasons correspond to messages in the clinical literature, while three reasons are not based on scientific evidence (53, 54). This quote illustrates a mother's scientifically sound belief that bottle use past one year of age is a problem:

“... I've seen one or two children with their teeth like that [rotting away] who are 3 or 4 years of age, and they're [caregivers are] still giving them the bottle. I think it

might be the bottle, that they [children] shouldn't still be drinking from the bottle ..."

Whereas this quote illustrates an erroneous belief that it is exposure to the material in the nipple of the baby bottle that is detrimental to teeth:

"...Well, the bottle is very bad for them [kids] because it produces lots of cavities. Most of all, the bottle does damage for them because it is made of rubber. It's very bad for their teeth, to be sucking on all that rubber..."

Mothers cited several main barriers to reducing bottle use in their children: lack of awareness of the bottle being a problem, as well as the child crying for the bottle and the mother not wanting to upset the child.

"I didn't take her off the bottle because she would cry a lot and I would feel bad about taking it away."

Some mothers would mention making efforts to wean their younger children early, after discovering their oldest children's poor oral health was attributed to use of a bottle for more than the child's first year.

"Once [second child] got older we took him off the bottle and gave him a cup. It was difficult because he got used to [the bottle]. We had to do it because we had the example of the eldest whose teeth got very damaged."

Occasionally, confusion and superficial knowledge about how bottle use contributes to caries resulted in ineffective attempts to reduce caries risk by removing the bottle. It was common, for example, to remove the bottle after the child was done drinking it, or replacing the night-time bottle with a night-time training (sippy) cup, as demonstrated by this interview dialogue:

I: How did you decide to switch from the bottle to a sippy cup?

R: Because the [medical] doctors had told me that [the bottle] was bad for his teeth... I remember them saying that it would make his teeth come out crooked and that it would give him caries. They said it was worse if he also fell asleep with it at night. That's why I decided to stop giving it to him.

I: Did they recommend you use the sippy cup instead?

R: Yes, they recommended that I start using the cup so that he would get off the bottle. He accepted it [the sippy cup]. The thing is that he had always drunk from a normal cup, but I never got him off the habit of drinking [the sippy cup] like that in the morning and night. I know it's bad, but he's small!

I: Have you tried taking him off the sippy cup?

R: No, I haven't really tried... I do want to get him off it. He's nearly four.

ADDITIONAL CAUSES OF CARIES

Mothers less frequently mentioned 7 additional causes of caries. These reasons were always given in addition to at least one primary reason. Nine mothers (19%) mentioned lack of calcium, either during the time the baby was developing in the mother's womb, or as a young child. Genetics was mentioned by 8 mothers (nearly a fifth of the sample), though their lay understanding of this term was distinctly different from that of professional scientists. For example, several mothers' genetic attributions took the form of claiming the child's "father's family all have bad teeth" or "people in my family always have a lot of caries." Four or fewer caregivers mentioned each of the following causes of caries: lack of dental visits, lack of fluoride, sleeping with milk, poor nutrition (fast food), and medications.

No mothers independently offered bacteria as a cause of caries, however 16 caregivers were specifically asked if they were aware that bacteria played a role in causing caries. Ten of these mothers were not aware that bacteria caused caries or that caries is contagious. The six who were aware of the link had learned about it recently from presentations in their child's preschool or kindergarten. When probed further, these six mothers said that the behavior that could prevent the spread of the bacteria was not sharing or letting small children play with other people's toothbrushes. This was not a common practice before the educational exposure, however, so no changes to daily routine were made. Sharing of food, utensils, pacifiers or toys chewed by other infants or children were not mentioned as possible ways of spreading bacteria.

INTERACTIVE EFFECTS

Almost all reasons given, including poor oral hygiene, were described as directly causing caries, as for example, this mother illustrates: "I think it is because of the candy. It ruins their teeth." Oral hygiene, however, was also often presented as a mediating variable in relation to the consumption of foods recognized as being cariogenic.

"... [children get caries] if they eat candies or if you give them a lot of soda, or if you don't brush their teeth... I think that if they eat their food and then brush their teeth, then there shouldn't be a problem..."

"...he goes and brushes his teeth after he eats candies or Cheetos® because I tell him those [foods] cause cavities to form quicker..."

"I think it's just a matter of saying 'no more candies, no more cookies' or letting them eat them once in a while and having them brush their teeth after they are finished eating..."

Oral hygiene was the only variable presented as having a mediating influence, predominantly for candy consumption. Some parents specially asserted that the detrimental behavior of eating candy could be counteracted by the beneficial behavior of tooth brushing. The ability of oral hygiene to reduce the impact of the other etiological factors was not recognized. For example, the effects of drinking a bottle could also be mediated by oral hygiene practices before the child goes to sleep, but parents did not make that connection. At another point in the interview, when mothers were asked about oral hygiene practices during their child's infancy, a few mothers noted the importance of infant oral hygiene practices after consuming milk, but it did not come up during the portion of the interview dedicated to caries causes (41). This reinforces the observation that mothers do not understand the relationship between bottle use and tooth damage. It also relates to previous findings about there being confusion among low-income Mexican-American mothers about whether or not milk exposure is bad for teeth (41).

SOURCES OF INFORMATION

Mothers mentioned learning about these caries etiology from dentists, WIC educators, family members, and from observing those around them. Very often mothers would find support for their beliefs about caries etiology by comparing two different cases, often two of their own children, or their children with their nieces or nephews (the child's cousins). One example concerned a mother who had two children by different fathers. She believed she raised the two children with similar efforts in diet and hygiene, yet one had no cavities and the other had many. In conjunction with the major causes of caries, she attributed this also to 'genetics,' to the differing influence from the two different fathers. In another example, a mother described having two children with differing levels of candy craving. The child who wanted to eat sweets all the time has had many cavities, while the other child who ate more fruits and vegetables and didn't like sweets, had no cavities. Thus the mother concluded that

diet and candy consumption have a profound influence on the etiology of caries, a conclusion that would be bolstered by any professional oral health educator she encountered.

When these types of observations did not coincide with a mother's beliefs about the cause of caries, or when a mother's beliefs were contradicted by a health educator's comments, however, then cognitive dissonance resulted.

“[The dentist] said that maybe [the child's tooth decay] was because she was drinking out of a bottle, but she never used a bottle. She never used a baby bottle. He said, ‘I think it's because she's drinking out of a bottle or she's drinking out of a [training cup] but those aren't things she uses... I think it's really strange that her teeth decayed if she didn't drink from a bottle and didn't use those cups with a teat...”

This produced doubts – the “I don't know” that were mentioned by so many mothers – and a search for additional etiological reasons. For example, when asked why she thinks her son has caries this mother reasoned:

R: The truth is, I don't really know. He doesn't eat an exaggerated amount of sweet things. He doesn't like cookies. I don't know why he got cavities... He doesn't like milk much either. He eats cornflakes once or twice per week. He eats the cornflakes and leaves the milk behind.

I: How does milk affect his teeth?

R: They say it has a lot of vitamins. I don't know. I'm not sure if that's true or not.

I: So you think he wasn't having enough milk?

R: Yes.

Discussion

In general, these findings are consistent with previous work on caregiver perceptions of caries etiology (26–30). These urban, low-income Mexican-American mothers understood the key biomedical influences of sugar consumption, oral hygiene, and bottle use in caries etiology as supported by previous findings (29), but had a limited depth of knowledge, especially of the mechanisms that generate carious lesions in teeth. Mothers lacked knowledge about the role of bacteria in caries etiology.

Limitations of this study include a small, convenience sample from a single location and socioeconomic level, along with possible recall and social desirability biases. Caution should be exercised in extrapolating results to another social class or geographic setting, and to other population groups. However, its in-depth examination of an under-researched topic provides a unique and valuable contribution. This article expands on existing findings by looking more closely at how mothers incorporate their beliefs/knowledge of caries etiology into daily habits, the barriers they perceive, and what happens when their observations contradict their beliefs. By exploring these topics through in-depth interviews, we have identified subtle discrepancies in and limited depth of understanding, thereby highlighting key areas for future education for this and similar at-risk populations.

Similar to the existing literature, mothers in this study knew that sugar consumption is important in caries etiology, but had a limited depth of knowledge on the topic. Mothers gave more importance to candy and juice specifically, while not often recognizing other sweet foods and drinks that could influence caries. Mothers never mentioned the timing or frequency of sugar consumption, key factors identified in the clinical literature (55, 56).

Mothers feel a lack of ability to control their children's access to sweets, especially when the children are outside the house and in the care of others (30).

Latinas strongly espouse a belief that oral hygiene routines comprise good habits, ones their children ought develop (57). Despite a belief that tooth brushing can reduce or even reverse the impact of consuming sweet substances, particularly candy, mothers in this study were often hesitant or inconsistent in their support of this activity. Research elsewhere shows that Latina mothers may lack knowledge about recommended brushing technique, such as daily frequency and duration of brushing, and importance of fluoridated toothpaste (27, 57), about when to initiate hygiene practices (41), and the need for parental assistance until a child is 6 or 8 years old (28, 41, 58, 59). In terms of oral hygiene, many mothers are holding children as young as four or five years of age responsible for independently remembering and effectively carrying out oral hygiene practices. Additionally, for mothers who do try to brush their children's teeth, the child's resistive behavior is sometimes a barrier that they have trouble overcoming (30, 60). A mother's sense of self-efficacy and a positive attitude towards brushing a child's teeth have been linked to improved oral hygiene (23, 61). Education needs therefore to be aimed at enhancing Latinas' sense of self-efficacy and control over supervising their children's oral hygiene habits.

Mexican-American children continue bottle feeding longer than children in other populations. One study showed that 36.8% of Mexican-American children were still bottle feeding between 24 and 28 months of age, significantly higher than white and black children (62). Reasons for prolonged bottle feeding include: low knowledge of proper time to stop, belief that young children should drink a high volume of milk, child asks for the bottle at night, and parental feeling that the child was too young to not be drinking from a bottle (63). Mothers' lack of understanding about how bottle use affects teeth resulted in well-meaning but ineffective attempts to reduce deleterious outcomes – through actions such as putting a child to bed with a training (sippy) cup instead of a bottle but still full of milk. Although we do not know if there is a significant difference in children's caries status between families that hold the beliefs and habits described here and those families that do not ascribe to such ideas, the confusions uncovered in this study could have detrimental outcomes. Parental misunderstandings and subsequent behaviors, combined with the prolonged duration of bottle use, puts this population of low income Latino preschool children at increased risk for early childhood caries.

These findings clearly illustrate the limitations of current dental education efforts. It has been well established in behavior change theory, that while knowledge is an important component of behavior change, it is by no means the only component (64–67). Knowledge alone rarely leads to behavior change. Many other factors such as skills, expectations, expectancies reinforcement and environment are necessary to bring about successful and sustainable behavior change (23, 64–67). Parents are learning key messages without the depth of understanding or skills -self-efficacy- necessary to implement the knowledge effectively in their behaviors and so improve their children's oral health. Merely telling a parent to reduce their child's juice and candy consumption is insufficient, as they may substitute something else that still is detrimental to teeth without the parent knowing it. Parents are capable of understanding basic caries processes, as illustrated by their recognition of the interaction between hygiene and candy consumption. However, parents need more in-depth education about caries etiology beyond a few sentences at the dentist's or physician's office. In particular, parents need to know exactly how the bottle results in detrimental effects, where sugars are "hidden" in other parts of the diet, the role of bacteria, and how to properly conduct and adequately supervise tooth brushing for their young children. While education itself is not likely to end the disparity of dental caries experienced by this population group, it will provide caregivers with the knowledge to ask appropriate

questions and make healthy choices for their children when they are in a position to make decisions related to their child's oral health.

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Table 1

Mother Demographics

	% or Mean	Range
Mother Age (years)	31.1 $\pm$ 5.6	20 – 44
Children in Family	2.5 $\pm$ 1.0	1 – 5
Annual Family Income	\$24,667 $\pm$ 12,868 Median = \$24,000	\$4,450–70,000
Years in U.S.	8.9 $\pm$ 4.8	0.75 – 21
Years Education	8.9 $\pm$ 2.8	2 – 15
Participated in WIC	89%	

Table 2

Child Demographics

	% or Mean	Range
Age (years)	5.8 ± 4.2 60% < 5	1 month to 18 years
% with dental insurance	97% (79% with public insurance)	
Ever had caries, by parent report	64%	
Age (years) at tooth brushing initiation	1.8 ± 0.8	5 months to 5 years
Age (years) at first dental visit	3.0 ± 1.7	8 months to 10 years

Table 3

Reasons for How the Bottle is Damaging to Teeth

REASON	NUMBER OF CAREGIVERS	% OF CAREGIVERS MENTIONING BOTTLE
Use beyond age 1 year	10	33
Sweet liquids inside	8	27
Prolonged sucking	7	23
Sleeping with the bottle	7	23
Material in the nipple	4	13
Makes teeth crooked	4	13
Residue left after milk	3	10