

ABSTRACT

Hispanic Culture and Dental Caries Risk Assessment

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Dental decay is one of the most prevalent infectious diseases in humans and is a complex process involving both protective and pathogenic factors. Dental caries risk assessment is a methodology utilized by dentists to assess the risk factors of each patient to determine treatment recommendations and prevent the disease process of caries. Culture influences our daily decisions, including those that affect oral health. This thesis examines the four categories of caries risk assessment (Fluoride Exposure, Caries Experience, Sugary Foods and Drinks, and Dental Home), as defined by the American Dental Association, and the effect Hispanic culture has in conjunction with each risk assessment category.

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HISPANIC CULTURE AND DENTAL CARIES RISK ASSESSMENT

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Preface

According to the 2010 United States Census, which includes U.S. territories, Hispanics are the largest minority within the United States, making up 16% of the population. From 2000 to 2010, more than half of the growth of the total U.S. population was from an increase in the Hispanic population.¹ Although dental disease rates in the U.S. have decreased over time, they are still disproportionally high for minority groups, including Hispanics.² Therefore, not only will dentists see more Hispanic patients, but there is also an increasing need for preventive dental care and treatment within the population.

Dental decay reflects the way we live, the things we eat, and the things we do, all of which is influenced by culture.³ I wrote this thesis to address a gap in the literature regarding Hispanic culture and dental caries risk assessment, which is used to predict future dental decay before its clinical onset. I intend to show that the caries risk factors of Hispanics are heavily influenced by their traditions, beliefs, and values, whether that is in a positive or negative way. I also wrote the thesis so that it could be read and used by those in charge of making policy, health educators, or anyone with an interest in its contents, and who may not have a strong science or dental background.

¹ Ennis, Ríos-Vargas, and Albert, "2010 Census Briefs."

² Palmer, "CDC: 'Disparities in Caries Continue.'"

³ Grayson, Van Nieuwerburgh, and Dworkin, "Culture and Caries."

DEDICATION

To the family, friends, and professors who helped to support and encourage me on my academic journey.

CHAPTER ONE

Cultural Factors Influencing Fluoride Exposure Among U.S. Hispanics

The first category listed on the American Dental Association's (ADA) Caries Risk Assessment Form is Fluoride Exposure.⁴ In this chapter, I will explore the available literature on Hispanic cultural factors that influence fluoride exposure in the United States. I will do this by explaining what fluoride is, sources of fluoride, water consumption beliefs, water regulations, and the consequences of inadequate or overexposure to fluoride.⁵

Dental caries, also known as dental decay, is an infectious disease that is caused by many contributing factors and affects 91% of adults ages 20-64 in the United States, 94-97% of adults ages 35-64, and 82% of adults ages 20-34.⁶ Fluoride reduces the prevalence of dental caries, as well as reduces its progression by inhibiting or reversing the demineralization of enamel.⁷ Fluoride is the ionic form of fluorine, a naturally occurring element found in the earth's crust. Due to its negative charge, fluoride typically bonds with positive ions to form a more stable compound form such as calcium

⁴ "ADA Caries Risk Assessment Form."

⁵ Different labels and identifying terms have been suggested in the past, but the two most common within the literature are "Latino" and "Hispanic." Unless mentioning a source in which Latino is used, I will be using "Hispanic," as that is what is used in the United States Census.

⁶ Dye et al., *Dental Caries and Tooth Loss in Adults in the United States, 2011-2012*.

⁷ Allukian Jr et al., "Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States."

fluoride or sodium fluoride and is naturally released into the environment through water and air.⁸

When fluoride is present in the mouth, the dental plaque retains and concentrates it for reuptake with the minerals that are lost due to demineralization (i.e. loss of calcium phosphate and carbonate due to the acid metabolic byproduct of bacteria).⁹ The fluoride is then incorporated into the crystalline lattice of the enamel mineral, modifying the dental enamel and its properties. Due to the small size of the ion, it is able to fit in between the coplanar space of the triangularly arranged calcium ions in the lattice. This results in a mineral with greater density, greater chemical stability, and more resistant to the acid metabolic byproduct and subsequent demineralization.¹⁰ A 2013 study published by the American Chemical Society found that fluoride might also have a cariostatic effect (i.e. inhibit the formation of dental caries) due to its ability to decrease bacterial adhesion for *Streptococcus mutans*, *Streptococcus oralis*, and *Staphylococcus carnosus*, as well as a bacteriostatic effect due to its inhibition of enolase, an enzyme and key component of the glycolysis cycle.¹¹

Fluoride exposure is defined in the ADA's assessment as, "through drinking water, supplements, professional applications, [and] toothpaste."¹² The most common

⁸ Myron Allukian Jr et al., 2.

⁹ Plaque is a sticky organic matrix of bacteria, salivary components, dead mucosal cells, minerals, and saliva components, and is a biofilm.; Myron Allukian Jr et al., 3.

¹⁰ Moreno, "Role of Ca-P-F in Caries Prevention."

¹¹ Loskill et al., "Reduced Adhesion of Oral Bacteria on Hydroxyapatite by Fluoride Treatment."""

¹² "ADA Caries Risk Assessment Form."

sources of fluoride in the United States are fluoridated community drinking water and fluoridated toothpaste.¹³ The CDC considers water fluoridation as one of the top 10 great public health achievements of the 20th Century.¹⁴ In its 1962 Drinking Water Standards related to community water fluoridation, the U.S. Public Health Service set the recommended concentration of fluoride at 0.7-1.2 mg/L.¹⁵ Many water systems for community water fluoridation use Sodium fluoride or fluorosilicate compounds, for which studies have found no evidence of toxicity from their post-dilution concentrations. These compounds are considered comparable to the natural fluoride compounds discussed above.¹⁶

Therefore, tap water versus bottled water intake in the U.S. is an important factor to consider in relation to fluoride exposure. Bottled water sales have tripled in the past decade. The global consumption of bottled water increases by about ten percent annually. The U.S.'s consumption of bottled water in 2008 was approximately equivalent to 27.6 gallons per person, a significant increase from the 10.4 gallons per

¹³ Allukian Jr et al., "Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States," 3.

¹⁴ "Over 70 Years | Basics | Community Water Fluoridation | Division of Oral Health | CDC."

¹⁵ U.S. Department of Health and Human Services Federal Panel on Community Water Fluoridation, "U.S. Public Health Service Recommendation for Fluoride Concentration in Drinking Water for the Prevention of Dental Caries."

¹⁶ Pollick, "Water Fluoridation and the Environment."

person in 1993.¹⁷ American Demographics found that women are more likely to drink bottled water than men, especially Hispanic women.¹⁸

Additionally, patients at an urban public health center in Salt Lake City, Utah, were surveyed regarding their bottled, filtered, and tap water consumption and fluoride use, the results of which were used to analyze differences between ethnic and socio-ethnic groups. The study found a statistical difference between Latino and non-Latino adults and children that never drink tap water, and an avoidance of drinking tap water because it causes illness. It concluded that the primary factor influencing Latinos to prefer drink bottled water over tap water was fear that the water would cause illness, and was not associated with annual income level.¹⁹ This lack of trust in tap water has important implications for adequate fluoride exposure and is a known factor for bottled water companies, who target Hispanic populations for sales since they are accustomed to using other alternatives to tap water due to past water problems.²⁰

Given issues with access to potable drinking water in Latin America, this is an understandable fear. While access has increased with the development of more water treatment plants in various countries, such as a high concentration of arsenic in both ground and surface water supply in many countries, including Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua,

¹⁷ Hu, Morton, and Mahler, “Bottled Water.”

¹⁸ Hedden, “Water Works.”

¹⁹ Hobson et al., “Bottled, Filtered, and Tap Water Use in Latino and Non-Latino Children.”

²⁰ Hedden, “Water Works.”

Peru, and Uruguay.²¹ These are typically in larger cities and so more rural areas still have issues. Some low-income and or rural areas also face issues of water contamination by pesticides and fecal matter.²² This stigma against tap water can also be passed down generationally.²³ Therefore, it is reasonable that there exists a link between Hispanic populations and increased bottled water consumption.

In the U.S., however, tap water is more strictly regulated than bottled water. In fact, they are regulated under two different federal laws: the Safe Drinking Water Act for tap water and the Federal Food, Drug, and Cosmetic Act (FFDCA) for bottled water. The first requires the Environmental Protection Agency (EPA), or states that have primary enforcement responsibility, to protect the public from contaminated drinking water and give them information on the quality of water provided, usually through creating regulations for limiting the level of contaminants in public water systems or treatment techniques. These are legally enforceable requirements.²⁴

In comparison, bottled water is treated as a food by the FFDCA, and it falls under the regulatory control of the Federal Drug Administration (FDA). They are required to set the quality regulation at least as stringent as the EPA's for drinking water, but they sometime fall short, such as in the case of not having a standard and regulations set for DEHP (Di-2-ethylhexyl), a phthalate and organic compound widely used as a plasticizer

²¹ Bundschuh et al., "One Century of Arsenic Exposure in Latin America"; Laborde et al., "Children's Health in Latin America."

²² Bain et al., "Fecal Contamination of Drinking-Water in Low- and Middle-Income Countries."

²³ Daley, "Denver Works To Get Latino Families To Trust The Tap Water."

²⁴ Stephenson, *Bottled Water*.

in manufacturing PVC (polyvinyl chloride) plastics). It is also linked to health problems including reproductive and developmental problems.²⁵ The U.S. Government Accountability Office (GAO) found that the FDA's regulation of bottled water differed from the EPA's regulation of tap water in several key ways. For example, the FDA does not have the authority to require that bottling companies have their water quality tests done at certified laboratories, and does not require reporting of the water quality test results, even if there were standard violations.²⁶

Despite its prevalence in choice over tap water for reasons including perceived purity, the incidents of compromised bottled water quality are increasing and are linked to the lenient requirements of the FDA. A study looking at the temperature and storage of bottled water found higher incidence of bacterial growth in bottled water, especially when stored at increased temperatures.²⁷ Another study, this one done in Cleveland, Ohio, found that 15 of the 57 samples of bottled water contained 6-4900 CFUs/mL (colony-forming unit used to measure viable bacterial numbers). The study also found that only 5% of the bottled water purchased in the state contained the recommended fluoride concentration, while 100% of the tap water samples met the recommended concentration.²⁸

²⁵ Stephenson; "Polyvinyl Chloride (PVC).";

²⁶ Stephenson, *Bottled Water*.

²⁷ Hu, Morton, and Mahler, "Bottled Water."

²⁸ Lalumandier and Ayers, "Fluoride and Bacterial Content of Bottled Water vs Tap Water."; Hu, Morton, and Mahler.

Another study looking at bottled water fluoride content in 105 different samples found that fluoride content also varies by type or category. For example, distilled having less than 0.1 mg/L average, drinking or purified bottled water having a less than 0.03 mg/L (excluding one sample), mineral water at 0.32 mg/L, and more varying by category up to the 6 defined types of the study. The closest to the recommended dose was the fluoride-added bottled water, with an average of 0.63 mg/L.²⁹

Additionally, a study of the water consumption beliefs and practices in a Latino community in the Central Valley of California found of the 178 adults in the 134 households surveyed, almost 99% of the adults purchased filtered water or water from water mills, and the other 1% purchased bottled water. Water mills treat the municipal water, which in this case had a 0.6 mg/L fluoride concentration, just below the recommended 0.7 mg/L, using reverse osmosis (a process that removes the ions and minerals in the water).³⁰ This removes any added or naturally occurring fluoride, and the fluoride content for bottled water is unknown.

Furthermore, the same study looked at the population's knowledge of and beliefs about fluoride. Most participants thought that fluoride was distributed through toothpaste or by a dentist, and were unaware of benefits or purpose. Specifically, 26% of the participants had not heard of fluoride, 56% had heard of it but were unclear about its purpose and benefits, and only 17% knew about fluoride and its purpose and benefits.³¹

²⁹ Quock and Chan, "Fluoride Content of Bottled Water and Its Implications for the General Dentist."

³⁰ Scherzer et al., "Water Consumption Beliefs and Practices in a Rural Latino Community."

³¹ Scherzer et al.

In the previously mentioned Utah study, 82% of the 216 participants reported that the physician had never discussed water use with them.³² This suggests that not all clinics and practices are explaining the importance of fluoride exposure, and its availability through tap water in the U.S. Given the tendency to drink bottled or reverse-osmosis treated water, this is important for the population.

Also, in the study of the Valley Community, the majority of participants expressed willingness to allow fluoride exposure to their children, in addition to that of their toothpaste, after the benefits were explained by the interviewer.³³ These additional sources are mouth rinse, dietary supplements, topical gel, foam, or varnish, and are classified as high concentration sources.³⁴ Another source can be if food is processed in fluoridated water, as in a halo effect.³⁵ The Institute of Medicine published recommendations for total dietary fluoride intake by age in 1997, which includes a lower limit for adequate caries prevention and an upper limit to prevent adverse effects and risks.³⁶

³² Hobson et al., “Bottled, Filtered, and Tap Water Use in Latino and Non-Latino Children.”

³³ Scherzer et al., “Water Consumption Beliefs and Practices in a Rural Latino Community.”

³⁴ Allukian Jr et al., “Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States”; Moreno, “Role of Ca-P-F in Caries Prevention.”

³⁵ American Academy of Pediatrics, “What Is Fluorosis?”

³⁶ Allukian Jr et al., “Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States.”

Inadequate exposure to fluoride can result in greater risk for developing caries, but over exposure can result in enamel fluorosis (a change in the appearance of the enamel) due to hypomineralization. The mild (and most common) form of enamel fluorosis is chalklike, lacy markings on the tooth's enamel surface (usually not apparent to the affected individual), the moderate form is more than half of the enamel surface appears opaque white (previously called "mottled enamel"), and the severe (rare) form is when the enamel appears pitted and brittle.³⁷ Moderate and severe forms may also develop brown spots on the enamel after teeth have erupted (emerged from tissue).

All the forms of fluorosis are considered a cosmetic effect and have been accepted as a minor consequence in order to prevent dental caries. Fluorosis is only developed during the first 8 years of life, or until preeruptive maturation is complete.³⁸ These are all things that dental practitioners have to take into account when prescribing supplements or application of fluoride at dental appointments and are part of the reason the new recommended fluoride concentration in tap water was lowered to 0.7 mg/L.

In conclusion, fluoride is an important factor for caries risk assessment and prevention. Exposure, or lack thereof, to it within the United States is greatly influenced by water consumption choices. Hispanic traditions and experiences influence water consumption beliefs and choices among U.S. Hispanics. Increased explanation of the

³⁷ American Academy of Pediatrics, "What Is Fluorosis?"; Allukian Jr et al., "Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States."

³⁸ Allukian Jr et al., "Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States."

benefits of fluoride and the importance of its use would increase fluoride exposure from additional fluoride sources and help prevent caries and dental fluorosis.

CHAPTER TWO

Caries Experience for Hispanic Families

The third contributing condition, though discussed as the second for explanatory purposes, is listed on the American Dental Association's (ADA) Caries Risk Assessment Form as "Caries Experience".³⁹ In this chapter, I will explore the available literature on Hispanic culture and caries experience of families, especially of mothers and siblings, by looking at how bacteria colonize the mouth, which types are cariogenic, the ways in which families interact and share these bacteria, and some ways in which it can be prevented.

The etiology (causation) of dental caries is from the inter-relation of five factors: teeth, bacteria, saliva, sugar, and time.⁴⁰ This chapter will be focusing on the bacteria found in the mouth, including means of introduction and their role in caries. The latter chapter will look more at diet (though these are closely linked).

Prior to birth, children's mouths are sterile. Their first encounter with microorganisms that can colonize the mucosal surfaces of the mouth is in the birth canal. The mouth can be colonized by over 250 different groups of microorganisms, from gram-positive cocci and rods to gram-negative cocci and rods, including many that have not been named or for which we do not have a method of identification.⁴¹ Streptococci can

³⁹ "ADA Caries Risk Assessment Form."

⁴⁰ Arens, *Oral Health*, 29.

⁴¹ Arens, 9; Wilson, *Food Constituents and Oral Health*, 3.

be isolated from dental plaque and saliva and are identified by testing for the ability to ferment certain sugars, and have been found in infants only a few hours old.⁴² Mutans streptococci, specifically, are linked to dental caries initiation and progression, and specific species form on different intra-oral surfaces. Actinomyces and related genera of bacteria are also found in the mouth and some are linked to different types of caries progression, including root caries, carious dentine, and calculus formation.⁴³ Numbers and proportion of Lactobacilli in the mouth are also associated with increased risk of caries.⁴⁴

Prior to tooth eruption (appearing or becoming visible from the surrounding tissue), the majority of the oral flora (bacteria of the mouth) are streptococci, including *S. oralis*, *S. mitis*, and *S. salivarius*.⁴⁵ Though recently, studies have found that several different gram-negative anaerobic bacteria, as well as other anaerobes, occur in infants during that time frame as well.⁴⁶ After the eruption of teeth, *S. mutans* and *S. sobrinus* (mutans streptococci) are colonized on these new surfaces. This typically occurs after eruption of the deciduous (also known as the primary or baby) lateral incisors. Several Scandinavian longitudinal studies (studies done over a longer period of time with the

⁴² Wilson, *Food Constituents and Oral Health*, 8.

⁴³ Wilson, 10–11.

⁴⁴ Wilson, 11.

⁴⁵ Arens, *Oral Health*, 12.

⁴⁶ Arens, 13.

same subjects) show an increased likelihood of a child developing decay with earlier acquisition of mutans streptococci.⁴⁷

Because the oral flora does not change much in adults, except due to certain factors pertaining to old age, caries experience as a caries risk assessment is more relevant for children. As discussed in chapter one, bacteria break down sugars and fermentable carbohydrates. This also causes the formation of acids, such as lactic, acetic, succinic, and propionic, which lower the pH near the enamel, increasing the solubility of the tooth's minerals and leads to demineralization.⁴⁸ The oral flora, however, is not all bad. It does have some protective benefits for its host, such as acting as a microbial barrier and preventing the acquisition of potentially pathogenic organisms.⁴⁹

Additionally, because caries is an infectious disease, children can acquire bacteria from horizontal and vertical transmission. Horizontal transmission is the spread of an infectious agent from one individual to another. Horizontal caries can occur between unrelated individuals.⁵⁰ These were nursery school children age 2 months-4 yrs. Another study looking at non-genetically related 5-6 year olds, all attending kindergarten in several of the San Francisco Bay Area public schools, found that one pair of children

⁴⁷ Köhler, Andréen, and Jonsson, "The Effect of Caries-Preventive Measures in Mothers on Dental Caries and the Oral Presence of the Bacteria Streptococcus Mutans and Lactobacilli in Their Children."

⁴⁸ Arens, *Oral Health*, 29–31.

⁴⁹ Wilson, *Food Constituents and Oral Health*, 11.

⁵⁰ Mattos-Graner et al., "Genotypic Diversity of Mutans Streptococci in Brazilian Nursery Children Suggests Horizontal Transmission"; Tedjosasongko and Kozai, "Initial Acquisition and Transmission of Mutans Streptococci in Children at Day Nursery"; Liu et al., "Genotypic Diversity of Streptococcus Mutans in 3- to 4-Year-Old Chinese Nursery Children Suggests Horizontal Transmission."

in each of the three schools, for a total of three pairs, shared an identical amplotype of *S. mutans*.⁵¹ Studies, however, show it occurs more readily between family members, including between spouses.⁵² In contrast, vertical transmission is the spread of an infectious agent from one generation to another (typically parent to offspring). In the case of vertical transmission, the relationship between the oral health of parents and that of their children was studied in 1946 by Klein, who found an increased level of caries in children of parents with high caries levels.⁵³ A Maryland study found that parents' number of decayed, missing, or filled teeth (DMFs) was significantly related to the caries status of their children, even into adulthood, but that mothers' caries status had a stronger correlation than fathers'.⁵⁴ A study including mother-child MS relationships of families in Houston, Texas, found that the correlation was strongest in the Hispanic mother-child

⁵¹ Doméjean et al., "Horizontal Transmission of Mutans Streptococci in Children."

⁵² Saarela et al., "Transmission of Oral Bacterial Species between Spouses"; Redmo Emanuelsson and Wang, "Demonstration of Identical Strains of Mutans Streptococci within Chinese Families by Genotyping"; Kozai et al., "Intrafamilial Distribution of Mutans Streptococci in Japanese Families and Possibility of Father-to-Child Transmission"; Emanuelsson and Thornqvist, "Genotypes of Mutans Streptococci Tend to Persist in Their Host for Several Years"; van Loveren, Buijs, and ten Cate, "Similarity of Bacteriocin Activity Profiles of Mutans Streptococci within the Family When the Children Acquire the Strains after the Age of 5"; Redmo Emanuelsson and Thornqvist, "Distribution of Mutans Streptococci in Families"; Nie, Fan, and Bian, "Transmission of Mutans Streptococci in Adults within a Chinese Population"; Ersin et al., "Transmission of Streptococcus Mutans in a Group of Turkish Families"; Dobloug and Grytten, "Correlation between Siblings in Caries in Norway. A Quantitative Study."

⁵³ Klein, "The Family and Dental Disease. IV: Dental Disease (DMF) Experience in Parents and Offspring *."

⁵⁴ Ringelberg, Matonski, and Kimball, "Dental Caries-Experience in Three Generations of Families"; Shearer et al., "Family History and Oral Health."

pairs in the study population.⁵⁵ This may be due to the expressed value of closeness and physical contact in Hispanic culture.⁵⁶ Furthermore, a study comparing physical contact between Hispanic and Anglo mother-infant pairs found that culture-related patterns of touch of Hispanic mothers included more close touch and more close and affectionate touch with their children, including kissing them.⁵⁷

Therefore, I will be focusing more on the interaction between mother and child for vertical transference, as it is the most common form.⁵⁸ Transference of carious bacteria from mother to child can be as simple and innocuous as a mother blowing on the child's food or touching it to her lips to test its heat. Even biting off a piece of food from their own meal to give the child, or sharing utensils, kissing, cleaning pacifiers or nipples of bottles using their own mouth, basically anything contaminated with saliva, can be a vehicle of transference⁵⁹ This is because saliva, specifically maternal saliva, is a major form of transmission for MS.⁶⁰ A population-based study of low-income Hispanic families in California, which controlled for demographics and other factors, determined a

⁵⁵ Korenstein, Echeverri, and Keene, "Preliminary Observations on the Relationship between Mutans Streptococci and Dental Caries Experience within Black, White, and Hispanic Families Living in Houston, Texas."

⁵⁶ Franco et al., "Cultural Differences in Physical Contact between Hispanic and Anglo Mother-infant Dyads Living in the United States," 121.

⁵⁷ Franco et al., 125.

⁵⁸ "Dental Caries Transmission."

⁵⁹ Lapidattanakul and Nakano, "Mother-to-Child Transmission of Mutans Streptococci"; Caufield, Cutter, and Dasanayake, "Initial Acquisition of Mutans Streptococci by Infants"; Günay et al., "Effect on Caries Experience of a Long-Term Preventive Program for Mothers and Children Starting during Pregnancy."

⁶⁰ Lapidattanakul and Nakano, "Mother-to-Child Transmission of Mutans Streptococci."

significant increased risk for untreated caries in children is associated with untreated caries in their mothers in all four of their statistical models.⁶¹

To address this dynamic, there has been research on ways to decrease maternal vertical transmission.⁶² This is especially significant for expectant mothers, who will be the main source of vertical transmission for their newborns. An early infection of *S. mutans* increases the child's risk of developing caries in their primary teeth.⁶³ One of the first studies on reducing child MS levels by reducing maternal MS was done in the early 1980s. This is still being studied today.⁶⁴

Studies show that primary prevention (the prevention of dental caries in a healthy mouth) and primary-primary prevention (the use of all prophylactic measures to prevent transmission of cariogenic bacteria) have been proven as effective means for caries prophylaxis (a prophylactic is used to prevent disease).⁶⁵ These measures include education about the caries process and nutrition, oral hygiene, fluoride exposure, and

⁶¹ Weintraub et al., "Mothers' Caries Increases Odds of Children's Caries."

⁶² Nisar, "Role of Mothers in Prevention of Dental Caries."

⁶³ Alaluusua and Renkonen, "Streptococcus Mutans Establishment and Dental Caries Experience in Children from 2 to 4 Years Old"; Alaluusua et al., "Caries in the Primary Teeth and Salivary Streptococcus Mutans and Lactobacillus Levels as Indicators of Caries in Permanent Teeth"; Thibodeau and O'Sullivan, "Salivary Mutans Streptococci and Incidence of Caries in Preschool Children."

⁶⁴ Köhler, Bratthall, and Krasse, "Preventive Measures in Mothers Influence the Establishment of the Bacterium Streptococcus Mutans in Their Infants"; Köhler et al., "Effect of Caries Preventive Measures on Streptococcus Mutans and Lactobacilli in Selected Mothers."

⁶⁵ Axelsson et al., "Integrated Caries Prevention."

traditional prevention.⁶⁶ An intervention that uses various methods and prophylactic measures (such as Chlorhexidine mouthwash) is associated with caries prevention in primary and permanent teeth, as well as short-term and long-term reduction in MS colonization.⁶⁷ Besides having a direct effect on the mothers' levels of MS and oral hygiene, these interventions can have both a generational and communal effect, when Mothers teach their children and share what they learn with their friends, and neighbors.⁶⁸

An additional suggestion for intervention would be a co-effort between medical and dental professionals. Often, parents have a misconception about when they should take their child to the dentist for the first time. Dentists can begin seeing children who are at least 6 months of age.⁶⁹ This is particularly important in high-risk populations. A study involving a Latino focus group in San Francisco, California, found that the caregivers trust that the Primary Care Physician (PCP) that they have been taking their child to would inform them if there was a problem with their child's oral health.⁷⁰ PCP's

⁶⁶ Günay et al., "Effect on Caries Experience of a Long-Term Preventive Program for Mothers and Children Starting during Pregnancy"; Axelsson et al., "Integrated Caries Prevention."

⁶⁷ Köhler, Andréen, and Jonsson, "The Effect of Caries-Preventive Measures in Mothers on Dental Caries and the Oral Presence of the Bacteria *Streptococcus Mutans* and *Lactobacilli* in Their Children"; Köhler, Andréen, and Jonsson, "The Earlier the Colonization by *Mutans Streptococci*, the Higher the Caries Prevalence at 4 Years of Age"; Köhler, Bratthall, and Krasse, "Preventive Measures in Mothers Influence the Establishment of the Bacterium *Streptococcus Mutans* in Their Infants."

⁶⁸ Chaffee et al., "Maternal Oral Bacterial Levels Predict Early Childhood Caries Development."

⁶⁹ Texas Department of State Health Services, "Texas Health Steps (THSteps) Dental Program."

⁷⁰ Hilton et al., "Cultural Factors and Children's Oral Health Care."

typically do not have adequate training to assess oral health and early dentition, but they see patients more often than dentists do.⁷¹ Therefore, a partnership between medical and dental professionals would be extremely helpful for providing dental care and information to patients.

In conclusion, dental caries is a complex process, but one that is dependent on bacteria. Interactions between families and between children and caregivers, especially between children and their mothers, are sources of bacterial exposure that can mean a greater risk for dental caries. This is significant for the Hispanic population, as they have a higher proportion of the population with caries as well as social norms, which may increase their risk. Programs to reduce MS levels in mothers, alongside oral health and nutritional education have proven to be effective means of reducing caries risk in children. Additionally, programs that employ a partnership between medical and dental professionals can be of greater use for providing oral health education and treatment to patients of all ages.

⁷¹ Cohen, “Expanding the Physician’s Role in Addressing the Oral Health of Adults.”

CHAPTER THREE

Hispanic Diet and Oral Health

The second contributing condition listed on the American Dental Association's (ADA) Caries Risk Assessment Form, though placed third in this thesis, is Sugary foods and drinks.⁷² In this chapter, I will explore the available literature on Hispanic culture and exposure to protective or harmful dietary foods. First I will explain the different types of sugars and fermentable carbohydrates, connecting it to Hispanic diet as appropriate. Next, I will discuss Hispanic diet related to acculturation. Then, I will discuss socioeconomic status and dental caries, including early childhood caries. Finally I will discuss diabetes as it is closely linked to diet and obesity, both of which are connected to caries risk.

The amount and frequency of sugar consumption is the most important dietary factor in caries process.⁷³ The relationship between the two has been studied through several different types of studies, including: human epidemiological and experimental studies, laboratory investigations, and animal studies.⁷⁴ The recommended diet from guides for both Americans and Europeans is rich in carbohydrates from whole grains,

⁷² "ADA Caries Risk Assessment Form."

⁷³ Hunter, "Risk Factors in Dental Caries."

⁷⁴ Wilson, *Food Constituents and Oral Health*, 85.

fruits, and vegetables.⁷⁵ These, however, are also sources of fermentable carbohydrates, meaning bacteria in the mouth can process them and create organic acids, and thus are part of the caries process. Therefore, “healthy” foods like certain milk products, fruit, vegetables, and starches can have a negative effect on oral health.

Given that carbohydrates are the main source of energy from food in the world, diet is a key part of the caries process. It is closely connected with the bacteria component of caries risk discussed in chapter two. For example, certain Mutans streptococci are not present in the mouth until eruption of the lateral incisors. If there is excessive consumption of fermentable carbohydrates, they may appear earlier (after the eruption of the central incisors, the first teeth to erupt).⁷⁶ There is evidence that the proportion of Lactobacili present in the mouth is also connected to excessive ingestion of fermentable carbohydrates.⁷⁷ Additionally, sugar in the diet increases the amount of extra-cellular polysaccharides produced by the bacteria within dental plaque, resulting in increased mass of the plaque.⁷⁸

Most carbohydrates are from plant products. Thus, except for lactose, which is found in milk, this chapter will focus on plant based carbohydrates. Excluding constant and long-term exposure, which will be discussed later in the chapter, lactose is neutrally

⁷⁵ Kantor, *A Dietary Assessment of the US Food Supply*; Ruxton, Garceau, and Cottrell, “Guidelines for Sugar Consumption in Europe”; James, “European Diet and Public Health.”

⁷⁶ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 13.

⁷⁷ Arens and British Nutrition Foundation, 11.

⁷⁸ Arens and British Nutrition Foundation, 14.

associated with caries. This is because it exists in small amounts (~5%) in milk, which also includes calcium (a protective factor).⁷⁹

The smallest form is monosaccharides (also known as simple sugars). These include glucose, fructose, and galactose. Fruits and vegetables contain small amounts of glucose, and it is one of the main ingredients of honey. Honey, fruits, and vegetables also contain fructose and galactose is one of the monosaccharides that make lactose.⁸⁰ Lactose is a disaccharide (a combination of 2 monosaccharides).

When we traditionally think of sugar, we think of table sugar, which is 99.9% pure sucrose, another disaccharide, and the main source of sucrose in most diets. Sucrose is extracted from sugar beet or cane but can also be found in fruits and vegetables. Maltose, also a disaccharide, is found in malted wheat and barley and the food products made from malt (including beer and whiskey). Trehalose is another disaccharide, and is found in mushrooms.⁸¹ Mushrooms are an aspect of tradition regional and national culture in Mexico, where more than 200 species of wild edible mushrooms are consumed, and over 100 species are sold in markets. They are less common in urban areas, but are becoming increasingly so due to mushroom festivals designed to introduce the tradition.⁸² These disaccharides are broken into their component monosaccharides during digestion.

⁷⁹ Arens and British Nutrition Foundation, 15; Wilson, *Food Constituents and Oral Health*, 87.

⁸⁰ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 16.

⁸¹ Arens and British Nutrition Foundation, 16.

⁸² Pérez-Moreno et al., "Wild Mushroom Markets in Central Mexico and a Case Study at Ozumba."

Monosaccharides can also be combined into short chains, called oligosaccharides, and are found primarily in legumes such as peas and beans. They are similar to polysaccharides, which are long chains of monosaccharides, such as starches. An example of a food containing starch would be rice or legumes, both of which are considered to have caries-promoting potential and are staples of the Hispanic and Latino diet.⁸³ Another staple in their diet are tortillas, which are associated with lower absorption of minerals, including calcium, which is essential to the mineral structure of teeth.⁸⁴

Bacteria, mainly through the glycolytic pathway, utilize these dietary sugars. Glycolysis produces acid, which lowers the pH in the mouth, increasing the solubility of the enamel and subsequent further demineralization and eventual caries.⁸⁵ There are some sugars, however, that these bacteria cannot utilize, known as sugar alcohols. They include xylitol, sorbitol, and inositol. They are less sweet than sucrose but can be used in place of sugar to make more ‘tooth friendly’ sweets.⁸⁶ A study done in Saudi Arabia

⁸³ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 16–17; Touger-Decker and Van Loveren, “Sugars and Dental Caries”; “Hispanic and Latino Diet.”

⁸⁴ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 22.

⁸⁵ Arens and British Nutrition Foundation, 31; Colby and Russell, “Sugar Metabolism by Mutans Streptococci.”

⁸⁶ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 17.

recorded a significant reduction of plaque in mothers using xylitol gum and in children who had xylitol tablets.⁸⁷

This is due to how *S. mutans* process xylitol. It is transported into the bacteria and forms xylitol-5-phosphate, which cannot be catabolized by the bacteria and therefore inhibits the formation of phosphoenolpyruvate to replace what was used in transporting the xylitol into the bacteria. Over time, xylitol-5-phosphate builds up in within the cell, and no new phosphoenolpyruvate is formed, resulting in the death of the bacteria.⁸⁸ Because few bacteria in dental plaque are capable of processing sorbital, sorbital chewing gum has a similar caries control to xylitol chewing gum, though it is not completely non-acidogenic and non-cariogenic like xylitol.⁸⁹

Additionally, “sugar-free” or alcohol sugar gums have another benefit. They stimulate saliva production. Saliva assists in clearance of sugars and carbohydrates out of the mouth, and raises the pH at the tooth surface when it diffuses into the plaque, stopping the caries process. Assuming no further exposure to sugar, saliva can repair the damage from the bacteria.⁹⁰ This is significant for the older population, who are more

⁸⁷ Alamoudi et al., “Effects of Xylitol on Salivary Mutans Streptococcus, Plaque Level, and Caries Activity in a Group of Saudi Mother-Child Pairs. An 18-Month Clinical Trial.”

⁸⁸ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 38.

⁸⁹ Wilson, *Food Constituents and Oral Health*, 137.

⁹⁰ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 29.

likely to have xerostomia (dry mouth disease), either from pathological changes, pharmaceuticals, or pharmaceutical side effects.⁹¹

The Hispanic diet typically contains more fruits and fewer vegetables than a non-Hispanic diet.⁹² Although these contain sugar, they are unlikely to contribute caries, especially given that chewing fruits and vegetables helps stimulate saliva production, which can act as a buffer. Depending on the fruit, they do, however, have a pH that can cause erosion of the enamel. This is not the same as caries, however, because bacteria do not cause it. Fruit juices are even greater risks of this since they are more concentrated and often have a lower pH. Children's fruit juices can also have a high titratable acidity that makes it difficult for saliva to neutralize them, resulting in longer exposure of enamel to a lower pH.⁹³ Similarly, soda is associated with enamel erosion, but it can also contain fermentable sugars and be a caries risk.⁹⁴

The Hispanic diet within the United States, however, can change due to acculturation. Acculturation is defined as “the process of adapting to the beliefs, values, and behaviors of a new culture.” It is also a significant predictor of drinking patterns in the Hispanic community. Hispanics are less likely to drink at all and have high rates of abstinence from alcohol. Those who do consume alcohol, however, tend to consume a higher volume than non-Hispanic whites. Acculturation is linked to an increased trend in

⁹¹ Curzon and Preston, “Risk Groups.”

⁹² Cataldo and Mitchell, “Hispanic and Latino Diet.”

⁹³ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 40.

⁹⁴ Harding et al., “Dental Erosion in 5-Year-Old Irish School Children and Associated Factors.”

alcohol consumption, particularly for Hispanic women. Research shows mixed results of the effects of acculturation on Hispanic men's drinking patterns. Increased consumption of alcohol is significant in that it contains sugar and results in dehydration, leading to reduced saliva flow.⁹⁵

Furthermore, acculturation can change the way Hispanics within the U.S. snack. Snacking habits are important to caries risk because frequency of exposure to sugars is also associated with increase caries.⁹⁶ A study looking at snacking trends within the United States from 1977-2014, found that all ethnic groups had an increase in per capital calorie intake and Hispanics experienced a 50% increase in intake of desserts and sweets.⁹⁷ Another study showed salads, fresh fruits and vegetables, fruit juice, milk and tortillas have become less popular as eggs, tea, chips, and potatoes become increasingly so within the Hispanic diet.⁹⁸

For example, some parents report that children in the U.S. have greater access to both money and candy, compared to children in their country of origin, making it harder for parents to prevent children's access to cariogenic foods. There are also specific holidays that give children reason to eat candy, such as Christmas, Halloween, and St. Valentine's Day.⁹⁹ Within that same study, one mother attributed her child's caries to putting him to bed with a bottle of milk. She knew this because another dentist told

⁹⁵ Curtis, "Alcohol And Teeth: Three Things To Consider Before You Drink."

⁹⁶ Arens, *Oral Health*, 55.

⁹⁷ Dunford and Popkin, "37 Year Snacking Trends for US Children 1977-2014."

⁹⁸ DNS Retailing Today, "Hispanic Eating Habits in America."

⁹⁹ Cortés et al., "Factors Affecting Children's Oral Health."

her.¹⁰⁰ Caries associated with bedtime or naptime habits that include lying in bed with formula, juice, milk, or any beverage other than water, is called early childhood caries (ECC) or Nursing-Bottle Caries.¹⁰¹

The main aspect of early childhood caries production is prolonged exposure to the sugary liquid. Children with ECC typically have caries on the upper and lower deciduous incisors. It can also, however, be from breast-feeding on demand, especially if the child is with the mother 24/7.¹⁰² ECC causes pain and infection and can result in the early extraction of primary teeth.

The early extraction of primary teeth can result in several problems, including loss of space for the permanent teeth, speech and psychosocial problems, and inadequate function.¹⁰³ A study done including young caregivers from various ethnicities found that the majority of the participants were not aware of the long-term importance of primary teeth, or of the connection between caries in primary teeth and caries in the subsequent permanent teeth. Often, they thought the primary teeth would just fall out and provide a “second chance” for the permanent teeth to be healthy.¹⁰⁴

¹⁰⁰ Cortés et al., 85.

¹⁰¹ Curzon and Preston, “Risk Groups.”

¹⁰² Weerheijm et al., “Prolonged Demand Breast-Feeding and Nursing Caries.”

¹⁰³ California Society of Pediatric Dentists, “The Consequences of Untreated Dental Disease in Children.”

¹⁰⁴ Hilton et al., “Cultural Factors and Children’s Oral Health Care.”

ECC is found more frequently in non-privileged communities, including disadvantaged immigrants.¹⁰⁵ A study using data from the National Health and Nutrition Examination Survey and from the Healthy Eating Index (developed by the U.S. department of agriculture), found that ECC prevalence within groups classified by race/ethnicity was greatest among Mexican-American children and children classified as “other.”¹⁰⁶ Also, ECC is associated with further caries development in both primary and permanent teeth.¹⁰⁷

The prevalence of ECC in underprivileged groups may be linked to the restrictions poverty places on an individual’s and family’s diet. Their choice of foods is related to their ability to purchase said foods. Strong evidence shows that disadvantaged communities consume more cariogenic foods and have eating patterns that may increase dental caries rates¹⁰⁸ Within the United States, 20-25% of those living in poverty are Hispanic.¹⁰⁹

A study involving Latino Parents in the WIC program found that the program was the parents’ main source of information on beverages. Forty-one percent of participants

¹⁰⁵ Johansson et al., “Snacking Habits and Caries in Young Children”; Carvalho et al., “Caries Trends in Brazilian Non-Privileged Preschool Children in 1996 and 2006”; Watt, “From Victim Blaming to Upstream Action”; Reisine et al., “Relationship between Caregiver’s and Child’s Caries Prevalence among Disadvantaged African Americans”; Carvalho, D’Hoore, and Van Nieuwenhuysen, “Caries Decline in the Primary Dentition of Belgian Children over 15 Years.”

¹⁰⁶ Nunn et al., “Healthy Eating Index Is a Predictor of Early Childhood Caries.”

¹⁰⁷ Alm et al., “Prevalence of Approximal Caries in Posterior Teeth in 15-Year-Old Swedish Teenagers in Relation to Their Caries Experience at 3 Years of Age.”

¹⁰⁸ Arens and British Nutrition Foundation, *Oral Health--Diet and Other Factors*, 108–9.

¹⁰⁹ Flores, López, and Radford, “Facts on U.S. Latinos, 2015.”

in the federal nutrition program for Women, Infants, and Children (WIC) are Hispanic. The participants' stance was mixed on 100% fruit juice, but beverages from stores were deemed as unhealthy. Interestingly, participants, despite the added sugar they contain, considered homemade beverages like "agua fresca," healthy. Therefore more counseling, that addresses homemade beverages, and avoids mixed messages, such as providing juice while discouraging drinking it, should be provided.¹¹⁰

While not directly linked to greater caries risk, diabetes is closely linked to diet and some of its side effects are linked to caries risk. Forty-two point five percent of Latino adults ages 20 and above are obese and 22.4% of Latino children are classified as obese. These rates are even higher, with 77.9% of adults and 38.9% of children, if you include those classified as overweight.¹¹¹ By the age of 70, more than half of Hispanic women and about 44.3% of Hispanic men will have developed diabetes.¹¹² This trend is significant in that people with diabetes have a greater risk of developing gingivitis and periodontal disease. The latter can lead to recession of the gingival margin, exposing more tooth surface to potential caries.¹¹³ Several studies support the hypothesis that obese patients have a higher incidence of dental disease. Those involving children,

¹¹⁰ Beck et al., "Understanding How Latino Parents Choose Beverages to Serve to Infants and Toddlers."

¹¹¹ "Special Report Racial and Ethnic Disparities in Obesity."

¹¹² Drive, Arlington, and 1-800-Diabetes, "Diabetes Among Hispanics."

¹¹³ Fejerskov and Kidd, *Dental Caries*; Grossi, "Treatment of Periodontal Disease and Control of Diabetes"; Novak et al., "Periodontal Disease in Hispanic Americans with Type 2 Diabetes."

however, were uncertain and only one of the studies involved data from participants in the U.S, the majority of which are non-Hispanic whites.¹¹⁴

In conclusion, there are several dietary factors that can have a negative or positive effect on the oral health of the Hispanic population within the U.S., including traditional food choices as well as ones from acculturation. A prevalent medical condition in Hispanic populations, diabetes, is closely linked to diet and its side effect can contribute to the caries disease process.

¹¹⁴ Al-Zahrani, Bissada, and Borawskit, “Obesity and Periodontal Disease in Young, Middle-Aged, and Older Adults.”

CHAPTER FOUR

Barriers to Access to Dental Care for Hispanics in the U.S.

The fourth contributing condition listed on the American Dental Association's (ADA) Caries Risk Assessment Form is Dental Home.¹¹⁵ In this chapter, I will explore the available literature on Hispanic Culture and barriers to the Dental Home, defined as "the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way."¹¹⁶ I will do this by looking at trends and studies involving barriers to access to care, including financial, experiential, transportation, and language.

Many caregivers, including Hispanic caregivers, do not always recognize visible signs of caries among children. A study involving Mexican-Americans in California's agriculture central valley found that they also do not respond quickly to signs of caries unless children also complained of pain.¹¹⁷ A different study involving Mexican immigrants found that sometimes, even with complaints of pain, caregivers thought the "stains" visible on the surface of the teeth were from fluorosis and needed a cleaning rather than treatment. Often, this would result in them delaying treatment.¹¹⁸

¹¹⁵ "ADA Caries Risk Assessment Form."

¹¹⁶ Council on Clinical Affairs, *Reference Material*.

¹¹⁷ Barker and Horton, "An Ethnographic Study of Latino Preschool Children's Oral Health in Rural California."

¹¹⁸ Horton and Barker, "Rural Mexican Immigrant Parents' Interpretation of Children's Dental Symptoms and Decisions to Seek Treatment."

This is interesting given that general health care for children is accepted as a priority. Some caregivers in a study involving cultural factors and children's oral health found that dental care was believed to be separate from general health care and should only be utilized when there is an obvious oral health problem. Many did not express the importance of preventive dental visits, like well-child visits.¹¹⁹ This could be in part why Hispanic children have the highest likelihood of never seeing a dentist. Even when they have insurance, Hispanics will have longer intervals between seeing dentists.¹²⁰

Many, however, do not have access to care due to the financial cost or a lack of dental insurance. This is especially true among low-income populations and some racial and ethnic minorities. Approximately 40% of people living in poverty did not have dental insurance in 2008. Living in poverty is here defined as a family of four with an income at or below \$21,200. Data from that same year's report by the agency for healthcare research and quality showed that about a quarter of Hispanics had at least one dental visit that year.¹²¹

Additionally, there are barriers for receiving public health insurance, such as fluctuating seasonal eligibility.¹²² Many dentists do not accept public insurance or provide charity care, making it even more difficult for those who are not able to obtain it.

¹¹⁹ Hilton et al., "Cultural Factors and Children's Oral Health Care."

¹²⁰ Agency for Healthcare Research and Quality, "National Healthcare Disparities Report"; Flores and Tomany-Korman, "Racial and Ethnic Disparities in Medical and Dental Health, Access to Care, and Use of Services in US Children"; Pourat and Finocchio, "Racial And Ethnic Disparities In Dental Care For Publicly Insured Children."

¹²¹ Felland, Lauer, and Cunningham, "Community Efforts to Expand Dental Services For Low-Income People."

¹²² Barker and Horton, "An Ethnographic Study of Latino Preschool Children's Oral Health in Rural California."

State Medicaid and SCHIP programs then play a significant role in helping underprivileged groups gain access to dental care.

These, however, are usually targeted more to children, as in the case of Medicaid, and dental coverage for children under SCHIP and adults with Medicaid is optional and therefore differs by state. Often, the only coverage for adults is for emergency treatment, usually resulting in extraction, rather than restoration of the tooth. Many low-income people may also wait to treat a tooth until it is infected or there is another urgent condition that also results in emergency treatment.¹²³

Additionally, often times, Medicaid has low reimbursement rates. Many providers choose not to participate in accepting Medicaid because of this and will also choose to work in an area where they know there are patients with private insurance. A study involving migrant workers in Florida analyzed these phenomena and labeled the insurance promises as a “false hope.” Many of the workers and their family members in Florida are eligible for Medicaid, which promises that they can receive dental services, but there are not adequate resources to receive those services.¹²⁴ Thus, even if the number of dentists within an area increases, it is unlikely to really improve vulnerable groups access to dental care.¹²⁵ Additionally, some migrants feel that they and their

¹²³ Felland, Lauer, and Cunningham, “Community Efforts to Expand Dental Services For Low-Income People.”

¹²⁴ Castañeda et al., “False Hope.”

¹²⁵ Felland, Lauer, and Cunningham, “Community Efforts to Expand Dental Services For Low-Income People.”

children are discriminated against by their inability to receive health insurance, and the selectivity of allocating coverage due to lack of citizenship.¹²⁶

Those who are unable to be treated by a private-practice dentist due to lack of insurance or cost often turn to the safety net.¹²⁷ It is defined as “providers, payment programs and facilities that provide clinical, nonclinical and support services.” Safety nets, therefore, include community health clinics, academic dental institutions, and programs such as Medicaid.¹²⁸

The dental safety net, however, is not as extensive as the medical one. Not all facilities within it offer dental care, let alone extensive dental services, and dental care has not traditionally been a focus of general safety net providers.¹²⁹ Also, the number of safety net clinics is insufficient for the number of patients that need care.¹³⁰ Therefore, in addition the limited services they can provide, they also can only provide help to a limited number of people.¹³¹

Thus, many low-income people will seek care from Hospital emergency departments (EDs). The Emergency Medical Treatment and Labor Act requires that ED

¹²⁶ Cortés et al., “Factors Affecting Children’s Oral Health.”

¹²⁷ “Disparities in Regular Source of Dental Care among Mothers of Medicaid-Enrolled Preschool Children.”

¹²⁸ “ADEA.”

¹²⁹ Felland, Lauer, and Cunningham, “Community Efforts to Expand Dental Services For Low-Income People.”

¹³⁰ Milgrom and Riedy, “Survey of Medicaid Child Dental Services in Washington State”; Capilouto, “The Dentist’s Role in Access to Dental Care by Medicaid Recipients.”

¹³¹ Felland, Lauer, and Cunningham, “Community Efforts to Expand Dental Services For Low-Income People.”

staff screen and stabilize all patients. This includes those seeking emergency dental care, despite most EDs not having staff or equipment to provide dental care. They are then often limited to prescribing antibiotics or painkillers and referring the patient to a dentist.¹³²

A study involving mothers of Medicaid enrolled preschool children in Washington State examined the access and utilization of dental services of those mothers. Approximately 54% of Hispanic mothers reported that their regular place for dental care was a community health center, farmworker clinic, or local health department. This was a significantly greater number compared to that of the other racial/ethnic groups in the study.¹³³

Additionally, across all groups, less than half of the mothers see the same dentist, and even less have seen that dentist for more than one year. They do not have a dental home, a dental practice where they have a patient-provider relationship with their dentist and receive comprehensive and family-centered care, including information about how to care for their children's oral health.¹³⁴ Access to care is especially important for mothers, as they are the main source of vertical transmission of carious bacteria and their oral health behaviors and attitudes towards it are associated with their children's dental

¹³² Felland, Lauer, and Cunningham.

¹³³ Grembowski, Spiekerman, and Milgrom, "Disparities in Regular Source of Dental Care among Mothers of Medicaid-Enrolled Preschool Children."

¹³⁴ Grembowski, Spiekerman, and Milgrom.

health.¹³⁵ There is a “policy paradox” within the way the health system works. Low-income mothers are unable to receive dental insurance through Medicaid for care beyond 60 days post-partum, even though they are the primary source of caries infection for their children.¹³⁶

They qualify for Medicaid if they are pregnant and their family income is 133% or less of the federal poverty level (though this percentage differs by state). Another study involving low-income Hispanic women at the California-Mexico border had 93% of its participants with untreated caries.¹³⁷ They concluded that a great need for treatment during pregnancy and post-partum exists in the underserved population, and that women may not be able to recognize their treatment needs or even act on them. However, depending on the insurance program, they are no longer covered 60 days after they have had the baby, when it would be important to teach them about early oral hygiene and when they should bring their child in for their first dental visit and to have a dental home.¹³⁸

Lack of a dental home and lack of continual dental care can become a negative cycle due to dental fear. Caries and dental pain are associated with dental fear, because prevalence of dental fear is associated with children who have never been seen by a

¹³⁵ Skeie et al., “Caries Increment in Children Aged 3-5 Years in Relation to Parents’ Dental Attitudes”; Wigen and Wang, “Caries and Background Factors in Norwegian and Immigrant 5-Year-Old Children.”

¹³⁶ 22 and 2017, “Medicaid’s Role for Women.”

¹³⁷ Weintraub et al., “Clinically Determined and Self-Reported Dental Status during and after Pregnancy among Low-Income Hispanic Women.”

¹³⁸ 22 and 2017, “Medicaid’s Role for Women.”

dentist or have frequently experienced dental pain.¹³⁹ It can also, however, be linked to previous history of dental treatment.¹⁴⁰ It may also be learned from their parents.¹⁴¹ Tuuti and Lahti's study found that children from anxious mothers were more likely to have untreated caries.¹⁴² This is logical given that if a parent had a bad experience, they may fear that their child will also have a bad experience or may have inadvertently inspired dental fear in their child from sharing about their experiences.

Children with dental fear or anxiety are less likely to visit the dentist and may have behavioral problems that are adverse to their oral health. Their anxiety can also persist into adulthood, no matter the age at which it began, and the age of onset of dental anxiety can influence adulthood.¹⁴³ From there the cycle can continue if they pass the fear or anxiety to their own children.

¹³⁹ Torriani et al., "Dental Caries Is Associated with Dental Fear in Childhood."

¹⁴⁰ Ten Berge, Veerkamp, and Hoogstraten, "The Etiology of Childhood Dental Fear"; Nuttall, Gilbert, and Morris, "Children's Dental Anxiety in the United Kingdom in 2003"; Tickle et al., "A Prospective Study of Dental Anxiety in a Cohort of Children Followed from 5 to 9 Years of Age"; Carrillo-Díaz et al., "The Moderating Role of Dental Expectancies on the Relationship between Cognitive Vulnerability and Dental Fear in Children and Adolescents"; Carrillo-Díaz et al., "Treatment Experience, Frequency of Dental Visits, and Children's Dental Fear"; Crego et al., "Applying the Cognitive Vulnerability Model to the Analysis of Cognitive and Family Influences on Children's Dental Fear."

¹⁴¹ Goettems et al., "Influence of Maternal Dental Anxiety on the Child's Dental Caries Experience."

¹⁴² Tuutti and Lahti, "Oral Health Status of Children in Relation to the Dental Anxiety of Their Parents."

¹⁴³ Ten Berge, Veerkamp, and Hoogstraten, "The Etiology of Childhood Dental Fear"; Tickle et al., "A Prospective Study of Dental Anxiety in a Cohort of Children Followed from 5 to 9 Years of Age"; Thomson et al., "Trajectories of Dental Anxiety in a Birth Cohort."

Additional barriers, however, also exist outside of the financial barrier and fear or anxiety. These include distance of dental practices from their residences, limited means of transportation, maybe because another family member drives them or they use public transportation, if it is available, which has its own additional challenges.¹⁴⁴ Additionally, the availability and scheduling of appointments and conflict with work schedules are barriers to access to care.¹⁴⁵ Most dental practices have the traditional office hours of 9am to 5pm. That means that in order to bring themselves and their children to the dentist, they will have to miss work and school.

Also, missing a day of work will mean missing a day's wages in addition to paying for the dental care.¹⁴⁶ For those with multiple children, they may have scheduled for multiple days, and if they do not have childcare, they may bring all of their children to each dental visit.¹⁴⁷ These multiple visits and subsequent missed days of work may even result in the loss of their jobs.¹⁴⁸ Therefore, even if there is free dental care available, as

¹⁴⁴ Maupome, Aguirre-Zero, and Westerhold, "Qualitative Description of Dental Hygiene Practices within Oral Health and Dental Care Perspectives of Mexican-American Adults and Teenagers"; Maupome, Aguirre-Zero, and Westerhold; Barker and Horton, "An Ethnographic Study of Latino Preschool Children's Oral Health in Rural California"; Cortés et al., "Factors Affecting Children's Oral Health."

¹⁴⁵ Maupome, Aguirre-Zero, and Westerhold, "Qualitative Description of Dental Hygiene Practices within Oral Health and Dental Care Perspectives of Mexican-American Adults and Teenagers"; Cortés et al., "Factors Affecting Children's Oral Health."

¹⁴⁶ Castañeda et al., "False Hope"; Barker and Horton, "An Ethnographic Study of Latino Preschool Children's Oral Health in Rural California."

¹⁴⁷ Cortés et al., "Factors Affecting Children's Oral Health."

¹⁴⁸ Barker and Horton, "An Ethnographic Study of Latino Preschool Children's Oral Health in Rural California."

in a study in New England, the dental care may be underutilized due to these other barriers to access care.¹⁴⁹

Moreover, a large obstacle to care is the language barrier. Within the United States, healthcare is geared towards English-speakers.¹⁵⁰ Several studies involving preventive health services showed a decreased use of those services in Latinos with limited proficiency in English.¹⁵¹ It may also be a barrier to access to health education and primary prevention, as well as an issue in practicing cultural competency in health care.¹⁵² This inability to communicate directly can be a hindrance to the relationship between provider and patient, which is part of having a “dental home.”¹⁵³

Therefore, translators are beneficial, but only if they are trained in the proper terminology and the conversation is still between the dentist and the patient, to foster the patient-dentist relationship, with the interpreter as a mediator. Interpreters that are not trained or utilized properly are not beneficial, and can even be harmful. For example, if

¹⁴⁹ Maserejian et al., “Underutilization of Dental Care When It Is Freely Available.”

¹⁵⁰ Chang and Fortier, “Language Barriers to Health Care”; Flores, “Culture and the Patient-Physician Relationship”; Hampers et al., “Language Barriers and Resource Utilization in a Pediatric Emergency Department”; Tocher and Larson, “Do Physicians Spend More Time with Non-English-Speaking Patients?”

¹⁵¹ Sherraden and Barrera, “Prenatal Care Experiences and Birth Weight among Mexican Immigrant Women”; Solis et al., “Acculturation, Access to Care, and Use of Preventive Services by Hispanics”; Stein and Fox, “Language Preference as an Indicator of Mammography Use among Hispanic Women.”

¹⁵² Fox et al., “A Trial to Increase Mammography Utilization among Los Angeles Hispanic Women”; Torres, “The Pervading Role of Language on Health.”

¹⁵³ Woloshin et al., “Language Barriers in Medicine in the United States”; Lee et al., “Does a Physician-Patient Language Difference Increase the Probability of Hospital Admission?”

they do not communicate everything that the doctor said, they may leave out an important component that the doctor is not aware that the patient is missing.¹⁵⁴

Clinics and practices that are not staffed with doctors and staff who can speak Spanish and are trained in medical terminology often use family members or personnel from other departments who may not be trained. These strategies have their own drawbacks, including ethical breaches and inaccuracy.¹⁵⁵ A study found, however, that if clinics and practices hire professional interpreters or bilingual physicians, of whom there is a scarcity in the U.S., there is no significant difference in quality of care provided to English-speaking or Spanish-speaking Hispanics¹⁵⁶

Thus, there is a growing need for bilingual healthcare providers. Latinos are more likely to be bilingual than Caucasian Americans, but they are underrepresented in health occupations. For example, only 5.4% of physicians in 1989 were Latino.¹⁵⁷ A sample of currently licensed dentists within the U.S. in 2013, from the American Dental Association, identified 12,983 underrepresented minority dentists, of which 5,926

¹⁵⁴ “Nutritional Health and Nutrition Examination Survey (NHANES): Interpretation Guidelines.”

¹⁵⁵ Tang, “Interpreter Services in Healthcare. Policy Recommendations for Healthcare Agencies”; Perkins and National Health Law Program, “Ensuring Linguistic Access in Health Care Settings: Legal Rights and Responsibilities.”; Torres, “The Pervading Role of Language on Health.”

¹⁵⁶ Enguidanos and Rosen, “Language as a Factor Affecting Follow-up Compliance from the Emergency Department”; Chang and Fortier, “Language Barriers to Health Care”; Hornberger, Itakura, and Wilson, “Bridging Language and Cultural Barriers between Physicians and Patients.”

¹⁵⁷ Ginzberg, “Access to Health Care for Hispanics.”

(45.6%) were Hispanic or Latino.¹⁵⁸ One way, then, to improve cultural competency, and therefore also dental homes through improved provider-patient relationships, would be to have more Latino and bilingual dentists. Children with a dental home are more likely to receive routine oral health care and appropriate preventive care and treatment.¹⁵⁹

Access to dental care and prevention of caries is so important because, though rare in the United States, a person can die from a tooth infection. There have been two high-profile cases, one from 2007 and one from 2009.¹⁶⁰ The incident in 2007 involved a 12-year-old boy from Maryland, named Deamonte. Deamonte had a toothache, but his family was unable to afford to pay for a dental visit. His tooth abscessed and he went through two costly surgeries and a week at the hospital, but they were too late.¹⁶¹ Deamonte later died when the infection spread to his brain.¹⁶²

Similarly, Kyle Willis, a 24-year-old from Ohio died when one of his wisdom teeth became infected and he could not afford both the antibiotics required to treat it. He was uninsured. Kyle Willis later died when the infection spread to his brain and caused lethal swelling.¹⁶³ Both of these deaths are due to a preventable and treatable disease and show a failing within the U.S. healthcare system, especially regarding

¹⁵⁸ Mertz et al., “The Hispanic and Latino Dentist Workforce in the United State.”

¹⁵⁹ American Academy of Pediatric Dentistry, “Policy on the Dental Home.”

¹⁶⁰ “Tragic Results When Dental Care Is Out Of Reach.”

¹⁶¹ News, “Toothache Leads to Boy’s Death.”

¹⁶² Otto, “For Want of a Dentist.”

¹⁶³ “Uninsured Man Dies from Tooth Infection.”

preventive oral health care, that needs to be addressed.¹⁶⁴

In conclusion, Hispanics within the U.S. face many barriers to access to care and a dental home. These obstacles to care include finances, access to insurance, dental anxiety or fear, transportation issues, and language divide. These barriers prevent formation of a dental home, resulting in less preventive care and treatment. They are major reasons why, according to the CDC, Hispanics in the U.S. have the highest rate of caries, a preventable and treatable disease, from which complications can result in major medical expenses and even death. For Hispanic patients, the above factors and those of each risk assessment category are affected by their traditions and beliefs. Given the importance of preventive dental care, it is necessary to consider the cultural background of a patient to improve their caries risk assessment and the approach to their care.

¹⁶⁴ Reinhardt, Hussey, and Anderson, “U.S. Health Care Spending in an International Context.”

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