

**TOOTH BRUSHING HABIT FORMATION IN CHILDREN OF MEXICAN
IMMIGRANT FAMILIES IN PENNSYLVANIA, U.S.: A QUALITATIVE STUDY**

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ABSTRACT

Oral diseases can greatly impact people's life. Latinos in the U.S. have higher risk of developing caries and gingivitis than non-Hispanic whites. These diseases can be prevented by implementing oral hygiene behaviors such as tooth brushing. For this behavior to be effective, it has to evolve into a habit. Few studies have addressed tooth brushing habit formation in children, and only one of them was targeted to the Latinos. **OBJECTIVES:** The purpose of this study is to: 1)describe efforts Mexican immigrants parents make to teach their children to brush their teeth, and 2)identify habit formation components. **METHODS:** This exploratory qualitative study included twenty in-depth interviews with Mexican immigrant parents. Participants were recruited in different Latino venues in Pittsburgh, PA and Philadelphia PA. The investigator conducted the interviews, which were recorded, transcribed verbatim and coded. Standard qualitative thematic analyses were performed. NVivo 10 software was used to aid the coding process. **RESULTS:** Parents experiences while teaching their children to brush their teeth were organized in four tooth brushing stages: entirely dependent tooth brushing, assisted tooth brushing, road to tooth brushing independence, and independent tooth brushing. Intention, attitudes, contextual cues, and motivation appeared to have great importance in children's tooth brushing learning process. Parental knowledge and sources of information available affected the initiation of tooth brushing. Tooth brushing was defined as a social and familial event or as an individual event. Consistent tooth brushing routines facilitated the compliance of the behavior.

CONCLUSION: Parents' efforts to teach their children to brush their teeth were reflected in their involvement in the development of daily tooth brushing routines. Consistency in their routines and attitudes affected the emotional tone of tooth brushing sessions. From participants' experiences we developed the hypothesis that there are four stages in the tooth brushing learning process that follow a progressive pattern throughout the growth of a child and ends with a tooth brushing habit. This information is relevant to public health as it can help diminish health inequalities. Future quantitative research studies should be conducted to evaluate tooth brushing habit formation in larger groups of Latinos.

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1.0 INTRODUCTION

Quality of life and overall health can be greatly influenced by changes in oral health. Oral diseases such as caries and gingivitis can produce discomfort, pain and also affect people's social life. These diseases' prevalence has been shown to be highly correlated to socioeconomic status and education (American Academy of Periodontology, 2005; CDC & NCCDPHP, 2010; Dye et al., 2007). Studies have shown that in the U.S., compared to the White non-Hispanic population, the Latino population has a higher risk of developing caries and of having untreated caries and gingivitis (Albandar & Kingman, 1999; CDC & NCCDPHP, 2010). These diseases can be somewhat prevented by implementing oral hygiene behaviors such as tooth brushing. Dentists recommend starting to brush children's teeth when primary teeth commence erupting. For this behavior to be effective it is necessary that it evolve into a habit. Existing literature points to the importance of automaticity, contextual cues, social norms, and knowledge of habit formation. Other factors such as repetition frequency have had a more controversial association to it.

There has been little research done to understand the process by which parents are able to successfully develop a tooth brushing habit in their children. None of the existing studies evaluated the different components of habit formation in Latino children. Considering the higher risk of the Latino population to oral diseases, a qualitative research study was designed to identify the main components of habitual behavior, as well as other tooth brushing practices in Latino children. The results of this study provide insight into parents' experiences when introducing tooth brushing to their children. Tooth brushing habit components, barriers, and motivators were also identified for this behavior. The knowledge gained with this study will help

design new interventions aimed at strengthening habit components and motivators and diminishing barriers. Throughout this document we will use the term Mexican immigrant to refer to the non-U.S. born Mexicans. In some cases we will use the terms Mexican American or Mexican to describe the results found in the literature by other authors. In these cases we will use the same term they use in their manuscripts.

In Chapter 2 of this dissertation, I will provide a background on the epidemiology of oral diseases and the etiology and prevalence of gingivitis which is the most commonly seen gum disease in children. I will also explain the psychological and social impact of oral diseases as well as identify the sociocultural determinants of oral health. Then I will focus on oral disease prevention, specifically on tooth brushing and the formation of habits. In Chapter 3, I describe a research study of the efforts Mexican immigrant parents make when teaching their children to brush their teeth, as well as the different tooth brushing habit components. Chapter 4 contains the methods used to achieve these aims. In Chapter 5 I show the results obtained which are later discussed in the Chapter 6 and 7.

2.0 BACKGROUND

2.1 EPIDEMIOLOGY OF ORAL DISEASES

The mouth and its components serve various functions within our body. They participate in the nutrition process, communication throughout expression, and talking. Diseases affecting the mouth can spread to other body cavities affecting the person's wellbeing.

In spite of being largely preventable, oral health diseases continue to have a high prevalence. These diseases range from dental cavities to oral cancer, causing pain and disabilities to millions of Americans each year (CDC & NCCDPHP, 2010). The two most prevalent dental diseases are caries and periodontal disease. These diseases are very common and widespread, affecting nearly everyone at some point in the life span (U.S. Department of Health and Human Services, 2000). Both of these diseases' etiological processes are related to dental plaque accumulation. Therefore to prevent them, improvement in oral hygiene must be pursued.

2.1.1 Dental caries

Dental caries is an infectious disease. The main etiological factors are fermentable carbohydrates, cariogenic microorganisms, and susceptible tooth surface. All three of these components must be simultaneously present for the initiation and progress of the disease.

The teeth destruction mechanism is defined by the bacteria in the dental plaque. These microorganisms metabolize sugars and starches to produce acids that lower the intraoral pH and promote mineral loss in tooth surfaces. This process is compensated by the deposit on tooth surfaces of other mineral present in the saliva such as calcium and phosphate ions. If this dynamic process of demineralization and remineralization is kept, the tooth surface will remain intact. On the other hand, if the pH drop is prolonged, the frequent loss of minerals will weaken and eventually break down the tooth surface (Gussy et al., 2006). Conditions such as excess plaque, inadequate saliva flow, or intake of acidic foods can favor the demineralization process and therefore the development of caries.

2.1.2 Epidemiology of dental caries

Dental caries is the major oral health problem in most industrialized countries, affecting 60-90% of the schoolchildren and most adults worldwide (World Health Organization, 2007). In most African countries dental caries prevalence is less common and less severe; this is mainly attributable to dietary patterns. Nevertheless, in light of new living conditions that are related to growing sugar consumption and inadequate exposure to fluorides, this prevalence is expected to change dramatically in the upcoming years (World Health Organization, 2011). In the U.S., tooth decay is four times more common than asthma and seven times more common than hay fever (Center For Disease Control and Prevention, 2005).

2.1.3 Dental caries prevalence in children

Among children, dental caries prevalence has decreased significantly since the 1970s; however it still is the most prevalent chronic disease of childhood (Dye et al., 2007). In the U.S. tooth decay affects more than one-fourth of children aged two to five and half of those aged twelve to fifteen (CDC & NCCDPHP, 2010); over fifty percent (51.6%) of five to nine year-old children have at least one cavity or filling, and this proportion increases to 77.9% among seventeen year-olds, and to 84.7% for adults eighteen or older (U.S. Department of Health and Human Services, 2000). Even more, approximately 23% of children aged two to eleven year-old have untreated dental caries.

Children from lower income groups are more likely to suffer from these problems. In this group, nearly 50% of all children and two-thirds of children aged twelve to nineteen have had caries (CDC & NCCDPHP, 2010). The mean score for decayed and filled teeth in primary dentition are higher and may peak earlier in children living in households less than 100% Federal Poverty Line (FPL) compared to children living in households greater than or equal to 200% FPL. This high prevalence reflects the impact that lack of education and lower income have on oral health. Increased prevalence of untreated dental caries and severe dental caries in children's primary dentition can be observed in both poor and non-poor groups (Dye et al., 2007). Also related to caries prevalence is dental services utilization. Edelstein et al. (2009) showed in their study that disparities in oral health access to dental care remained strong from 1996 to 2004. Despite the positive impact in coverage and utilization of the State Children's Health Insurance Program (SCHIP), still 30.8% of poor children attended at least one dental visit in 2004 compared to 61.8% of high income children.

Children in some racial and ethnic groups experience high proportions of untreated dental cavities. Between the years of 1998-1994 to 1999-2004 the prevalence of untreated permanent tooth decay has remained nearly unchanged for all youth groups (23%), except non-Hispanic black youth for whom prevalence significantly decreased by 4.5% (Dye et al., 2007). This percentages contrast dramatically with those of other ethnic groups. For example, nearly 40% of Mexican American children aged six to eight have untreated decayed teeth, compared to 25% of non-Hispanic whites (CDC & NCCDPHP, 2010) which reflect the differences in overall health status and access to care between groups. In a recent study, Pourat and Finocchio (2010) evaluated racial and ethnic disparities in dental visits among children on Medicaid, SCHIP, and private insurance. They concluded that racial/ ethnic differences in “time since last visit to the dentist” exist, especially within Medicaid, to the detriment of Latino and African American children. The authors state that these disparities could be attributable to systemic barriers to dental care, such as ethnic or racial differences between dentists and patients, and difficulty in making and keeping appointments. One aspect that is not mentioned in the article is the impact of cultural beliefs on oral health. Even though there is only limited literature on health-related cultural beliefs of Latinos and African Americans and their influence on oral health, it is still an aspect that must be considered when designing new health strategies and therefore should be further studied.

2.1.4 Dental caries prevalence in adults

In this increasingly aging society, the need to keep teeth healthy has become extremely important to maintain a good quality of life in later years. Among adults, dental caries remains the most prevalent disease (Petersen et al., 2005) with 85% of adults aged eighteen and older affected

(U.S. Department of Health and Human Services, 2000). Nearly 21% of people twenty years and older have untreated dental caries, and among people aged twenty to sixty-four years, 26.6% of males had untreated dental caries compared to 19.9% of females (National Center for Health Statistics, 2011). Even though edentulism (absence of teeth) has declined over the years, nearly 23% of those aged sixty-five and older had lost all their teeth in 2005-2008 (National Center for Health Statistics, 2011).

In the last two decades a diminishing trend of dental caries and improvement of gingival health has been observed. Nonetheless this trend is not reflected on people's perception of good oral health. The prevalence of adults stating their teeth and mouth being in "excellent or very good" condition has significantly declined from 30% to 26%, reflecting a diminishing perception of good oral health (Dye et al., 2007). This change in perception could be attributed to an increase in people's awareness of their oral health, or changes in their appearance self-perception, among other reasons.

The proportion of teeth affected with caries varies by race or ethnic origin. Most of the published studies differentiate between Black or African American, non-Hispanic Whites, and Hispanic/ Latinos. In these studies, the Hispanic/ Latino group consists mainly of Mexican Americans, which makes it difficult to compare with other ethnic groups of Latino origin (Dye et al., 2007; U.S. Department of Health and Human Services, 2000). A recent report of the National Center for Health Statistics (2012) showed that Black or African American people aged between 20 and 64 years have the largest percentage of untreated dental caries (39.7%), followed by Mexican (35.2%), and non-Hispanic Whites (19.3%). Furthermore, when income level is considered, 52.7% of Black or African American people below 100% FPL had untreated dental caries, compared to 43.8% of Mexicans and 39.8% of non-Hispanic Whites. Overall, 41.9% of people below 100% FPL and that are aged between 20 and 64 years have untreated dental caries.

The striking higher prevalence of dental caries on Black and Hispanic groups has been related to higher risk factors on this population. Lower income, lack of education, social environment, and cultural beliefs affect peoples' oral health and willingness to seek care (Davidson & Andersen, 1997; Finlayson, Gansky, Shain, & Weintraub, 2010; Patrick et al., 2006).

The undocumented status of immigrants has also shown to be related to the use of healthcare services (Berk et al., 2000; Goldman et al., 2006; Pourat et al., 2014; Rodríguez et al., 2009). Vargas et al. (2012) used data from the 2007 California Health Interview Survey to analyze differences in healthcare access and utilization among Mexican immigrants by documentation status. Their results showed that undocumented immigrants from Mexico are 27% less likely to have a doctor visit in the previous year and 35% less likely to have usual source of care compared to documented Mexican immigrants. Rodriguez et al. (2009) used cross-sectional data from the 2007 Pew Hispanic Center/ Robert Wood Johnson Foundation Hispanic Healthcare survey (wave 1) to evaluate the relationship between immigration status and different health care services. They found that undocumented Latinos were less likely to have had preventive services such as blood pressure check in the previous 2 years (OR=0.60; 95% CI, 0.43-0.84), cholesterol check in the past 5 years (OR=0.62; 95% CI, 0.39-0.99). These studies showed that immigration status does affect the use of health care services.

2.2 GINGIVITIS

Gingivitis is the mildest form of periodontal disease. The most common type of gingivitis is called *plaque-induced gingivitis* and is caused by poor oral hygiene. This type of gingivitis is defined as inflammation of the gingiva in the absence of clinical attachment loss. Clinical

attachment loss is a measure that represents the amount of periodontal ligament fibers that have been lost (American Academy of Periodontology, 2000).

2.2.1 Etiology

Numerous studies have recorded the relationship between plaque deposits and gingivitis (Loe et al., 1965; Lovegrove, 2004; Marsh, 1994). Bacteria are normally present in teeth and gingiva, and are kept in a dynamic equilibrium with the innate host defense system. When this balance is disrupted, because of regular sugar consumption, or drop in pH levels, new species of bacteria begin to colonize intraoral tissues leading to homeostasis breakdown and local inflammation (Darveau & Tanner, 1997; Marsh, 1994). If not treated, the inflammatory response from the host will lead to an increase in the sulcus gingival fluid and consequently changes in the subgingival plaque composition. An increase in the obligated anaerobic bacteria can result in a destructive inflammatory response that may cause destruction of the periodontal attachment and pocket formation. Therefore, if changes in the oral environment lead to the acquisition of certain bacterial species that break down the host defense system, gingivitis could advance to periodontitis (Marsh, 1994). Not all gingivitis lesions progress to periodontitis, although it is agreed that all established periodontitis lesions are preceded by gingivitis (Lang, Schätzle, & Löe, 2009).

The influence of long-standing gingival inflammation on periodontal attachment loss was further studied by Schatzle (2003). In a twenty-six year longitudinal study he was able to determine that sites that consistently bled on probing had a 3.22 higher odds of converting to attachment loss, compared with non-inflamed sites. Also, subgingival calculus formation appeared to have an increased odds ratio (OR) for converting to attachment loss on sites that bled

on probing compared to sites that were healthy (OR= 4.22 versus OR=1.31). In other words, sites that showed high levels of inflammation and bled on probing had a significant higher risk for attachment loss than sites with slight inflammation and when compared to always healthy sites.

Gingivitis can also be found as a result of a lesion. In this case gingivitis will be classified as *non-plaque induced gingival lesion*. As its name states, this type of gingivitis is not caused by bacterial plaque, and therefore does not disappear once plaque is removed. However, the severity of the clinical manifestations is determined by the amount of dental plaque present (Caton et al., 1999; Holmstrup, 1999).

Clinically gingivitis is characterized by the following signs and symptoms (Lang et al., 2009):

- An early sign of gingivitis is the passage of gingival fluid to the sulcus.
- Redness of the gingival margin: because of aggregation and enlargement of blood vessels.
- Swelling and loss of texture of free gingiva: because of loss of fibrous connective tissue and the semi liquidity of the interfibrillar substance.
- Usually is painless.
- Rarely spontaneous bleeding can be observed.

2.2.2 Prevalence

Worldwide, the most prevalent periodontal signs are gingival bleeding and presence of calculus (CPI score 2), reflecting a poor global oral hygiene condition (Petersen & Ogawa, 2005). National surveys in the U.S. have shown different gingivitis prevalence; the Health Resources and Services Administration (HRSA) showed a prevalence of 50% of gingivitis in adults eighteen

years and older, whereas the National Institute of Dental Research (NIDR) found a gingivitis prevalence of 44% in employees aged eighteen to sixty-four, and the National Health and Nutrition Evaluation Surveys (NHANES III) found 63% gingivitis prevalence (Oliver, Brown, & Løe, 1998). Even though the prevalence is high in all three national surveys, there has been a diminishing prevalence trend over the last twenty-five years. The U.S. national survey of 1960-1962 showed a prevalence of gingivitis of 85% for adult men and 79% for adult women (American Academy of Periodontology, 2005). Over the years many discoveries related to the etiology and association of periodontal health with other systemic diseases have changed the approach towards gingival health prevention, which might be associated with the diminishing trend of gingivitis prevalence.

In children, the most common type of gingivitis is *chronic gingivitis*. This type of disease characterizes for redness of the gingival margin, swelling, loss of texture, and bleeding. If a tooth brushing and flossing routine is established and regular dental care is provided it can be preventable and treated if needed (American Academy of Periodontology, 2013). Most of the published literature focuses on gingival disease on adults; only a few analyze this problem in children and fewer in the Latino population. National surveys in the United States have shown a prevalence of gingivitis among school children that ranges from 40% to 60% (American Academy of Periodontology, 2005). Two studies conducted in Latin American countries showed similar gingivitis prevalence in children. Aranza et al. (2011) conducted a cross-sectional study in 77 preschool children in Mexico City to evaluate the prevalence of gingivitis. The results of this study showed a prevalence of 39% in four and five year-old children, which was higher than expected. Similarly, in Chile gingivitis prevalence ranged from 32.6% in two year-old children, to 45% in four year-olds, and 55.1% in six year-olds in the first decade of the year 2000 (Ministerio de Salud de Chile, 2013).

As stated by the American Academy of Periodontology (2005), there is a clear relationship between gingivitis and a lower S.E.S. This relationship is likely to be mediated by a function of better oral hygiene among better educated individuals, more positive attitudes toward oral health, and more frequent dental visits. The same reasons could explain the prevalence difference among races and ethnicities. Analyzing the data collected in NHANES III, which included adults between the ages of thirty and ninety, Albandar et al. (1999) were able to conclude that between non-Hispanic Blacks, non-Hispanic Whites, and Mexican Americans, Mexican Americans had the highest prevalence and extent of gingival bleeding (63.61%). Also analyzing data from NHANES III, but including adults from 20 years or older, the National Institute of Dental and Craniofacial Research (2002) found that a greater percentage of Mexican Americans (66.5%) than non-Hispanic Whites had gingivitis (50.1%).

Mixed results were found in relation to children's gingival health and parents' socioeconomic status. Ravera et al. (2012) studied the association between parents' formal schooling and oral health status on school children of different socioeconomic status. The study was conducted in Mar del Plata, Argentina. It included 300 school children aged six to fourteen years. Parents were asked to answer a questionnaire and their children's dental and gingival status was recorded by members of the research team. The results showed that parents schooling level was significantly associated with bleeding on probing and plaque index both of which are indicators for gingivitis. On the other hand, different results were found in a study conducted in Brazil by Feldens et al. (2006). This cross-sectional study included 490 preschoolers aged three to five years-old. Parents were sent a questionnaire for recording demographic and socioeconomic data. One single, trained observer examined children and recorded visible plaque and gingival bleeding index. Results showed a 77% prevalence of gingivitis. Children whose family income was lower than two Brazilian minimum wages had higher dental plaque index

than those of families with higher wages ($p < 0.05$); and children with high dental plaque index had three times higher odds of gingivitis than children with a low dental plaque index (OR=3.31, CI 95% 1.86, 5.93). Nevertheless, mother's educational years as well as family income level showed to not be significantly associated with gingivitis ($p > 0.05$). These results suggest that despite the reported positive correlation between dental plaque and gingivitis (Spencer et al., 1983) other factors such as microbial composition of plaque, differences in immune system, and anatomy of primary teeth might have a role in the formation of gingivitis.

Studies have also shown that males have a higher prevalence of gingivitis than females (American Academy of Periodontology, 2005; Li et al., 2010). Albandar's study (1999) showed that in adults the prevalence and extent of gingival bleeding was significantly higher in males (15.02%) than in females (12.11%) ($p < 0.001$). This relationship was further explored on a research study that demonstrated that these gender's differences could be explained by oral health behaviors and hygiene status, which are influenced by lifestyle, knowledge, and attitudes (Furuta et al., 2011).

2.3 PSYCHOLOGICAL AND SOCIAL IMPACT OF ORAL DISEASES

The oral cavity has a very challenging anatomy. Its structure allows it to participate in numerous functions, some as important as digestion and speech. When harmony of these structures is disrupted by an abnormality or disease, consequences can be devastating. Oral health or disease can deeply impact peoples' daily functioning, wellbeing and quality of life.

In the U.S. more than 51 million school hours are lost each year to dental-related illness (U.S. Department of Health and Human Services, 2000). Three work-loss days per 100 employee

persons/year are due to dental disease. Although this number is small, it is similar or larger than the rate for eye conditions, ear infections, indigestion, and headache (Hollister & Weintraub, 1993). From an educational and economical stand it is important to determine if time loss due to oral disease can be reduced by preventive measures and improving access to care.

The negative impact of caries can be seen in chewing difficulties, decreased appetite, weight loss, and sleeping difficulties. These can lead to irritability, difficulty concentrating, school absences, poor appearance, and low self-esteem, affecting people's ability to succeed and their quality of life (Abanto et al., 2011).

On 2010 O'Dowd published a paper that evaluated patients' experiences and impact of periodontal diseases in their lives. The results of this qualitative study showed that patients with periodontal diseases had impaired masticatory function, and physical and psychological discomfort. The latter was closely related to psychological disability which could lead to social limitation. The data supported the assertion that periodontal disease affects patient's daily lives in a negative way.

2.4 SOCIOCULTURAL DETERMINANTS OF ORAL HEALTH

Oral health disparities are ruled by a web of determinants among which biological, behavioral, cultural, social, economic, and political factors can be mentioned. Sociocultural determinants can be defined as features or pathways by which social and cultural conditions affect health and well-being (Patrick et al., 2006). Family life, birth, childbearing, aging, and death are set around cultural values and beliefs, as well as their recognition of illness and care-seeking practices (Butani, Weintraub, & Barker, 2008). In oral health, people's behaviors are usually guided by the

different meanings given to certain oral health situations such as the presence of decayed teeth. Their interpretations are often coupled with their beliefs, values, traditions, perceived available choices, and perceived barriers. Butani's et al. study (2008) provides a review of the existing literature on Hispanic and Latino's cultural beliefs regarding oral health. The authors stated they found relatively little research on this topic. The literature suggested that some Latino groups believed that the purpose of tooth brushing was to freshen up breath rather than prevent oral disease, other groups feared that oral prophylaxis would lead to loosening of their teeth, some parents held feeding practices such as putting their baby to bed with a bottle or a honey-dipped pacifier, and others valued aesthetics and encouraged their children to have a "bright smile", but reportedly did not seek dental care and preventive services.

The most frequently cited barriers to oral health care in Latinos are costs of dental care, immigration status, insurance, transportation, and language (Flores et al., 1998; Patrick et al., 2006). With the objective of identifying access barriers to health care for Latino children, Flores et al. (1998) conducted a cross-sectional survey of 203 parents. Results showed that parents perceived that the greatest barrier for care was language (26%), followed by waiting time at physician's office (15%), lack of insurance (13%), and difficulty paying bills (7%). Transportation difficulties were also mentioned by 27% of the participants as the cause of having missed at least one of their child's doctor appointments.

Hilton et al. (2007) conducted a qualitative study aimed at identifying cultural beliefs, practices and experiences that influence access to preventive dental care for young children of different ethnic groups. The study consisted in four to six focus groups in different ethnic communities (African-American, Chinese, Latino, and Filipino). Within each ethnic group participants were stratified into age groups. The researchers conducted separate sessions based on the participants' immigration status (U.S.-born, non U.S.-born). Qualitative analysis showed that

it was believed across ethnicities that primary teeth did not have long-term importance because “they would fall out anyway” and that parent’s negative personal experiences with dentists worked as a barrier for accessing dental care for their children. Immigrant status was found to affect dental care seeking. U.S. born caregivers were more likely to bring their child to preventive dental visits at younger ages and received support from their families in this process. Non U.S.-born caregivers were more likely to wait for their child to be older to take him to the dentist.

These studies help envision the impact that cultural determinants might have in oral health. Perceived barriers as well as cultural beliefs described in the literature make the Latino population at a higher risk of developing dental diseases due to perceived lack of access or difficulties accessing preventive dental care as well as inadequate and sometimes harmful dental care at home.

2.4.1 Acculturation

Acculturation has been defined as a multidimensional concept involving the interaction between two cultures and the process of change that occurs as a result of the interaction. It is an adaptation process where some beliefs and values of the new culture are integrated, while some beliefs and values of the original culture are maintained. The literature on this topic identifies factors such as “continuous contact among the different cultures”, and the importance of the sociocultural context as key in the for acculturation to happen (Siatkowski, 2007).

A few studies have evaluated the effect of acculturation on oral health among Latino groups. Their results have consistently shown that acculturation is a predictor of better oral health, increased utilization of oral health services, and more positive self-rated oral health

(Patrick et al., 2006). Graham et al. (2005) conducted a telephone survey to examine the extent to which perceived social status and language were associated with the use of culturally competent comprehensive dental care services (dental homes). Perceived social status was included as a measure of “acceptance into communities”, and language spoken at home as a measure of acculturation. Participants were 810 Latino adults in Florida, U.S. The telephone survey included questions about the influence of ethnicity in oral health care, access to dental homes, and assessed perception of possible prejudice or preferential treatment of non-Hispanics. Participants were also asked to answer the MacArthur Scale of Subjective Social Status to evaluate their perception of their social status in the U.S. and their social status within their own community. Bivariate analyses and multiple logistic regressions showed that respondents who perceived themselves at a higher social status in the U.S. were more likely to have a dental home compared to those that perceived to have a higher status in their community. Latinos who spoke Spanish primarily at home were less likely to have a dental home compared to those who spoke English at home. Also, respondents who spoke Spanish primarily at home were more likely to perceive their status to be high compared to those who mostly spoke English at home. The authors stated that since language is a measure of acculturation, these results would suggest that acculturation is a predictor of greater use of health services in Hispanics.

Even though behavioral indicators such as language are commonly included in instruments for measuring acculturation, its use is controversial. Thomson & Hoffman-Goetz (2009) systematic review of the literature reviewed 134 articles that measured acculturation in the United States. Language was a domain common to all the instruments used to measure acculturation in this review. The author states that these scales have limited use for measure cultural change and adaptation in salient domains such as values, beliefs and attitudes. This

stance is supported by other researchers (Felix-Ortiz, Newcomb, & Myers, 1994; Kim & Abreu, 2001).

To compare oral health and use of dental health services between low and high acculturated Mexicans in the U.S., Ismail and Szpunar (1990) conducted a cross-sectional study that analyzed the data of HHANES (Hispanic Health and Nutrition Examination Survey). This national survey utilizes a brief (8-item) validated acculturation measure that includes the dimension of language and ethnic background. Analyses showed that Mexican-Americans adolescents and adults with low acculturation had 73% more dental caries and 116% more missing teeth than those with high acculturation. This difference did not remain significant when accounting for age, sex, education, and income. Gingivitis was highly prevalent in both groups but those with low acculturation had significant higher disease levels than those with high acculturation. Additionally, Mexican-Americans with low acculturation status were less likely to have dental insurance and to have visited the dentist compared to the high acculturation group.

To further study the relationship among oral health and acculturation Gao (2011) conducted a review of the literature on this topic. The author found seventeen studies that investigated the impact of acculturation on the use of dental services. Sixteen of these articles found a positive relationship between at least one acculturation indicator and the use of dental services. Fifteen of the studies suggested better oral health among acculturated individuals. Still, more research needs to be done in this topic to assess oral health behaviors and their association to acculturation.

It is difficult to compare the results of these studies because of the lack of consistency in the use of instruments to measure acculturation and the difference in the definition of acculturation. Nevertheless, the existing literature does suggest that more acculturated individuals have better oral health and access to care. Acculturation should be considered when conducting

studies in Latino population that include health behaviors and their outcomes. There is need to conduct more research on the effect of acculturation on dental health, and its relationship with other variables such as income and education.

2.5 ORAL DISEASE PREVENTION

2.5.1 Risk factors for caries and periodontal disease

A risk factor has been defined by the World Health Organization as a characteristic, behavior, or exposure that increases the likelihood of developing a disease. Risk factors associated with caries are poor oral hygiene and consumption of sugary foods and the frequency with which they are consumed; and risk factors that affect the onset and the progression of periodontitis are diabetes mellitus and smoking (Genco, 1996). For gingivitis the main risk factor is the accumulation of dental plaque, which can result from poor oral hygiene, poorly contoured restorations, and anatomical tooth abnormalities (Loe et al., 1965). The definition of oral hygiene as a risk factor for periodontitis is less straightforward. Good oral hygiene can positively influence the bacterial ecology of shallow and moderate periodontal pockets (incipient and moderate periodontitis), but it has little effect on deep pockets (severe periodontitis). It has been shown that professional supragingival cleaning added to good oral hygiene behaviors can have a beneficial effect in moderately deep pockets. This evidence gives support for the implementation and promotion of good oral hygiene behaviors as an essential part of periodontal treatment (American Academy of Periodontology, 2005).

2.5.2 Oral hygiene

Oral hygiene education and promotion can have an effect on both caries and periodontal disease prevention. This approach aims to change the causative factor of disease, cariogenic bacteria. Approaches to implement oral hygiene promotion interventions are varied and can be adapted to serve the need of different cultures or income segments of the population.

Tooth brushing is the main oral hygiene behavior, and even though it is widely associated to good oral health, most people do not perform it thoroughly enough to prevent accumulation of dental plaque. Most oral hygiene interventions are based on motivation and development of aptitude. This approach is widely used, and can be further improved if the interventions are tailored at assessing each individual's risk, needs and diagnosis, and developing personal skills and motivation (Jönsson et al., 2009).

Tooth brushing

Several key factors such as consumption of sugary foods, and dental plaque accumulation contribute to the cariogenic process and the onset of gingivitis. To prevent these diseases several strategies have been pursued. One of these approaches is tooth brushing. Even though there is conflicting evidence on the effects of tooth brushing without fluoride on caries risk (Reisine & Psoter, 2001), poor oral hygiene continues to be considered one of the major risk factors in the development of cariogenic lesions (Maltz et al., 2010). Furthermore, if this behavior is complemented with the use of fluoride toothpastes, its result in preventing dental caries is strengthened (Twetman et al., 2003).

Studies that date back to the 70's have evaluated the effect of tooth brushing on gingivitis. One of the first studies that assessed this relationship was conducted by Lang et al. (1973). This clinical trial included thirty-two dental students as participants, who were randomly assigned to one of four groups. Group I removed plaque by brushing their teeth every 12th hour, Group II did so once every 48th hour, Groups III every 72th hour, and Group IV every 96th hour. Results showed that the rate of plaque accumulation increased before the appearance of clinically detected gingivitis, and that only tooth brushing practices done at intervals of 48 hours or less are compatible with gingival health. Also with the intent of measuring the effect of plaque removal, Kelner et al. (1974) studied the effect of time between brushings and gingival health. This study included ten participants who were randomly assigned to brushing their teeth thoroughly every 24 hours or every 72 hours. The results indicate that complete plaque removal every 72 hours is not compatible with the maintenance of gingival health. It is important to consider that even though the contribution of these studies is unequivocal, the number of participants in each condition is a considerable limitation for data analyses. A more contemporary study in this field was done by Pinto et al. (2013). This study was based on Lang's research design and consisted of a single blinded randomized control trial (RCT). In it, fifty-two participants with clinical signs of slight gingivitis were assigned to one of four groups. Groups differed in the frequency with which dental plaque was removed by tooth brushing (G1: every 12 hours, G2: every 24 hours, G3: every 48 hours, and G4: every 72 hours). Plaque index and gingival inflammation were recorded at baseline, 15, and 30 days. Results indicated a significant increase, from baseline till the end of the study, in the gingival inflammation score in Group 3 (0.48 ± 0.19 versus 0.84 ± 0.21 , $p < 0.01$) and Group 4 (0.55 ± 0.20 versus 0.94 ± 0.25 , $p < 0.01$). Also, by the end of the 30 day period participants in Group 3 and 4 had a significantly larger percentage of sites with gingival inflammation scores of 1 (visual inflammatory changes) and 2 (bleeding upon probing) ($p < 0.05$)

than did Groups 1 and 2. These results support Kelner's findings, but not Lang's. It is also important to consider that as opposed to Kelner's and Lang's studies the Pinto et al. study did include the necessary number of participants to obtain 80% power as stated in their methodological section.

As can be concluded dental plaque removal is essential for the prevention of both dental cavities and gingivitis and should be practiced frequently for it to be effective. Given its importance, tooth brushing has been recommended by the American Academy of Periodontology as one of the four basic preventive steps for parents to follow to help their children maintain good oral health (American Academy of Periodontology, 2013). These steps are:

- Establish good dental hygiene habits including tooth brushing and flossing,
- Serve as a good role model
- Schedule regular dental visits
- Check your child's mouth

Tooth brushing is a complex behavior that encompasses a number of interrelated factors that combined lead in a successful or unsuccessful endeavor. These factors derived from the following questions: how often should I brush my teeth? should it be done before or after meals? for how long? and how should it be done?

How often should I brush my teeth? (Tooth brushing frequency)

The American Dental Association recommends brushing your teeth twice a day. Evidence of the effectiveness of this practice was studied by Davies et al. (2003) in a summary of the available evidence in tooth brushing. Their investigation supported the effectiveness of twice daily tooth brushing with fluoride toothpaste. Their analysis referred to four studies, two of which were

surveys (Hinds & Gregory, 1995; Kelly et al., 2000) and two clinical trials (Chesters et al., 1992; Chestnutt et al. , 1998). As the author mentions, Hinds's study (1995) found that 24% of children aged 3.5 to 4.5 years that brushed their teeth more than once a day had caries, compared to 38% of those that brushed once a day, and 48% of those that brushed less often. The strength of this evidence was classified as type 4 and 5, meaning "observational studies" and "traditional reviews, expert opinion" respectively. A recent cross-sectional study in Mexico that included 322 children aged between six and nine showed a prevalence of 86% of daily tooth brushing. This behavior was correlated with their mother schooling years (Casanova-Rosado et al., 2013). Also among schoolchildren in Mexico, Vallejos-Sanchez et al. (2008) conducted a cross-sectional study that showed that girls (OR=1.41), older children (OR=1.07), and offspring of mother with higher education (OR=1.07) were more likely to brush their teeth more frequently. Also, positive mother's attitude increased the likelihood of frequent brushing in children who received dental care in the last 12 months (OR=2.45, $p<.001$). These studies support the practice of daily tooth brushing and intend to describe factors associated with increased tooth brushing frequency. Still, it is important to consider that other factors can act as confounders in the evaluation of the efficacy of tooth brushing frequency, such as consumption of sugary foods, and the fact that people that brush their teeth more frequently are likely to be more concerned about their oral health.

When should tooth brushing be done?

Evidence on the time when tooth brushing should be done is scarce. Generally, it is recommended to brush your teeth after every meal to prevent bacterial plaque and food impaction for long periods. Attin & Hornecker (2005) address this topic in their review of the literature. They state that this recommendation is based on a study conducted in 1950 by Forsdick. In this

study, 946 participants were assigned to a control group (tooth brushing before and after bedtime) or to an experimental group (brushing within 10 minutes following a meal). The experimental group (1.49 decay score) reported significantly lower caries increment than the control group (2.53 decay score). No more studies were found to specifically address the question of the relative benefits of brushing before or after meals.

For how long?

The effects of brushing time in oral health have not been extensively studied. In their review of the literature, Davies et al. (2003) cited one article and one chapter book that addressed this topic (Rugg-Gunn & Macgregor, 1978; Yankell, 1991). Their review concluded that based on the available literature individuals' tooth brushing rarely exceeds 60 seconds. Also on this topic, Attin et al. (2005) referred to Huber et al.'s (1985) study in their review of the literature, which demonstrated that "more plaque is removed when brushing time is increased from one to four minutes". But even when brushing four minutes areas of the oral cavity still had dental plaque. A similar finding was obtained by Gallagher et al. (2009) who conducted a randomized, single-centered, single-product, multi-use, 6-way crossover study. Forty-seven participants were included. During each brushing session dental plaque was disclosed using a coloring solution and then subjects would be instructed of the amount of time they should brush their teeth (30, 45, 60, 120, or 180 seconds). Every brushing session would use toothpaste, but only the 60 second session was also evaluated without the use of dentifrice. After participants brushed their teeth, dental plaque was recorded. A washout period of 72 hours was observed between treatments, where subjects would refrain from tooth brushing 24 hours prior to the study's session. Results indicated that at shorter times (30, 45, 60 seconds) the amount of plaque was highly dependent on brushing time, but tended to stabilize at longer times. Brushing for 180 seconds removed 55%

more plaque than brushing 30 seconds, and brushing for 120 seconds removed 26% more than brushing for 45 seconds. There was no significant difference in the mean of dental plaque removed between brushing with and without dentifrice ($p>0.05$). The two later studies lead us to the next topic in question: quality of the tooth brushing technique.

How should it be done? (Technique)

For tooth brushing to be effective it has to eliminate the dental plaque in contact with the tooth. How much dental plaque is removed in this process will be dependent on the subject's technique and skills. Many interventions have been designed that aim to improve tooth brushing effectiveness (Clarkson et al., 2009; Hawkins et al., 2001; Horowitz et al., 1980; Kay & Locker, 1998; Little, Hollis, & Stevens, 1997; Stewart et al., 1991). Some of these interventions are strongly theoretically-based like Clarkson et al. (2009) study. This research study evaluated the effectiveness of using the Social Cognitive Theory (SCT) and Implementation Intentions Theory on the delivery of oral hygiene advice to adult dental patients. The design was a two-group randomized controlled trial. The intervention group received a powered toothbrush and behavior advice on timing, method, and duration of tooth brushing; and the control group received routine care, even if it included chair-side advice provided by dentists. The author based the design of the intervention on the sources of self-efficacy which are vicarious modeling, performance, verbal persuasion and physical state, creating a model of "tell-show-do". Participants in the intervention group improved significantly more in self-efficacy, planning and their oral hygiene behaviors (timing, method and duration of tooth-brushing) than the control group; and decreased their mean percentage of surfaces with plaque significantly more than the control group. One of the limitations of Clarkson's study is that it provided a very vague definition of the routine care given to the participants in the control group. Although the author recognizes that reporting receiving

less oral hygiene advice in the control group might be a source of contamination of the study, it was not stated what type and how was this advice given which might also be a source of contamination.

Other studies provide the effectiveness of mechanical removal and fluoridated toothpaste as the justification and framework of their designed study without mentioning the use of any theoretical framework for behavioral change. An early study in this topic was a 3-year randomized controlled trial aimed at evaluating the effectiveness of a supervised tooth brushing and flossing intervention. Participants at the beginning of the study were children aged 10 to 13. The intervention consisted in providing instruction in plaque removal to groups of children during ten days. Specially trained personnel supervised participant's tooth brushing and flossing daily, for a period of three years during school-time. The control group did not receive instructions nor did they engage in plaque removal in school. Even though significant changes could be identified among intervention and control groups, the pattern of behavior on the treatment group was of concern. Every year after summer time, the improvement in plaque scores would be lost which reflected that the intervention could not be sustained by the participants at home. This study shows the importance of providing continuous feedback and behavior reinforcement to change behavior. Additionally, it shows that the behavior did not generalize from the school setting to the home setting, which might be explained by the presence of situational and environmental cues at school that were not present at home. Also it suggests that additional efforts have to be made to effectively improve behavior when the continuous feedback is not provided in daily basis (Horowitz et al., 1980).

In 2001 a cluster randomized control trial compared two interventions based on dental health education in first grade students from schools in New York. Schools were selected based on having a high proportion of high risk dental students. For each selected school, a matching

school with similar characteristics (demographics, dental needs, socioeconomic status) was selected. For each pair of matching schools, one was randomly assigned to the intervention and one to the control group. The control group received classroom-based lessons on oral health (the author does not describe specifically how many sessions were provided), and the intervention group additionally received two participatory follow-up group sessions. These sessions focused on oral hygiene instruction. Tooth brushing skills were measured with an observational instrument in which interviewers had to fill a checklist based on the tooth brushing skills of the child. The results of the intervention were more effective than dental health education by itself and significantly improved tooth brushing skills in the intervention group. As recognized by the author, one of the main limitations of this study is the lack of calibration among interviewers/evaluators of the instrument used to measure tooth brushing skills (Hawkins et al., 2001).

In general the evidence on the effectiveness of these studies on changing behaviors is weak. Interventions such as Horowitz's that evaluate the effect of providing continuous feedback, exemplify the importance of aiming at factors other than skills and knowledge to obtain effective behavioral change. Given that most published studies are in adults and only a few in children, additional research should focus on testing this type of interventions in different age ranges. Also new and effective methods should be explored to sustain the oral hygiene improvements and have a lasting effect in time.

2.6 HABIT FORMATION

2.6.1 Definition

The definition of habit has been debated for long. Norsworthy was one of the first researchers to study habit formation (Norsworthy & Whitley, 1937). He stated that habitual behaviors typically emerged from repeated actions in stable contexts, and that the emotional tone of the environment also influenced the learning process. Habit has also been referred by some researchers as a learned recurrent pattern that is repeated so often that no longer involves conscious thought (Darity, 2008). The importance of the frequency component of habits has been questioned, and automaticity and contextual cues have been said to play a larger role (Gardner, 2012). In this context, habits are defined as automatic responses triggered by specific cues (Verplanken & Aarts, 1999) where repetition frequency is its precursor and possible consequence (Gardner, 2012). According to Bargh (1994), automaticity has four defining qualities: unintentionality, uncontrollability, lack of awareness, and efficiency. Nevertheless, mental processes are not exclusively automatic or exclusively controlled, but combinations of the features of each. In habitual behaviors initiation is often intentional, even if in their execution there are a series of acts that are unintentional. Also habits are to some extent controllable, but their most prominent features of automaticity are lack of awareness (people make routine choices without being aware of them) and efficiency (they require little mental effort to execute) (Verplanken & Aarts, 1999). Research suggests that nearly 45% of people's daily lives activities are "habitual" (Wood, Quinn, & Kashy, 2002). Psychological states and environmental factors can be perceived as predictors of habits. It is suggested that in newly acquired habits favorable attitudes and intentions play a major role, but as the behavior is repeated sufficiently to become automated their role becomes

less determinative and contextual cues such as people, places, and time of day assume a major role (Darity, 2008). Therefore it can be said that habitual behaviors are an expression of the performance itself and not a response to people's own thoughts.

Automaticity in behaviors such as texting while driving were studied by Bayer (2012). This study included four hundred forty one college students of a large American university who volunteered to answer a survey about their perceptions and use of mobile communication technology. Additionally participants had to complete the Self-Report Habit Index (12-item index that evaluates history of repetition, automaticity, and expressing identity) (Verplanken & Orbell, 2003). Regression analyses showed that texting while driving can be partially attributable to individuals doing so without awareness, control, attention, and intention. Norms (subjective, moral, group) also proved to be significant in predicting this behavior, as opposed to attitude and perceived control.

To develop a simpler measure of automaticity, Gardner et al. (2012) validated a four-item automaticity subscale (the "Self-Report Behavioral Automaticity Index or SRBAI). They evaluated its validity by testing it with multiple datasets. Analyses proved SRBAI to be reliable, strongly correlated to the Self-Reported Habit Index, and sensitive to effects predicted by theory (correlating with behavior frequency and moderating impact on the intention-behavior relation).

Understanding the main components of habitual behaviors can help design more successful interventions. Such was the case of a weight loss intervention based on principles of habit formation. This study included 104 obese and overweight adults that were randomly assigned to one of two intervention groups or to a control group. The intervention consisted of a leaflet containing information on habit formation, simple recommendations for eating, and activities shown to be associated with weight loss. It also included a brief self-monitoring checklist. The two intervention groups differed only on the frequency of weighting: weekly

weighting or monthly weighting. The development of habits was measured by using the SRHI. Results showed that at eight weeks both intervention groups had lost significantly more weight ($p < 0.05$) than those in the control group, no significant differences were observed between intervention groups. Participants that completed the study (until thirty-two weeks) continued to lose weight (approximately 3.8 kilos). At thirty-two weeks, the automaticity scores measured with SRHI increased by an average of nine points on the forty-two points scale. Post hoc analysis showed a significant correlation between automaticity and weight loss ($r = 0.424$, $p < 0.05$). These results demonstrated that the habit formation process was instrumental in helping participants achieve behaviors related to weight loss (Lally, Chipperfield, & Wardle, 2008).

The available research on habit formation suggests that to introduce a behavior known to have beneficial effects, it is imperative to transform it into a habit. To create interventions that can achieve this goal, researchers should first aim at identifying different components of habits associated to the behavior of interest. For example, what are the contextual cues (people, places, and time of day) associated to tooth brushing behavior? On the other hand, interventions aiming at eliminating a bad habit should focus on controlling contextual cues related to that behavior, and not aimed exclusively at motivating behavior change.

Certain behaviors need special skills for them to be performed. Tooth brushing has been defined as a complex skill. It involves a motor component (toothbrush grip and dexterity) and a cognitive component (understanding of the process and its goal). People at different ages have different skills. During the first years of life the human body and mind changes at exponential rates. Developmental skills such as the ability to process new knowledge, appreciate their environment, and control motor skills change during childhood and this should be considered when designing an intervention.

2.6.2 Children's habit formation process

Childhood development is marked by a number of developmental milestones. As children grow, physiological changes together with brain maturation, cognitive development, and stimulation from the environment result in the emergence of new skills and abilities. Two main types of skills can be defined: motor skills and cognitive skills. Learning these abilities is essential to successfully introduce new behaviors that are expected to be maintained in time. It is important to note that while developmental sequence follows a predictable path in most children, there is great individual variation due to intrinsic and extrinsic forces such as physical characteristics and temperament, as well as cultural environment and socioeconomic status (“Developmental Milestones,” 2007; Gerber, Wilks, & Erdie-Lalena, 2010).

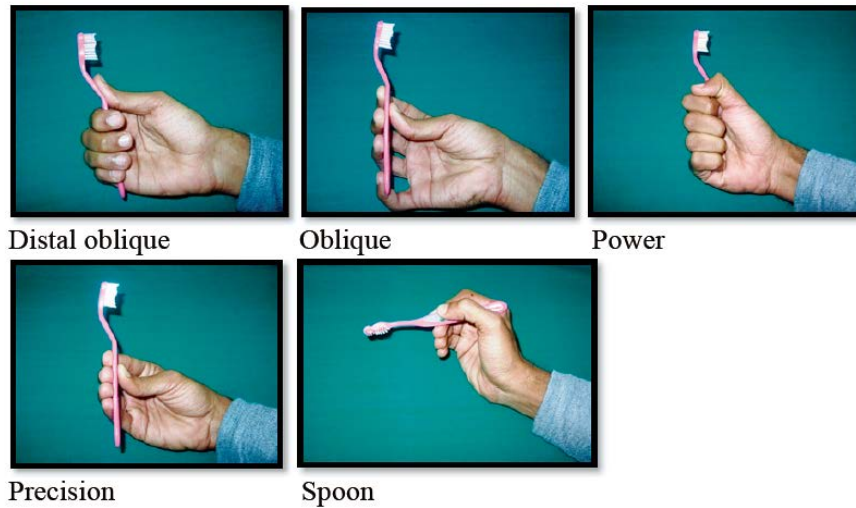
Motor skills

Motor development tends to be the most noticeable skill learned. Gross motor skills involve the use of large muscle groups. Their main goal is to gain independence and volitional movement. Infants are born with primitive reflexes that slowly disappear as they grow giving way to postural reactions such as righting and protection responses. As balance, strength, and coordination continue to develop infants start to pull-up and eventually walk. In subsequent years, toddlers learn to master muscle movement adding speed and rapid change of direction.

Fine motor skill involves the use of the upper extremities. The development of this specific skill will determine how tooth brushing is manually performed. When born, infants are dominated by a primitive grasp reflex (infants will involuntarily grasp anything put in their hands

and hold it tightly). Slowly, infants begin reaching for objects and grabbing them voluntarily, and eventually releasing them voluntarily. Between six to twelve months of age, infants' grasp evolves from scissor grasp to radial digital grasp and finally pincer grasp. By their second year of life children master reach, grasp, and release. At thirty months of age a child's motor skills have developed enough to allow them to brush his/her own teeth with assistance, and at four years of age they are physically capable of brushing their teeth by themselves (Cairns, 2011; "Developmental Milestones," 2007; Gerber et al., 2010).

Given that motor dexterity evolves with age, several studies have been conducted with the goal of evaluating tooth brushing techniques among children of different ages and genders (Das & Singhal, 2009; Menten & Atukeren, 2002; Sharma, Yeluri, Jain, & Munshi, 2012). Toothbrush grip has been studied in different age groups (Beals, Won-Paredes, Allen, Rutter, & Stegemen, 1999; Das & Singhal, 2009; Sharma et al., 2012). Beals (1999) described five types of toothbrush grips: precision, distal oblique, power, oblique, and spoon (Figure 1). Subsequent studies used this categorization to further analyze difference in toothbrush grip at different ages and between genders. Das et al. (2009) conducted an observational study of forty-five children aged three to eleven years-old that evaluated the duration and grip type during tooth brushing. Even though the description of its methodology is incomplete, the author concludes that no significant difference could be found on grip types among children at different ages, and between genders ($p>0.05$).



(Source: (Sharma et al., 2012))

Figure 1: Grip types

In an attempt to evaluate the effectiveness of different techniques and toothbrush grips, Sharma et al. (2012) conducted a study among 100 children aged eight to twelve. The participants were asked to meet twice. Dental plaque before and after tooth brushing, as well as toothbrush grip was documented. In the first session, they were asked to brush their teeth as they did at home, and then were taught to brush their teeth using the modified Stillman tooth brushing technique (rolling stroke after vibratory phase). A week later, their brushing technique and grip was evaluated again. The results showed that the most common tooth brushing technique used was horizontal scrubbing, and the most common grip was distal oblique which was more effective than the oblique grip for dental plaque removal. Plaque scores at baseline differed significantly ($p < 0.05$) from those immediately after brushing, and seven days later on the second session after brushing. However there was no significant difference between dental plaque scores after brushing in the first session and after brushing in the second session, which shows that children had trouble learning the new tooth brushing technique. The authors also noticed that

most of the participants kept their tooth brushing grip unmodified on both sessions. This study shows that habits are difficult to modify and that tooth brushing motor skills may require practice with feedback to be performed effectively.

In 2002, Mentis et al. conducted an observational study of seventy-five children aged between three and eleven years-old. They documented toothbrush grip, and tooth brushing duration. The researchers concluded that the most common grip was distal (73%), and that there were statistically significant differences among group ages on grip type ($p < 0.001$). Younger children tended to brush their teeth a shorter amount of time. Even though the authors assessed brushing efficacy, no analyses were performed to evaluate its association to the different tooth brushing grip which could have been a very interesting finding (Mentis & Atukeren, 2002).

Cognitive development

Cognitive development is the foundation of intelligence, understood as the ability to learn or deal with new situations. In infants and children intelligence depends on progression through two developmental processes: problem-solving and language. Cognitive development is based on the following domains: memory, representational competence (ability to create a mental image of an object or idea that is not seen), attention, and processing speed (Wilks, Gerber, & Erdie-Lalena, 2010).

Part of cognitive development is related to achieving language milestones. The normal cognitive development of the child has been studied by Wilks et al. (2010). In the second of a series of three articles, they focus on the foundational aspects of cognitive development and the stages that children go through. They state that receptive language skills are present since birth.

One of the first evidences of receptive language skills is the ability to respond to “no” and their name. By twelve to fifteen months of age toddlers are able to point to different body parts when named, and by eighteen to twenty-four months their grammar understanding increases. By two to three years of age they are able to follow two-steps commands, and by three to four years of age they understand most of what is said, and are able to follow complex instructions (Wilks et al., 2010).

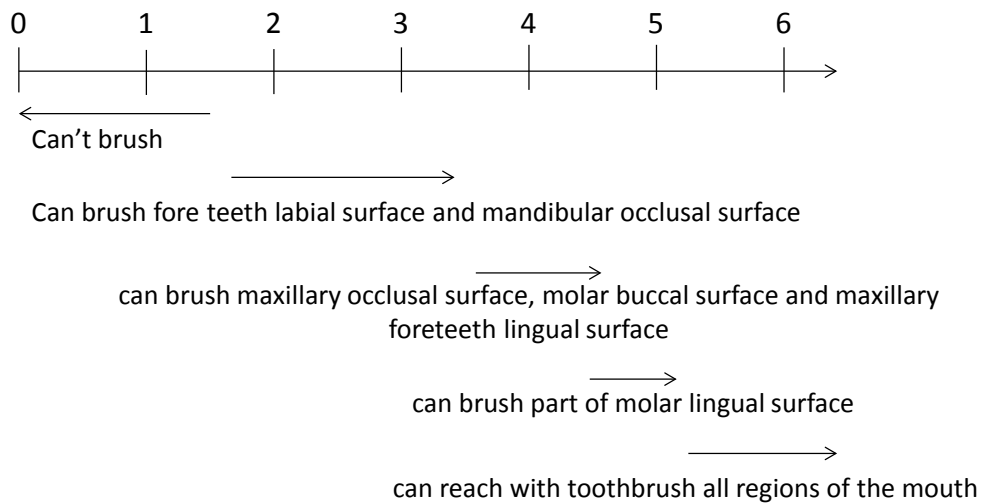
The importance of cognitive development, language skills, and social involvement can be observed in Leal et al.’s. study (2002).The goal of this study was to assess preschool children’s learning processes and ability in performing tooth brushing. This research study compared different methods of tooth brushing instruction and motivation: audiovisual (models and slide projections), child as a model (dentist demonstrated tooth brushing on a child), and individual instruction (each child received personalized tooth brushing instruction). This study was conducted in Brasilia, Brazil. Forty children between the age of three and six were selected to participate. Children were separated into two groups according to age (group 1: three and four years-old, group 2: five and six years-old). All children were exposed to all three types of instruction. After each intervention, dental plaque index was recorded. The individual instruction method proved to be the most effective in diminishing dental plaque for the older group, followed by the audiovisual and child as a model. In the youngest group all instruction methods seemed to work similarly. This research showed that language skills and cognitive development in children at different ages allow them to perform behaviors differently.

Also with the purpose of evaluating the most effective instructional tooth brushing method in preschool children, Makuch (2011) conducted a study in eleven daycare centers in Leipzig, Germany. One hundred forty one children between thirty to fifty months-old were enrolled to participate in this study. Tooth brushing position and movement were evaluated.

Children were randomly assigned to one of four groups. Each group received different methods of tooth brushing instruction: use of a giant teeth model, teeth model in the mouth of an animal puppet, tooth brushing by the child in front of a mirror (self-image), and adult demonstrating tooth brushing for the child in a mirror sitting next to the child. Results showed that children who received tooth brushing instruction using a giant teeth model and those using the animal puppet had significantly lower imitation rates (adequate tooth brushing position and movement); children that were instructed by brushing their teeth on the mirror tended to make the right tooth brushing movements (28%) but not at the right place; and 75% of children that received demonstration by an adult in front of a mirror were able to place and move the toothbrush correctly. Feedback while practicing tooth brushing enhanced the efficacy of the behavior. The authors recognize the importance of considering the developmental stage when aiming an intervention. They stated that until four years of age children live an egocentric development phase of thinking where they are unable of put themselves in other people's place. Therefore instructional methods such as parallel demonstration by an adult and practicing in front of a mirror will tend to have better impact.

Considering the importance of developmental stages for tooth brushing in children, Ogasawara (1992) conducted a study to determine what type of guidance in tooth brushing are suitable for children at young ages. This study included ninety-seven children under the age of six, and evaluated children's capacity to learn tooth brushing through verbal guidance, demonstration, and practice. Researchers designed a test to evaluate children's ability to brush different regions of the mouth, and they provided immediate positive reinforcement when the behavior was achieved. Tooth brushing ability was evaluated by the regions of the mouth reached by the toothbrush. As a result five groups could be identified: can't brush, can brush front teeth labial surface and mandibular occlusal surface, can brush maxillary occlusal surface, molar

buccal surface and maxillary front teeth lingual surface, can brush part of molar lingual surface, and can reach with toothbrush all regions of the mouth . Age and brushing abilities were interrelated and a border age for each brushing level was identified by the authors (Figure 2). The authors concluded that tooth brushing guidance is effective since eighteen months of age, and that children three years six months of age can reach almost every dental surface in their mouth, but their ability is still not adequate so assistance should be provided. By five years of age children possess the ability to reach every region of the oral cavity properly without assistance.



(Source: Ogasawara, 1992)

Figure 2: Developmental stages of children's tooth brushing

Similarly, with the purpose of determining tooth brushing ability at different ages, Unkel et al. (1995) conducted a study that included twelve adults and 122 children ages six to eleven. In this study adults were used as the control group, given their established dexterity to brush their teeth. A dental hygienist applied dental plaque disclosing solution to each participant before giving them oral hygiene instructions in horizontal scrub technique. This solution shows the sites in the mouth that were not brushed correctly and that still have dental plaque on it. A dentist

recorded un-brushed dental areas. Data was analyzed using ANOVA. Results showed an age-related trend in tooth brushing ability. This skill improved with age, and by ten years of age approached that of adults.

All these studies show that developmental factors such as motor skills and cognitive development should be considered when designing interventions targeted to children at young ages.

2.6.3 Tooth brushing habit in children

The period of early and middle childhood has been said to be “exceedingly important” for learning hygiene habits. Tooth brushing twice daily is recommended as soon as the enamel of teeth is evident (usually around four to eight months of age). In cases where primary teeth have not erupted by ten months, parents are advised to start gently brushing their child’s gums to get them used to the tooth brushing sensation and establishing an early routine (American Dental Association, 2013; Brothwell, Jutai, & Hawkins, 1998).

Successful oral hygiene behaviors are those that are performed in a timely manner and with good technique. Prevention of diseases due to removal of dental plaque through tooth brushing, flossing, and the application of fluoridated dentifrice on dental surfaces through tooth brushing, are the foundation of the promotion of oral hygiene behaviors (Claydon, 2008). To date the published literature shows research in oral health that focuses on evaluating the frequency of tooth brushing as an outcome measure for different types of interventions (Kolawole, Oziegbe, & Bamise, 2011; Petersen, Jiang, Peng, Tai, & Bian, 2008). Nonetheless, only few studies could be found that tried to understand tooth brushing habits in children (Hoeft, Masterson, & Barker, 2009; Huebner & Riedy, 2010; Suzuki, 1990a, 1990b)

With the intention of identifying parents' motivation, support, and barriers to twice daily tooth brushing of children, Huebner and Riedy (2010) conducted a qualitative study in a rural location of Washington State. The study consisted on one-on-one interviews with forty-five parents of infants and preschoolers (zero to five years old). The results showed that most parents (63%) had begun brushing their child's teeth before they were one year old; almost half of interviewed parents (48%) acknowledged that no one had showed them how to brush their children's teeth; approximately half of the parents said that they supervised or brushed their teeth at the same time as their children, 25% brushed their children's teeth for them, and a few children brushed their teeth without supervision. The analysis showed that the most common facilitators for tooth brushing were positive oral health beliefs such as effectiveness of oral hygiene, social norms (support of extended family), emotional reactions to the consequences of not brushing teeth, high self-standards, make it part of a routine, and find ways to make it easier (make it fun, use reminders, incentives). The most common barriers were related to negative oral health beliefs such as believing that brushing teeth too much would wear out the enamel, lack of social support, avoid a stressful situation, low self-standards, lack of child's cooperation and time.

With the purpose of investigating the process by which tooth brushing habit was formed in children, Suzuki et al. (1990) conducted a quantitative study based on a survey to mothers of children attending kindergarten or daycares in Nagoya, Japan (n=1,396). The results showed that approximately 49% of the parents expressed "eruption of teeth" as their main motive for starting to brush their child's teeth, and parents who had "caries prevention" as their main motivator started this process at an earlier age; 51.6% of parents stated they brushed their children's teeth, 37.1% brushed their child's teeth after they had done it by themselves, and 6.8% stated that their child brushed their teeth by themselves with no further help.

More recently, Hoeft et al. (2009) conducted in-depth interviews to examine mothers' initiation and understanding of home oral hygiene practices for their children. This qualitative study included 48, low income, Mexican immigrant mothers whose younger child was 5 years-old or younger. Results showed mothers initiated oral hygiene care by wiping their children's teeth and/or gums (48%) or by brushing their teeth with a toothbrush. Parents' exposure to information affected children's oral hygiene initiation (cleaning of gums, but not tooth brushing). Tooth brushing initiation happened on average at 1.8 years old which is late considering the American Dental Association (ADA) recommendations to start brushing children's teeth by 12 months old.

These studies identified motivators, facilitators, and barriers for tooth brushing in young children of different backgrounds. They also helped understand the role of parents in tooth brushing habit formation. Parents can have different roles in this process, they can play an active role by helping their child's brush their teeth, or they can play a passive role by just observing how their child brushes his/her teeth. All studies stress the importance of beliefs in oral hygiene effectiveness as a trigger for the initiation of tooth brushing behavior. Only one of these studies focused on Mexican parents experiences with oral hygiene practices. More research should be done to corroborate if this information replicates in other Mexican communities in the U.S. and to assess habit components related to the formation of a tooth brushing habit in children.

2.6.4 Parents role in children's habit formation

At early ages children are extremely dependent; this makes them vulnerable to develop oral diseases such as caries and gingivitis. The different developmental stages that take place during

this period make children more prone to learn health habits that can help prevent the onset of such diseases (Lapresa, Barbero, & Arizaleta, 2012).

Family guidance is an essential element in habit formation in children. One of the factors that could influence habit formation is parenting style. This topic was further studied by Bowne (2009) in a survey (n=80) intended to compare the effect of parenting styles in eating habits of children aged three to five. The results showed that authoritative parents tended to label their children's eating habits as either very good or good, whereas permissive parents labeled their children's eating habits as fair. The cross-sectional nature of these data did not allow the authors to conclude that parenting style is the cause of developing certain types of habits, but it did show that there is an association between parenting style and parents' perception of their children's habits.

The American Dental Association recommends parents to teach their children the importance of oral hygiene at an early age, so that good oral habits can be established and enhance their overall health (*Cavity Prevention Tips From the American Dental Association*, 2008). Family, as their more proximal social environment, has a large impact on children's performance. It has been shown that parents' oral health and habits are associated to their children's oral health and habits (Faye et al., 2009; Mattila, Rautava, Sillanpaa, & Paunio, 2000; Rajab, Petersen, Bakaeen, & Hamdan, 2002). Costa et al. (2008) conducted a descriptive study on a sample of 248 children aged six and twelve of the city of Leiria, Portugal. Authors found that parents who brushed their teeth twice or more daily had children who had similar tooth brushing habits and less prevalence of caries ($p < 0.05$). Sixty nine percent (69%) of the participating parents reported reminding their children to brush their teeth, 33% helped them, and 52% checked their children's tooth brushing. Similarly, Faye's study (2009) evaluated the relationship between parent and child oral health status (n=200 dyads). Dental caries index, Silness and Loe

index, and a questionnaire on dental habits were assessed by the research team. Analyses showed a significant relationship ($p < 0.05$) between children's and parent's oral health habits, and between children's caries index and that of their parent's. Both of these studies, together with others reported in the literature, suggest that parents teach their children what they practice themselves.

Brushing children's teeth is a dynamic learning process that requires parents to develop the habit of teaching their children to brush their teeth (Phillippa Lally, Wardle, & Gardner, 2011). Teaching tooth brushing and turning it into a habit require that parents create a routine that includes helping their children develop the necessary skills and talk to their children to help them understand the importance of this process. Even though it is much easier for parents to brush their children teeth, it is necessary to allow children to do it themselves so they can learn self-help and independence (Lapresa et al., 2012). Nevertheless, when learning tooth brushing behaviors, children younger than six years-old should always be supervised while brushing to prevent them from swallowing toothpaste (ADA, 2008). Norimatsu's study (1993) questions the role of the adult-child interaction in the development and level of autonomy of the child, as well as what are the cross-cultural differences in the path towards autonomy. This research study was conducted in Paris, France and Tokyo, Japan. It consisted of a survey of nursery staff and parents of children between one and three years of age and class observations of these children and their nursery staff at daycare centers. A total of 33 Japanese and 36 French children participated in the study. The authors assessed children's behavior and adult's interventions during meals and during toilet training. Results showed that in meals and toilet training children's progress and adult's intervention were related. Also, in both countries the decrease of adult assistance was related to an increase in the child's autonomy. However, progress towards autonomy and adult intervention varied between meal time and toilet training activities. This study points out that

gaining independence is a process, and that adult help and guidance are essential elements at early stages of learning a behavior. Nonetheless, as developmental changes and behavior practice takes place; adult involvement should be less for child's independence and autonomy to occur.

Behavior independence has also been studied in the Latino adolescent group by Roche et al. (2013). The goal of this study was to examine how cultural beliefs affected parenting practices on giving adolescents independence. Their literature review revealed that "Latino parents tend to endorse greater legitimacy of parental authority, and have later age expectations for youth to engage in autonomous behaviors". The authors performed secondary data analyses of the Variations in Parenting Study. This research study consisted of a multi-site study of a representative sample of public school students and their primary caregivers (n=5,119 dyads, n=684 Latinos). Parents and students were surveyed in 5th, 7th, and 10th grade. Surveys included questions to assess cultural orientation, expectations for youth independence, perceived legitimacy of parental authority, parental supervision, youth autonomy in decision-making, parental rules, and other background information. Results showed that there are different cultural orientations within Latinos that reflect different parenting processes related to their adolescents independence. Parental beliefs that endorse youth's behavioral autonomy were associated with less stringent parental rules, less parental supervision, and more youth autonomy in decision-making.

These studies demonstrate that the progress towards behavioral independence is a process that is tightly related to parental beliefs, support, and guidance. The same stance should be valid for teaching children to brush their teeth. The learning process of this behavior is associated with parental guidance and promoting children's autonomy.

In summary, the available literature in tooth brushing habits describes the process of tooth brushing initiation and the role of parents in teaching this behavior to their children, and it also

identifies motivators, facilitators, and barriers for tooth brushing. The different authors were able to identify several cues that acted as triggers for the parents to start brushing their children's teeth, such as eruption of teeth, oral health beliefs, and social norms. Nevertheless all other habit components described in the literature (automaticity, frequency, and emotional tone) have not been studied, or in the case of emotional tone components just mentioned as a barrier for tooth brushing. Future research should identify these components as well as other developmental skills needed to practice tooth brushing and acquire a habit. It is also important to consider that only one study could be found to evaluate tooth brushing factors such as initiation and understanding in the Mexican immigrants in the U.S. The high prevalence of dental cavities in Mexicans in the U.S. and the positive impact that preventive oral hygiene measures can have in oral health make research in habit formation in tooth brushing a highly relevant topic.

2.7 THEORETICAL FRAMEWORK

Based on the literature just discussed I developed a theoretical framework that included all habit components. The literature suggests that when a new behavior is introduced, individual's intentions and attitudes play a major role (Bargh, 1994). To evaluate children's' tooth brushing habits, parents' attitude and intentions were considered because of the utter dependence children have on their parents. As tooth brushing becomes a habit, automaticity and other components such as contextual cues, and emotional tone become more relevant (Darity, 2008). Frequency has been debated to be relevant for habit formation (Gardner et al., 2012), but other factors such as social norms and knowledge have been shown to have an important influence on habitual

behaviors (Verplanken & Orbell, 2003). Motor skills and cognitive development components were included due to their relevance in the implementation of new behaviors in children.

This theoretical framework (Figure 3) shows the dynamic process of developing a habit. It considers the factors that affect a behavior when it is new and is being learned, as well as factors that determine the formation of a habit. Also, it integrates concepts that have been proposed to impact habit formation with the essential components of child development.

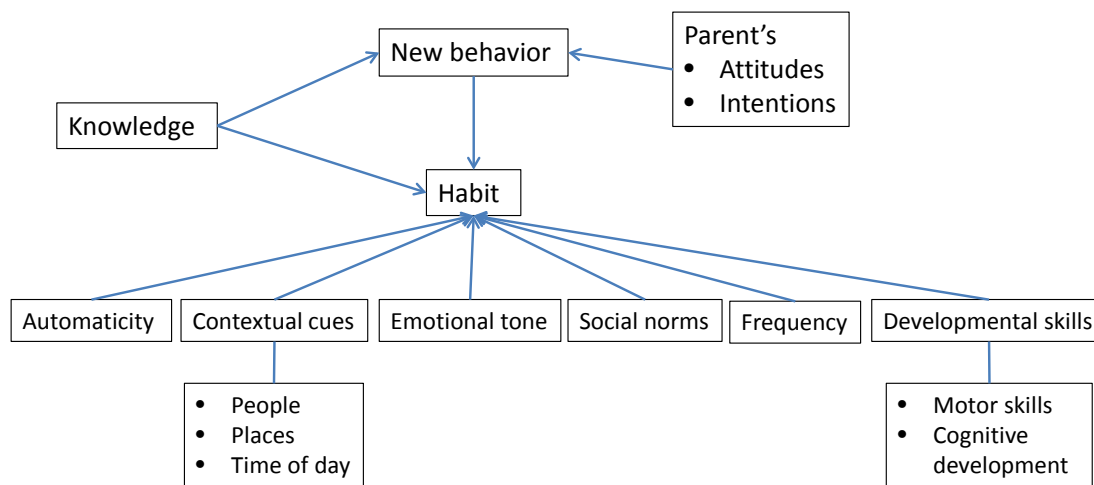


Figure 3 : Theoretical framework of habit formation in children

3.0 OBJECTIVES

The importance of oral hygiene habits and its impact on oral health has been widely demonstrated. The ADA encourages the initiation of oral hygiene habits such as tooth brushing at the eruption of primary dentition or by 12 months of age. The literature on habit formation focuses on automaticity, social norms, emotional tone, and frequency, as well as motor and cognitive skills for children at young ages. Some of these factors have been mentioned in the tooth brushing literature, but have not been studied purposively to assess their role in the formation of tooth brushing habits in children. Latino groups are especially at high risk of developing caries. Only one study could be found to study tooth brushing initiation and understanding in Mexican immigrant families (Hoeft, 2009). Even though this study contributes enormous knowledge to the tooth brushing habit topic in this particular group, it is still necessary to evaluate all other habit components and see if the results found by Hoeft replicate in other Mexican immigrant communities in the U.S. This research study will explore parents' perspectives and experiences while teaching this new behavior to their children. Their narratives will help identify habit components present while developing the tooth brushing habit.

Research question: What is the process children of Mexican immigrant families go through when developing a tooth brushing habit?

Aim 1: Describe efforts Mexican immigrant parents in the U.S. make when teaching their children to brush their teeth.

Aim 2: Identify habit components present during the tooth brushing learning process in children of Mexican immigrant families in the U.S.

- I. Define the role of automaticity in children's tooth brushing behavior
- II. Describe how social norms affect tooth brushing behavior in children
- III. Identify cues that are present when brushing children's teeth
- IV. Describe the emotional tone of the tooth brushing experience between parent and child
- V. Describe how motor and cognitive skills affect the tooth brushing experience at young ages

4.0 METHODS

4.1 RESEARCH DESIGN

The following is an exploratory qualitative research study. It uses a case study design to describe the in-depth experiences of immigrant Mexican families when teaching their children to brush their teeth.

4.2 STUDY POPULATION

Oral diseases can affect anyone no matter their gender, race, or age. The prevalence of caries and gingivitis is higher in lower socioeconomic and lower education groups in the Latino population compared to other ethnic groups (Albandar & Kingman, 1999; CDC & NCCDPHP, 2010; Dye et al., 2007; Pourat & Finocchio, 2010b). In the U.S., people with Latino or Hispanic origins account for 16.3% (50.5 million people) of the total population, of these 11.3% are under five years-old, and 16.6% between five and thirteen years-old. The largest Latino group in the U.S. is Mexicans, 31,798,258, equivalent to 63% of all Latinos. In Pennsylvania, 5.67% (719,660 people) of the state population is Latino. In this state the two most populated cities are Philadelphia and Pittsburgh. The Mexican population in this cities account for 7.28% (13,208

people) of the Latino population in Philadelphia, and 28.59% (2,153 people) in Pittsburgh (U.S. Bureau Census, 2010).

4.3 INCLUSION CRITERIA

The inclusion criteria were the following:

- Participants must be the primary care giver of at least one child between one and six years-old. This age range accounts for the dental eruption timeline and the oral hygiene recommendations for dental care in children of the American Academy of Periodontology (2005). It is expected that during the first years of life, child and parents will go through a learning process that involves different types of efforts, some of them successful some of them not, to finally achieve the behavior. This process is different for every parent and child. The ample age range defined, allowed understanding of different experiences and efforts made by parents during this process.
- Children must have at least one tooth present in their mouth.
- Participants must be Mexican immigrants, non-U.S. born. The inclusion of only this ethnic group will control for cultural differences that might affect learning and implementation of habits in children.

4.4 EXCLUSION CRITERIA

Participants with children with developmental disabilities that limited their tooth brushing skills were excluded from the study. Severe developmental disabilities can have mental and/or physical impairments that limit their mobility, language, and learning requiring additional efforts from the child and parents to practice tooth brushing. Therefore such cases, which were evaluated in an individual basis, were excluded from the study.

4.5 SAMPLE SIZE

In qualitative studies sample size is defined by a series of factors such as aims of the study, heterogeneity of the population, selection criteria, groups of special interest, types of data collection methods, budget, and resources available (Charmaz, 2006; Ritchie, Lewis, & Elam, 2003). In general, it is stated that sample size should be large enough that all perceptions that might be important to the topic are uncovered (Mason, 2010).

Saturation is usually the guiding principle to define a sample size in qualitative studies. It has been discussed in the literature that researchers tend to claim to have achieved saturation but do not prove or describe it (Bowen, 2008; Morse, 1995). In an attempt to define saturation, Strauss and Corbin (2008) wrote that it should be defined as the point where it becomes counter-productive to gather more information and that the new data does not necessarily add anything to the overall story, model, theory, or framework. Some sources that provide guidelines for sample size in qualitative studies give the following numbers: “25 participants for smaller projects”

(Charmaz, 2006), “often less than 50” (Ritchie et al., 2003), “in interviews studies often little that is new comes out of transcripts after 20 interviewed people” (Green & Thorogood, 2009).

Based on the narrow focus of the research topic, inclusion/exclusion criteria, the relatively homogeneity of the study population, and budget constraints, the author of this study decided to include at least 20 participants, or until no new topics emerged and saturation was reached.

4.6 SAMPLING STRATEGY

The author of this study invited a purposive sample of Mexican immigrant primary care givers of children aged between one and six years-old to participate in the study. The researcher tried to include participants with high and low educational level with the goal of obtaining a sample that was representative of the population of interest. High educational level was defined as college or more, and low educational level as high school or less.

4.7 INSTRUMENT: INTERVIEW PREPARATION

Initially, the author of this study developed a set of questions which she pilot-tested and modified if participants thought they were difficult to understand. All interviews were conducted by the author of this study, for which she received proper training in conducting qualitative interviews. These procedures are described in more depth in the following section.

4.7.1 Pilot-testing and training

The author of the study developed an initial set of questions based on the research aims and the theoretical framework. Questions were open ended and covered topics related to participant's background, tooth brushing knowledge, and habits. For each question there were at least two probes which the interviewer could use to clarify what was said and get more details, thoughts or feelings. This initial set of questions was evaluated by an expert in qualitative studies with experience in interviews. She suggested the following modifications:

- Write down all the expected dialogue between interviewer and participant from the beginning until the end of the interview. This process would allow the interviewer to rehearse the interview in advance, therefore promoting a more fluent conversation.
- Reorganize the questions and arrange them in modules that followed a certain logic which would allow better flow of topics in the conversation. The created modules were the following (in order of conversation): welcome, general information, dental health, mother's dental health, child's dental health, parent's personal experience, dentist, and closure.
- Add a subset of general questions that could be used as an introduction to the dental topic. These questions asked about participants' experiences in the U.S. and were developed to initiate conversation.

The next step was to pilot test the questions. A copy of the script was sent to two Mexican immigrants not related to the study. They suggested changing some of the wording to fit Mexican language expressions. Next, the author of the study tested the interview with one participant following all pre-defined protocols. As a result of this exercise the following situations were considered for future interviews:

- Using the Mexican expressions was not natural for the interviewer, and it became a barrier for fluidity of the conversation. It was decided to acknowledge the Latino origin of the interviewer (Chilean) as part of the initial presentation, and even use it to develop rapport with the participant. The suggested Mexican expressions were used if a word mentioned by the interviewer was not understood.
- Two questions had to be re-written to ensure their comprehension.
- The order of the modules was rearranged to improve transitions between topics. The final order was: welcome, general information, dentist, dental health, mother's dental health, child's dental health, parent's personal experience, and closure.

4.8 RECRUITMENT

The investigator recruited participants in Latino community events, local stores, health centers, churches, and other community gathering places throughout Pittsburgh, PA and Philadelphia, PA. Additionally, participation was promoted through flyers (Appendix A), word of mouth, and was facilitated by extensive contacts of the author's advisors.

When the researcher made initial contact with a potential participant, whether over the phone (because the participant saw the flyer or was referred by a friend) or in person at a community event, she explained the research study goals and procedures (explained in the consent document). If the individual approached was interested in participating in the study he/she was asked questions to verify he/she met the inclusion criteria (Appendix B). If eligible, a meeting was scheduled at a place and time of convenience for the participant. At this time contact information would be asked (first name and phone number) with the only purpose of maintaining

communication with the participant. This information was confidential and was not linked to their interview responses.

4.9 IMPLEMENTATION OF INTERVIEWS

After the participant was contacted by the researcher and she confirmed the eligibility for the study, they scheduled a date and place for the interview. Settings for interviews were coffee houses or the participant's home.

Before beginning the interview the interviewer read a consent script in Spanish previously approved by the University of Pittsburgh IRB (Appendix C) to the participant. This document followed IRB guidelines and described research goals, interview process, and monetary incentives. It also emphasized that interviews were anonymous and that participation was voluntary. The interviewer reminded participants that they could withdraw from the research study at any time, and that their answers were confidential.

After the interviewer read the consent form she turned on the audio-recorder. The interview started with the introduction of the interviewer and thanking the participant for her time. The interview script was used as a guide for questioning and transitioning between topics (Appendix D). Probing was used to promote the explanation of topics but participant's responses determined the amount and type of information given on each topic and their perceived relevance.

Once the interview finished, the interviewer turned off the audio-recorder and asked the participant to answer a short questionnaire to gather demographic information and additional data to describe the sample (Appendix E). This questionnaire included questions of ethnicity, age,

gender, educational level, family structure, at home resources for dental care, and acculturation (Short Hispanic Acculturation Scale (Marin et al.,1987)). After the interview and survey were completed the interviewer gave each participant a gift card with \$30.

4.10 DATA ANALYSIS

The qualitative analysis of the data was performed by the author and a dental student trained in qualitative analysis. Qualitative analysis was based on thematic analysis. Thematic analysis is a process for coding qualitative information where observation precedes understanding. Three main phases of inquiry are described in thematic analysis: seeing (perceiving a pattern or theme in seemingly random information), coding (giving each theme a label, definition, and description), and interpretation (contribution of the information in the development of knowledge) (Boyatzis, 1998). This analytic process was systematical and sequential as suggested by Corbin and Strauss (2008).

Units of analysis were Mexican immigrant parents and their children. The following steps were followed to analyze the information:

- 1) The author of the study developed a list of predefined topics on habit formation (automaticity, contextual cues, emotional tone, social norms, frequency, developmental skills) based on the reviewed literature.
- 2) The author heard the audio-recordings and transcribed all interviews verbatim.
- 3) To make the analytical process more efficient, a computer software program for qualitative data analysis was used (NVivo).

- 4) The researcher trained a second researcher (dental student) in qualitative analysis and coding in order to help the analytic process and ensure reliability of the analysis. Both researchers coded the first 8 interviews and the author did the other twelve by herself.
- 5) Each researcher read the transcriptions of the interviews.
- 6) Both researchers began the analytical process with open coding, assigning codes line by line throughout the entire reading of the interview.
- 7) Reliability was sought by comparing identified codes and themes from the author with those coded by the second researcher for the same interview. Similarities and differences in the coding were discussed and definitive codes were agreed on. This process was done until agreement was reached.
- 8) The researchers wrote memos throughout the entire analytical process to allow fluent theoretical thinking during the coding process. Memos provided a firm base for reporting on the research and its implications.
- 9) The author developed a codebook with a compilation of all the codes in the study to help identify key themes and how they were to be labeled (Appendix F and G).
- 10) In an axial coding process, the researchers grouped together conceptually similar codes to assigned categories, and subcategories; they determined relationships among them and more abstract categories were developed where new concepts could fit.
- 11) In later phases of the study, the associations between categories were looked at in more detail by the researchers in order to define the presence of a core category central to all the data in a process of selective coding.
- 12) Topics unrelated or tangent to the main research question were identified, and described separately.

5.0 RESULTS

5.1 DESCRIPTION OF THE SAMPLE

Twenty interviews were conducted between the months of November 2013 and March 2014 in Pittsburgh, PA (17 participants) and Philadelphia, PA (3 participants). Interviews lasted an average of 30 minutes. Participants were all Mexican immigrants, female, aged between 28 and 43 years-old (Table 1). Two husbands were present during the interviews of their wives, one did not talk during the interview and the other one answered some questions and then left before the interview was over. All participants were primary care takers of at least one child between the ages of one and six. Eleven participants (55%) had at least one child younger than three years-old, and three (15%) were first time parents. Collectively, there were 55 children between six months and 22 years-old. Information on three children was excluded from the study because of the following reasons: 1) one mother did not live with two of her three children, therefore she provided information only about the child that lived with her; 2) even though one mother described herself as primary care taker of five children, two of which were her nephews and three her own children, she only provided information about the tooth brushing of her own children. One mother had one child with autism (4 years-old) and one healthy child (5 years-old); her experience was still accounted for in this study because of her teaching experience with her 5 year-old son and because both of her children practiced tooth brushing by themselves without any constraints. Participants provided information regarding their experience teaching tooth brushing

to all of their children. For analysis purposes when referring to children in the result’s section only children aged 16 or younger will be considered (47 children total), unless explicitly stated.

Table 1: Descriptive statistics. Family characteristics

	Mean	SD	Min	Max
Parent's age	34.45	3.85	28	43
Number of children	2.7	0.98	1	5
Age of children (months)	88.54	62.17	6	267
Age of children (years)	7.38	5.18	0	22

Even though the author did not intend to compare results by educational level there are some interesting findings that will be presented throughout the result section. The educational level of participants was assessed by asking “What is the highest educational level you achieved?” Thirty-five percent (seven parents) of the participants had a college degree or higher. None of the participants described themselves as having “some college” education (Table 2). Parents with low educational level had an average of 2.7 children ranging from 10 months-old to 22 years-old; high educational level parents had an average of two children ranging from six months-old to eight years-old.

Table 2: Descriptive statistics. Educational level of participants

Educational level	Grade	n	%
Low	Elementary school	3	15
	High school	10	50
High	College	1	5
	University (incomplete)	2	10
	University (complete)	4	20

Four types of work situations were described by participants. As can be seen in figure 4, eight participants (40%) reported working only a few days a week on a regular basis, or occasionally when asked for; six participants (30%) stayed at home to take care of their children; four (20%) worked full-time; and two were staying at home temporarily because of a situation that prevented them to work (pregnancy, and taking care of infant). Most participants, no matter their work situation, explicitly stated that one of the best aspects of being in the U.S. was being able to enjoy their children. Also, most of the participants say they felt that if they were back in their home countries they would have to be working full-time.

Answers to the Short Acculturation Scale (SHAS) showed that all parents had low levels of acculturation (average score between 1 and 2.99). Despite the low level of acculturation registered all participants reported using health care services for their children, and identified health care providers as one of the main sources for tooth brushing knowledge. Their personal experiences in navigating the healthcare system are reported in Appendix H.

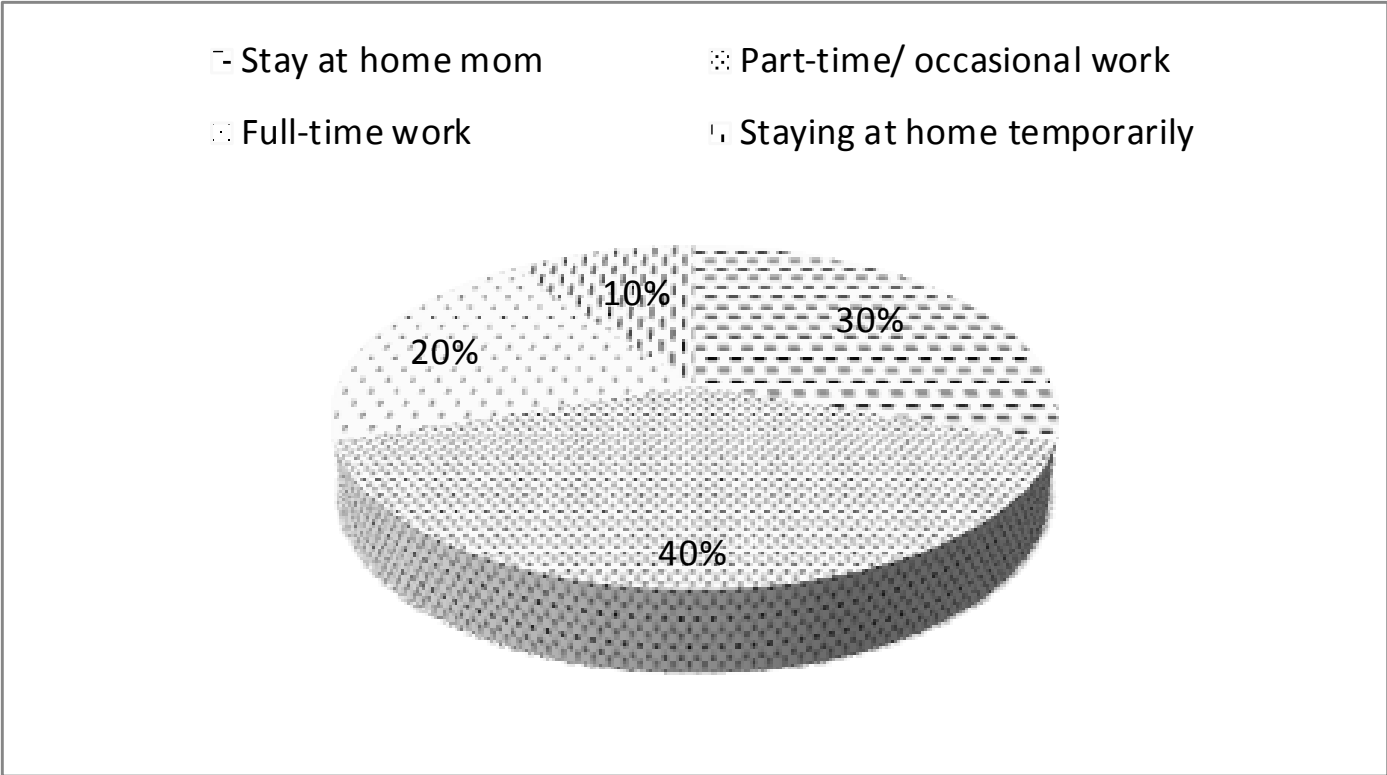


Figure 4: Participant's work status. Percentage of participants working full-time, part-time or occasionally, staying at home, or living a temporary situation that prevents them from working.

5.2 QUALITATIVE RESULTS

Thematic analysis showed the presence of four main emergent themes: tooth brushing, participant's background information, healthcare, and parenting. For a list of codes in each of this topics see Appendix F and G.

In the following section only the tooth brushing theme and related analysis will be explained in detail. For additional results and analyses please refer to Appendix H

The researchers identified over seventy codes (see Appendix G for list of codes) that were grouped in nine major themes about different aspects of tooth brushing: habit, developmental trajectory, factors associated with tooth brushing stage, knowledge, general health and oral hygiene, eating and oral health, motivation, routine, and attitude. Additionally, they searched for predefined codes for habit formation in tooth brushing behavior such as automaticity, frequency, cues, social norms, emotional tone, motor skills and cognitive development.

A) Habit

The author searched for predefined topics in habit formation previously identified in the literature. These topics were automaticity, frequency, cues, social norms, and emotional tone.

- a) *Automaticity*: Automaticity components such as lack of awareness and efficiency were often not reached. Even though there is no evidence on stages of habit formation these groups were noticeable: no intention, intention, and routine/habit. In the *no intention* group two participants explicitly indicated their child (four and seven years-old) “*doesn't still have the habit... it's not natural for them (to brush their teeth)*”. The participants had

to remind and take them every time they had to brush their teeth. In the *intention* group two participants with children of young ages (two years-old) stated their children did demonstrate signs of intention “... *she has the intention too, she says I want to brush my teeth, and we brush them for her*”. Two participants with older children (four, five, and fifteen years-old) also recognized their children’s initiative for tooth brushing and even recalled events when their children had brushed their teeth without being reminded of it “*Yes. There are times when he says mommy I already brushed them*”. In the *routine/habit* group two participants said their children “*knew their tooth brushing routine*” (four and five years-old). Only one mother mentioned automaticity when talking about her sixteen year-old son’s tooth brushing, she said he “*automatically knows he has to brush his teeth*”.

b) *Social norms*: In 12 cases tooth brushing was reported as a social situation where family members would practice this behavior as a group. In these cases tooth brushing could be defined as a social norm for participating family members. In other cases tooth brushing was practiced individually. Some of the reasons provided for this approach were infrastructural constraints (“*because the bathroom is too small*”), different schedules, and behavioral reasons (“*no, I feel like together they make a... they start to play and splash water. I feel like individually is better, more organized, and not so much work*”).

Also, two participants stated having told their children “*your friends brush their teeth*” and “*your friends at school are going to tell you that your breath smells*” when trying to convince their children to brush their teeth. These situations reflected the use of social norms by comparing the child with his/her peers.

c) *Contextual cues*: cues for tooth brushing in the morning included: after waking up (reported to be done by 9 children), after breakfast (28 children), and before school (24 children). Night-time cues for tooth brushing included: before going to bed (83% of all children), part of the bath-time routine (7 children), and after dinner (6 children). Fourteen participants did not mention only a single cue to be associated to their children's tooth brushing, but two or more, eg. *"they have their breakfast and then brush their teeth, and they are ready for the school bus"*

d) *Emotional tone*: The emotional tone set for each tooth brushing session varied between children and even between sessions. Parents would even state that *"each child is different"* and it could not be expected to be the same for everyone.

Six participants expressed to perceive that brushing their child's teeth was an easy task because their children wanted and enjoyed brushing their teeth. Their experiences reflected a much lighter and positive emotional tone, as can be observed by the following statement of a mother of a seventeen month-old child *"...she is little and she wants to do it when she sees us that we go to the bathroom. She points her toothbrush and when I hold her and start brushing her tiny teeth she is happy and opens her mouth and looks in the mirror. It is fascinating for her"*.

On the other hand, some participants described tooth brushing sessions where their children would be *"angry"* because they did not want to brush their teeth, or parents would have to *"battle"* with their children to get them to brush their teeth. These situations provided a negatively emotionally charged environment as can be understood by the statement of one participant *"She always cries and that is frustrating"*. Still, some participants reported that their children would sometimes be annoyed to brush their teeth

and sometimes not. For example, a mother of a three year old child explained “*in the morning he doesn’t like to brush his teeth, in the morning when I wake him up to go to school. He is like NO! MOMMY I DON’T WANT TO! And when I’m bathing him he knows that he is going to brush his teeth...He doesn’t like it in the morning, but in the afternoon when I bathe him he says yes mommy brush my teeth...*”.

- e) *Frequency*: Participants’ responses expressed variance in frequencies in the practice of this behavior. As showed in figure 5 all children aged less than one year-old had not started brushing teeth or cleaning gums. One child 19 month-old child had not had any type of oral care provided. In general the number of times a day children brushed their teeth varied within and between ages. Participants would commonly refer to their tooth brushing as something done “regularly” or “in general” a certain number of times per day.

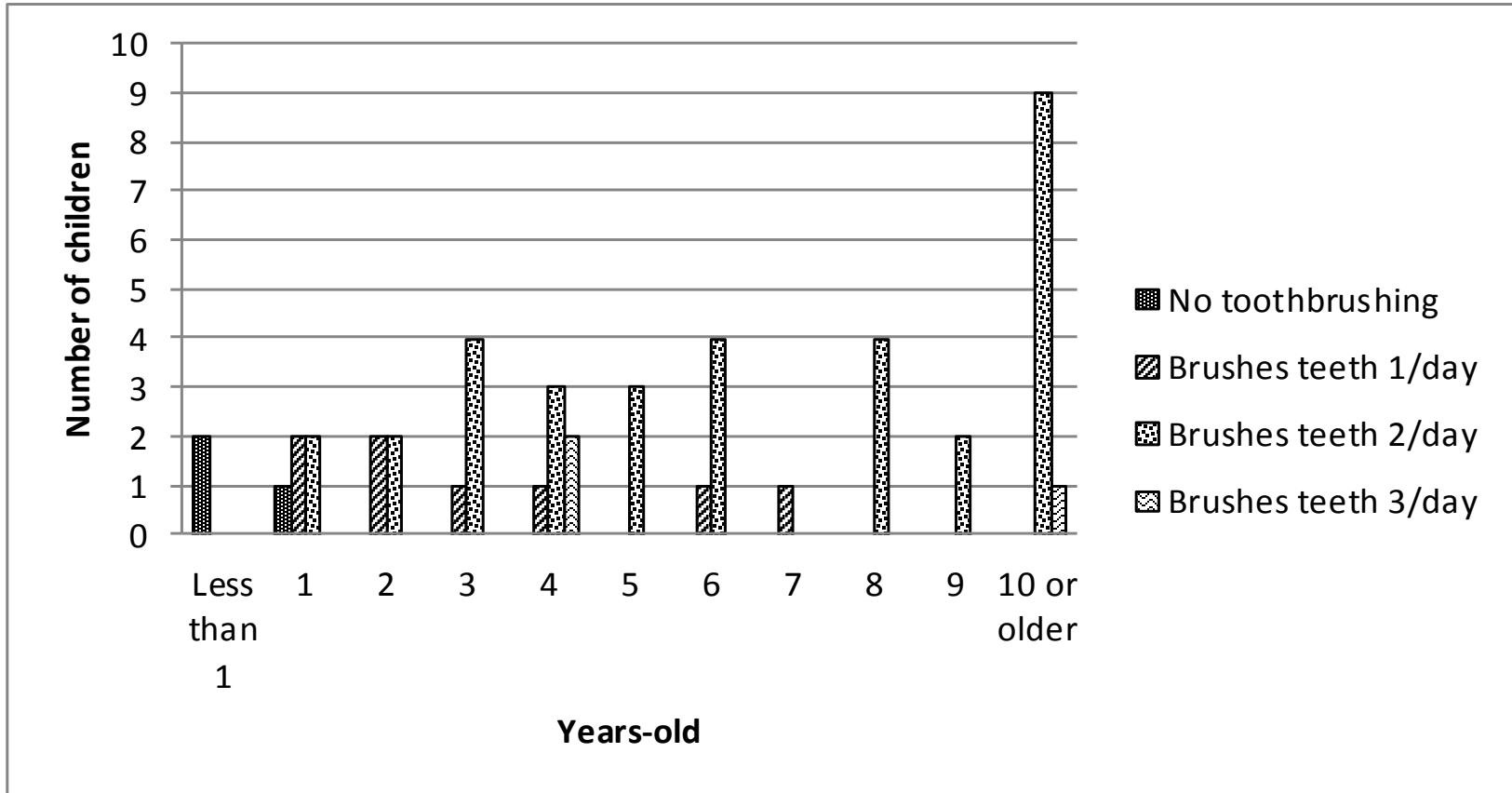


Figure 5: Tooth brushing frequency by age of the child

B) Developmental trajectory of tooth brushing

Participants described a process that started with receiving information about oral hygiene, progressed to introducing the behavior to their child, and learning to brush teeth (going through different tooth brushing learning stages as they develop motor control and cognitive maturity), demonstrating intention to brush teeth and developing a habit.

Several concepts seemed to be of importance when teaching children to brush their teeth. Defining at what age to start brushing their child's teeth and determining until what age children needed help from parents to brush their teeth was one of the main topics. Participants' experiences while teaching their children to brush their teeth were organized in four stages: entirely dependent tooth brushing, assisted tooth brushing, road to tooth brushing independence, and independent tooth brushing. This information emerged from the data gathered during the interviews. Participants did not necessarily recognize having experienced all stages with their children, but stages did follow a progressive pattern.

- a) *Entirely dependent tooth brushing*: This is the stage in which parents introduced their children to oral hygiene practices such as cleaning of gums and tooth brushing. The most commonly mentioned cue to initiate children's tooth brushing was the appearance of teeth in the mouth. Other cues were starting to walk and talk, doctor's recommendation, and child's request. For example a participant remembered starting to brush his eldest son's teeth as "*The eldest saw us brushing our teeth and he also wanted to brush his teeth, so we went and bought him a toothbrush...*"

Three parents of children between six and nineteen months-old had not started brushing their child's teeth or cleaning their gums. When the interviewer asked about her daughter's tooth brushing (thirteen months-old) one participant stated "*Ah, there still is*

time, she only has one tooth!” Upon starting, over half of interviewed participants reported using a soft cloth to clean the child’s gums/teeth. Consistent with this, at the time of the interview, one participant (mother of a thirteen month-old child), out of three who provided oral hygiene care to their children (less than 24 months of age), stated she was using a soft cloth to clean her child’s gums; the other two participants assisted their children (17 and 19 months-old) in brushing their teeth with a toothbrush. Nevertheless, these two participants remembered having used a soft cloth or a finger toothbrush to clean their children’s gums before (“*I used to use that [soft cloth] with my daughter, but when she saw her brother using a toothbrush she wanted to use one too*”).

b) Assisted tooth brushing: Sixteen participants, parents of children between seventeen months to eight years-old, stated they assisted their children in brushing their teeth every time. Most of these parents said they would let their children brush their teeth first and then brush their teeth for them; some would brush their children’s teeth first and then let them use the toothbrush and practice.

A mother described this process with her two year-old son as “*the technique now is that...well he doesn’t like us to brush his teeth, but I give him the toothbrush and tell him “go on try to do it yourself” and sometimes I take his hand so that he starts brushing but he gets anxious, or I don’t know... feels funny holding the toothbrush. So I end up taking the toothbrush and brushing his teeth for him.*”

c) Road to tooth brushing independence: Defined as the stage when children would start brushing their teeth independently, without any assistance from an adult. Six participants said they found themselves in a stage where their children (four to nine years-old) would brush their teeth by themselves occasionally without any assistance. Sometimes children

would brush their teeth without being reminded of it. For example, emphasizing the practice her four year-old son was gaining by brushing her teeth by himself, a mother stated “*So I have to take turns, one day I let him so he can feel that he is doing it by himself, and one day I do it so that I can make sure that he is doing it correctly or that the teeth are clean*”.

- d) *Independent tooth brushing*: Twenty children aged four to sixteen years-old and older brushed their teeth by themselves without any assistance of their parents. Also, sometimes children would brush their teeth without being reminded of it.

The depiction from the graph in figure 6 allows an understanding of the flow of the different tooth brushing stages at different ages. The use of a soft cloth to clean gums and first emerging teeth serves as an initial stage for oral hygiene. Participants stated having started assisting their children to brush their teeth with a toothbrush as early as seventeen months of age. This behavior was common among children two and three years-old. Participants -parents of children four years-old to nine years-old started allowing more independence in tooth brushing, still providing assistance in some cases and letting their child brush their teeth without any further assistance in others. All children over 10 years-old brushed their teeth by themselves.

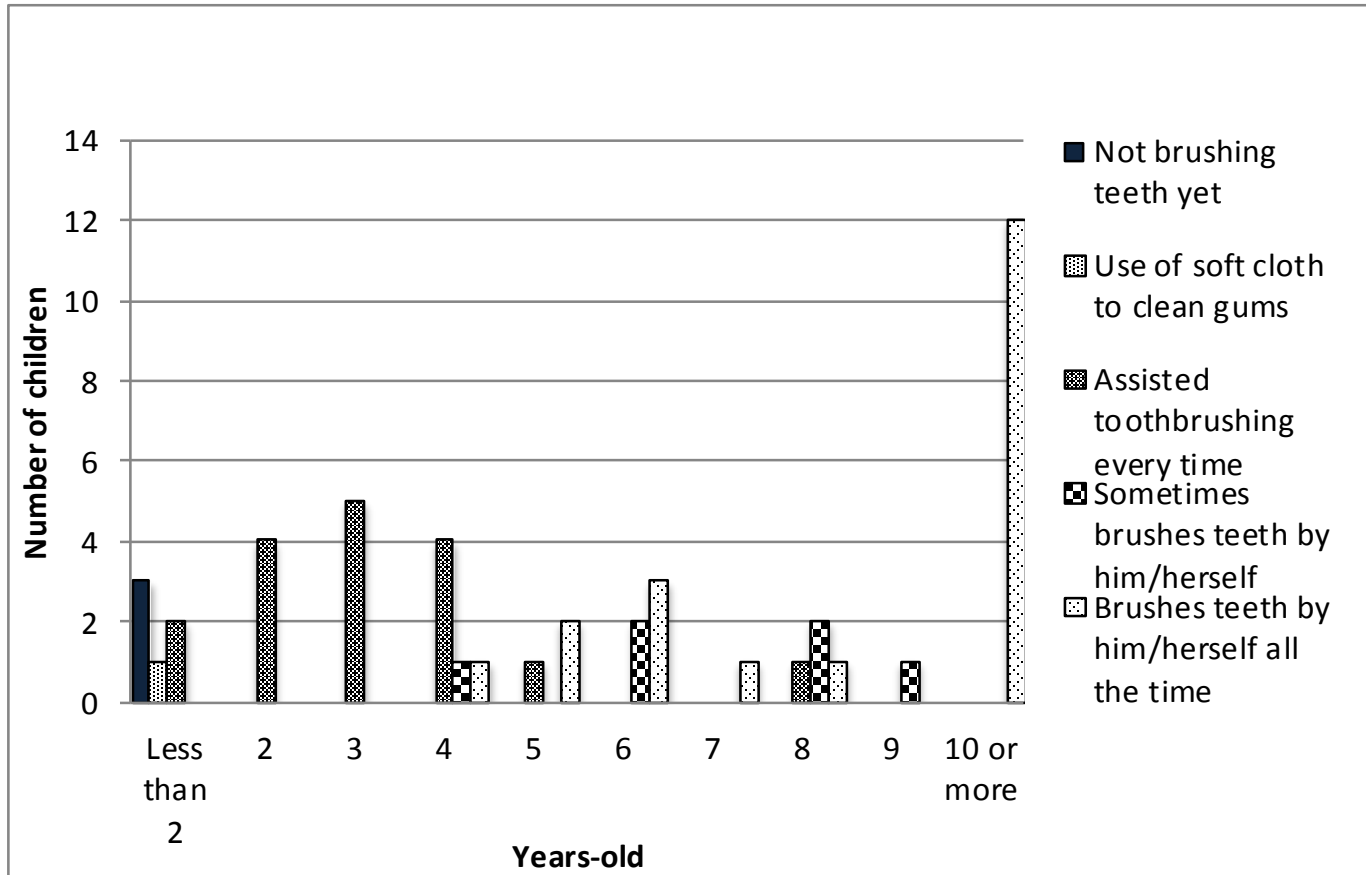


Figure 6: Tooth brushing developmental trajectory. Graph depicting number of children at different tooth brushing stages throughout ages

C) Factors associated with tooth brushing stage:

The author related two predefined topics (developmental milestones [motor and cognitive skills] and information) with parent's approach when teaching their children to brush their teeth.

a) Developmental milestones: Participants' perceptions of their children's developmental competencies in motor control and comprehension affected the degree of independence they provided when tooth brushing.

- **Motor Skills:** Participants perceived their children had little or no motor control, some motor control, or good motor control. Children in the first group (little or no motor control) were all between thirteen months and two years of age. Some examples of how participants described their children's tooth brushing skills in this group are: "*grabs the toothbrush and start biting it*", "*all he wants to do is hold it*" (referring to the toothbrush), and "*She doesn't brush her teeth correctly, but at least she tries to put the toothbrush (in her mouth)*". Participants who had children with some motor control described tooth brushing scenarios where their children would brush their teeth but would "*not brush well*", "*not brush her molars very well*" or "*only brushes the teeth in the front*". Therefore parents would aid them by brushing their teeth for them. Most children in this group aged between two and five years-old. Two children, one eight years-old and one nine years-old received their parents assistance because their parents felt they didn't "*brush well*". In general, parents perceived their children's motor dexterity to be normal according to the developmental stage they were in. The third group of children was defined to have good motor control. Children in this group were five years-old or older. All parents of children in this group stated their children were capable of brushing their teeth by themselves.

It is also important to consider that to achieve effective tooth brushing behavior motor skills must be accompanied by good tooth brushing technique. Addressing the tooth brushing technique a mother commented on the lack of rigor and poor cleaning results of her son's tooth brushing, "*Because the eldest brushes them, but I keep telling him brush them correctly! Use the floss. I always tell him, because I don't like him to have his teeth yellow*". In this case, teeth coloration was the method used by the parent to evaluate his child tooth brushing effectiveness. Other parents used the presence of dental cavities to evaluate their children tooth brushing. For example, a mother stated, referring to her child's tooth brushing, "*Good. He doesn't have any cavities. It's all normal*".

- Cognitive Development: Participants -mothers of younger children (17 and 20 month-old) stated their children had a perception of tooth brushing as they would try to use the toothbrush correctly ("*...when we go to the bathroom she points to her toothbrush and I hold her and start brushing her teeth...*" "*...and every time she goes, she tries to brush her teeth*"). Even though the literature states that children aged two to three years-old are able to understand simple instructions, some participants said they perceived their children did not understand what they were explaining when giving instructions about tooth brushing or when talking about its importance. For example when the interviewer asked if she (the mother) talked about tooth brushing to her two year-old son, the mother said "*No. I haven't talked about it. Because he is only two years-old and he doesn't understand what I tell him*". Parents of children aged three to sixteen years-old expressed they perceived they children did understand instructions and explanations about tooth brushing. For example, a mother expressed that her four year-old child "*...learns everything one teaches him. Do it like this, move it upwards like this....*"; referring to a three and a five year-old a participant

stated “[They] do understand. They understand that behind not being allowed to eat candies there is a reason... .. I don’t know to what extent they understand, but they do have a vague idea that we are looking after their health and their teeth”.

b) *Information*: Participants’ knowledge or lack of knowledge on tooth brushing affected their children’s tooth brushing learning and therefore the stage in which they were. For example, one participant explained her experience visiting her daughter’s pediatrician at her eighteen month-old well child visit, “We went to her well-child visit and asked the doctor: Is it ok? [to brush her teeth] And he looked at us and said hadn’t you already started doing it?, [I said] No! But we really didn’t know when it was the right age to start doing it! Once he gave us the authorization we started”. During this appointment she learned for the first time that she should have started brushing her child’s teeth earlier. Also talking about her experience initiating tooth brushing with her children a participant stated “... it’s easier because with the first child you are all new, and all how do I brush them, and at what age I should start, and for how long... And you learn and then you have your second child, and the third...”.

A participant that actively assisted her son in brushing his teeth said she was unsure about certain aspects of teaching tooth brushing to her son, for example she mentioned “... I don’t know how I’m gonna do it with the middle one, because I don’t know if I’m right or not in helping him so much”.

D) Knowledge

The author evaluated participants’ knowledge about oral hygiene behavior with the question “How do you think people should take care of their teeth?” All interviewed participants mentioned tooth brushing as a mean to take care of teeth. Four parents additionally mentioned

flossing and the use of mouthwash. Other means mentioned by participants as aiding to taking care of teeth are dental check-ups and dental cleanings. Some parents that talked about these topics specifically said that these should be done regularly.

The word cloud below (Figure 7) shows the frequency with which words were mentioned when participants answered the previous question. The bigger the word the more frequently it was mentioned by participants. This figure allows us to visually identify that brushing teeth was a commonly known way to take care of teeth. On the other hand, floss and mouthwash are visibly smaller meaning that they were mentioned fewer times as a way to take care of teeth.

When the interviewer asked about frequency of tooth brushing, participants mentioned it should be done two, two or three, or three times per day. Other participants just mentioned it should be done daily. Participants also said that teeth should be brushed after meals and before going to bed.



Figure 7: Word cloud representing word frequency in participants' answers about how to take care of teeth

The following bar graph (Figure 8) shows the frequency with which parents mentioned each oral hygiene topic when the interviewer asked them about how to take care of teeth. Each topic (tooth brushing, flossing, mouthwash, and dental visit information) has a different pattern. This graph reflects the different answers provided by participants. Flossing, the use of mouthwash, going to regular dental check-ups, and having dental cleanings were also mentioned by the participants as ways to take care of teeth.

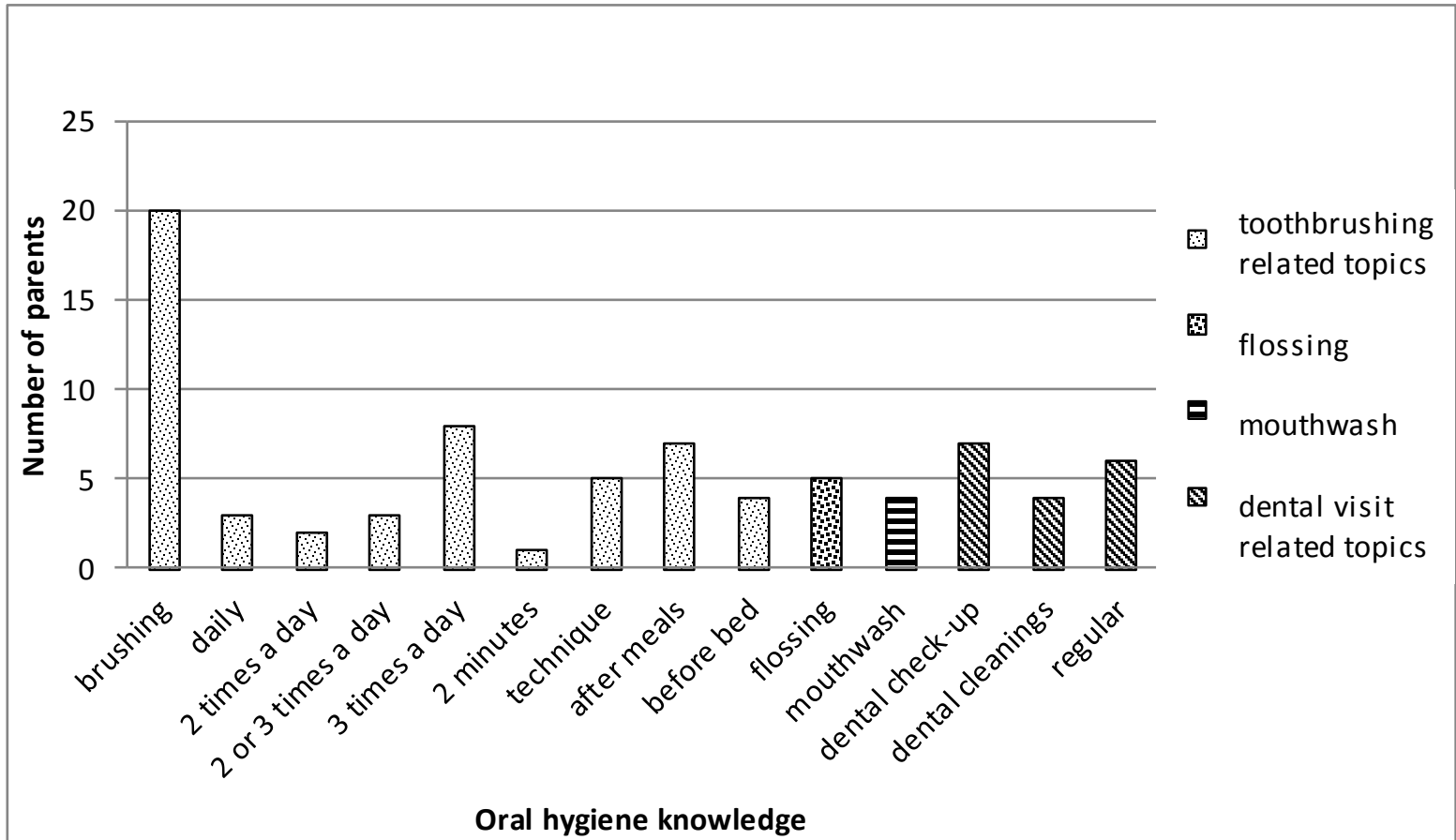


Figure 8: Parental knowledge in oral hygiene. This graph describes the answers provided by participants when asked how they thought people should take care of teeth

Four emerging subtopics were identified within the knowledge category: external sources of knowledge, parental past experiences, doubts, and erroneous beliefs.

- a) *External sources of knowledge*: Four main groups were identified by the author to have provided knowledge regarding oral hygiene to participants: health providers, family, literature, and friends (in rank order from most to least frequent). More than half (twelve parents) referred to a health professional (doctors, dentists, nurses) as the main source of information about oral hygiene. The type of information provided about oral hygiene varied from tooth brushing frequency (“...*brush three times after every meal, brush three times a day that is what the doctor said*”) to tooth brushing routines (“... *my mom who taught us to bathe, brush our teeth. Before going anywhere wash our mouth*”).
- b) *Previous dental experiences*: Participants previous experiences gave them confidence and knowledge on the topic. For example, regarding the experience a participant had with her eldest daughter where she had to take her for emergency dental care because of an abscess she stated “*I think that with children we learn. I think that with my children I have learned, because every time I have to take them to the dentist...I think it is also because of my (experience with) my eldest daughter, because of what happened to her. It is my goal that they have their teeth healthy*”.
- c) *Doubts*: Half of the interviewed participants demonstrated being unsure about oral hygiene practices and/or the teaching and learning process of tooth brushing. For example, one participant when talking about access to dental products “*Should I keep brushing Alonso’s teeth with baby’s toothpaste?*”. Ninety percent of the questions about oral hygiene practices were asked by parents of low educational level, whereas sixty-seven percent of the questions about teaching and learning processes were asked by

higher education level participants. The researcher answered the participants' questions once the interview was finished.

- d) *Erroneous knowledge*: Parents knowledge about oral hygiene was sometimes accurate and sometimes was wrong. For example, a mother did not brush her two year-old son's teeth with toothpaste because she was afraid that he would "*swallow it and for it to hurt him*". She did not mention fluoride or the use of fluoride-free toothpaste, but her actions reflected her knowledge in using toothpastes once swallowing is controlled. On the other hand, one mother only started to brush her daughter's teeth once she had her doctor's authorization "*... we went to her well-child visit and asked the doctor. Is it ok? And he looked at us and say hadn't you already started doing it? No! But we really didn't know when it was the right age to start doing it! Once he gave us the authorization we started*".

E) General health and oral hygiene:

Participants showed understanding of the relationship between oral health and general health. For example based on her experience with her diabetic husband, one participant said "*sometimes you don't know that you have diabetes... because that doesn't help, and deteriorates teeth even more*". Other participant recalled "*brushing her teeth more frequently and gargle with Listerine and mouthwash*" when she had a sore throat.

F) Eating and oral health:

When talking about taking care of teeth, one of the most commonly mentioned topics were sugar consumption. Most participants (80%) tried to have some control over candies and sugary foods at home. Participants would hide or simply not buy these foods to limit their children's access to them. Participants positively related cavities with sugary food consumption and stated they

constantly reminded their children to brush their teeth after they had eaten candies. For example, one participant explained what happened if they children ate candies at home “...or that if they eat candies they have to go brush their teeth”. A few participants also mentioned that after brushing their children’s teeth at night they would not allow them to eat anything else. One participant, based on her personal experience, mentioned the connection between feeding night formula to her child and cavities (“...because the problem was the baby bottle. The formula would stay in his teeth and the sugar started to damage his teeth”).

G) Motivation for oral hygiene:

Several topics were identified by the author to motivate parents and their children to brush their teeth. The interviewer did not specifically probe for this topic, but it emerged from the conversation with the participants. The most frequently mentioned reason for tooth brushing was the impact of keeping teeth healthy in general health. For example one participant stated “...especially if they don’t brush their teeth they are going to have health problems in the future”. Participants’ previous dental experiences (their own or their children’s dental experiences) as well as avoiding curative dental care and costs, having a good image, and avoiding pain associated with bad oral hygiene were other frequently mentioned reasons to promote tooth brushing. Less frequent motivators were to have good breath, and cleanliness.

Figure 9 compares motivational factors between parents with low and high educational levels. It is surprising to find that “image” was only mentioned by participants of low educational level. The most frequently mentioned motivational topics by parents with low educational level were impact of oral care, image, and previous experiences. On the other hand, participants with high educational level most frequently referred to impact of oral care, and avoiding curative dental care and costs.

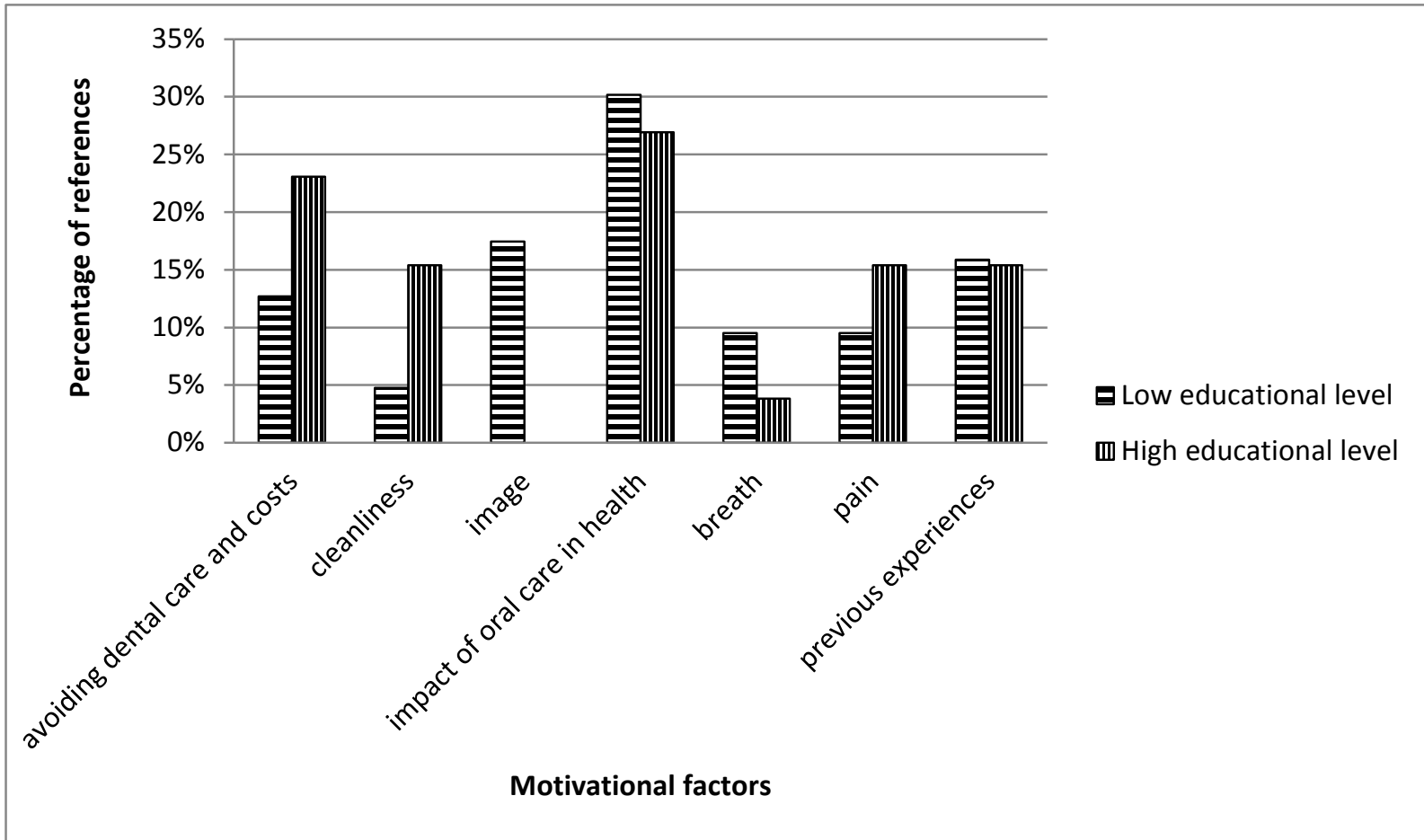


Figure 9: Motivational factors by educational level

Techniques for motivating children to brush their teeth: Techniques can be understood as the means to put into practice the motivation towards tooth brushing. Parents resorted to different tactics to have their children brush their teeth. The most commonly use strategy (mentioned by 11 participants) to make children brush their teeth was imitation. Participants noticed that their children tended to want to brush their teeth when they saw a family member doing it. For example one participant stated that her son got interested in brushing his teeth “...because he saw his cousins and he would take his toothbrush and started brushing his teeth. And with Wilmar was the same. He saw Brian brushing his teeth and he wanted to brush his teeth as well.”.

Other commonly mentioned theme (9 participants) was to verbalize the negative outcomes of not brushing teeth such as having to endure pain, loss of teeth, or having to go to the dentist for an extraction. For example, participants would say to their children “*You have to brush your teeth, because if you don’t they are going to hurt. There is going to be an elf drilling your teeth and you won’t be able to tolerate it!*”, or “*I told you that if you don’t brush your teeth they are going to break and they will fall, and you won’t have anything to eat with*”.

Other less common strategies were reading books about dental care (2 participants), using movie characters to demonstrate possible outcomes of bad oral hygiene (2 participants), making tooth brushing fun by singing and playing games (2 participants), and buying dental products with cartoons characters (2 participants).

H) Routine

Twelve participants’ morning tooth brushing routine was practiced first thing in the morning (right after waking up). Four parents and their children did not brush their teeth together in the

morning. The children of six participants brushed their teeth after breakfast, and the children of two participants didn't brush at all in the mornings. Two participants explained the difference in their routines to be a result of their children's sensitivity to toothpaste's flavors if used before breakfast. Night time routines in all cases were similar between parents and their children. Only one participant admitted not brushing her teeth at night and that most days her children (ages six and seventeen) didn't do it as well. Her eldest son (twenty-two years-old) usually brushed his teeth more than three times a day. This behavior was attributed to "*being young and going out*".

To manage stressful situations where children did not brush their teeth when they should have some parents settled verbal agreements a priori with their children. In some cases these agreements would enforce tooth brushing ("*... well I insist, and I have told them that if they go to bed without brushing their teeth I will wake them up and make them go.*") and in some cases they would condone not brushing teeth and reinforce brushing next day ("*I tell them, if you don't do it every day there is no need. But if you don't do it today you have to do it tomorrow*"). Having these conversations with their children would define a course of action if tooth brushing was forgotten.

In all cases participants were the primary care providers for their children. Mothers usually were in charge of reminding, supervising, and implementing the tooth brushing routine of their children. Fathers' role usually would be to remind their children of brushing their teeth ("*... it's law to brush teeth at night, if I don't remind them their dad does*"), and in some cases implement the night time routine ("*...my husband does it more at night, while I clean-up he takes him upstairs and he does it*").

- a) *Participant's perception of the tooth brushing routine:* Having an established tooth brushing routine facilitated, according to some participants, the practice of the behavior.

For example when talking about brushing her children's teeth a participant stated "... well I think it's easy, because it is part of the routine...". In other cases participants would state that it was difficult sometimes because of their children uncooperativeness ("*...and with him is more difficult, because he is young and he doesn't open his mouth...*") and/or because it was perceived to be an exhausting and frustrating task ("*...it's frustrating because I have to be chasing him to take him every day*"). Other motives for defining this task as difficult were the need to be constantly supervising and reminding their children to brush their teeth, as one participant said when referring to brushing her children's teeth "*I think it's very hard! Because they don't like to brush their teeth so we have to be asking them all the time "did you brush your teeth?" "Go brush your teeth before going to bed" We have to be constantly there.*" Children's perceived bad attitude or lack of interest in tooth brushing, and the negative emotional tone because of constant fighting to convince their children to brush their teeth also made tooth brushing a difficult task for their parents. For example, a participant described how her child acted when brushing his teeth "*He gets really mad, but we have to do it (brush his teeth)...it's difficult because he doesn't like the material (of the toothbrush)*". Two mothers attributed this constant battle when brushing their children's teeth to being in the "all by myself" stage, "*...she doesn't let me help her. That is the problem. And obviously she doesn't brush her teeth good. The problem is that is "all by myself"*".

b) *Barriers to maintaining a tooth brushing routine:* Daily and weekly routines could be disrupted because of other activities and changes in schedules. Fourteen participants mentioned not being able to brush their own teeth because they did not have time or forgot about it when doing other things ("*...and since we have more work and we are in*

a hurry, and I think that sometimes I neglect myself and specially the days that I'm in a rush I forget"). Two participants remembered that in their previous work they brushed their teeth after lunch, but now as their working status and conditions have changed they don't have time to do it anymore ("Before I used to have time. I would finish eating... and now you just forget, or you start doing something else and forget. Before I used to work and there was a routine, I would finish eating, went to the bathroom to brush my teeth, and continue working").

Participants reported that breaks in the routine such as vacations, weekends, and occasional work opportunities would change tooth brushing schedules or lead to omission of tooth brushing sessions. For example, one participant recognized that during the weekends her children would *"forget to brush in the morning, but they HAVE to brush at night"*; other participant stated that *"Saturdays and Sundays with all of the rush of taking them to activities"* she would not be able to brush their children's teeth three times a day.

I) Attitude towards tooth brushing

Parents described situations that facilitated tooth brushing introduction and learning processes. For example, they would describe situations where their child would remind them they had to brush their teeth: *"They say mammy, let's go brush my teeth!"*, *"...every time I see him, he come with his toothbrush and wants to brush his teeth"*.

The author identified negative attitudes towards tooth brushing in 80% of the interviews. In children, attitudes reflected a state of disinterest and rejection towards the behavior and in some cases led to anger and emotional distress (*"I sometimes battle with Isabella, Isa lets go brush your teeth!, Soon mom! And Sofi, even though she knows it's going to happen she always*

cries, I don't want to brush my teeth!"). Parental negative attitudes indicated disinterest and lack of understanding about the importance of tooth brushing. One parent commented about her tooth brushing behavior stating *"I do it fast and do it bad"* and *"I don't pay attention to its importance"*. In this case her negative attitude toward tooth brushing was reflected in her children's tooth brushing behavior who brushed their teeth one time a day or hadn't started brushing at all (19 month-old).

6.0 DISCUSSION

This study's objective was to provide insight on tooth brushing habit formation in children of Latino families. All the identified themes helped understand and describe in some ways the efforts Mexican immigrant parents make when teaching their children to brush their teeth. Habit formation was explored more in depth, analyzing each of the predefined topics described in the literature. Some unexpected findings lead us to hypothesize the presence of stages in the tooth brushing learning process (initial stage, independent tooth brushing, road to independence, independent tooth brushing) which might be a key finding in explaining the dynamic process of learning and developing a tooth brushing habit. This information will constitute the foundation to design future quantitative research investigations intended to study implications of early learning tooth brushing routines on children's and adult's oral health and oral hygiene habits.

The author was able to identify habit components described in the literature and evaluated them according to their role and impact in the development of a tooth brushing habit. In children, the role of automaticity was not clearly defined. As suggested by Verplanken & Aarts (1999) intention did seem to have a major role in the initiation of tooth brushing as an automatic behavior. However, it was impossible to assess how long the intention stage preceded the automaticity stage since this was not a longitudinal study. Factors that affected the change from intention to automatic behavior could not be identified.

Several research studies have evaluated social norms and its association to oral hygiene within the frame of the Theory of Planned Behavior (Buunk-Werkhoven et al., 2010; Buunk-Werkhoven, et al., 2011; Van den Branden et al., 2013). Their results show that social norms are determinants of oral hygiene behavior which is consistent with the results found in this study. During the interviews, participants explained situations where tooth brushing could be experienced either as a social and familial event or as a personal and individual event. It could not be determined which of the two types of situations created more of an incentive for tooth brushing behavior in children. In only a few cases participants compared their children to their friends to incentivize tooth brushing. Given the small sample size it is unclear if this is a common practice or if it is effective.

Another interesting topic was the establishment of a tooth brushing routine and its relationship with consistent cues throughout time. Parents stated that having an established routine in the morning and at night helped them practice tooth brushing with their children. Some children would brush their teeth first thing in the morning (following their parents' tooth brushing routines); this practice does not follow dentists' recommendation to brush after breakfast to eliminate food that could remain between teeth (*American Dental Association, 2008*). To evaluate if this morning routine is a common practice for parents and their children, a telephone survey could be conducted in a selected area, eg. Pittsburgh. Questions about dental practices of parents and their children as well as their timing during morning routines could be included in the survey.

Other morning routines had cues associated to breakfast and morning preparations for school; night cues were associated to going to bed at night, bath-time routines, and dinner. These cues were established as a routine during weekdays but they were easily disrupted on weekends

when school routine was absent or other activities took place. Participants identified two barriers: weekends and vacation time. Even though participants were able to notice the change in their tooth brushing behavior when routine was disrupted, no measure was taken to prevent it from happening. To manage times when routines are disrupted, interventions could be developed that use implementation intention theory to increase tooth brushing behavior during these periods of time. This theory is based on anticipating critical situations, identifying cues related to them, and planning how to act once they have to be faced. In this case parents would plan in advance their approach to tooth brushing their children's teeth during weekends and vacations and identify a cue during those special days that will help them practice the behavior.

Being able to recognize cues and act on them is essential for the initiation of tooth brushing in children at young ages. This topic is closely interrelated with the information available and the knowledge gained by parents. If the information is not available for parents, they won't be able to practice their learning. Similarly to Hoeft et al.'s study (2009) nearly half of the interviewed participants had used a soft cloth to clean their infants' gums, which reinforces the idea that this is a behavior in the Mexican immigrant community that still needs to be promoted to increase its practice. Hoeft et al. also identified health professionals as a particularly important source for oral hygiene education, which was corroborated by the findings of the present study. This information was complemented by adding three additional external sources of information: family, literature, and friends. These findings highlight the importance of reaching out to the community and provide the necessary information not only to the mother of the child but also to those who might be in contact with her and serve as a provider of information like pediatricians, nurses, WIC staff, and teachers.

The emotional tone of tooth brushing sessions was variable between and within children. The emotional environment was defined by the child's willingness to brush his/her teeth. A positive emotional tone would define the tooth brushing experience as welcoming, whereas a negative emotional tone would make evoke in parents feelings of frustration and avoidance. These results are consistent with those of Cortes et al. (2012) who found that parents reported challenges when brushing their children's teeth. To enhance the tooth brushing experience, it would be recommended to make it a habit. Recently a study demonstrated that pre-school children with defined routines have higher social emotional health, in other words they rated more positive in the constructs of prosocial skills, problem behavior and emotions, approaches to learning, emotion knowledge, and approaches to friendship (Muñiz, Silver, & Stein, 2014).

Another finding was participants' perceptions regarding motor control and cognitive development. In general participants were able to accurately perceive their children's motor skills and stages. The descriptions participants provided of tooth brushing sessions demonstrated in young children a low level of dexterity mostly grasp, release, and some direction which was normal according to the descriptions in the literature of developmental stage they were in (Gerber et al., 2010). In his article Gerber (2010) also mentions that by eight years of age children's dexterity should be good enough to allow them to brush all areas of their mouth for themselves. In the present research study, it is possible that children's inability to brush their teeth correctly at this age is explained by the use of poor tooth brushing techniques. This could be improved by implementing short educational interventions, based on the tell-show-do strategy, at the dental clinic or the doctor's office.

An unexpected finding was the identification of tooth brushing stages (entirely dependent tooth brushing, assisted tooth brushing, road to independence, and independent tooth brushing).

Given the nature of this study we can only identify these stages, but we hypothesize, based on participants' narratives, that they follow a progressive pattern. So far the author has not been able to find studies that identify such stages throughout the tooth brushing process. Future longitudinal studies that follow a cohort of children from 6 months forward (age in which first tooth erupts) should be done to test and corroborate the trajectory of these stages starting at early ages in life.

In tooth brushing, children's ability to understand simple instructions about how to brush their teeth is essential. It is described in the literature that by two to three years of age children are able to follow two steps simple commands demonstrating their understanding of situations (Wilks et al., 2010). Cognitive maturity was not easily assessed by most participants. In general participants perceived that their children understood less than what they are cognitively capable of, especially when giving instructions about tooth brushing or when talking about its importance. This limited the information and teachings provided to their children at early stages. These findings address the importance of teaching parents about children's developmental stages and how to evaluate these with their own children.

Some really interesting findings were those related to the techniques used to motivate children to brush their teeth. Only few parents described situations where they would use positive experiences to incentivize their children to brush their teeth, such as reading books or making tooth brushing fun; most parents recalled situations where they would use negative experiences that would produce fear in the child to promote the behavior (pain, loss of teeth, or having to go to the dentist for an extraction). The extreme difference between approaches makes us wonder why they choose one approach before the other. Also, is one approach more effective than the other? How do these approaches affect children's perspective about tooth brushing? To

answer these questions we could design an intervention were children are motivated to brush their teeth through the use of positive (eg. singing and games) or negative experiences (eg. relating possible negative outcomes). As part of this intervention we could evaluate if the effect of the experience changes if a non-relative to the child (man/woman), or a relative (parent) provide the stimulus. Outcome variables could be intention, attitudes, motives for tooth brushing, and the practice of the behavior itself. This might help understand how tooth brushing is perceived by children and how it affects its practice and the formation of a habit.

Participants demonstrated fair familiarity regarding the most important components about oral hygiene, but still showed uncertainty about their capabilities in teaching this behavior. This finding underscores a problem that should be considered not only when designing interventions but also in the day-to-day treatment of patients in dental clinics. The information provided to parents/patients is not sufficient; answering questions after the information has just been provided is not sufficient either. Dentists, dental hygienists, and even pediatricians should provide constant feedback about new learned behaviors and the information/practice of the behavior should be evaluated to make sure it was learned correctly. Implementing this approach could provide parents/patients with a solid base to start learning and practicing this new behavior.

Since this study was targeted to the Mexican immigrant population it was important to evaluate how/if acculturation affected their behaviors. The available literature shows that low level of acculturation is associated with below average use of health services (Gao & McGrath, 2011). Contrary to previous studies, in this study, despite the low level of acculturation, nine participants (45%) had taken their children to the dentist before they age of 2, and over 50% of interviewed participants (12 mothers) reported having received advice about oral hygiene from a

healthcare professional. Even though tooth brushing can be described as a home-based behavior, the use of health services for children provides the opportunity to evaluate oral health and give advice on oral care which can impact the practice of tooth brushing at home.

Cultural background did seem to affect participants' knowledge about tooth brushing practices. In Mexico the recommendation is to brush after each meal (Instituto de Salud del Estado de México, 2014). Noticeably brushing teeth was a much known behavior in oral hygiene care. It is also remarkable that more participants thought that people should brush their teeth at least three times a day rather than two times a day (as it is recommended by the ADA), and sometimes even excused themselves for only doing it two times. Even though brushing three times per day could be perceived as beneficial it might have a negative impact if it is perceived as a barrier and provides a notion of failure to perform if not done as many times a day. Given the ADA recommendation of brushing teeth two times per day (*American Dental Association*, 2008) it might be a good approach to inform parents of this new guideline so they can reset their daily goals and therefore their perception of accomplishment.

Participants' educational level was related to specific topics in tooth brushing behavior. It was related to the type of motivational factor that boosted tooth brushing as well as the areas of uncertainty when teaching this behavior to their children. When analyzing this topic in participants with different educational levels I found that those with low educational level were more motivated by the effect of tooth brushing on the image of the person, and they also showed hesitancy about teaching/practice adequate oral hygiene behaviors. On the other hand, participants with high educational level were more motivated by the importance of taking care of teeth and its associated costs, and uncertain about the teaching and learning processes associated with tooth brushing. These differences lead to the hypothesis that areas of uncertainty on tooth

brushing as well as motivational cues for tooth brushing vary depending on parents' educational level. This might prove of importance when designing interventions aimed at people with diverse educational backgrounds.

One of the main limitations of this study was that it was based on parents' perceptions and memories of their experiences with their children. Information provided was biased by parents' perspectives, their recall of events and social desirability response bias. Other limitations were the small purposive sample used and therefore the lack of generalizability of the results. To control for this limitation, the researcher conducted interviews until no more new information was gathered reaching saturation. Still it must be considered that the results will only reflect the experiences of this particular group. Since this was an exploratory qualitative study, the investigator had no stake in any specific findings. Nevertheless, to control for possible researcher bias, another investigator knowledgeable in the dental field coded some of the interviews separately. After the coding of each interview, the coding was compared and themes were discussed. This process allowed reliability in coding. Despite of all these limitations, the knowledge gained by conducting this research and its results will contribute in the development of successful tooth brushing habits in children. Additionally the biggest strength of this study is that by using qualitative methods we could gather detailed information about tooth brushing habits in immigrants' families which was previously unknown in this field. By studying this process in the Mexican immigrant population we can help diminish oral health disparities by creating, in the long term, culturally relevant oral health interventions that promote oral hygiene habits in children.

Future studies should aim to test the effect that establishing tooth brushing routines have in the emotional tone of the tooth brushing session. The dynamic of the tooth brushing stages

should also be targeted in future longitudinal studies, as well as describing the characteristics of each of these stages and the profile of the children in it. This information could help design interventions targeted at a specific age group and at a stage where changes are more plausible. Interventions could be designed to be implemented in the pediatrician office during the well-child visits or in pre-school and school settings during parent teacher's conferences. It is expected that the knowledge gained with this study will contribute to the oral health promotion field and will help design more effective oral health interventions.

7.0 CONCLUSIONS

Based on this study's results the following conclusions can be made:

1. Mexican immigrant parents' efforts to teach their children to brush their teeth are reflected in their involvement in the development of daily tooth brushing routines. These routines are dynamic throughout time and the role of parent and child change as the child grows.
2. Even though only one Mexican immigrant parent reported automaticity traits in her child's tooth brushing behavior, we were able to identify signs of intention to brush their teeth in children of other participants as it was reported by them.
3. Parents reported using social norms as a source of motivation for their children to brush their teeth.
4. Cues for tooth brushing in the morning were right after waking up, after breakfast, and part of the getting ready for school routine. Tooth brushing cues at night time included before going to bed, part of the bath-time routine, and after dinner.
5. Parents' and children's attitudes contribute to the emotional tone of tooth brushing sessions which can positively or negatively affect the compliance towards the behavior.
6. Parents' perceptions of their children's motor skills and cognitive development affected the information and guiding in tooth brushing.

7. Children of Mexican immigrant families go through different stages in learning to brush their teeth: entirely dependent tooth brushing, assisted tooth brushing, road to independence, and independent tooth brushing. The pattern these stages follow throughout childhood is not clear and should be further studied.
8. Parental knowledge and sources of information available affected the initiation of tooth brushing. Participants' question about oral hygiene practices and tooth brushing learning processes reflected uncertainty in these topics.
9. Consistency in tooth brushing routine augmented compliance of the behavior. Breaks in the routine, for example on weekends and vacations, diminished compliance of the behavior.

Results of this study provide insight into children's tooth brushing behaviors and their parents' role in the formation of oral hygiene habits. This study should be read as an introduction to a topic that has been scarcely investigated in the dental field. The continuation of research in this area can lead to better understanding of people's tooth brushing habits, and to improvements in oral hygiene practices. The knowledge gained as a result of this study will affect future research projects in the area of dental public health and behavioral practices.

APPENDIX A: RECRUITMENT MATERIAL

Eres Mexicano(a) y tienes un hijo(a)
entre 1 y 6 años de edad?



Investigadores de la Universidad de Pittsburgh están conduciendo un estudio de investigación para aprender más acerca del cuidado de los dientes de niños Latinos.

Participantes serán compensados por participar en una entrevista de aproximadamente 1 hora.

Para más información llamar a Dafna Benadof al **412-2949848** o por email a **dab141@pitt.edu**



Translation to English: “Are you Mexican and have a child between the ages of 1 to 6?. Researchers from the University of Pittsburgh are conducting a study to learn more about the dental care of Latino children. Participants will be compensated for participating in an hour long

interview. For more information call Dafna Benadof at 412-2949848 or email at dab141@pitt.edu”

APPENDIX B: ELEGIBILITY SURVEY

Nombre (solo primer nombre):

Ciudad:

Fecha entrevista:

Lugar:

Numero de contacto:

- Donde nació usted?
 ___ México
 ___ Otro. Cuál? _____
- Cuantos hijos tiene? _____

Hijo	Fecha de nacimiento	Dientes	
		Si	No
1 (Menor)			
2			
3			
4			
5			
6			
7			

- “Hasta qué grado llego usted en sus estudios?”
 - ___ Primaria
 - ___ Secundaria completa
 - ___ Preparatoria o Bachillerato incompleto
 - ___ Preparatoria o Bachillerato completo
 - ___ Universidad incompleta
 - ___ Universidad completa
- “Quien se encarga mayormente del cuidado de su hijo?”
 - ___ Participante
 - ___ Otro: _____

Translation to English

Name (only first name):

City:

Date of interview:

Place of meeting:

Phone number:

- Where were you born?
___ México
___ Other. What country? _____
- How many children do you have? _____

Son/daughter	Date of Birth	Teeth	
		Yes	No
1 (Youngest)			
2			
3			
4			
5			
6			
7			

- What is the highest degree or level of school you achieved?
___ Incomplete High School
___ Complete High School
___ Incomplete College or Technical Institute degree
___ Complete College or Technical Institute degree
___ Graduate School

- Who takes care of your children in your home?

____ Participant

____ Other: _____

APPENDIX C: CONSENT FORM

Consentimiento para participar en una encuesta anónima

Título del estudio: Salud dental en niños Latinos.

El propósito de esta investigación es aprender acerca de la salud dental de su hijo(a). Para lograr esto, entrevistaré a padres Mexicanos que tengan al menos un hijo(a) entre 1 y 6 años de edad, y vivan en Pittsburgh o en Filadelfia, Pensilvania. Su participación en esta investigación será completamente anónima. Esto significa que no le preguntaré nada que lo identifique. Si usted decide participar, se le pedirá que participe en una entrevista personal (60 minutos) y que además conteste una encuesta corta (3 minutos). En la encuesta se le preguntará información general (por ejemplo: edad, género, etnia, máximo nivel educacional alcanzado, número de niños en la casa, número de adultos en la casa, etc.). Durante la entrevista hablaremos acerca de la salud dental de su hijo(a), el cuidado de los dientes, así como también de lo que usted siente emocionalmente mientras esto sucede. Si durante la entrevista alguna situación sugiere que su integridad o la de su hijo están en riesgo esto será notificado a la institución correspondiente como lo indica la ley. La entrevista será grabada (audio), para que yo pueda enfocarme en escucharlo a usted en vez de estar tomando notas. Usted puede detener la entrevista en cualquier momento que lo sienta necesario. El riesgo de participar es que usted se puede sentir incómodo con las preguntas. No hay beneficios directos por su participación. Su participación es voluntaria,

y usted puede retirarse del estudio cuando lo desee. En agradecimiento, usted recibirá \$30 por su participación y para ayudar a cubrir los costos de una niñera el día de la entrevista.

Este estudio lo conduce Dafna Benadof, a la que puede llamar al 412-2949848, si tiene cualquier consulta.

Consent to participate in an anonymous interview

Title of the study: Dental health in Latino children.

The purpose of this research is to learn about your child's oral health. To meet this goal, I will be interviewing Mexican parents that have at least one child between 1 and 6 years old, and live in Pittsburgh or Philadelphia, Pennsylvania. Your participation in this research study will be anonymous. This means that identifying information will not be asked. If you accept to participate, you'll be asked to participate in an interview (approximately 60 minutes) and additionally answer a short survey (7 minutes). The survey will ask about your background (e.g. age, gender, ethnicity, educational level, number of children in household, and number of adults in household, etc.). During the interview we will talk about your child's dental health, taking care of teeth, as well as your experience as a parent throughout this process. If at any point of the interview, situations suggest there is risk to you or the child it will be notified to the correspondent institution, as stated by law. The interview will be tape-recorded, so I can focus on listening to you rather than in taking notes. You can stop the interview whenever you want. The risks of participating are that you may feel uncomfortable with questions. There is no direct benefit to you, in participating. Your participation is voluntary, and you may withdraw from the study at any point. As a thank you, you will receive \$30 for your participation and to help pay for babysitting for your child the day of the interview.

This study is being conducted by Dafna Benadof, who can be reached at 412-2949848 if you have any questions.

APPENDIX D: INTERVIEW SCRIPT

Welcome

First of all I would like to thank you for coming here today. I know being a mom is not easy and sometimes is difficult to organize our time and schedules.

Before we start I would like to read you this document. It's basically the same we already talked on the phone. It is to remind you what the study is about and tell you a bit about the interview. If at any point you have something to say or ask just go ahead and let me know so we can talk about it, ok?

READ INFORMED CONSENT

General information

To start I would like to know a little bit more about yourself, like how did you first got to Pittsburgh/ Philadelphia?

Probe: how long have you being living here?

Probe: and in the United States?

Probe: how has been your experience living here?

Probe: do you have any close relatives here?

Probe: do they live in your house?

Probe: do they help you with taking care of your child/ children?

Probe: now, thinking about your experience as a mother, what would you say would be different if you were living in your home country?

Probe: what has been the most difficult thing or things for you while living here?

Probe: and what would you say are the things you have most enjoyed?

Probe: how has been your experience with health services here?

Dental Health

Now, what can you tell me about taking care of teeth?

Probe: and what about tooth brushing?

Probe: how many times a day do you think it should be done?

Mother's dental health

And, how do you take care of your teeth?

Probe: do you this every day?

Probe: about brushing your teeth, can you tell me how do you do it?

Probe: would you say that brushing your teeth is something that you do automatically?

Or do you need to plan ahead how you will do it?

Probe: would you say it is difficult or easy for you to brush your teeth every day?

Probe: what reminds you that it's time to brush your teeth?

Child's dental health

Now, let's talk a little bit about your child. How do you take care of his/her teeth?

Probe: does your child brush his/her teeth?

If answer is YES continue. If answer is NO skip to page 5.

Probe: but does he brush his/her teeth by himself/herself? Do you help him/her? Or do you do it for him/her?

Probe: and how did you start brushing his/her teeth?

Probe: at what age was this?

Probe: what reminds you that it's time for your child to brush his/her teeth?

Probe: is every day the same?

Probe: would you say that it's part of a routine? Or does it change depending on the day?

Probe: Could you tell me how a typical tooth brushing session is with your child?

Probe: where does this happen?

Probe: who is present when this happens?

Probe: and does he/she use dental paste? Do you remember what type?

Probe: and is every day the same?

Probe: at what time of the day this usually happens?

Probe: Would you say he/she brushes his teeth without even realizing that he is doing it?

Or do you think he needs to be reminded every time or most of the time?

Probe: Have you ever talked about how to take care of teeth with your son/daughter?

Probe: And how was that conversation?

Probe: do you think he/she understood what you were explaining?

How do you think is his/her experience while brushing his/her teeth?

Probe: does he/she like to brush his teeth?

Probe: what does he do when you tell him/her that it's time to brush his/her teeth?

Probe: tell me, how does he/she handle the toothbrush?

Probe: Tell me a little bit more about this

Probe: do you think it would be easy or difficult for him/her to brush his/her teeth all by herself?

Parent's personal experience

We have talked about how your child lives this process. Now, thinking more about YOUR personal experience.

Tell me, how is it for you to brush or help brush your child's teeth?

Probe: how would you say is the relationship with your son/daughter when you brush his/her teeth?

Probe: what emotions do you feel during this process?

Probe: what happens when you forget to brush his/her teeth?

Probe: what do you do?

Probe: do you brush them as soon as you remember or do you just not do it?

Probe: what do you feel when this happens?

Probe: has it ever happened that your child reminds you that he/she did not brush his/her teeth?

Thinking from the time when you first brushed your child's teeth until now, how would you say this whole process has been?

Probe: has it changed at all from the beginning until now?

Probe: what have been the most difficult and the easiest moments?

Probe: would you change anything about it?

Sometimes we chat with other parents about our children. Have you ever talked about taking care of your child's teeth with them?

Probe: what have you talked about?

Probe: and what happened after the conversation?

Dentist

How has your experience been with dentists here in the U.S.?

Probe: have you ever taken your child to a dentist?

Probe: Can you tell me more about it?

Probe: what was the reason you had to take him/her?

Probe: do you remember if the dentist said anything or gave any advice about your child's teeth?

Closure

Well, I wanted to thank you for your time and help. This conversation will be very helpful to learn more about children's and parents dental care.

The last part of the study consists on a survey. It will take about 7 minutes to answer. It has some general questions and some other about taking care of teeth.

SURVEY

Thank you

Here are \$30 for your participation and time today and also to help paying for a babysitter for your child while you were here.

If you have any questions you would like to ask me you can contact me to this email or this phone number.

Have you ever talked about how to take care of teeth with your son/daughter?

Probe: And how was that conversation?

Probe: do you think he/she understood what you were explaining?

Parent's personal experience

We have talked about how your child lives this process. Now, thinking more about YOUR personal experience...

Sometimes we chat with other parents about our children. Have you ever talked about taking care of your child's teeth with them?

Probe: what have you talked about?

Probe: and what happened after the conversation?

Dentist

How has your experience been with dentists here in the U.S.?

Probe: Have you ever taken your child to a dentist?

Probe: Can you tell me more about it?

Probe: What was the reason you had to take him/her?

Probe: Do you remember if the dentist said anything or gave any advice about your child's teeth?

Closure

Well, I wanted to thank you for your time and help. This conversation will be very helpful to learn more about children's and parents dental care.

The last part of the study consists on a survey. It will take about 7 minutes to answer. It has some general questions and some other about taking care of teeth.

SURVEY

Thank you

Here are \$30 for your participation and time today and also to help paying for a babysitter for your child while you were here.

If you have any questions you would like to ask me you can contact me to this email or this phone number.

APPENDIX E: FINAL SURVEY

Encuesta demográfica

1. Edad: _____
2. Género
Masculino _____ Femenino _____
3. Número de niños en la casa _____
4. Número de adultos en la casa (incluyéndote a ti mismo) _____
5. Estado marital
____ Soltero
____ Separado/ Divorciado/ Viudo
____ Viviendo con la pareja
____ Casado
6. Son ambos padres de origen Latino?
____ Sí
____ No
7. Cuántos baños hay en tu casa? _____
8. En general, en tu familia se lavan los dientes en el baño?
____ Sí
____ No

Por lo general, que idioma(s) lee y habla usted?

	Solo	Español	Ambos por	Inglés
Solo	Español	mejor que	igual	mejor que
	Inglés	Inglés		Español
	1	2	3	4

Por lo general, que idioma(s) habla en su casa?

Solo Español	Más Español que Inglés	Ambos por igual	Más Inglés que Español	Solo Inglés
1	2	3	4	5

Por lo general, en que idioma(s) piensa?

Solo Español	Más Español que Inglés	Ambos por igual	Más Inglés que Español	Solo Inglés
1	2	3	4	5

Por lo general, en que idioma(s) habla con sus amigos?

Solo Español	Más Español que Inglés	Ambos por igual	Más Inglés que Español	Solo Inglés
1	2	3	4	5

Translation to english

Demographic survey

1. Age: _____
2. Gender
Male_____ Female_____
3. Number of children in household_____
4. Number of adults in household (including participant) _____
5. Marital status
____ Single
____ Separate/ Divorced/ Widow
____ Living with partner
____ Married
6. Are both parents Latino?
____ Yes
____ No
7. How many bathrooms do you have at home? _____
8. Does your family usually brush their teeth in the bathroom?
____ Yes
____ No
9. In general, what language(s) do you read and speak?
Only Spanish Spanish better than English Both equally English better than Spanish Only English
1 2 3 4 5
10. What language(s) do you usually speak at home?
Only Spanish More Spanish than English Both equally More English than Spanish Only English
1 2 3 4 5
11. In which language(s) do you usually think?
Only Spanish More Spanish than English Both equally More English than Spanish Only English

1 2 3 4 5

12. What language(s) do you usually speak with your friends?

Only Spanish	More Spanish than English	Both equally	More English than Spanish	Only English
1	2	3	4	5

**APPENDIX F: CODEBOOK IN BACKGROUND INFORMATION, PARENTING AND
HEALTHCARE**

Background information

Code	Definition	Example
Acculturation	Signs that demonstrate that the participant is acquiring "American" traits, like saying words in English when having a conversation in Spanish.	"porque ahorita le hicieron a mi niño, el mediano, que le taparon acá que le pusieron como silver " (<i>"because my child, the middle one, he got a filling and they put like silver"</i>)
Experience in the U.S.	Description of an array of experiences lived while being in the U.S.	
• Childcare	Description of who takes care of the child or school programs children assist.	"I: y tu niño va al daycare?... P: no. I: o sea esta acá? P: está conmigo siempre." (<i>"I: and does your child go to daycare?"</i> <i>P: no</i> <i>I: so he is here with you?</i> <i>P: he is always with me"</i>)
• Culture	Cultural traits (American or of their home country) that participants relate to while living in the U.S.	"Pues la cultura es muy diferente." (<i>"Well, the culture is very different"</i>)
• Settling or adjustment	Situations that are part of the process of establishing residence and getting use to changes associated with it.	"Entonces pues así pasamos y ya después nos dieron el apartamentito chiquito." (<i>"So, that is how we lived, and after that they gave us the small apartment"</i>)
• Social events	Celebrations of special occasions where many people attend and socialize.	"En Navidad nos juntamos para las posadas. El día de acción de gracias nos juntamos." (<i>"During Christmas we get together for the Christmas party. And in Thanksgiving we also get together"</i>)

•Difficult	Experiences that reflect a difficult time while living in the U.S.	
○ Cost	Experiences that reflect the use or lack of money, or income in the U.S.	"No hay dinero, no hay" (<i>"There is no money, none"</i>)
○ Discrimination	Treatment or making a distinction against a person based on her class, or ethnical origin.	"Yo he tenido muchas experiencias que te humillan. Con los Americanos yo he tenido muchas experiencias" (<i>"I have had many experiences were they humiliate you. With the Americans I have has many experiences"</i>)
○ Family abroad	References to the participant's family abroad.	" Que sí lo siento porque tengo ya 12 años sin verlos" (<i>"I do feel it, because I haven't seen them for 12 years."</i>)
○ Health situations	Health related situations were considered difficult for the participant.	"Y luego yo me embarace y yo me sentía mal." (<i>"And then I got pregnant and I felt bad"</i>)
○ Housing	Crowded or poor living arrangements or precarious house conditions.	"Es que el baño no es muy grande tampoco" (<i>The thing is that the bathroom is not that big either"</i>)
○ Immigration related issues	Experiences the participant or her family has had to endure due to their immigration status in the U.S.	"Y sí fuimos a una clínica. Las chicas no son nacidas acá entonces tienen que tomar como un servicio que hace el doctor para una clínica." (<i>"And we went to a clinic. The girls were not born here so they have to take a service that the doctor has for a clinic"</i>)
○ Language	References to situations when language has been a barrier or a factor that causes difficulties for their living experience in the U.S.	"El inglés. El idioma. Como podemos comunicarnos. Eso creo que ha sido lo más difícil." (<i>"The English. The language. How we can communicate. That is what I think has been the most difficult"</i>)
○ Socialization	Lack or type of social life the participant has. This code can be given when participants describe not having friends or any kind of support network aside from their partner.	"Como siempre uno esta solo " (<i>"Is like I'm always alone"</i>)
○ Support network	Lack of or limited peer support in the U.S.	"Por eso le digo que teníamos a nuestra cuñada que ella no trabajaba entonces le dejábamos. Un tiempo le deje más al grande, porque el segundo... porque ella también tenía niños también a veces

		trabajaba" <i>("That is why I say that we had our sister in law. She did not work so we would leave them with her. For a while I left the little older one with her, because the second one...because she also has children and sometimes works.")</i>
○ Transportation	Issues related to lack of or difficulties with mobilization.	"Y pues no iba cada domingo porque yo estaba con mis hermanos que me movieran." <i>("And I didn't go every Sunday because my brothers had to take me there")</i>
○ Weather	Weather as a factor that makes living in the U.S. more difficult.	" Difícil por el clima" <i>("Hard because of the weather")</i>
○ Work	Negative references to paid or unpaid job experiences including volunteering.	"Trabajaba uno de noche, y a veces quería uno descansar y pues no... y fue difícil." <i>("I worked during the nights, and sometimes I wanted to rest and I couldn't.... it was difficult")</i>
● Good or positive	Experiences that reflect a positive or good time while living in the U.S.	
○ Family time	Being able to have to time to share with their children.	"I: que es lo que más has disfrutado de vivir acá en Estados Unidos? P: mis hijos. Salir a pasear con ellos por las calles" <i>(I: what is it that you have enjoyed the most about living in the United States? P: my children. Being able to go on a walk with them")</i>
○ Housing	Living arrangements or house with spacious and comfortable spaces or areas.	"Sí es como un dúplex. Es una casa muy grande." <i>("Yes it's like a duplex. It is a big house")</i>
○ Infrastructure	References to the infrastructure or architecture of places in the U.S. that facilitate mobilization or make living in the U.S. a better experience.	"Puedo salir felizmente con mi carriola y yo sé que hay rampas yo sé que hay elevadores, yo sé que hay baños amplios que puedo meterme con los tres al baño. En México a veces los baños públicos no están preparados para eso. O sea en México si a veces vas a salir a algún lado a veces es mejor dejarlos con la mama que andar en la calle con eso" <i>("I can go happily with my stroller outside and I know that there are ramps, elevators, big bathrooms where I can go</i>

		<i>in with the three of my children. In Mexico the public bathroom are not prepare for that sometimes. I mean, in Mexico if you are going out is better to leave your children with your mom that being in the streets with them.”)</i>
○ Language	Learning or speaking English as a perk of living in the U.S.	"El idioma me gusta." (<i>“I like the language”</i>)
○ Opportunities	Comments that reflect a positive change in the participants lives	"Yo si me iría mis niños ya no tendrían esas oportunidades." (<i>“If I leave my children would not have these opportunities”</i>)
○ Peaceful or calmer	Reference to a state of peacefulness or living with a slower pace	"Lo que me gusta es que estoy tranquila, no tengo problemas. Estoy tranquila con mis hijos." (<i>“What I like is that I’m calmer, I don’t have problems. I’m calmer with my children”</i>)
○ Resources	Reference to different types of resources available to people in the US. for example technology, government programs, information, etc.	"Mi hijo recibe unas ayudas que necesita como terapia de habla este..." (<i>“My child receives the help that he needs, like speech therapy...”</i>)
○ Safety	Feeling of being safe from undergoing or causing hurt, injury or loss.	"Hay mucha seguridad. Cosa que en mi país no hay. La seguridad más que nada." (<i>“There is plenty of safety. This is not like in my home country. Security more than nothing”</i>)
○ Socialization	Process where an individual develops bonds with other people through social events.	"También somos miembros del centro Latino. Entonces ahí también tenemos actividades para los niños." (<i>“We are also members of the Latino center. So there we have activities for the kids”</i>)
○ Support network	Peer support in the U.S. that occur when people provide knowledge, experience, emotional, social or practical help to each other.	"Conocimos a la Sister Janis. Entonces hemos recibido mucha ayuda, mucho apoyo por parte de ella. Porque en cuanto supimos de ella, ella nos contactó una clínica que está aquí cerca" (<i>“We met Sister Janis. So we have received lots of help and support from her. Because as soon as we heard from her, she contacted us with a clinic near here”</i>)
○ Weather	Weather as a factor that makes living in the U.S. more	"Me gusta que las estaciones están bien marcadas. Me gustan muchos los

	pleasant.	cambios, por decir en el otoño lo arboles, colores que en mi estado en mi país jamás había visto" <i>("I like that the seasons of the year are very clear. I like the changes very much, like in the fall I like the trees, colors that I have never seen in my country")</i>
○ Work	Positive references to paid or unpaid job experiences including volunteering.	"Pero acá mi esposo tiene un buen trabajo, no tengo que trabajar y me puedo dedicar a los niños. " <i>("But here my husband has a good job. I don't have to work and can dedicate my time to my children")</i>
● Work or volunteering	References that describe job situation of the participant.	
○ Occasional work	Irregular or infrequent paid job.	"A veces que trabajo en el día, digo se me hace fácil porque estoy en la parte de la noche que estoy con ellos." <i>("Sometimes I work during the day, it is easier because at night I'm with them")</i>
○ Stay at home mom	Participant does not work and stays at home to take care of her children.	"Ya cuando estoy aquí con mi niña, ya con mi esposo va a trabajar y como yo no trabajo... cuidando aquí con mis niños" <i>("When I'm at home with my girl, my husband goes to work. And since I don't work...taking care of my children")</i>
○ Temporary situation	Due to a special situation the individual is not currently working as usual.	"Después otra vez nació ya el otro. Pues otra vez se queda uno un rato sin ayudarle a él y se queda aquí en la casa. Y yo pues cuando me quedo aquí en la casa estoy pendiente de con los niños que lleguen de la escuela, lavar la ropa, estar haciendo aquí." <i>("And then the other one was born. Again I have to stay at home and I cannot help him. And when I stay at home I look after the kids when they are back from school, I do the laundry, and that")</i>
○ Regular working schedule	Individual has a regular paid job.	"...ahora trabajo en un restaurant. Preparando ensaladas..." <i>("...now I work at a restaurant. Preparing salads...")</i>
● Immigration	Situations related to the entry to the U.S.	
○ Family	Family ties that influenced the immigration process at some level.	"Entonces dije porque no me voy para allá... de México me vine para acá, dije está bien la oportunidad que están mis hermanos y ya está mi esposo ahí. Así

		que decidí venirme." <i>("So I said why don't I go there... and I came from Mexico, I said it was a good opportunity since my brothers and husband are already there. So I decided to come")</i>
○ Opportunities	The main reason for moving to the US was to achieve new goals in life.	"Por eso uno inmigra a veces para tener mejores beneficios o poder vivir un poquito mejor a comparación como uno vive en nuestro país. Es muy pobre." <i>("That is why sometimes we immigrate, to have more benefits or be able to live a little bit better than how we live in our country. It's very poor.")</i>
○ Work	Job situations that influenced the immigration process at some level.	"Mi esposo consiguió trabajo, este... un amigo lo invitó a trabajar con él." <i>("My husband got a job... a friend invited him to come work with him")</i>
● Life in home country	Description of living experiences in the participants home country.	"Porque allá no voy a poder... porque nosotros vivíamos en un pueblito donde no hay nada." <i>("Because there I won't be able to... because we lived in a small town where there is nothing")</i>
○ Support network	Peer support at the participant's home country that occur when people provide knowledge, experience, emotional, social or practical help to each other.	"Mi familia que en México era de la que teníamos mucho apoyo." <i>("My family in México helped us a lot")</i>

Parenting

Code	Definition	Example
Family	Situations that reflect a deep connection between family members	"...tal vez tener a mis hijos, estar con ellos. Estar juntos. Porque estamos juntos pues toda mi familia. No todos pues, pero especialmente la familia que estoy formando con mi pareja. Estamos juntos" (<i>"...maybe having my kids, being with them. Being together. Because all of our family is together. Not all of them, but especially the family that I'm having with my husband. We are together."</i>)
First pregnancy or child	References made to mom's first pregnancy or upbringing of the first child	"Como mama primeriza... oye crees que ese cepillo le ayude? Ah sí perfecto! Y también dale palitos de pan para muerda" (<i>"As a first time mom...hey do you think that toothbrush would help him? Oh, perfect! And also give him those sticks so he can chew"</i>)
Guilt	Feeling of responsibility for doing something wrong	"Sí entiendo que fue mucho mi culpa lo que le paso a ella con lo de sus caries porque realmente no me fijaba." (<i>"Yes I understand that what happened to her with the cavities was mainly my fault because I did not pay attention"</i>)
Parent's role	Feeling that it's a parent duty to teach and be with their child	"Sí yo se los voy a dar es mi obligación después del dulce que tiene que lavarse los dientes." (<i>"Yes if I give them to him it is my duty to make him brush his teeth after he is done with the candy"</i>)

Healthcare

Code	Definition	Example
Doctor, general health	Experiences the participant has had with doctors or comments on their general health	"Cada vez que voy al doctor me hacen las mismas preguntas, que ya están en el sistema, pero es porque siempre te atiende alguien diferente." (<i>"Every time I go to the doctor they ask me the same questions, that are already in the system, but that is because it is"</i>)

		<i>always someone different who checks you”)</i>
Search for providers	Description of a process that involves looking for healthcare providers	"No, me dicen las áreas donde hay más cerca. Entonces cuando yo voy a su chequeo general les pregunto dónde puedo llevarlo. Y yo llevo al más grande... tengo un desorden!... lo llevo al Childrens' al hospital. Está lejos! Y al mediano lo llevo aquí cerquita, porque yo les dije que quería un lugar más cerca. " <i>("No. They tell me where I can go near here. So when I go to their annual check-up I ask where I can take him. And I take the eldest... I have such a mess! I take him to the Children's Hospital. It's very far! The middle one I take him close to here, because I told them I needed somewhere close")</i>
Requirement for school	Dental or doctor visits as a requirement set by the child school or a care program	"...porque uno nunca sabia hasta que entran a la escuela y ahí te piden" <i>("...because I didn't know until they ask me when they got into school")</i>
Insurance, costs	Comments that are related to the use or type of insurance, payments and costs of dental treatments	"...entonces mis niños como no son nacidos aquí los dos mayorcitos. Ellos hay un plan que se llama chip que es para niños no nacidos acá." <i>("...since my two eldest kids are not borne here. They have a plan that is called Chip that is for kids not borne here")</i>
Barriers to access to care	Obstacles that prevent the practice of a behavior or access to care.	
• Attitude	Having a bad attitude towards brushing teeth, or not being interested at all in doing it.	"...y es que yo creo que aparte mi trauma hacia los dentistas implica que yo le saque la vuelta hasta con mis hijas. No las llevo frecuentemente" <i>("...and I think that my trauma with the dentists makes me avoid them with my daughters. I don't take them regularly")</i>
• Costs	Expenses related to health care are an obstacle when looking for care.	"Yo antes de niña como le explico nunca tuve una limpieza de dientes. Mis papas allá es caro para ellos hacer una limpieza de dientes. Nunca nos llevaron a limpiarnos los dientes." <i>("As a child I never had a teeth cleaning. It is expensive for my parents to pay for a</i>

		<i>cleaning over there. They never took us to get our teeth cleaned.”)</i>
•Language	Language issues that happen at the doctor's or dental office	"No, porque a veces uno no entiende ya bien uno todo, ya te das una idea de lo que te están diciendo. Y también si fuera algo grave buscan a alguien de interprete, o en las clínicas hay o algo. Cuando mi niño el mediano tuvo una cirugía aquí de las tonsils, pero ahí tuve traductores" <i>(“No, because sometime even if you don’t understand all of what they are saying you can get an idea. And also if it was something serious they would get an interpreter or something in the clinics. When my middle child had tonsils surgery I had translators”)</i>
•Transportation	Issues related to mobilization to or from healthcare providers.	"Bueno pues fue fácil porque teníamos carro y todo eso. Pero ahorita ya ni carro tenemos. A ver cómo nos vamos... sería más fácil." <i>(“Well it was easy because we had a car. But now we don’t have a car. How are we gonna go.... It would be easier.”)</i>
•Traumatic	Previous experience with dentist that made the participant feel scared	"...luego a ella cuando esa cirugía, les digo, no no, como que siempre quede con ese miedo." <i>(“...then she had that surgery, and I say no no, it’s like I’m always scare of that”)</i>
•Waiting times	Amount of time waiting for the provision of care. Also, those situations where the patient is evaluated by many health professionals, or referred between health professionals before obtaining treatment.	"Si me voy desde las 8 que dejo a los niños, llego allá a las 9:30. Tengo que esperar hasta las 12 a que abran" <i>(“If I leave at 8 when I drop off the kids I get there at 9:30. Then I have to wait until 12 when they open”)</i>
•Culture	When participants mentions their home country or a culture trait in reference to a health treatment	"Porque si el pediatra de los niños es Latino para mi influye mucho, es diferente. Lo escogí porque era Latino, de Colombia. Entonces a veces lo veo en la iglesia y así, pero si no fuera de esa forma yo estaría a lo mejor muy desesperada" <i>(“Because if the pediatrician is Latin, it is very different for me. I chose him because he is Latin, for Colombia. Sometimes I see him at church, but if it</i>

		<i>wasn't like this I might be desperate")</i>
○ Discrimination	Act of making a distinction based on the person's ethnic background or race.	"Y porque? Por ser hispana. Porque yo juro que se lo dice a una persona de raza negra, lo manda a volar. O a una persona americana igual! Pero como sabe que somos latinos. Que no podemos defendernos, yo siento que por eso lo hizo." <i>("And why? Because I'm Hispanic. Because I swear if they tell that to a black person they would react differently. Or the same to an American! But as they know that we are Latinos. That we can't defend ourselves, I think that is why they did that")</i>
○ Rapport	Special connection or relationship marked by harmony, comfort, and affinity between healthcare professional and patient	"Este pero pues si en general yo creo que esa es la principal diferencia que yo vería. En Monterrey es más la confianza de doctor paciente de hablar por teléfono yo te puedo recetar yo te puedo dar una consulta informal. Y aquí pues no existe eso." <i>("In general that is the main difference that I can see. In Monterrey the relationship with the doctor is more about trust, talking on the phone they can prescribe and can give informal consults. Here that doesn't exist")</i>
Dental care	Diagnosis, treatment, and prevention of oral diseases.	
● Baby bottle	References made to the use of baby bottle or sippy cup	"Como en plena madrugada, casi 2 3 de la mañana y empieza con un chupón." <i>("In the middle of the night, around 2 or 3 in the morning he starts with the bottle")</i>
● Beliefs	Feeling of being sure that something exist or must be done.	
○ Age appropriate	Parent believes that child's behavior reflects a behavior appropriate for child's age	"No le he explicado a él nada. Porque considero que ahorita a sus dos años, aun no comprende bien lo que le explico." <i>("I haven't explained anything to him. Because I consider that with his two years of age he does not understand well what I'm telling him")</i>
○ Oral hygiene	Beliefs about best oral hygiene practices or about or what happens if these behaviors are not practiced.	"Yo le digo que como dos veces enjuague el cepillo y se ponga pasta. Yo lo hago así. No no más con una vez. Porque si no te lo lavaste bien la primera vez, la

		segunda vez ya quedan mejor” <i> (“I tell him to rinse the toothbrush two times and to put toothpaste again. I do it like that. Not just once. So that if you did not brush correctly the first time, with the second time they will be better”</i>
○ Pressure	Parents’ belief of being pressuring their child when reminding them to brush their teeth.	“Hay unos días en que me siento que me digo no los estaré presionando o algo? Pero digo, es para su bien para ellos... y yo digo, y si no lo hiciera? Que harían ellos?” <i> (“some days I ask myself am I pressuring them or something? But this is for their own good... and I say what if I don’t do it? What would they do?”)</i>
○ Cavities and periodontitis	Parent’s beliefs about the reasons why or how cavities and periodontitis occur.	"Que te digo para mí era normal el sangrado era algo que no tenía yo la información, no me afligía porque no tenía yo dolor." <i> (“For me the bleeding was something normal it was something I did not know about and I was not worried because it did not hurt”)</i>
○ Dentist	Beliefs about when to go to the dentist	“...creía que no podía porque creía que no era la edad para llevarla. Porque no sabía yo que podía llevarla tan chiquita.” <i> (“...I thought I couldn’t take her because she was not old enough. I didn’t know I could take her even if she is so little”)</i>
○ Others	Random beliefs about teeth and their biology	“...la parte de cómo le va saliendo los dientes y les duele y luego les da fiebre...” <i> (“... when the teeth are coming out and it hurts and then they get a fever...”)</i>
● Dental products	References made by participant about the use of any type of dental products (mouth wash, toothpaste, toothbrushes, and floss)	
○ lossing	F References made by participant about the use of dental floss	"Porque el hilo a veces cuando me lo meto y me lo jalo con el hilo." <i> (“Because sometimes I put the dental floss in and pull”)</i>
○ Mouthwash	.References made by participant about the use of mouth wash	"...el enjuague es después de cepillarme ya en la mañana" <i> (“...mouthwash after I brush my teeth in the morning”)</i>
○ Toothbrush	References made by participant about the use of toothbrushes	"De hecho ahorita a veces veo el cepillo y cuando esta gastado... antes salió un

		<p>cepillo que tenía unas marcas, creo que oral B, que se iba acabando y ya se tiraba. Pero ahora ya salieron unos nuevos cepillos unas nuevas formas y ya dice no quiero ese que limpia la lengua!"</p> <p><i>("In fact now I see the toothbrush and can notice when it wore out...there was a toothbrush before I think it was Oral B, that had some marks that when they fainted you had to throw it away. But now there are new toothbrushes in new forms, and he says I want that one that cleans the tongue")</i></p>
○ Toothpaste	References made by participant about the use of toothpaste	<p>"Como es tan pequeño no le he metido la pasta dental porque tengo miedo que se la trague y le haga daño"</p> <p><i>("Because he is so little I haven't introduce him to toothpaste because I'm afraid he will swallow it and get hurt")</i></p>
•Dental visit	Dental appointments	
○ Child	Child's dental visits	
▪ First dental visit	Description of child's first dental visit. When and/or what happened during that visit.	
✓ Age	Age the child had his first visit to the dentist.	
Less than 2 year-old	Child was less than two years-old when he/she first visited the dentist.	<p>"Cuando tienen el año los llevo a que les miren los dientes."</p> <p><i>("When they turn one I take them to get their teeth checked")</i></p>
Two year-old or older	Child was two years-old or older when he/she first visited the dentist.	<p>"Yo pienso que a los 5 años. Que ya me entere que ya podía llevarla."</p> <p><i>("I think when she was 5 years old. When I learned that I could take her")</i></p>
✓ Experience	Description of the child's dental experience.	
Negative	Description of a negative child dental experience.	<p>"Y me costó mucho trabajo. Porque a él en general el médico le causa mucho pánico."</p> <p><i>("And it was so hard. Because in general the doctors makes him panic")</i></p>
Positive	Description of a positive child dental experience.	<p>"...y pues todo muy amable y a ella le gusto. El lugar estaba adaptado para niños y muy amable la enfermera y la doctora, entonces fue una buena experiencia para ella."</p> <p><i>(...and well everyone was so kind and she liked it. The place was adapted for children and the nurse and the doctor</i></p>

		<i>were very nice, so it was a good experience for her”)</i>
▪ Frequency	How often the child goes to the dentist	"...pues cada seis meses yo los llevo a su chequeo." <i>(“...well every six months I take him to his check-up”)</i>
▪ Treatment experience	Description of children's dental treatments and their experiences	"No. Cerraba la boca y le mordía los dedos. No se dejaba. Entonces ella dijo es que no podemos trabajar así. Él tiene que ir al hospital children para que le trate la caries, porque si tiene un caries aquí no puedo atender. Aparte ellos saben cómo hacer el trabajo con el pequeñito tan rebelde." <i>(“No. He would close his mouth and bite her fingers. He would not let her check him. So she said that she could not work like that. I had to take him to the Children’s Hospital to get his caries treated, because she could not treat his caries. Besides they know how to treat a rebel child”)</i>
○ Parent	Parent's dental visits	
▪ Frequency	How often the parent goes to the dentist	"Apenas tengo como un año que empecé." <i>(“I just started one year ago”)</i>
▪ Treatment experience	Description of parents' dental treatments and their experiences	“Nos hicieron primero como por dentro. Como se dice esa limpieza por dentro? Que te ponen anestesia?” <i>(“First they did it from the inside. How do you call that cleaning from the inside? The one where they have to put anesthesia?”)</i>
▪ Doubts	Uncertainty about oral health and oral hygiene facts.	
○ Dental providers	Uncertainty about how to search for dentists, and where they can learn more about them.	"Tiene un listado de dentistas que hablen español?" <i>(“Do you have a list of dentists that speak in Spanish?”)</i>
○ Oral Hygiene	Lack of sureness of an alleged fact related to oral hygiene.	"Le enjuago a veces con una toallita aquí así. Pero no con cepillo ahorita todavía. No se si esté bien eso?" <i>(“I rinse her with a towel like this. But not with a toothbrush yet. I’m not sure that is correct?”)</i>
○ Dental	Uncertainty about different	"Tú sabes a qué edad se pueden poner

treatments	types of dental procedures.	braces o dependiendo del niño?" ("Do you know at what age they can get braces or does it depends on each child?")
○ Nutrition	Uncertainty about the impact of certain foods or meals in oral health.	"Pero uno piensa que es porque come mucho dulce, no sé si venga a esto?" ("But don't know if it is because they eat too many sugary things?")
○ Other	Uncertainty about health situations and their impact on oral health.	"Con la lactancia del niño, no sé si sea eso? Pero me empezaron a doler mucho los dientes." ("When breastfeeding the baby, I don't know if it was because of that? But my teeth began to hurt a lot")
● Motivation for going to the dentist	Reasons because of which people go to the dentist.	
○ Cleanliness	Having a clean mouth as a motivation for seeking oral health	" Porque yo digo, porque no hacerse una limpieza?" ("Because I say, why not getting a dental cleaning?")
○ Image	Having nice teeth as a motivation for seeking oral health	"Ese es mi trauma que le digo, 30 años y ya sin dientes. O sea ya tener quizá un postizo, pues de dónde." ("That's my trauma, 30 years and with no teeth. I mean even having a fake tooth")
○ Importance of going to check-ups	Taking care of teeth because they are important for their health as a motivation for seeking oral health	" Yo les digo que cada seis meses hago citas al dentista o cosas así que necesiten ellos, yo pienso que yo los llevaría porque es importante para ellos cuidarles los dientes" ("I tell them that every six months I get dentist appointments or things like that, I think I would take them because it is important to take care of their teeth")
○ Pain	Avoiding pain is the main motivation for seeking oral health	"...de que ya necesitaba yo el cuidado. Con la lactancia del niño, no sé si sea eso? Pero me empezaron a doler mucho los dientes. Entonces necesitaba ir de urgencia la dentista." ("...that I needed to be taken care of. Because of breastfeeding my baby, I don't know if it was that why? But my teeth began to hurt a lot. So I needed to go to the dentist urgently.")
○ Visualization of	Participant is motivated to seek	"...como unas manchitas. Entonces yo no

dental problem	oral care or start brushing their teeth after they see that their teeth are in bad conditions.	creía que eran normales." ("...like stains. So I thought they were not normal")
Knowledge about oral hygiene	Acquaintance with facts, truth, or principles related to practicing good oral hygiene behaviors.	
• Parent's knowledge	Parent's acquaintance with facts, truth, or principles related to maintaining good oral hygiene behaviors	"lavándolos y yendo a ver al dentista." ("brushing them and going to the dentist")
• Sources of knowledge	Places, people, or things that provided information about oral hygiene behaviors.	
○ Literature	Written information whether it is in books, brochures, or internet provided information about oral hygiene.	"Solo sé que lo tenía que hacer. Yo no sabía que tenía que lavarle los dientes antes. Pero después fui al dentista y vi los folletos que decía que había que lavarle los dientes a los niños. Su primer dientito. Pero antes de eso yo no sabía." ("I just knew that I had to do it. I didn't know that I had to brush their teeth before. But then I went to the dentist and saw the brochures that said that we should brush children's teeth. Their first tooth. But before that I didn't know")
○ Community	People in the community, friends or acquaintances, are the provide information about oral hygiene.	"Porque primero preguntas, a donde la llevas?, y creo que coincidimos con lo de las muelas al menos dos o tres mamás las mismas cosas. "es que no se deja cepillar bien las muelas!" o "qué tipo de pastas usas?" ("Because first you ask. "Where do you take her?" and I think two or three moms agree about the teeth in the same things")
○ Family	Family members provide information about oral hygiene.	"...me enseñó mi mamá..." ("... my mother taught me")
○ Health providers	Dentist, doctors, nurses, or other health providers give parents information about oral hygiene.	"Porque en las revisiones de pediatra me dijo que en cuanto el tuviera los primeros dientes, o desde un poquito antes debía limpiarle la encía con un trapo limpio. Y en cuanto viera sus primeros dientes cepillarlos." ("Because during the check-ups the pediatrician told me that as soon as he had his first teeth, or even before that I should clean his gum with a clean cloth. And that as soon as I saw his teeth brush

		<i>them”)</i>
<ul style="list-style-type: none"> • Type of information provided 	Dental health/hygiene information topics provided to participants.	
<ul style="list-style-type: none"> ○ Oral hygiene advise 	Oral hygiene information.	<p>“Yo les compro el hilito que me dice el doctor, un líquido para que se enjuaguen para que no estén las bacterias.”</p> <p><i>(“I buy the floss that the doctor recommends, and a liquid for them to rinse with that way they won’t have any germs”)</i></p>
<ul style="list-style-type: none"> ○ Nutrition 	Information related to consumptions of food and its impact in oral health.	<p>“Me dijeron que evitara tanto dulce porque lo dulce es lo que le daña los dientes a los niños.”</p> <p><i>(“I was told to avoid candies because this is what damages children’s teeth”)</i></p>
<ul style="list-style-type: none"> ○ Dentist 	Information about provision of dental care.	<p>“Porque me dijo el doctor que llevo a mi niño al mediano que ya era tiempo de que ya!”</p> <p><i>(“Because the doctor told me it was time to take my middle child, it was time!”)</i></p>

APPENDIX G: CODEBOOK TOOTH BRUSHING

Code	Definition	Example
Motivation for oral hygiene	Reasons because of which people take care of their teeth.	
• Avoiding dental care and costs	The main reason to keep oral hygiene behaviors is to prevent going to the dentist and therefore don't pay for treatments associated to bad oral health.	“Porque últimamente, yo les digo que tengo que tenerlos limpios porque yo no tengo un seguro como ustedes entonces tengo que tenerlos limpios.” (“ <i>Because lately, I tell them that I have to keep them clean because I don't have insurance as they do, so I have to keep them clean</i> ”)
• Cleanliness	The main reason to practice oral hygiene behaviors is to keep teeth clean.	“...porque si no, le digo, miijo vas a estar al rato grande y vas a tener tus dientes bien cochinos...” (“ <i>...because if not, I tell him, son son you are going to be an adult and your teeth are going to be really dirty...</i> ”)
• Image	The main reason to practice oral hygiene behaviors is to have teeth that look good and that give a pleasant appearance to the person.	“Porque es algo que yo siempre les digo que es importante, la sonrisa de los dientes” (“ <i>Because it's something I always tell them to be important, the smile of the teeth</i> ”)
• Importance of oral care	The main reason to practice oral hygiene behaviors is because taking care of the mouth and its components it's deemed as important.	“...y yo siempre les platico que se tienen que cuidar los dientes porque es lo más importante que se tienen que cuidar.” (“ <i>... and I always tell them to take care of their teeth because it is the most important thing they have to take care of.</i> ”)
• Breath	The main reason to practice oral hygiene behaviors is to have good breath or to avoid halitosis.	“...que van a tener un mal olor en la boca...” (“ <i>... that they are going to have bad smell in the mouth</i> ”)

<ul style="list-style-type: none"> • Pain 	<p>The main reason to practice oral hygiene behaviors is to avoid painful experiences associated to poor oral health.</p>	<p>“Ay les digo, tienen que lavarse bien los dientes, porque yo no quiero que tengan el problema de la encía porque duele feo!” <i>(“Aw, I tell them, you have to brush your teeth, because I don’t want you to have problems with your gums because it hurts bad!”)</i></p>
<ul style="list-style-type: none"> • Previous experiences 	<p>The main reason to practice oral hygiene behaviors is to avoid repeating bad or traumatic dental experiences.</p>	<p>“...entonces como las niñas traían muy mal tratadas sus boquitas cuando venían de México, no quería que el pasara por lo mismo.” <i>(“...so as the girls had their mouths in really bad shape when they arrived from México, I didn’t want him to go over the same thing”)</i></p>
<ul style="list-style-type: none"> • Techniques 	<p>Methods applied to facilitate the practice of oral hygiene behaviors.</p>	
<ul style="list-style-type: none"> ○ Imitation 	<p>Child imitates behaviors from others.</p>	<p>"El me mira a mí, mira a a su papá, sus hermanas. Le damos el cepillo y le decimos a ver ahora tú, así como lo hacemos nosotros." <i>(“He looks at me, looks at his dad, and his sisters. We give him his toothbrush and tell him it’s his turn, just like we do it”)</i></p>
<ul style="list-style-type: none"> ○ Making it fun 	<p>Parent transforms the tooth brushing experience in a game that challenges the child and encourages him or her to brush his or her teeth.</p>	<p>“... pero jugando entre el día principalmente el fin de semana que lo tengo todo el día. Sí, pero no te lavas los dientes. Y como a él no le gusta perder... entonces si no te quieres lavar los dientes no te preocupes, yo me los voy a lavar y a mi si me van a quedar limpios... No mami yo si voy! Trata de ganarme. Entonces jugando juagando él se lava más de tres veces a al día.” <i>(“...but playing during the day especially during the weekend that I have him all day. Yes, but you have to brush your teeth. And as he doesn’t like to lose... so if you don’t want to brush your teeth don’t worry, mine are going to be clean... No mommy, I’m coming! He tries to win. So by playing he brushes his teeth more than three times a day.”)</i></p>
<ul style="list-style-type: none"> ○ Movies 	<p>Parent uses character or scenes of movies to demonstrate to</p>	<p>“...el miraba una de un mono. Un monkey. Que abría la boca y tenía los</p>

	their children the reasons why they should brush their teeth.	dientes mal. Entonces le digo si no te lavas los dientes se te van a hacer como el monkey sin saber y yo no te voy a poder llevar al dentista” <i>(“... he watched one of a monkey. A monkey. That opened his mouth and had his teeth all bad. So I tell him if you don't brush your teeth you are going to end up like the monkey without even knowing and I won't be able to take you to the dentist”)</i>
○ Books	Parent uses books to demonstrate to their children the reasons why or how they should brush their teeth.	“Le regalaron un libro de doctor Zeus de toothbook.” <i>(“They gave him a book of doctor Seuss the tooth book”)</i>
○ Novelty	Parent notices that children get more motivated to brush their teeth when they have new dental products (toothbrushes, toothpaste) to use when brushing their teeth.	“...pues como te digo ahorita que tienen los cepillos nuevos y la pasta dental ellos solos ven el cepillo y quieren cepillarse.” <i>(“... now that they have the new toothbrushes and toothpaste they see the toothbrush and want to brush their teeth”)</i>
○ Scare	Parent uses phrases that exemplify scary situations that might happen if the child does not brush his/her teeth.	“Te los tienes que lavar porque o si no te van a doler. Va a estar ahí un duendecillo picando y no lo vas a soportar!” <i>(“You have to brush them because if you don't they are going to hurt. There is going to be an elf drilling in your teeth and you won't be able to stand it”)</i>
Tooth brushing initiation	Act of brushing teeth for the first time	
● Cue	People, place, situation, or things that made parents realize that they should start brushing their child's teeth.	"Cuando les iban saliendo sus primeros dientes." <i>(“When the first teeth were coming out”)</i>
● Age	Age around which parents started brushing their child's teeth	"Con las chicas? Creo que fue a los tres años cada una de ellas. El pequeñito empezó a dar en el transcurso de los seis meses." <i>(“With the girls? I think it was when they were three years old. The little one started when he was six months old”)</i>
● Cleaning gums	Parent cleaned their child's gums when starting to take care of their child's oral health.	“Y era con un cepillito que tú te ponías en el dedo. Entonces era más suavcito. Y antes de eso usábamos unos pañitos.” <i>(“It was a toothbrush that you put on your</i>

		<i>finger. It was softer. And before that we used a washcloth”</i>
Tooth brushing learning process	Behaviors that reflect processes associated to learning to brush teeth.	
• No brushing	Parents haven’t started brushing their child’s teeth or cleaning their gums.	“Ah todavía falta, si apenas tiene un diente!” “ <i>Ah, there still is time, she only has one tooth!</i> ”
• Cleans gums	Currently parent cleans their child’s gums.	“...le enjuago a veces con una toallita aquí así. Pero no con cepillo ahorita todavía” “ <i>...I clean her with a cloth here like this. But I not with a toothbrush yet</i> ”
• Entirely dependent toothbrushing	Parent has to brush his/her child’s teeth every time because the child lacks motor control to do it by him/herself	“Ella nada más muerde el cepillo de dientes. Ella quiere sacarle los hilitos, y yo le digo no! si te los quieres lavar, te los tengo que lavar yo.” “ <i>She just bites the toothbrush. She wants to pull the strings, and I say no! if you want to brush them, I have to brush them for you</i> ”
• Assisted tooth brushing (every time)	Adult brushes child’s teeth; or child brushes his/her teeth and then an adult does it again for them; or an adult brushes the child’s teeth for them and then the child does it again by him/herself.	"estoy dejando que se los lave primero que ella vaya practicando y después lávelos tú porque luego no se los lavan bien ya que ella dio su practicada de lavárselos ya voy y se los vuelvo a lavar bien todos." “ <i>I’m letting her brush her teeth first so she starts practicing and when she is done I brush them for her, because she doesn’t do it right and she already practiced so I brush them again</i> ”
• Occasional by themselves	Child occasionally brushes teeth by him/herself without further assistance from parents.	“Entonces tengo que estarlas turnando un día lo dejo hacerlo a él para que se sienta que solito lo está haciendo y un día lo hago yo para asegurarme que el sí lo está haciendo bien o que sí están limpios los dientes.” “ <i>So I have to take turns, one day I let him so he can feel that he is doing it by himself, and one day I do it so that I can make sure that he is doing it correctly or that the teeth are clean</i> ”
• Alone	Child brushes his/her teeth by himself/herself without any assistance.	"Al grande ya no se los lavo" “ <i>I don’t brush the teeth of my eldest</i> ”

<ul style="list-style-type: none"> • Practicing, road to independence 	<p>Parent makes comment that suggest that child is practicing behavior to do it without supervision by himself in the future</p>	<p>"Yo deje de cepillárselos cuando ellos tenían como 5 años. Porque ellos les cupo la curiosidad de hacerlo. Pero de ahí yo he estado mirándolos a ellos que se laven los dientes." <i>("I stopped brushing their teeth when they were 5 years old. Because they started to want to do it themselves. But since then I have been checking that they brush their teeth")</i></p>
<p>Parents experiences in teaching toothbrushing</p>	<p>Parents' personal experiences while teaching their children to brush their teeth.</p>	
<ul style="list-style-type: none"> • Division of parental work 	<p>Parents share/divide the task of taking their child or remind them to brush their teeth</p>	<p>"Es que el papá a veces llega más tarde de trabajar. Cuando llega temprano sí lo hace también. O a veces también cuando le dice su papá, "ya me voy a lavar los dientes hijo" y ya va también." <i>("Sometimes dad gets late back from work. When he is home early he takes him. Or sometimes when his dad says "I'm going to brush my teeth son" he also goes")</i></p>
<ul style="list-style-type: none"> • Agreements 	<p>Parents tell their children that if they don't brush their teeth today they HAVE to do it tomorrow.</p>	<p>"Sí. Pero yo le ando diciendo, si no puedes todos los días no hay necesidad, pero si no haces hoy mañana si lo haces le digo." <i>("Yes. But I keep telling him, if you can't do it every day there is no need, but if you don't do it today tomorrow you have to do it")</i></p>
<p>Perception of the routine</p>	<p>Personal experience and opinion of the oral hygiene routine.</p>	
<ul style="list-style-type: none"> • Difficult 	<p>Brushing teeth is an effort, and tiring.</p>	<p>"Se me hace difícil ya cuando digo vámonos a dormir y ahí tengo que subir con ella, luego con el segundo, y luego tengo que estar chequeando con el grande. Se me hace difícil. Es difícil." <i>("It is hard when I tell her that it's time to go to sleep, and I go upstairs with her, with the second one, and then I have to be checking on the eldest. It is difficult for me. Hard")</i></p>
<ul style="list-style-type: none"> • Easy 	<p>Children make it easy for parents and are cooperative. Or parents find it effortless</p>	<p>"Yo pienso que es fácil. Es fácil porque siempre, pues yo digo que es mi obligación hasta que ellos ya... yo pienso que para mí es fácil. Porque no tengo más</p>

		<p>cosas que hacer más que estar con mis niños recordándoles. A veces que trabajo en el día, digo se me hace fácil porque estoy en la parte de la noche que estoy con ellos."</p> <p><i>("I think it's easy. It is easy because always, well I think it's my obligation until they... I think it's easy. Because I don't have anything more to do than being with my children reminding them. Sometimes I work during the day, I say it is easy because at night time I'm with them")</i></p>
Barriers for tooth brushing	Obstacles that prevent the practice of a behavior.	
• Attitude	Disposition or feeling with regard to tooth brushing.	
○ Child	Child has a bad attitude towards brushing teeth, or not being interested in doing it.	"Les da como un poco de pereza, así como ay otra vez!" <i>("They are kind of lazy about it, like Oh no! Not again!")</i>
○ Parent	Parent has a bad attitude towards brushing teeth, or not being interested in doing it.	"Entonces que como uno dice, para que te lavas tantas veces los dientes, si a cada rato vas a estar comiendo. " <i>("So I say, why should I brush my teeth if I'm going to be eating all the time")</i>
• Activities, time	The perception that because parents or children have too many activities they don't have time to brush their teeth.	"Sábado y Domingo a veces con las prisas que llévalas a las clases y corre... que sábado y domingo a veces no logro 3 veces... " <i>("Saturday and Sunday sometimes with all the running from taking them to one class to the other... that on Saturday and Sunday sometimes I don't do it 3 times...")</i>
• Break in the routine	Situations that restrict the performance oral hygiene behaviors that are practiced regularly.	"Hay ocasiones cuando el fin de semana por la mañana se les olvida. Pero de ley en la noche ellas se lavan la boca" <i>("There are times during the weekend in the mornings that they forget. But at night is law that they brush their teeth")</i>
Habit	Acquired behavior pattern regularly followed until it becomes almost involuntary.	
• Child	Habitual behaviors in children 1	
○ Automaticity	Reference that suggests that the practicing of tooth brushing does not require conscious thought. In the case of children it also considers those situations that suggest that the child is showing intention for brushing their	

	teeth.	
▪ Intention	Act or instance of determining mentally upon brushing teeth.	"Ella ya tiene la intención de también "quiero lavarme los dientes" y nosotros se los lavamos." (<i>"She also has the intention "I want to brush my teeth" and we brush them for her"</i>)
▪ No intention	Lack of intention towards tooth brushing.	"O sea todavía no tiene ese hábito. " (<i>"I mean she doesn't have the habit yet"</i>)
▪ Routine/habit	Child has brushed his/her teeth in the past without been reminded of it. This action could be interpreted as the initiation of a tooth brushing habit.	"Sí. Hay momentos de "mami ya me lavé los dientes". " (<i>"Yes. There are moments of "mommy I already brushed my teeth"</i>)
○ Cognitive	Child understanding of tooth brushing and its meaning.	
▪ Understanding	Parent perceives that child understands tooth brushing instructions and/or explanations given about its importance.	"La mayor sí, como que sí lo entendió. Porque dijo como ay no! Me tengo que cuidar más! (<i>"The eldest yes, she understood. Because she said "Oh no! I have to start taking better care!"</i>)
▪ No understanding	Parent perceives that child does not understand tooth brushing instructions and/or explanations given about its importance.	"Y la chiquita si como que, si te escucho pero no entiendo lo que me dices." (<i>"And the youngest is like "I hear you but I don't understand what you are saying"</i>)
○ Cues	Contextual cues such as people, places, and time of day that influence the child tooth brushing.	
▪ Morning cues	Contextual cues that take place in the morning that influence the child tooth brushing.	
✓ After breakfast	Contextual cues for children's' tooth brushing, after breakfast in the morning.	"...toman su desayuno y después de tomar su desayuno se lavan los dientes" (<i>"...they have their breakfast and after having their breakfast they brush their teeth"</i>)
✓ Getting ready for school	Contextual cues for children's' tooth brushing. In this case the cues are associated with getting ready to take the child to school in the morning.	"Nosotras sí, antes de irnos a la escolita es peinarnos y los dientes." (<i>"Me and her yes, before we go to school we comb our hair and brush our teeth"</i>)
✓ Right after waking up	Contextual cues for children's' tooth brushing that take place first thing in the morning. Right after waking up.	"El es ya más responsable, en la mañana que se levanta el agarra su cepillo y se cepilla." (<i>"He is more responsible, in the morning"</i>)

		<i>he gets up and grabs his toothbrush and brushes his teeth”)</i>
▪ Night cues	Contextual cues in the night time for children’s tooth brushing.	
✓ After dinner	Contextual cues for children’s tooth brushing after dinner in the night time.	"En la noche le doy su leche, alguna fruta, a veces una galleta si él quiere. Si quiere cereal en la noche le doy cereal. Le digo: ya vamos a lavarnos los dientes." <i>(“At night I give him milk, a fruit, sometimes a cookie if he wants one. If he wants cereal at night I give him cereal. I say: now, let go brush our teeth”)</i>
✓ After taking a bath	Contextual cues for children’s tooth brushing related to the bathing time routine of the child at night.	"...en la noche se baña y se vuelve a lavar." <i>(“...at night he bathes and he brushes again”)</i>
✓ Before going to bed	Contextual cues for children’s tooth brushing before going to bed at night.	"Cenamos y se prepara poniéndose la pijamita. El pañal. Y cuando yo digo ya vámonos para la cama es cuando le lavamos la boca." <i>(“We eat dinner and he gets ready and puts on his pajama. The diaper. And when I say is time to go to bed is when we wash his mouth”)</i>
○ Emotional tone	Emotional situation that causes the both parent and child to have strong feelings	
▪ Negative	Emotional situation that causes the both parent and child to have strong negative feelings	"...entonces así le digo mete el cepillo y empieza a tallar. Y empieza a tallar nada más aquí (muestra los dientes anteriores). Entonces le digo pero tienes que abrir y tallar todo adentro. Se enoja demasiado. Pero tenemos que hacerlo." <i>(“...so I tell him put the toothbrush and start brushing. And he starts brushing only here (points at anterior teeth). So I tell him you have to open and brush everywhere inside. And he gets very angry. But we have to do it”)</i>
▪ Positive	Emotional situation that causes the both parent and child to have strong positive feelings	"...y lo sabe y le gusta porque hasta que me señala así que arriba esta su cepillo ,que ella quiere, la cargo y se emociona y me abre la boca" <i>(“...and she knows about it and she like to do it because she points to the toothbrush, she wants to do it, so I hold</i>

		<i>her and she gets happy and opens her mouth”)</i>
○ Frequency	How often child’s tooth brushing	is performed
▪ 1 time per day	Child usually brushes teeth 1 time per day.	"Ella nada más una vez, en la noche, porque en la mañana ya está dormida..." ("She, only one time, at night, because in the morning she is sleepy...")
▪ 2 times per day or more	Child usually brushes teeth 2 or more times per day	"Los niños se los lavan dos veces" ("The children brush their teeth two times")
▪ Not brushing yet	Child has not yet started brushing teeth	"I: y a ella tú le has empezado a limpiar las encías o algo? P: no. Aún no." ("I: and have you started brushing her gums or something like that? P: no. not yet.")
○ Motor skills	Toothbrush grip and dexterity of the child	
▪ Little or no motor control	Child does not hold the toothbrush and parent brushes his/her teeth. Also, child can grasp the toothbrush but has little or no motor dexterity to adequately brush his teeth.	"...porque ella nada más muerde el cepillo de dientes. Ella quiere sacarle los hilitos, y yo le digo NO! Si te los quieres lavar te los tengo que lavar yo." ("...because she just grabs the toothbrush and start biting it. She wants to pull the bristles, and I say No! If you want to brush them, I'll do it for you")
▪ Some motor control	Child can grasp toothbrush and tries to brush his/her teeth. Parent notices his/her control of the toothbrush in not sufficient to adequately brush teeth.	"Sí lo agarra y luego como que le hace y dice no se mamá lávamelos tu" ("Yes, she holds it and then says mom you do it")
▪ Good motor control	Child has good toothbrush grip and dexterity to correctly brush his/her teeth by him/herself.	"Ella ya sabe. Ella se levanta se lava sus dientes. Desayuna, se lava sus dientes otra vez, y en la noche se lava sus dientes" ("She knows. She brushes her teeth. She has breakfast, and brushes her teeth again, and at night she brushes her teeth")
○ Social norms	Belief about how children should behave in a given context.	"...tus amiguitos no lloran cuando se los lavan" ("...your friends don't cry when they brush their teeth")
• Parents	Habitual behaviors in parents	
○ Automaticity	References made that suggest	"pues yo creo que fácil, porque ya es

	that the practicing of tooth brushing does not require conscious thought	como la costumbre que lo hacemos y hacemos y ya." ("well I think that easy, because it's the habit of doing it, so we do it and that's it")
○ Cues	Contextual cues such as people, places, and time of day that influence the parent's tooth brushing.	
▪ Morning	Contextual cues that take place in the morning that influence the parent's tooth brushing.	
✓ After breakfast	Contextual cues for parent's tooth brushing, after breakfast in the morning.	"Después de que tomo desayuno." ("After I have breakfast")
✓ Right after waking up	Contextual cues for parent's tooth brushing that take place first thing in the morning. Right after waking up.	"En cuanto me paro. Pues ya me paro lo primero que voy es a lavarme los dientes" ("As soon as I wake up in the morning. I get up, and the first thing I do is go brush my teeth")
✓ While getting ready to take kids to school	Contextual cues for parent's tooth brushing. In this case the cues are associated with getting ready to take the child to school in the morning.	"Nosotras sí, antes de irnos a la escuelita es peinarnos y los dientes." ("Me and her yes, before we go to school we comb our hair and brush our teeth")
▪ Night time	Contextual cues in the night time for parent's tooth brushing.	
✓ Before bed	B Contextual cues for parent's tooth brushing related before going to bed at night.	"...también. Antes de ir a dormir." ("...too. And before going to sleep")
✓ After dinner	Contextual cues for parent's tooth brushing after dinner in the night time.	"...después de la comida..." ("...after dinner...")
▪ Lunch time	Contextual cues for parent's tooth brushing at lunch time.	"Después del almuerzo, 12 o 1." ("After lunch, at 12 or 1.")
○ Emotional tone	Emotional situation that causes the parent to have strong feelings	"Lo hago rápido, lo hago mal" ("I do it quickly and I do it badly")
Frequency	How often parent's tooth brushing is performed.	
▪ 1 time per day	Parent usually brushes teeth 1 time per day.	"...a veces que una, a veces que se me olvida." ("...sometimes one, sometimes I forget")
▪ 2 times per day	Parent usually brushes teeth 2 times per day.	"Por lo general en la mañana. En el medio día a veces... a veces se me olvida. Y en la noche sí antes de..." ("Usually in the morning. At mid-day sometimes I forget. And at night, before...")
▪ 3 times per day	Parent usually brushes teeth 3	"Yo me lavo mis dientes tres veces al

	times per day.	día.” (“ <i>I brush my teeth three times per day</i> ”)
○ Social norms	Belief about how adults should behave in a given context.	“Por lo general toda la gente... o al menos la gente que estaba en mi área. Porque tocaba que te encontrabas una que otra compañera en el baño y la misma... y ah que se me acabo la pasta no tienes tantita?” (“ <i>In general everyone... at least everyone in my area did. Because you find a work colleague in the bathroom and the same... and oh I don't have any more toothpaste do you have some?</i> ”)

APPENDIX H: SUMMARY OF ADDITIONAL RESULTS

Parents were asked about their experiences with dental professionals, personal and their children's, and their knowledge in this topic.

Knowledge: parents acknowledge learning about when to take their children to the dentist from their pediatrician, friends, and other health professionals. Information provided varied from advice on where to take children for dental care, mother-baby bacteria transmission, dental check-ups frequency, dental care programs, and insurances.

Despite all the information provided by dentists and other health professionals, parents still had doubts about how and where to seek for affordable dental providers who preferably talked Spanish. Few parents also mentioned having questions about dental treatments provided in the past and about what treatment would be more appropriate. For example, one mother said *“What will happen with the tooth that he has a cavity? Will they have to take it out or fill it?”*

Dental visits: Parents personal experiences with dentists in some cases affected their attitude towards their children's dental care and oral hygiene. For example one mother stated *“...less than one year ago I had problems in my gums, and had to have a cleaning. So I tell them that they have to brush their teeth really good, because I don't want them to have gum problems because it hurts!”*

Regarding the timing and frequency of parents' dental visits, five participants stated they started going to the dentist less than three years ago. Also nine parents said they regularly visited

the dentist for check-ups (*"In fact I will make an appointment for December because they told me that I had to do it every four months so they didn't need to put anesthesia again"*), and three parents acknowledged not going to the dentist at all. The reason one mother gave for not going to the dentist was *"because I haven't had any pain"*.

When asked about their children's dental experiences nine parents reported their children's first dental visit being before they were two years-old, whereas eight parents took their children when they were two years-old or older. One mother remembered *"I took her when she was 5 years-old. That is when I learned that I could take her"*. Children's first dental visits were perceived by their parents to have a negative emotional tone or a positive emotional tone. Negative experiences were described by parents as situations where their children had fear and cried. Only some of these experiences involved dental treatments with anesthesia. Positive experiences described situations with amiable dentists and assistants. One mother said *"...since he (the dentist) has attended his older brothers, he loved it! Also, because we prepared him by showing him dental floss and fake dental instruments, when we took him he already knew"*. Regarding the frequency of their children's dental visits, parents who had initiated taking their children to the dentist (sixteen participants) stated to take them every six months. Only one mother acknowledged not having taken her daughters to the dentist in a long time (years since their first dental visit).

Motivation for going to the dentist: The main reasons for going to the dentist were (in ranking order from most to least frequently mentioned) pain, clean feeling, taking care of teeth, visualization of a dental problem, and image.

Motivation	Number of parents who mentioned it	Example
Pain	5	“I take them to the clinic (dental) and they charge me \$25 every time they are in pain or there is an emergency”
Clean feeling	5	“Because you feel it, right? Is like I need a dental cleaning. And that’s when I started going (to the dentist) a few years ago”
Taking care of teeth	3	“I don’t like going to much, but because of health I have to go”
Visualization of dental problem	3	“my molars have cavities, and I need to... especially because my molars are very damaged”
Image	2	“Because I looked at them (teeth) and saw they were dirty”

Barriers to access to care: During their interviews parents mentioned topics or situations that complicated their dental visit and therefore acted as barriers. The most commonly mentioned topic was language. Parents remembered situations where it was difficult for them to communicate or understand what was being said during a dental visit which frustrated and sometimes limited their access to care. As one mother remembers *“Well for me it was difficult the first years because the staff did not talked Spanish. Now there is more and all. I did not know*

where to go.” Cultural differences between provider and patient as well as having experienced previous traumatic dental experiences were also perceived as barriers. Participants perceived the lack of rapport with the provider to be a matter of cultural differences (*“Regarding dentists, it’s very different in Mexico. Sometimes when we are in Mexico we rather go there to the dentist, we feel more comfortable... is like they pay more attention and are more careful”*). Other topics mentioned by parents as barriers were long waiting times, negative attitude towards going to the dentist, costs, and transportation.

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