

## ABSTRACT

### Oral Health Education for Children: A Delphi Study of Effectiveness

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Oral health is a primary component of health that can have a large impact on the overall health and wellbeing of a person, yet it is commonly overlooked. In the United States, dental caries is the most common chronic disease of childhood, even though it is highly preventable and treatable. Oral health education may help to lessen the burden of such oral health problems, and oral health education programs are widely available, but there is no standard for these programs and very little research has been done on whether or not these programs—especially the ones targeting children—are actually effective. In this pilot Delphi study, three key informants from different fields relating to pediatric oral health education were interviewed about the effectiveness of current oral health education programs for children. From their responses, consensus was developed and recommendations formed regarding further execution of and research into children's oral health education programs.

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ORAL HEALTH EDUCATION FOR CHILDREN:  
A DELPHI STUDY OF EFFECTIVENESS

A Thesis Submitted to the Faculty of  
Baylor University  
In Partial Fulfillment of the Requirements for the  
Honors Program

By  
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Waco, Texas

May 2012

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## ACKNOWLEDGMENTS

This thesis would not exist without the help and encouragement of several individuals to whom I am extremely grateful. Dr. Eva Doyle is a wonderful mentor who has been supportive and encouraging throughout this process. From the very beginning, she has freely offered her time and aid to me; without her willingness to guide me through these three semesters, this thesis would not have come to fruition.

I am also grateful to all the people in the oral health field who I contacted during this process. Their information was vital in shaping this thesis. I am especially thankful for my panel members who carved time out of their busy lives to answer my many questions and participate in this study.

Last but not least, I would like to thank my friends and family, who provided endless moral support for me during this process. They have truly been a pillar of strength for me during all the ups and downs of this thesis-writing process.



## CHAPTER ONE

### Background and Literature Review

Oral health can have a significant impact on the overall health of a person, yet it is commonly overlooked. Problems with oral health can start before birth and play a huge role throughout a person's entire lifespan. According to the United States Surgeon General (2000), dental caries is the most common chronic disease of childhood, affecting more than five times as many children as asthma or hay fever. This is a highly preventable disease for which treatments exist, yet by late adolescence, nearly 80% of children have experienced dental caries (Mouradian, Wehr, & Crall, 2000). This chapter will discuss the main issues of note in the field of children's oral health, contributing factors that affect these issues, and current solutions of these issues. There will also be a brief background and overview of the Delphi method to be used in this study.

#### *Issues in Children's Oral Health*

The primary issues currently of note in the field of children's oral health can be subdivided into four areas: infections, developmental problems, oral habits, and oral trauma. Each is discussed in detail below.

#### *Infections*

Infections are perhaps the best known and most significant of children's oral health issues, as they include dental caries as well as various gingival infections. Dental caries are caused by cariogenic bacteria (most notably *Streptococcus mutans*) that produce acids; these acids erode enamel and cause tooth decay. This process can start as

soon as tooth eruption occurs; caries at such an early age are called early childhood caries (ECC) and greatly increase the risk of future tooth decay (National Maternal and Child Oral Health Resource Center, 2010). According to the CDC's National Oral Health Surveillance System, between 40.6% and 75.0% of third graders have experienced dental caries, and between 12.0% and 42.7% of third graders have untreated tooth decay (CDC, n. d.).

Gingival infections, though not as common as dental caries, can also cause many oral health problems for children. Deposits left in the mouth by bacteria can cause the gums to become inflamed, therefore causing plaque-induced gingivitis. This is a mild disease that clears up upon the removal of plaque, and is relatively common in children. Periodontitis is a more severe form of gingival disease, and can lead to bone loss surrounding the teeth and, eventually, tooth loss. Thankfully, this disease has a low prevalence and affects less than one percent of children (Califano, 2003).

### *Developmental Problems*

Developmental problems include cleft lip/palate, premature or delayed tooth eruption, and other various dental anomalies and malocclusions. Cleft lip/cleft palate is one of the most common birth defects and can be caused by a combination of genetic and environmental factors. Cleft lip and cleft palate can cause a variety of oral health related complications, especially when the cleft extends through the upper gum. Such a cleft will interfere with tooth development and can cause feeding difficulties by disrupting the sucking reflex (Mayo Foundation for Medical Education and Research, 2010).

Premature or delayed tooth eruption can also cause problems in children's oral health. Premature teeth, called natal teeth, are fully formed at birth and precede the

eruption of primary dentition. They occur every one in two to three thousand births, and usually do not cause many problems. Natal teeth are poorly developed with weak enamel and roots, and only need to be extracted if they interfere with breastfeeding (Leung & Robson, 2006). Delayed tooth eruption is usually innocuous, but if it is delayed more than twelve months, it can be indicative of a more severe underlying problem, such as Down Syndrome or various endocrine anomalies.

Dental anomalies include variations in the number, size, shape, quality, or position of teeth. These anomalies can occur in either the primary teeth (also called baby teeth or milk teeth) or in the secondary teeth (also called permanent teeth). The primary teeth are developed in utero, so any anomalies in the primary teeth are the result of problems with fetal development. Secondary teeth develop between birth and age six, so they can be affected by a number of factors during a child's development (National Maternal and Child Oral Health Care Resource Center, 2010).

Extra teeth, called supernumerary teeth, are rare, and usually do not interfere with the child's health. Missing teeth are usually caused by various genetic factors and also are usually asymptomatic. Teeth that are smaller than usual are called microdontic teeth; these teeth are usually lateral incisors and are conical in shape. Megadontic teeth are rare. Genetic factors play a large role in both microdontia and megadontia (National Maternal and Child Oral Health Care Resource Center, 2010).

Misshapen primary teeth are uncommon because tooth development is so well protected during fetal life; however, maternal infection with rubella, cytomegalovirus, or syphilis can cause teeth to be poorly formed. When the permanent teeth begin

developing, their shape can be affected by trauma to the primary teeth, local infection, or various systemic disorders.

Teeth can also be discolored or have defective enamel. Discoloration is frequently caused by the use of medications such as tetracycline (either by the mother during pregnancy or by the child before age eight) or by the child's oral hygiene habits. Discoloration is usually a superficial problem if it affects the entire dentition; if a single tooth is highly discolored, however, it can be indicative of caries or other disease. Enamel defects are rare, but can be severe. Two main enamel defects are enamel hypoplasia, where not enough enamel is produced, and enamel hypocalcification, where the enamel is of poor quality (National Maternal and Child Oral Health Resource Center, 2010). Defective enamel causes the teeth to be exceptionally vulnerable to infection and caries (Holt, Roberts, & Scully, 2001).

Malocclusion is the improper alignment of teeth; this condition is especially common in children with disorders that affect muscle function, such as cerebral palsy. Malocclusions make maintaining good oral hygiene more difficult since the teeth become harder to clean when they are not in proper alignment. Malocclusions are more common in the secondary dentition, and are frequently corrected by orthodontia (National Maternal and Child Oral Health Care Resource Center, 2010).

### *Oral Habits*

Poor oral habits can also lead to significant oral health problems in children. Proper oral hygiene is essential in reducing plaque and cariogenic bacteria; tooth brushing, fluoride use, flossing, and regular dental checkups are all recommended as preventive measures to keep oral health problems from developing. However, oral habits

extend beyond oral hygiene and can cause many different problems; the most common detrimental oral habits include thumb sucking and bruxism.

Thumb sucking—as well as lip sucking and tongue thrusting—is a normal, even healthy, habit during the first six years of a child’s life; it only becomes an issue when the permanent teeth begin to erupt. The repetitive sucking motion can cause the permanent teeth to become maloccluded, the jaws to become misaligned, and the roof of the mouth to become malformed. All of these problems can lead to speech difficulties and other problems associated with malocclusion (WebMD, n. d.).

Bruxism, the habitual grinding of teeth, is also a fairly common oral habit among children and does not usually pose a problem unless it is severe. Severe bruxism can lead to flat biting surfaces, muscle soreness, and damage to the sensitive pulp of the teeth. Extreme cases may require crowns to correct the damage and prevent further erosion of the pulp (National Maternal and Child Oral Health Resource Center, 2010).

### *Oral Trauma*

Oral trauma is also a major concern in children’s oral health. Such trauma is most frequent in one to two year olds (O’Neil, Clark, Lowe, & Harrington, 1989), and is more frequent in children with mental retardation, chronic seizures, and muscle incoordination. Restorative dental procedures are often necessary in the treatment of such trauma (National Maternal and Child Oral Health Resource Center, 2010) .

While these are far from all of the issues that plague children’s oral health, these are the major problems affecting children today. In the next section, the main contributing factors that affect children’s oral health will be discussed.

## *Contributing Factors to Children's Oral Health Issues*

Many factors contribute to children's oral health, but significant contributing factors include diet and nutrition, oral hygiene and access to dental care and education, and socioeconomic disparities. All of these factors play a role in the current issues in children's oral health.

### *Diet and Nutrition*

Diet and nutrition can cause many problems with children's oral health. Diet has a local effect on the oral cavity by affecting the pH, saliva and plaque composition, and strength of the teeth, whereas nutrition has a systemic effect on the overall health of the oral cavity (Touger-Decker & van Loveren, 2003). Yen, Huang, and Hu (2010) showed that deficiencies in a number of vitamins, particularly vitamin A, can affect tooth development and are associated with an increase in dental caries. Eating more between-meal snacks also increases a child's risk for dental caries, as does consuming fewer vegetables. However, the most significant dietary factor that affects children's oral health is carbohydrate and sugar intake.

Sugars create an excellent environment for cariogenic bacteria. After carbohydrates are digested by salivary amylase, they serve as substrates for bacterial enzymes. The enzymatic processes of the bacteria lower the pH of the mouth and lead to progressive tooth demineralization. A higher exposure of the oral cavity to sugars—whether by increased time (e.g., sipping a sugary beverage over a long period of time) or by increased volume—increases caries risk (Touger-Decker & van Loveren, 2003).

The consumption of sugars is especially relevant when speaking of children's oral health due to the trend of increased sugar intake in the latter half of the twentieth century

(Johnson & Frary, 2001). Sugar consumption increased 23% between 1970 and 1996, though that trend has lately been reversed. A 2011 study by Welsh, Sharma, Grellinger, and Vos showed that since 2000, there has been a 23% decrease in consumption of added sugars. This decrease is primarily the result of reduced soda consumption, though overall sugar consumption still exceeds recommended limits.

The dangers of sugar can start as early as infancy. Infants are exposed to sugars primarily through breast milk; these sugars alone have not been demonstrated to be cariogenic. However, breast milk can increase in cariogenicity when consumed in tandem with other sugars (Prabhakar, Kurthukoti, & Gupta, 2010).

#### *Oral Hygiene and Access to Dental Care and Education*

Oral hygiene plays a very important role in overall oral health. Tooth brushing is the most common and easiest way to maintain a healthy oral cavity. It has long been shown that tooth brushing helps to prevent caries and periodontal diseases by removing plaque as well as by helping to apply anti-caries protection such as fluoride. Because lifelong habits are often formed during childhood, it is especially important that children learn proper tooth brushing techniques, as this can have a substantial impact on their oral health throughout their lives.

Flossing also helps to improve oral health by removing leftover food from in between the teeth where a toothbrush cannot reach; however, it is often difficult to get children to floss. Young children also may not have the fine motor skills necessary to floss. In a survey of parents, only 21% reported that their child had flossed the previous day (R. C. Wiener, Crout, & Wiener, 2009). It was suggested that factors such as

children's lack of the fine motor skills required for flossing and a low rate of parental knowledge about the importance of flossing contribute to this low rate of flossing.

Access to dental care can also contribute to a child's oral health. The American Academy of Pediatric Dentistry (AAPD) recommends that a child's first dental visit occurs with the eruption of his first tooth, or by twelve months old. Though this guideline has been endorsed by the AAPD since 1989, many general dentists do not see patients under four years old, which can delay the start of proper dental care for children; in fact, Seale and Casamassimo (2003) discovered that as many as 60% of dentists disagree with this recommendation. Instead, nearly half of general dentists refer children under the age of 3 to pediatric dentists (Shulman, Ngan, & Wearden, 2008). Parents may not follow up with this referral, which can introduce a gap in children's oral health care.

Poverty can play a large role in a child's access to dental care. A recent study performed in Greece showed that "children who live in areas with lower average income present 1.20 to 2.14 greater risk of having higher caries severity and poorer oral hygiene in comparison to those living in more affluent areas" (Gatou, Koletsi Kounari, & Mamai-Homata, 2011, p. 144). Seale and Casamassimo (2003) conducted a survey of 1,251 general practitioner dentists gathering information about their practice patterns regarding children and their access to dental care. They discovered that less than 40% of general practitioner dentists ever saw children covered by Medicaid. They also found that once a child has a high level of caries, dentists are also less likely to take him or her on as a patient, creating a detrimental cycle.



### *Education on Oral Hygiene*

Education regarding oral hygiene can greatly affect a child's oral health; daily, at-home preventative dental routines are one of the most crucial elements in maintaining oral health. If patients do not know how to properly conduct these routines, their oral health can suffer as a result. This education can either be given to parents/caregivers, primary care physicians (usually pediatricians), or to the children themselves.

Several studies have been conducted in regards to the oral health literacy of parents/caregivers. Parental care is essential in maintaining proper oral hygiene when the child is too young to do it without assistance, and parental guidance later becomes crucial in teaching children proper oral health habits. Vann, Lee, Baker, and Divaris showed that "lower caregiver literacy was associated with deleterious oral health behaviors, including nighttime bottle use and no daily brushing/cleaning" (2010, p. 1395). Miller, Lee, DeWalt, and Vann (2010) studied the relationship between caregiver literacy and the clinical oral health status of children. Their analysis "revealed a significant relationship between caregiver literacy scores and clinical oral health status as determined by using a standardized clinical examination." (p. 107)

Recent attention has been given to the role of the primary care physician in children's oral health. Because more children see a pediatrician for routine medical care at a young age than they do a dentist, the only oral health information that many parents and children may receive is through their pediatrician (de la Cruz, Rozier, and Slade, 2004). Regardless, many organizations such as the American Academy of Pediatrics, Association of American Medical Colleges, and the Council on Medical Student Education in Pediatrics "do not include oral health in key guidelines and surveys of the

medical education continuum” (Krol, 2004, p. 487). A survey of pediatricians conducted in 2004 revealed that the amount of time spent on oral health education is inadequate. An increase in pediatrician oral health knowledge could increase children’s oral health by reaching children who would otherwise not receive any dental care (Krol, 2004).

Many programs also exist to educate children themselves on proper oral health care. However, there is a lack of information regarding the effectiveness of these programs. This will be discussed in more depth later.

### *Current Solutions to Children’s Oral Health Issues*

Three main solutions to the various children’s oral health issues exist today: water fluoridation, preventative dental screening and sealant programs, and education programs. These solutions all contribute to alleviating many of the oral health problems that children face.

#### *Water Fluoridation*

The fluoridation of municipal water supplies in the twentieth century has had a dramatic effect on the overall oral health of society. The CDC calls water fluoridation one of the top ten public health achievements of the past century, and estimates that every dollar invested in this system saves thirty-eight dollars in future dental costs (National Institute of Dental and Craniofacial Research, 2000). Fluoride helps to strengthen the enamel in teeth, which in turn helps to prevent dental caries. When teeth are being developed during childhood, the presence of fluoride in the diet creates much stronger teeth that are more resistant to caries.

Evidence has existed since the 1940s about the effectiveness of community water fluoridation (CDC, 1999). The current recommended level of fluoridation by the U.S. Department of Health and Human Services is 0.7-1.2 milligrams of fluoride per liter of water, though the execution and exact amount of fluorine in municipal water supplies is left up to local authority.

### *Screening and Sealant Programs*

Preventative measures can be crucial in maintaining children's oral health. Routine dental visits have been recommended for children beginning at the age of 1 or with the eruption of the first tooth. However, as discussed earlier under *Oral Hygiene and Access to Dental Care and Education*, many families and dentists are not following these guidelines. In order to try to solve this problem, some states have begun mandating dental checkups in addition to the usual battery of immunizations and general health checkups that are required to enter the public school system. As of 2011, eleven states have such requirements, though there is limited research on whether these requirements are effective or not (National Conference of State Legislatures, 2011).

Dental sealant programs are another key component of the preventative measures taken to try to solve the problems in children's oral health. Many states have initiated school-based sealant programs in poor or underserved areas in order to provide cariogenic prevention for those children who would not otherwise have access to it. The CDC recommends school-based sealant programs and has shown that they "effectively prevent and decrease decay for children and adolescents by 60 percent" (National Conference of State Legislatures, 2011, Prevention and Awareness section, para. 2).

### *Education Programs*

Many education programs exist, with the ultimate goal of raising people's awareness of oral health problems and increasing their oral health. Such programs have been made by national entities, such as the CDC, ADA, and WHO; state organizations, such as the California Dental Association and the Texas Smiles Foundation; and many independent, local groups. These programs are designed to target different groups of people who play a role in children's oral health, including dentists, primary care physicians, parents and caregivers, and the children themselves. The programs vary widely in their scope, curriculum, and method of delivery; some are in-class demonstrations on oral hygiene techniques, some are online webpages and games, and some are brochures or handouts that include the information. There is no standard for what information should be included in these programs, and limited research has been completed on whether or not these programs—especially the ones targeting children—are actually effective.

Worthington, Hill, Mooney, Hamilton, and Blinkhorn (2001) conducted a randomized control trial in northwest England testing the effectiveness of a dental education program geared towards ten-year old children. Similar studies were conducted by Shenoy and Sequeira (2010) on twelve and thirteen year olds in India, Redmond et al. (1999) on adolescents in the UK, and Tolvanven et al. (2009) on 5<sup>th</sup> and 6<sup>th</sup> graders in Finland. While all these studies showed moderate improvements in plaque scores, oral health knowledge, and other various oral health indicators, none of them focused on children younger than 10. The programs also varied widely in content, scope, length, and method of administration.

### *The Delphi Method*

The Delphi technique was developed in the 1950's by the Rand Corporation and allows groups of expert "key informants" to come to consensus on complex issues. This qualitative method is executed using a series of questionnaires, compiling the answers of the entire group to develop the next round of questions. Anywhere between two and ten rounds may be used; this depends on the complexity of the issue and degree of consensus required (Ali, 2005).

## CHAPTER TWO

### Methods

This chapter details the pilot Delphi study methods used to qualitatively examine key informants' perceptions about the efficacy of children's oral health education programs. A two-round Delphi technique was used to develop information consensus on complex issues. Descriptions of participant recruitment, data collection, and data analysis are provided below.

#### *Participant Recruitment*

Ten experts or "key informants" involved in many different aspects of children's oral health and/or children's oral health education were invited via email in November 2011 to participate in the Delphi study. This group included private pediatric dentistry practitioners and leaders of public health organizations/agencies that develop children's oral health education programs at local, state, and national levels. The email included an overview of the study purpose, procedures, and the first round of questions.

Of the ten invited, three experts agreed to participate in this pilot. The participants were offered the option of conducting the interviews via email or telephone. All three opted to email their responses.

#### *Instrumentation and Data Collection*

The Delphi technique was used to measure the participant's views about factors that impact the effectiveness of children's oral health education programs. Two rounds

of interviews were used to collect data. The first round entailed a moderately scheduled, qualitative interview guide in which the participants were asked to type and email their responses to the following questions:

1. Do you think oral health education programs actually impact the oral health of the children who are exposed to these programs? Why or why not?
2. What should be included in an oral health education program for children in order for the program to be effective? (What are the essentials?)
3. What challenges or limitations, if any, currently exist for those trying to implement oral health education programs for children?
4. For what age groups should these children's programs be designed? How young is "too young" to be effective?
5. Are oral education programs more effective when used in conjunction with oral health care, such as in a dental office during a visit or during a free community dental clinic day? Why or why not?
6. What recommendations do you have for improving the impact of oral health education programs on children's oral health? Who should be involved and how can they help?

The responses to these questions were then analyzed using the qualitative techniques described in a subsequent section (see *Data Analysis*). The results, described in *Chapter Three: Results*, were then used to identify emerging response themes and subthemes that could be used to develop the questionnaire for Round 2. Based on responses, six themes emerged that matched the six original questions. Subthemes were also identified for each of the six themes. The themes and subthemes identified in Round 1 were then used to develop the Round 2 questionnaire provided in the appendix.

In Round 2 the same three participants were emailed the follow-up questionnaire. This questionnaire contained six tables, each based on themes and subthemes derived from one of the six original questions. Each table contained the original Round 1

question. Beneath each question was a set of summarized statements designed to represent response subthemes that emerged from Round 1 responses. Each statement was presented with a 5-point Likert scale on which the participants were asked to mark the degree to which they believed the statements were accurate and complete. The participants were also invited to provide any comments or recommended changes for each item (response statement). There was also space provided to add any additional comments or changes for the question as a whole. With the second questionnaire, participants were also asked to provide information about their job title, how their job pertains to this study, and how long they have been active in their chosen field. Copies of these Round 2 questionnaires were distributed and returned via postal mail and email, based on the participant's preference.

### *Data Analysis*

Data analysis was conducted in two stages that corresponded with each round of the Delphi study. In the first stage of analysis, answers to the six Round 1 questions were examined by two members of the research team. Each researcher worked independently to identify common response themes across participants.

The Round 2 responses were analyzed by calculating the mean score for each Likert item to determine the degree to which participants agreed with each item. Any item that was scored "somewhat agree" (score of 2) or "do not agree" (score of 1) by any participant was considered to not be in consensus with the group, and was not included in the final consensus statements or was modified based on the suggestions provided by the dissenting participant.



## CHAPTER THREE

### Results

This chapter contains a description of study results. It includes descriptions of participant demographics, followed by the results of Round 1 (the initial six-question interview), and the results of the Round 2 follow-up questionnaire.

#### *Participants*

Three participants participated in this pilot study. Each represented a different professional perspective of the pediatric oral health education field. Participant 1 was a community health worker and program coordinator for a local health education group. She had been delivering an oral health education program for that group for nine years. Participant 2 was a female assistant professor of pediatric dentistry at a dental school who was involved with both the academic and clinical sides of pediatric dentistry. She had been working in this capacity for five years. Participant 3 was a male private pediatric dentistry practitioner. He also had been in the field for five years.

#### *Round One: Interview Findings*

Six common themes emerged from the first round of interviews. These themes were: 1) the impact of oral health education programs, 2) oral health education program components, 3) current challenges, 4) appropriate age groups, 5) needed partnerships, and 6) recommendations. Each is described in more detail below.

### *Theme 1: Impact of oral health education programs*

Three common subthemes developed from the first theme, as indicated in Figure 1. The first subtheme was that oral health education programs *do* have an impact on the oral health of children; children exposed to these programs show signs of practicing healthy behaviors, such as brushing, seeing the dentist twice a year, using preventative measures like topical fluoride and sealants, and practicing proper nutrition. Participant 1 said that “students that were exposed to our children’s oral health presentation show signs of practicing the new healthy habits learned”, and Participant 2 stated that “the children [who are] enrolled in [oral health education] programs tend to have a healthier mouth and much healthier dental attitude and habits.”

Figure 1: Theme 1 and Subthemes

#### Theme 1: Impact of oral health education programs

Subtheme 1: Oral health education programs do have an impact on the oral health of children; children show signs of practicing healthy behaviors, such as brushing, seeing the dentist twice a year, using preventative measures like topical fluoride and sealants, and practicing proper nutrition.

Subtheme 2: Methods of measuring oral health education programs’ impact include feedback from parents, feedback from local dental clinics, examination of existing dental records, and assessment of various clinical indicators such as caries rates and demineralization surfaces

Subtheme 3: Factors beyond the content of the program greatly affect the impact of children’s oral health education programs; parental involvement and the use of experiential learning techniques can play a role in determining the impact of oral health education programs.

Subtheme 2 related to how we know that these oral health education programs improve oral habits; feedback from parents, feedback from local dental clinics, examination of existing dental records, and assessment of various clinical indicators such as caries rates and demineralization surfaces have all served as measurement methods for the effects of oral health education programs. Participant 1 cited the usefulness of “parent evaluation feedback forms” and the comments she heard from “a local dental

clinic” regarding the oral health education program she administers. Participant 3 cited clinical indicators like “caries rates as measured by decayed, missing, or filled teeth (DMFT) or DMFS (surfaces). Other measured [*sic*] have been clinical exams measuring demineralization surfaces or periodontal health status.”

The third subtheme focused on factors beyond program content that impact the outcome of children’s oral health. Factors such as parental involvement and the use of experiential learning techniques were deemed to affect the quality of impact of oral health education programs. According to Participant 3:

Oral health education programs can impact the oral health status of children involved, especially when they are part of the process. Behavior modification techniques are most effective when they involve the parent and the child at the same time and when they have an active component of teaching.

He further explained that “oral health education programs for children should involve active behavior modeling including ‘tell, show, do’ play and learn, as well as parental involvement.” Participant 2 echoed this perspective with the following statement:

Education given to very young children alone is seldom effective. Oral health care of children is a collective effort in the sense it [*sic*] in order to be effective, the primary and secondary caregivers of these children need to be involved and educated and motivated as well.

### *Theme 2: Oral health education program components*

Theme 2 focused on the components that should be included in an oral health education program; three subthemes developed from this theme (see Figure 2). The first subtheme was a summary of all the topics that panel members thought should be included in an oral health education program for children. These identified topics included: a) information on normal teeth (anatomy, composition, function), b) proper oral hygiene, including brushing and flossing techniques and frequency, c) routine oral health care, d) injury prevention, e) nutrition, f) fluoride, and g) an explanation of the caries process.

Figure 2: Theme 2 and Subthemes

Theme 2: Oral health education program components

Subtheme 1: Topics that should be included in an oral health education program

- a) Information on normal teeth (anatomy, composition, function)
- b) proper oral hygiene, including brushing and flossing techniques and frequency
- c) routine oral health care
- d) injury prevention
- e) nutrition
- f) fluoride
- g) an explanation of the caries process

Subtheme 2: Techniques that should be used for delivering oral health education include experiential learning, parental involvement, and age-appropriate presentation format and length.

Of the topics previously listed, proper oral hygiene and nutrition were identified by all three participants as topics that must be covered by an oral health education program. Most other topics were included as part of at least two participants' responses: routine oral health care (Participants 1 and 2), injury prevention and an explanation of the caries process (Participants 2 and 3), and information on the anatomy, composition, and function of teeth (Participants 1 and 3). The inclusion of fluoride as a necessary topic was only mentioned by Participant 3 in Round 1.

The second emerging subtheme pertained to the techniques that should be used to deliver these oral health education programs, such as experiential learning, parental involvement, and an age-appropriate presentation format and length. Participants 2 and 3 both used the phrase “age-appropriate education” in their responses; Participant 3 listed “‘tell, show, do’ play and learn, as well as parental involvement” as being important techniques for delivering oral health education programs.

### *Theme 3: Current challenges*

Theme 3 pertained to what challenges or limitations currently exist for those trying to implement oral health education programs for children. Two subthemes emerged from this theme, as shown in Figure 3. The first subtheme relates to funding. All three participants cited funding as one of the main challenges with the implementation of oral health education programs. Participant 2 further specified that there is a challenge in “finding the right type and number of workforce required to deliver these services to communities that need the most.”

Figure 3: Theme 3 and Subthemes

#### Theme 3: Current challenges

Subtheme 1: Funding is currently one of the largest limitations in implementing oral health care education programs for children.

Subtheme 2: A second challenge is presenting oral health education programs in a neutral setting with parents/caregivers present.

The second subtheme that emerged from Theme 3 was that presenting oral health education programs in a neutral setting with parents/caregivers present is a challenge for those implementing oral health education programs for children. Participant 3 said that “finding the children with their parents” and “being present in a neutral setting” was a challenge, but the other two participants did not mention these challenges.

### *Theme 4: Appropriate age groups*

The fourth theme identified in Round 1 related to the participants’ perspectives regarding appropriate age groups for oral health education. Two subthemes emerged from these responses (see Figure 4). The first established the recommended ages for oral health education programs. Four appropriate age categories were determined: 1)

pregnant mothers, 2) infants and toddlers (3 years and younger), with parental involvement, 3) children ages 4-6, and 4) children 7 years (2<sup>nd</sup> grade) and up. Participant 2 was the only participant who mentioned pregnant mothers. She said:

It is never too early to educate families of young children about dental diseases, oral health care needs and to stress the importance of noncariogenic diet and disease prevention...caregivers of these children need to be involved and educated and motivated as well. So, I feel that starting with pregnant mothers...would be appropriate.

Participant 3 presented three primary age groups that he felt were appropriate: “age 18 months to 3, 4-6 years old, and 7 and up...it is questionable even for the time between 18 months and 2 years of age whether [sic] it is effective or not to include them as well.”

Participant 1 stated that “an ideal age to begin teaching this type of program would be around age 5. Anyone younger may find it difficult to understand all of the components being covered in our curriculum. We offer an oral health component for grades 2<sup>nd</sup> to senior adults.”

#### Figure 4: Theme 4 and Subthemes

##### Theme 4: Appropriate age groups

###### Subtheme 1: Recommended ages for oral health education program delivery:

- Group 1: pregnant mothers
- Group 2: infants and toddlers (3 years and younger), with parental involvement
- Group 3: children ages 4-6
- Group 4: children 7 years (2<sup>nd</sup> grade) and up

Subtheme 2: Programs must be tailored to be age-appropriate for the targeted group in areas including content depth and presentation length.

The second subtheme again emphasizes that programs must be tailored to be age-appropriate for the targeted group in areas including content depth and presentation length. Participants 2 and 3 both use the phrase “age-appropriate education” in their responses, and Participant 3 goes on to further detail some of the differences in the

programs for various age groups. He says that “different variations of the same information [should be] presented in different ways for [the different] age groups”, and that the “timing of [the] presentation should be 3-5 minutes for the first group [age 18 months to 3 years], 5-15 minutes for the second group [4-6 years old], and 15-20 minutes for the third group [7 years and up].”

#### *Theme 5: Partnerships*

The fifth theme focused on the concept of partnerships and the effectiveness of delivering oral health education programs in conjunction with oral health care, etc. Four subthemes emerged, as shown below in Figure 5.

Figure 5: Theme 5 and Subthemes

#### Theme 5: Partnerships

Subtheme 1: Partnerships allow for better allocation of resources.

Subtheme 2: Partnerships increase the efficacy of oral health education programs.

Subtheme 3: Partnerships increase the amount of participation by offering incentives to patients, such as free or easily accessible health care.

Subtheme 4: Partnerships encourage follow-up and continued care and/or education.

The first subtheme was that partnerships allow for better allocation of resources.

Participant 1 provided an example:

We recently completed a partnership with a local dental clinic and the [local community chapter of the] Masonic Lodge, and I would certainly have to say that this partnership not only educated the students on the importance of practicing proper oral hygiene but it allowed the students to receive some much needed oral health services. During this partnership our center provided the education for the students, the clinic provided the oral health services, and the Masonic Lodge provided the students with the supplies they needed to continue with the lessons learned. I certainly feel that this partnership was more effective than [sic] doing the instruction alone.

The second subtheme that emerged was that partnerships increase the efficacy of oral health education programs. Participant 2 said that because “parents and children have already made a trip to the dentist/dental camp to receive dental services...[they] may be better tuned to getting hands on and customized oral health care instructions”.

Participant 3 echoed a similar sentiment:

[Oral health education programs] are effective in the dental environment...the community environment...[and places like] the WIC clinics. Children are there with their parents at an early age, together, captive audiences...Another place is the pediatricians office. Since the children are there at an early age before there are cavities, you can really impact the lives of these kids.

Subtheme 3 represented the concept that partnerships increase the amount of participation by offering incentives to patients, such as free or easily accessible health care. Participant 2 suggested that “these (especially those free) services may act as an incentive to enroll in and to continue participating in these programs.” Participant 3 alludes to this as well by mentioning the WIC clinics; mothers and children going there are receiving free services and therefore have an incentive to participate in such programs.

The fourth subtheme was that partnerships encourage follow-up and continued care and/or education. Participant 2 stated that “it will be easy for the dentist/dental team to monitor progress and access success of the educational services and recommend appropriate intervention when required,” and Participant 3 said that “the key is repetition”.



### *Theme 6: Recommendations*

The sixth response theme pertained to participants' suggestions and recommendations for bettering the impact of children's oral health education programs. Five subthemes emerged from this question. These subthemes are listed in Figure 6.

Figure 6: Theme 6 and Subthemes

#### Theme 6: Recommendations

Subtheme 1: Cooperation between various groups is necessary, as it allows for children to be impacted in as many ways as possible. Groups that should be included in this process are dentists, community clinics, health educators, civic organizations, day care and school workers, other health care providers such as pediatricians, and students interested in entering the health care field.

Subtheme 2: Parents and caregivers need to be included in the oral health education programs.

Subtheme 3: Programs need to be administered to children early in order to reach them before problems develop and/or bad habits develop.

Subtheme 4: Oral health education needs to be repeated multiple times; repeated exposure to the content will improve the impact of oral health education programs.

Subtheme 5: Taking a "systems approach" (e.g. linking government benefits to health care visits and receipt of oral health education) may help to impact more children.

The first subtheme established that cooperation between various groups is necessary, as it allows for children to be impacted in as many ways as possible. It also identified the groups that should be included in this process: dentists, community clinics, health educators, civic organizations, day care and school workers, other health care providers such as pediatricians, and students interested in entering the health care field. Participant 1 highlighted the involvement of "community clinics, organizations, health educators, [and] civic organizations", as well as "students that might be interested in going into a career in health care". She said that "if we could find a number of [these groups]...that might be willing to work together to implement this type of program we could have a great impact on the individuals we serve."

Participant 2 listed the following people as groups who should be included in oral health education programs: “1. The community health care workers/school nurses and dental workforce (Dentists, dental hygienist, assistants) who deliver information and education to these children and their families and 2. Parents or the primary caregivers of these children.” Participant 3 mentioned “day cares [and] pediatricians offices” as specific groups who should be involved.

The second subtheme was that parents and caregivers need to be included in the oral health education programs. Participant 2 specifically mentioned parents and caregivers in her response to this question, and Participant 3 mentioned parental involvement in his responses to Questions 1, 3, and 5.

The third subtheme that emerged was that programs need to be administered to children early in order to reach them before problems develop and/or bad habits develop. Participant 3 recommended that we must “start where the children are from an early age”, and repeated this phrase several times throughout his responses.

Subtheme four focused on the repetition of oral health education. Participants indicated that oral health education needs to be repeated multiple times; repeated exposure to the content will improve the impact of oral health education programs. Participant 3 said that “the key [to making an oral health education program effective] is repetition.” Participant 1 mentioned that her organization offers oral health education programs for not only children, but also adults, and states that “a refresher on practicing proper oral hygiene can always be beneficial”.

The fifth subtheme was derived from a unique suggestion of Participant 3; taking a “systems approach” (e.g. linking government benefits to health care visits and receipt of

oral health education) may help to impact more children. Participant 3 recommended in his response that “government benefits [should be linked] to health care visits and education (i.e. renewal of WIC benefits dependent on having an oral health care education program visit and dental screening.”

### *Round Two: Follow-Up Questionnaire*

Responses to the Likert items in the second round questionnaire are summarized in Table 1. A summary of these quantitative results are reported below along with the written comments provided in the questionnaire by participants.

#### *Question 1*

Question 1 of the Round 2 questionnaire was designed to measure participants’ opinions about Theme 1 regarding the impact of children’s oral health education programs. The results are summarized in Table 1, below.

Table 1: Theme 1: Impact of oral health education programs

<i>Subtheme</i>	<i>Mean Score*</i>
1.1: Yes, oral health education programs have an impact	4.00
1.2: Methods of measuring impact	4.33
1.3: Factors beyond the content of the program greatly affect the impact	5.00
*Scale: 1=do not agree, 2=somewhat agree, 3=moderately agree, 4=mostly agree, 5=strongly agree	

The response frequencies for Question 1.1 (Subtheme 1.1 *Oral health education programs do have an impact on the oral health of children; children show signs of practicing healthy behaviors, such as brushing, seeing the dentist twice a year, using preventative measures like topical fluoride and sealants, and practicing proper nutrition*) and for Question 1.2 (Subtheme 1.2 *Methods of measuring oral health education programs' impact include feedback from parents, feedback from local dental clinics, examination of existing dental records, and assessment of various clinical indicators such as caries rates and demineralization surfaces*) ranged from 3 to 5 with mean scores of 4.00 and 4.33 respectively. All three participants scored Question 1.3 (Subtheme 1.3 *Factors beyond the content of the program greatly affect the impact of children's oral health education programs; parental involvement and the use of experiential learning techniques can play a role in determining the impact of oral health education programs*) as a "5" for "strongly agree".

For Question 1.1, Participant 1 added an additional comment saying that although children enrolled in these programs do show signs of being impacted by these programs, such as "understand[ing] that they need to see a dentist", this is not sufficient in itself to make an impact on the oral health of children; "it is ultimately up to the parents" to take action on this knowledge.

## *Question 2*

Question 2 reflected on needed components of oral health education programs; the scores are shown in Table 2. Questions 2.1 and 2.2 were both given unanimous scores of 5 from all participants. Participant 1 made one additional comment about Question 2; she said that "incentives for the participants would also be beneficial. Due to

the lack of funding, this isn't always possible. Students need the tools to continue to practice the new habits/techniques [*sic*] learned.”

Table 2: Theme 2: Oral health education program components

<i>Subtheme</i>	<i>Mean Score*</i>
2.1: Topics that should be included	5.00
2.2: Techniques for delivering oral health education	5.00
*Scale: 1=do not agree, 2=somewhat agree, 3=moderately agree, 4=mostly agree, 5=strongly agree	

### *Question 3*

Question 3 was designed to measure participants' opinions regarding Theme 3, the current challenges that exist for children's oral health education programs. All three scores for Question 3.1 were 5, strongly agree. Question 3.2 had a mean score of 4.3, with responses ranging from 3 to 5 (see Table 3).

Table 3. Theme 3: Current challenges

<i>Subtheme</i>	<i>Mean Score*</i>
3.1: Funding	5.00
3.2: “Neutral setting” with parents/caregivers present	4.33
*Scale: 1=do not agree, 2=somewhat agree, 3=moderately agree, 4=mostly agree, 5=strongly agree	

Three additional questions were asked of participants in order to further clarify their Round 1 responses for Question 3. The first additional question was “What things

are funding needed for?” Participant 1 listed “educational models (ex: brushing puppet, toothbrush, tooth model) and supplies for students.” Participant 2 also listed “supplies” as an answer; she further added “publicity” and “recruiting an able workforce” as other items for which funding is necessary. Participant 3 did not list additional needs in response to this question.

The second additional question pertained to what settings are appropriate for delivery of oral health care education programs. Participant 1 said “schools, churches, [and] community centers”, Participant 2 listed “primary health care clinics, WIC clinics, schools, and even homes”, while Participant 3 mentioned “WIC offices, pediatricians office[s], [and] dental offices.”

The final additional question was “Who composes an appropriate workforce for implementing oral health education programs? What qualifications must they have and what is necessary to train them?” For the “who” question, Participant 2 mentioned “dentists, hygienists, dental assistants, physicians, physician’s assistants, nurses, and community dental and health care workers.” Participant 3 listed “nurses, social workers, pediatricians, dentists, childcare staff, [and] daycare staff.” For the question about qualifications, Participant 1 was the only participant to respond; she said that the workforce must have “knowledge of teeth and understanding of the necessary steps to practice proper oral hygiene” as well as “public speaking skills.” Regarding the necessary training for this workforce, Participant 3 was the only respondent; he listed “minimal training.”

#### *Question 4*

Question 4 was used to probe participants about appropriate age groups for children's oral health education programs. Both Questions 4.1 and 4.2 were scored with a unanimous score of 5, and no additional comments were made (see Table 4).

Table 4: Theme 4: Appropriate age groups

<i>Subtheme</i>	<i>Mean Score*</i>
4.1: Recommended ages: <ul style="list-style-type: none"><li>• Pregnant mothers</li><li>• Infants/toddlers with parental involvement</li><li>• Ages 4-6</li><li>• Age 7 (2<sup>nd</sup> grade) and up</li></ul>	5.00
4.2: Programs must be age-appropriate in depth and length	5.00
*Scale: 1=do not agree, 2=somewhat agree, 3=moderately agree, 4=mostly agree, 5=strongly agree	

#### *Question 5*

In the fifth question, participants were asked about partnerships. The results are summarized in Table 5. Questions 5.1, 5.2, and 5.3 each had a mean score of 4.67 with a range of 4 to 5. Question 5.4 had a mean score of 4.33, also with a range of 4 to 5. Participant 3 made one additional comment about Question 4 as a whole; he said that partnerships “are effective, but you need to reach the children and parent early and go where they are.”

Table 5: Theme 5: Partnerships

<i>Subtheme</i>	<i>Mean Score*</i>
5.1: Better allocation of resources	4.67
5.2: Increased efficacy	4.67
5.3: Increased participation through incentives	4.67
5.4: Encourage follow-up/continued care and education	4.33
*Scale: 1=do not agree, 2=somewhat agree, 3=moderately agree, 4=mostly agree, 5=strongly agree	

#### *Question 6*

The final question pertained to participants' recommendations for oral health education programs as established by their Round 1 responses. All 5 questions under Question 6 were scored a 5 by all participants. These results are summarized in Table 6.

Table 6. Theme 6: Recommendations of the participants

<b>Subtheme</b>	<b>Mean Score*</b>
6.1: Cooperation is necessary	5.00
6.2: Parents/caregivers need to be included	5.00
6.3: Reach children early before problems and habits develop	5.00
6.4: Repetition	5.00
6.5: "Systems approach"	5.00
*Scale: 1=do not agree, 2=somewhat agree, 3=moderately agree, 4=mostly agree, 5=strongly agree	



Participant 1 made an additional comment about competition within the oral health education field, saying that “we need to focus more on the needs of the community than competing with one another. There are various ways we could all partner to most effectively reach out to community. We tend to target many of the same locations and leave others out. This has been the case in the past.” Participant 3 also made an additional comment, expressing enthusiasm about Question 6, saying that “these are your best answers!!”

## CHAPTER FOUR

### Discussion and Conclusions

This chapter contains a discussion of the limitations of the study and a discussion of the results. Conclusions and recommendations developed from the results of this study are also given.

#### *Study Limitations*

One key limitation of this study was its small sample size. Efforts were made to contact individuals located in many fields related to children's oral health education, including national policy and program coordinators, state-level program administrators, state-level public health officials, local public health education programs, and local dental staff (general dentists, pediatric dentists, dental hygienists, and dental assistants). Many potential participants did not respond, despite repeated efforts of contact. Some individuals who were contacted felt that they were not knowledgeable enough to participate in this study, and others initially consented but later failed to fully participate. In addition, some stakeholder groups, such as parents and children, were not included in the study.

The study findings were limited to the perspectives of three professionals with 5-9 years of experience in oral health education. All measures were limited to a 2-week window of time in this cross-sectional study. Despite these limitations, the three professionals did provide a wide range of perspectives as a representative of a local public health agency, a dental professor and clinician, and a local practitioner of pediatric

dentistry. Each participant was given two opportunities to provide in-depth information through the two Delphi rounds. According to Akins, Tolson, and Cole (2005), a relatively small Delphi panel can still produce reliable results.

### *Discussion of Results*

The participants' responses in both rounds of this Delphi study yielded some interesting results. In this section, the results and their significance are discussed.

#### *Theme 1: Impact of oral health education programs*

The participants all agreed that oral health education programs do have an impact on children's oral health, as is evidenced through the "mostly agree" scores assigned to Item 1.1 in Round 2. However, based on their "strongly agree" responses to Item 1.3, the participants agreed even more strongly that factors beyond just the content of the program can impact children's oral health. While the curriculum and content of oral health education were considered important, additional comments from the participants indicated that factors such as the delivery technique of the program and parental involvement can play an even larger role in impacting children's oral health.

Participant-reported methods of measuring the impact of oral health education varied widely, ranging from highly quantitative clinical indicators (e.g., demineralization surfaces and caries rates) to casual feedback from parents. Clinical indicators are commonly used and standardized (Lees, Gerhard Jr, & Oppenheim, 1973; Pitts, 2004), but other qualitative measurements vary widely. If oral health education programs are to have an increased impact and effectiveness, it will require many different groups working together to reach as many children in as many ways as possible. Some of these groups

may not be dentists or trained clinicians capable of measuring quantitative indicators such as demineralization surfaces. Qualitative measurements may be easier for non-clinicians to use and report. If such measurement methods can be standardized, the impact of oral health education could be more easily and accurately reported. Some such methods exist already, such as the Early Childhood Oral Health Impact Scale, developed by Pahel, Rozier, and Slade (2007), which is used to measure oral health-related quality of life of preschool aged children and their caregivers.

Parental involvement was also mentioned repeatedly by participants as a central influence on the impact of oral health education programs. Parents play a crucial role in the oral health of their children; if parents/caregivers have low oral health literacy, their children are likely to have poorer oral health outcomes (Miller et al., 2010). A four-year-old child is incapable of buying a toothbrush or visiting the dentist alone, so if parents are not actively involved in the oral health education process, there is only so much that educating the children can accomplish. Participant 1 lamented that, no matter how well the children understand the concepts presented to them, “it is ultimately up to the parents” to act on this information and buy the children oral hygiene supplies or take them to a dentist. In the future, oral health education should target parents and children simultaneously or in tandem so that the education does not reach a dead-end with the children.

### *Theme 2: Oral health education program components*

When participants were asked about what information should be included in an oral health education program, there were a wide variety of responses. However, when these responses were compiled in Round 2, all participants unanimously agreed on all

components listed in the questionnaire and scored all items pertaining to Theme 2 with 5s for strongly agree. There is clearly agreement among oral health education professionals about what should be included in oral health education.

No recommended standardized curriculum was found in the literature to which participant recommendations could be compared. Based on participant responses, it appears as though oral health education needs to cover a broad range of topics to address the multiple facets of oral health. Information about normal teeth—including their anatomy, composition, and function—would provide children with an understanding of why their teeth are important and stress the significance of oral health. Demonstrations of proper oral hygiene, including brushing and flossing techniques as well as frequency, give children one of the most important skills for maintaining their own oral health.

By providing information on routine oral health care, children learn the importance of visiting the dentist twice a year. Teaching children about oral injury prevention can help children to prevent injuries, such as by wearing a mouth guard during sports. Proper nutritional education not only has benefits for oral health, but for general health as well. By teaching children healthy oral nutrition habits, like avoiding sugary foods, limiting carbonated beverages, and eating plenty of fruits and vegetables, they are also learning habits that may help reduce the growing epidemic of childhood obesity. Informing children about the importance of fluoride and explaining what happens when they do not take care of their oral health may help provide motivation to keep their mouths healthy. Together, all of these topics provide a comprehensive overview of oral health and provide children with all the tools and information necessary to improve their oral health. This is a crucial step towards making oral health education effective

Participants emphasized that age-appropriate format and length are very important in delivering an effective oral health education program. Not only is the content and information included in the oral health education important, but the method of delivery also plays a large role. Sitting preschoolers in a lecture hall and showing them a slideshow is clearly not an effective method of delivery.

One particular example given by the participants was “tell, show, do play” learning. “Tell, show, do” is a method recommended by the AAPD for communicating with children about what goes on during a dental visit. This method involves verbally explaining procedures to children (“tell”), demonstrating the procedure a non-threatening way that is carefully controlled (“show”), and then performing the procedure in the same way (“do”) (National Maternal and Child Oral Health Resource Center, 2010). This method has been applied in other ways, such as for use in oral health education. The educator “tells” about the concept to be taught, “shows” the child how to apply the concept, and then provides the child with the opportunity to “do” and practice the concept himself. This is an example of experiential learning, where education is reinforced through actions and experience (Kolb, 1984).

Powell and Wells (2002) tested Kolb’s widely popular theory of experiential learning and showed that experiential learning did greatly increase children’s knowledge when it was used. Experiential learning may help to increase the effectiveness of oral health education. Playing and interacting during oral health education may not only provide an opportunity for the concepts taught in the program to be learned and experienced by the children in a different way, but may also allow for educators to correct and further change the children’s oral health behaviors. For example, if a dentist

tells a child how to brush his teeth, demonstrates proper tooth brushing on a model, and then lets the child do it himself, the dentist then has an opportunity to intervene if the child is not brushing correctly. The dentist could immediately demonstrate again, giving the child a second opportunity to internalize the lesson, rather than failing to realize that the child has not fully understood what has been taught.

### *Theme 3: Current challenges*

All participants mentioned funding as one of the largest challenges that the field of oral health education currently faces. To further understand the challenges posed by funding, participants were asked additional questions about funding in the Round 2 questionnaire. Supplies, publicity, and workforce were listed as the primary areas that funding is needed for. The category of supplies included not only supplies for program administration, such as educational models or brushing puppets, but also supplies for student consumption, such as informational worksheets or oral hygiene supplies. These supplies can not only help enhance the age-appropriateness and interactivity of the program, thereby increasing its effectiveness, but they can also help provide students with the tools to take care of their oral health and reinforce the lessons learned in the program. If adequate funding were available, these supplies could become part of every oral health education program, which would increase the overall effectiveness of oral health education.

With more ample funding, publicity of programs could be increased. If more children and families heard about events where oral health education was offered, such as at health fairs or free oral health clinic days, more children could be exposed to oral health education. Funding for publicity could also be applied to increasing mass-media

oral health education campaigns. Mass-media campaigns have been shown to be effective in increasing the public's awareness of dental health issues (Schou, 1987; Harper, 2003), and increased funding could be used to develop these campaigns and reach new segments of the population who might not have previously been exposed to oral health education.

The hiring and training of an appropriate workforce could also be supplemented by additional funding. One of the additional questions asked of participants pertained to who this workforce should be. Dentists and other dental workers, pediatricians and other physicians, community health care workers, social workers, and daycare staff were all mentioned as possible members of this workforce. Participants also recommended that the workforce be knowledgeable about teeth and oral health, have public speaking and presentation skills, and require minimal additional training.

While dentists and others working in the dental field are knowledgeable about oral health, they may often not have the time to devote to oral health education in addition to their clinical duties. Some public health agencies that are devoted to delivering health education in a variety of forms may not be trained to deliver oral health education. A representative (T. Johnson, personal communication, September 20, 2011) of one local public health agency confessed that their oral health program was not very in-depth and that other groups in the area had more effective programs. If more public health agencies were equipped to deliver oral health education, the impact of oral health education could be increased. Pediatricians, schoolteachers, social workers, and daycare workers are other groups that reach children in need of oral health education; they could easily deliver this education to the children they already interact with if they were



properly trained. Increased funding for oral health education would allow for training of these groups and an increase in the impact of oral health education. While unlimited funding would be ideal, that is clearly never going to be a reality. Funding needs to be carefully allocated and used in the most effective manner possible.

The other challenge identified by participants was delivering oral health education in a neutral setting with parents/caregivers present (Subtheme 3.2). The mean Likert score for this item was 4.33, revealing that participants “mostly agree” that this is a relevant challenge. The second additional question asked of participants in Round 2 was designed to further identify appropriate settings for oral health education delivery. A wide variety of answers were provided, including dental clinics, schools, churches, community centers, primary health care clinics, and WIC clinics. Most of these settings corresponded with at least one of the suggested workforce members from the third additional question—schools with schoolteachers, dentists with dental clinics, pediatricians with primary health care clinics, social workers with WIC clinics, and community health care workers with community health care clinics. It appears that the workforce and settings are intimately connected. If additional settings are to be explored, perhaps a new segment of the workforce can be identified, and if an additional group of the workforce emerges, perhaps a new setting for oral health education delivery can be developed. Existing settings should also not be neglected; if one setting, such as public schools, is working better than another, then the programs there could be expanded and altered to increase the overall effectiveness of oral health education.

#### *Theme 4: Appropriate age groups*

Participants identified four age groups that were appropriate for receiving oral health education. Group 1 consisted of pregnant mothers, Group 2 was infants and toddlers under 3 years of age (with parental involvement), Group 3 included children ages 4-6, and Group 4 encompassed children 7 years (2<sup>nd</sup> grade) and up. All three participants “strongly agreed” with these groups in Round 2 and scored Item 4.1 with 5s. This strong agreement reveals that oral health education should be delivered to children of all ages, yet many programs only target Groups 3 and 4 (preschool and up), such as the Colgate Bright Smiles Bright Futures program (Colgate-Palmolive, 2012), the California Dental Association’s Dental Health Resource Guide (California Dental Association Council on Community Health, n. d.), and the “Healthy Teeth” website of the Nova Scotia Dental Association (NSDA, n. d.). This may be because these children are easier to access through school systems, or because they understand more than infants and toddlers, therefore they are easier to educate. However, some programs have begun to emerge that target Group 2, such as the Baby Oral Health Program (bOHP) designed by the National Children’s Oral Health Foundation (2009) to accompany their Toothfairy Island curriculum designed for older children.

Maternal education has been the area of several studies (Vann, et al., 2010; Miller, et al., 2010) regarding caregiver oral health literacy discussed in Chapter 1. Leaders of the American Academy of Pediatric Dentistry (AAPD, 2011) have stated that expectant mothers are an ideal group to educate and treat for dental problems. While they are pregnant, they can not only be educated on their oral health problems, but can also learn how to prevent future problems in their child. These guidelines were first

established in 2009, making them relatively new and not as widespread as guidelines on topics such as fluoridation or oral hygiene. Because it can have such a large impact on the infant's oral health, education of pregnant mothers should become more on the radar for oral health educators.

Under Theme 4, age-appropriateness was again emphasized by participants as crucial to oral health education. The frequent mentions of age-appropriateness continue to highlight its importance to the effectiveness of children's oral health education programs.

#### *Theme 5: Partnerships*

Oral health education is often delivered in conjunction with oral health care or other services provided by organizations other than the one offering the education. Participant 1 mentioned a recent partnership in which her public health agency worked with a local dental clinic and the local chapter of the Masonic lodge in order to provide oral health education, oral health care, and oral health care supplies to patients simultaneously. The Texas Dental Association Smile Foundation's (TDSAF) Texas Mission of Mercy (TMOM) events partner with dentists from across the state of Texas to provide free oral health care, while TDSAF provides educational information for the patients (Texas Dental Association Smiles Foundation, 2012). Many such partnerships exist throughout the oral health care world.

In Round 1, participants were asked their opinions on such partnerships. Four main benefits of partnerships were identified from their responses: better allocation of resources, increased efficacy, increased participation through incentives, and increased follow up.

The participant's perspectives appear to be supported in the literature. According to Gray (1985), partnerships can "accomplish something the engaged organizations could not do individually" (as cited in Chaskin, Brown, Venkatesh, & Vidal, 2001, p. 143). "Funding catalysts" (Chaskin et al., 2001, p. 146) often play a role in triggering the development of partnerships, and these partnerships can help build communities. Through community building, the focus of partnerships shifts from "*doing for* the community to *working with* the community in partnerships that enable the community to *do for itself*" (Doyle, Ward, & Oomen-Early, 2010, p. 33). Stimulating and promoting partnerships for oral health education in the future may be able to help enable the community to take oral health into its own hands.

#### *Theme 6: Recommendations*

In the final question, participants were asked about recommendations for improving oral health education in the future. In the second round, all participants strongly agreed with all recommendations, scoring everything with a 5. This suggests that these recommendations should be investigated further since the expert panel agreed so strongly on these items. Participant 3 even went as far as to praise these recommendations, highlighting them as the "best" of the Round 2 items.

The first recommendation was that cooperation between various groups is necessary to impact children in as many ways as possible. Numerous partnerships already exist at both local and state levels in order to help achieve this goal; however, as Participant 1 pointed out in her final remarks during Round 2, there is still significant competition between groups: dentists may be competing for patients from the same local population and public health agencies may be fighting for funding. However, in order to

make the most effective impact on the problems in children's oral health, competition needs to cease and cooperation needs to move to the forefront. By coordinating with other programs with the same goal in mind, successes and failures can be shared and new strategies can be developed for reaching as many children in the most effective possible way.

The importance of the involvement of parents and caregivers was again highlighted in the recommendations participants made. Clearly, parental involvement is a crucial aspect in making children's oral health education effective.

The third subtheme developed from the participant's recommendations was that programs need to be administered to children early in order to reach them before problems develop and/or bad habits develop. Participant 3 mentioned "starting where the children are at an early age" several times throughout his responses; this concept of early intervention was found throughout the literature. The AAPD recommends that children see a dentist as soon as their first tooth erupts or by twelve months of age. Programs like the National Children's Oral Health Foundation's Baby Oral Health Program and the National Maternal and Child Oral Health Resource Center's online "knowledge path" that provides education to mothers regarding their infant's oral health are becoming more available as the importance of early intervention is acknowledged. With proper prevention and careful monitoring, oral health problems can be caught early or avoided altogether. Education should not be left out of this early intervention; preparing parents and children with the proper knowledge of oral health issues and how to prevent them can perhaps play a large role in reducing the burden of oral health problems during childhood.

The fourth recommendation that emerged from participants' responses was the necessity of repetition of oral health education. Participant 3 called repetition "the key" to making an oral health education program effective, suggesting that this is a crucial element. Most of the studies that have been conducted on the effectiveness of oral health education were conducted on programs that had multiple repetitions. Redmond et al. (1999) repeated oral health education over a six and twelve month period, Worthington et al. (2001) administered a series of four one-hour lessons, Tolvanen et al. (2009) conducted intervention over 3.4 years, and Shenoy and Sequeira (2010) examined the differences between programs administered every 3 weeks and every 6 weeks, both for 36 weeks total. None of these programs that were studied were simply one single intervention, yet many of the education programs that currently exist are designed for a single exposure. While this single exposure to oral health education is better than no exposure at all, this brings the effectiveness of non-repeated programs into question. More research needs to be conducted in this area in order to evaluate the true effect of repetition on oral health education.

The last recommendation developed from participants' responses was of taking a "systems approach" to help impact more children. Participant 3 suggested this approach to oral health education multiple times; he mentioned tying WIC benefits to receiving oral and general health education and incorporating oral health education in daycares and schools. Werhane (2006) examined the potential uses of systems thinking in the oral health field and concluded that "a systems approach is essential if we are to understand, evaluate, and institute structural, organization, professional, and individual change in the oral health delivery system." By incorporating a systems approach in not only the oral

health delivery system but also oral health education, a larger impact could be made on the overall oral health of the population.

### *Conclusions and Recommendations*

Though the research methods and procedures used in this study were valid, recommendations for future research are in order. Having the input of someone who deals with large state or nationwide oral health education efforts would lend another dimension to this study. Additional perspectives of others who play relevant roles in oral health education, such as parents or children, would also augment the depth of the study. Getting the perspective of a more experienced expert who has been working in the oral health education field for 30 years, who could possibly contribute a different viewpoint on the topic, would also make this study more well-rounded. Repeating this study in a year after new developments are made in the field of oral health may also bring new perspectives, opinions, and ideas on the topic of children's oral health education.

Based on study findings, increasing parental involvement in oral health education is recommended. Because parental involvement has such a strong impact on children's oral health, more education programs should target parents and children together. Educating both the parent and the child could potentially have a synergistic impact on the oral health of the child.

A standardized curriculum should also be developed. Research should be conducted to determine which topics are the most significant in determining a child's oral health, and those topics should be covered in every oral health education program. More investigation should also be done on program delivery methods; while experiential learning has been effective, perhaps there are other teaching methods that could be

explored and used to supplement oral health education, especially with our ever-evolving world of technology.

Future research should be conducted into the effectiveness of oral health education across all ages and delivery methods. If more information was known about what locations, what delivery methods, and what ages were most effectively impacted by oral health education programs, more effective and concisely targeted programs could be developed. This research could also help to maximize the available funding, since there are always going to be limits on funding.

More research needs to be conducted on repetition of oral health education. Repeated education has been part of a majority of the studies done on the effectiveness of oral health education. If repetition is necessary to truly make an impact on the oral health status of children, are one-time programs worth the cost of administering them?

Current resources for oral health education should also be more well-publicized whether through dental offices, general public media campaigns, or other methods. Many people do not understand the importance of oral health nor do they know about the resources that currently exist to educate and assist them. The media is currently inundated with public service campaigns about smoking, eating healthy, and cancer, among other things; if awareness about oral health issues could be increased, people might be more likely to take their oral health into their own hands.

Oral health education has the potential to make a large impact on children's oral health. Further research into and development of these programs might be able to help decrease the burden of oral health problems and encourage healthier habits for children and adults alike.



## APPENDIX

## APPENDIX

### Round 2 Questionnaire

Dear [Participant's Name],

Thank you for your participation in my thesis; I truly appreciate your time and effort. The previous responses of everyone in the group were used to compile this second and final questionnaire. This questionnaire should take less than an hour to complete.

**Please complete this questionnaire by Monday, March 5th.**

*Purpose and use:* The purpose of this questionnaire is to establish group consensus on responses provided in the first round of questions. You will receive a copy of this summary once it is complete.

*Instructions:* Each of the six questions asked in the first round is listed at the top of one of the following pages. Beneath each question are key *response themes* (lists or statements) that represent the group's first-round responses. Please indicate on the 5-point scale the degree to which you believe each numbered response theme (each list or statement) is *accurate and complete*. You may add comments/recommend changes for each. I also added a few questions at the bottom of the page for question #3 to further clarify needed information. Please follow the steps listed below to complete this questionnaire.

**Step 1: Please answer the following questions in the space provided.**

1. What is your current job title?
2. In what ways does your job pertain to my study topic?
3. For how many years have you been working in this field?

**Step 2: Please complete the remaining pages of this questionnaire and return this document to me by the date indicated at the top of this page. You may do this one of three ways:**

1. You may type your responses in this document and highlight your selections on the scale in yellow, then send the completed document back to me via email.
2. You may print this document, complete it by hand, then scan it back into the computer and return the completed document to me via email.
3. You may print this document, complete it by hand, then mail it to me at:

[researcher's address deleted for privacy]

Again, thank you for participating in this Delphi study; if you have any questions about this round, please do not hesitate to contact me at [researcher's email deleted for privacy] or [researcher's phone number deleted for privacy].

Thank you!

Rebecka Haats

Question 1: Do you think oral health education programs actually impact the oral health of the children who are exposed to these programs? Why or why not?

Summarized Group Responses	Agreement Scale					Item-specific comments/ Recommended changes
	do not agree	somewhat agree	moder-ately agree	mostly agree	strongly agree	
1.1. Yes, children <i>do</i> show signs of practicing healthy behaviors, such as: --Brushing --Seeing the dentist twice a year --Using preventative measures like topical fluoride and sealants --Proper nutrition	1	2	3	4	5	
1.2. We have seen the effects of these programs measured through feedback from parents, feedback from local dental clinics, examination of existing dental records, and assessment of various clinical indicators (caries rates, demineralization surfaces, etc.).	1	2	3	4	5	
1.3. More than just the content of the program impacts the outcome of children's oral health; factors such as parental involvement and the use of experiential learning techniques affect the quality of impact of oral health education programs.	1	2	3	4	5	
<b>Additional Questions/Comments:</b>						
Additional comments:						

Question 2: What should be included in an oral health education program for children in order for the program to be effective? (What are the essentials?)

Summarized Group Responses	Agreement Scale					Item-specific comments/ Recommended changes
	do not agree	somewhat agree	moder-ately agree	mostly agree	strongly agree	
2.1. Topics that should be included in an oral health education program for children are: --Information on normal teeth (anatomy, composition, function) --Proper oral hygiene, including brushing and flossing techniques and frequency --Routine oral health care --Injury prevention --Nutrition --Fluoride --Explanation of the caries process	1	2	3	4	5	
2.2. Techniques that should be used to deliver these programs include: --Experiential learning ("tell, show, do play") --Parental involvement --Age-appropriate presentation format and length	1	2	3	4	5	
<b>Additional Questions/Comments:</b>						
Additional comments:						

Question 3: What challenges or limitations, if any, currently exist for those trying to implement oral health education programs for children?

Summarized Group Responses	Agreement Scale					Item-specific comments/ Recommended changes
	do not agree	somewhat agree	moder-ately agree	mostly agree	strongly agree	
3.1. Funding is currently one of the largest limitations in implementing oral health care education programs for children. A lack of funding affects the supplies available for these programs, as well as the workforce; it is more difficult to employ an appropriate and substantial workforce with inadequate funding.	1	2	3	4	5	
3.2. Presenting oral health education programs in a neutral setting with parents/caregivers present is a challenge for those implementing oral health care education programs for children.	1	2	3	4	5	
<b>Additional Questions/Comments:</b>						
3a. What things are funding needed for?						
3b. What settings are appropriate for delivery of oral health education programs?						
3c. Who composes an appropriate workforce for implementing oral health education programs? What qualifications must they have and what is necessary to train them?						
Additional comments:						

Question 4: For what age groups should these children’s programs be designed? How young is “too young” to be effective?

Summarized Group Responses	Agreement Scale					Item-specific comments/ Recommended changes
	do not agree	somewhat agree	moder-ately agree	mostly agree	strongly agree	
4.1. It is appropriate to deliver oral health education to the following age groups: --Pregnant mothers --Infants and toddlers (3 years and younger), with parental involvement --Children ages 4-6 --Children 7 years (2 <sup>nd</sup> grade) and up	1	2	3	4	5	
4.2. Programs must be tailored to be age-appropriate for the targeted group in areas including content depth and presentation length.	1	2	3	4	5	
<b>Additional Questions/Comments:</b>						
Additional comments:						

Question 5: Are oral education programs more effective when used in conjunction with oral health care, such as in a dental office during a visit or during a free community dental clinic day? Why or why not?

Summarized Group Responses	Agreement Scale					Item-specific comments/ Recommended changes
	do not agree	somewhat agree	moder-ately agree	mostly agree	strongly agree	
5.1. Yes, they are more effective. Partnerships like these allow for better allocation of resources.	1	2	3	4	5	
5.2. Yes, they are more effective. Partnerships like these increase the efficacy of oral health education programs.	1	2	3	4	5	
5.3. Yes, they are more effective. Partnerships like these increase the amount of participation by offering incentives to patients, such as free or easily accessible health care.	1	2	3	4	5	
5.4. Yes, they are more effective. Partnerships like these encourage follow-up and continued care and/or education.	1	2	3	4	5	
<b>Additional Questions/Comments:</b>						
Additional comments:						



Question 6: What recommendations do you have for improving the impact of oral health education programs on children’s oral health? Who should be involved and how can they help?

Summarized Group Responses	Agreement Scale					Item-specific comments/ Recommended changes
	do not agree	somewhat agree	moderately agree	mostly agree	strongly agree	
6.1. Cooperation between various groups is necessary, as it allows for children to be impacted in as many ways as possible. These groups should include: --dentists --community clinics --health educators --civic organizations --day care and school workers --other health care providers, such as pediatricians --students interested in entering the health care field	1	2	3	4	5	
6.2. Parents and caregivers need to be included in the oral health education programs	1	2	3	4	5	
6.3. Programs need to be administered to children “where [they] are from an early age” in order to reach them before problems and/or bad habits develop.	1	2	3	4	5	
6.4. Oral health education needs to be repeated multiple times; repeated exposure to the content will improve the impact of oral health education programs.	1	2	3	4	5	
6.5. A “systems approach” (e.g. linking government benefits to health care visits and receipt of oral health education) can help to impact more children.	1	2	3	4	5	
<b>Additional Questions/Comments:</b>						
Additional comments:						

## REFERENCES

- Akins, R. B., Tolson, H., & Cole, B. R. (2005). Stability of response characteristics of a Delphi panel: application of bootstrap data expansion. *BMC Medical Research Methodology*, 5, 37. doi:10.1186/1471-2288-5-37
- Ali, A.K. (2005). Using the Delphi technique to search for empirical measures for local planning agency power. *The Qualitative Report*, 10(4), 717-744.
- American Academy of Pediatric Dentistry. (2011). Guideline on Perinatal Oral Health Care. Retrieved from [http://www.aapd.org/media/policies\\_guidelines/g\\_perinataloralhealthcare.pdf](http://www.aapd.org/media/policies_guidelines/g_perinataloralhealthcare.pdf)
- Califano, J. (2003). Periodontal Diseases of Children and Adolescents. American Academy of Pediatric Dentistry. Retrieved from [http://www.aapd.org/media/Policies\\_Guidelines/E\\_PeriodontalDisease.pdf](http://www.aapd.org/media/Policies_Guidelines/E_PeriodontalDisease.pdf)
- California Dental Association Council on Community Health. (n. d.). Dental Health Education Resource Guide. Retrieved from [www.cda.org/library/dentalhealthguide.pdf](http://www.cda.org/library/dentalhealthguide.pdf)
- CDC. (n. d.) Caries Experience - Overview - National Oral Health Surveillance System. Retrieved September 28, 2011, from <http://apps.nccd.cdc.gov/nohss/IndicatorV.asp?Indicator=2&OrderBy=2>
- CDC. (1999). Ten Great Public Health Achievements--United States, 1900-1999. *Morbidity and Mortality Weekly Reports*, 48(12), 241-243.
- Colgate-Palmolive Company. (2012). Dental Care Education & Resources For Teachers. *Colgate Bright Smiles Bright Futures*. Retrieved September 15, 2011, from <http://www.colgate.com/app/BrightSmilesBrightFutures/US/EN/Program-Materials/For-Educators/Teachers.cvsp>
- de la Cruz, G. G., Rozier, R. G., & Slade, G. (2004). Dental screening and referral of young children by pediatric primary care providers. *Pediatrics*, 114(5), e642-652. doi:10.1542/peds.2004-1269
- Gatou, T., Koletsi Kounari, H., & Mamai-Homata, E. (2011). Dental caries prevalence and treatment needs of 5- to 12-year-old children in relation to area-based income and immigrant background in Greece. *International Dental Journal*, 61(3), 144-151. doi:10.1111/j.1875-595X.2011.00031.x

- Harper, H. J. (2003). Buckle-up and smile for life: uncommon partners find common ground to collaborate and eliminate disparities. Part 1. *Dental Assistant (Chicago, Ill.: 1994)*, 72(3), 8–12.
- Holt, R., Roberts, G., & Scully, C. (2001). Oral health and disease. *Western Journal of Medicine*, 174(3), 199-202.
- Johnson, R. K., & Frary, C. (2001). Choose Beverages and Foods to Moderate Your Intake of Sugars: The 2000 Dietary Guidelines for Americans—What's All the Fuss About? *The Journal of Nutrition*, 131(10), 2766S -2771S.
- Kolb, D.A. (1984). *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall. Retrieved from <http://academic.regis.edu/ed205/Kolb.pdf>
- Krol, D. M. (2004). Educating pediatricians on children's oral health: past, present, and future. *Pediatrics*, 113(5), e487-492.
- Leung, A. K. C., & Robson, W. L. M. (2006). Natal teeth: a review. *Journal of the National Medical Association*, 98(2), 226-228.
- Mayo Foundation for Medical Education and Research. (2010, April 23). Cleft lip and cleft palate. Retrieved September 28, 2011, from <http://www.mayoclinic.com/health/cleft-palate/DS00738>
- Miller, E., Lee, J. Y., DeWalt, D. A., & Vann, W. F. (2010). Impact of Caregiver Literacy on Children's Oral Health Outcomes. *Pediatrics*, 126(1), 107 -114. doi:10.1542/peds.2009-2887
- Mouradian, W. E., Wehr, E., & Crall, J. J. (2000). Disparities in Children's Oral Health and Access to Dental Care. *JAMA: The Journal of the American Medical Association*, 284(20), 2625 -2631. doi:10.1001/jama.284.20.2625
- National Children's Oral Health Foundation. (2009). Oral Health Education. *National Children's Oral Health Foundation*. Retrieved September 15, 2011, from <http://www.ncohf.org/what/oral-health-education/>
- National Conference of State Legislatures. Children's Oral Health Policy Issues Overview. (n. d.). Retrieved March 25, 2011, from <http://www.ncsl.org/default.aspx?tabid=14495>
- National Institute of Dental and Craniofacial Research. (2000). *Oral Health in America: A Report of the Surgeon General*. Department of Health and Human Services. Retrieved from <http://www2.nidcr.nih.gov/sgr/sgrohweb/chap4.htm>

- National Maternal and Child Oral Health Resource Center (2010). Pediatric Oral Health Management. Retrieved March 24, 2011, from <http://www.mchoralhealth.org/PediatricOH/index.htm>
- NSDA. (n. d.). About This Site. *Healthy Teeth*. Retrieved April 1, 2012, from <http://www.healthyteeth.org/teachers/index.html>
- O'Neil, D. W., Clark, M. V., Lowe, J. W., & Harrington, M. S. (1989). Oral trauma in children: A hospital survey. *Oral Surgery, Oral Medicine, Oral Pathology*, 68(6), 691-696. doi:10.1016/0030-4220(89)90157-6
- Pahel, B. T., Rozier, R. G., & Slade, G. D. (2007). Parental perceptions of children's oral health: The Early Childhood Oral Health Impact Scale (ECOHIS). *Health and Quality of Life Outcomes*, 5(1), 6. doi:10.1186/1477-7525-5-6
- Powell, K., & Wells, M. (2002). The Effectiveness of Three Experiential Teaching Approaches on Student Science Learning in Fifth-Grade Public School Classrooms. *The Journal of Environmental Education*, 33(2), 33-38. doi:10.1080/00958960209600806
- Prabhakar, A. R., Kurthukoti, A. J., & Gupta, P. (2010). Cariogenicity and acidogenicity of human milk, plain and sweetened bovine milk: an in vitro study. *The Journal of Clinical Pediatric Dentistry*, 34(3), 239-247.
- Redmond, C. A., Blinkhorn, F. A., Kay, E. J., Davies, R. M., Worthington, H. V., & Blinkhorn, A. S. (1999). A cluster randomized controlled trial testing the effectiveness of a school-based dental health education program for adolescents. *Journal of Public Health Dentistry*, 59(1), 12-17.
- Schou, L. (1987). Use of mass-media and active involvement in a national dental health campaign in Scotland. *Community Dentistry and Oral Epidemiology*, 15(1), 14-18. doi:10.1111/j.1600-0528.1987.tb00473.x
- Shenoy, R. P., & Sequeira, P. S. (2010). Effectiveness of a school dental education program in improving oral health knowledge and oral hygiene practices and status of 12- to 13-year-old school children. *Indian Journal of Dental Research: Official Publication of Indian Society for Dental Research*, 21(2), 253-259. doi:10.4103/0970-9290.66652
- Shulman, E. R., Ngan, P., & Wearden, S. (2008). Survey of treatment provided for young children by West Virginia general dentists. *Pediatric Dentistry*, 30(4), 352-357.
- Texas Dental Association Smiles Foundation. (2012). Programs of the Texas Dental Association Smiles Foundation. Retrieved April 8, 2012, from <http://www.tda.org/displaycommon.cfm?an=1&subarticlenbr=1798>

- Tolvanen, M., Lahti, S., Poutanen, R., Seppä, L., Pohjola, V., & Hausen, H. (2009). Changes in children's oral health-related behavior, knowledge and attitudes during a 3.4-yr randomized clinical trial and oral health-promotion program. *European Journal of Oral Sciences*, 117(4), 390–397. doi:10.1111/j.1600-0722.2009.00640.x
- Touger-Decker, R., & van Loveren, C. (2003). Sugars and dental caries. *The American Journal of Clinical Nutrition*, 78(4), 881S -892S.
- Vann, W. F., Jr, Lee, J. Y., Baker, D., & Divaris, K. (2010). Oral health literacy among female caregivers: impact on oral health outcomes in early childhood. *Journal of Dental Research*, 89(12), 1395-1400. doi:10.1177/0022034510379601
- WebMD (n. d.). Dental Problems in Children: Tongue Thrusting, Thumbsucking, and More. Retrieved March 24, 2011, from <http://www.webmd.com/oral-health/oral-health-problems-children>
- Welsh, J. A., Sharma, A. J., Grellinger, L., & Vos, M. B. (2011). Consumption of added sugars is decreasing in the United States. *The American Journal of Clinical Nutrition*, 94(3), 726 -734. doi:10.3945/ajcn.111.018366
- Wiener, R. C., Crout, R. J., & Wiener, M. A. (2009). Toothpaste use by children, oral hygiene, and nutritional education: an assessment of parental performance. *Journal of Dental Hygiene: JDH / American Dental Hygienists' Association*, 83(3), 141-145.
- Worthington, H. V., Hill, K. B., Mooney, J., Hamilton, F. A., & Blinkhorn, A. S. (2001). A cluster randomized controlled trial of a dental health education program for 10-year-old children. *Journal of Public Health Dentistry*, 61(1), 22–27.
- Yen, C.-E., Huang, Y.-C., & Hu, S.-W. (2010). Relationship between dietary intake and dental caries in preschool children. *International Journal for Vitamin and Nutrition Research*, 80(3), 205-215. doi:10.1024/0300-9831/a000022