Parents' Knowledge of Children's Oral Health and Their Ability to Retain Information

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Abstract:

Background: Caries is the most common chronic childhood disease. The caries incidence in Nevada is higher than the national average. Studies have shown oral hygiene programs can increase caregiver knowledge as it relates to the oral health of their children, but changing the oral health behavior of the caregivers remains a challenge. The purpose of this study was to evaluate change in caregiver knowledge following an eight minute, one-on-one oral health presentation with visual images and hands-on oral hygiene instruction. **Methods**: Caregivers were recruited from two clinics at the University of Nevada, Las Vegas School of Dental Medicine. Three identical surveys were used to track any change in caregiver knowledge: baseline at time one (T1), immediately following the presentation at time two (T2), and an evaluation of retention at a one to four month follow-up visit at time three (T3). **Results:** Mean correct scores, out of a possible 29, for each testing period were: T1(x=17.92, sd=4.15), T2(x=25.06, sd=3.63), and T3(x=23.69, sd=3.51). Change in scores were statistically significant ($p<0.01$). **Conclusion:** Individual oral hygiene instruction increased caregiver oral health knowledge. Additional support is needed from the healthcare community to educate caregivers, to increase knowledge and change behaviors that will improve oral health outcomes in children.

Key words: *Anticipatory Guidance, Oral Health Education for Parents, Oral Health Instructions*

Introduction

According to the Surgeon General's Report titled," Oral Health in America," dental caries is the most common chronic childhood disease (Surgeon General's Report, 2000). Despite prevention efforts by dental professionals, caries status among children in the United States remains high. After reviewing findings from the National Health and Nutrition Examination Survey (NHANES), the Centers for Disease Control and Prevention (CDC) found that the prevalence of untreated decay in primary teeth of children aged two to five years old increased from 24% to 28%, from 1988-1994 to1999-2004 (Dye et al., 2007). According to a Nevada Department of Health and Human Services (NDHHS)," Head Start Oral Health Survey," Nevada's rate of untreated decay in three to five year olds was 12.3% (Nevada Department of Health and Human Services, 2013). For untreated decay, Nevada exceeded the Healthy People (HP) 2020 objective (Oral Health Objective 2-1, 21.4%) by 74.0%, a difference of 9.1 percentage points. According to the same survey, the percentage of children, three to five years of age that have experienced caries (have fillings) in their primary teeth is 47.1% (HP 2020, Oral Health Objective 1.1, 30%) [NDHHS, 2013]. To meet the HP2020 objective for caries experience, Nevada must reduce the prevalence of caries experience by 36.3% to drop from 47.1% to 30.0%, a difference of 17.1 percentage points (NDHHS, 2013). Nevada's rate for caries experience (47.1%) is higher than the national average (33.3%) for three to five year olds (NDHHS, 2013). In a 2008-2009 survey by the NDHHS titled, "Third-Grade Oral Health Survey," it was found that well over half of third graders (64.9%) had experienced caries (had fillings) and almost one third (28.1%) of these students had caries that had not been treated (untreated cavities) (NDHHS, 2009). To meet the HP2020 objective for caries experience in six to

nine year olds (Oral Health Objective-1.2), Nevada must reduce the prevalence of caries experience by 24.5% to drop from 64.9% to 49%, a difference of 15.9 percentage points (NDHHS, 2009, Healthy People 2020). For untreated decay in this population, Nevada must reduce the rate by 8% to drop from 28.1% to 25.9%, a difference of 2.2 percentage points (NDHHS, 2009, Healthy People 2020). The caries experience in Clark County is higher than that of the overall state, with 67.5% of third graders having experienced caries (NDHHS, 2009). Clark County is the most populous county in Nevada, and is the physical location of the University of Nevada, Las Vegas School of Dental Medicine (UNLV SDM). Caries prevalence is distributed unevenly based on family income levels and ethnic groups. In 2009, Nevada's third graders from minority groups, including Asians, Hispanics, and African Americans, had a higher rate of caries experience (76%) than the state average for the same age group (NDHHS, 2009). The majority of patients attending the UNLV SDM pediatric dental clinic are Hispanic and it was noted that Nevada's Hispanic third graders, in particular, had a caries prevalence of 71.8% (NDHHS, 2009).

Untreated caries has been shown to have negative consequences in children. Dental caries is an infectious disease caused by the *Streptococcus mutans* bacteria which can be spread by direct contact from mother to child. It has been shown that the earlier the infection of the child the greater the dental disease and children with caries in primary teeth are more likely to have caries in permanent teeth (Gussy, Waters, Walsh, & Kilpatrick, 2006). Dental caries causes pain that can limit eating and sleeping (Low, Tan, & Schwartz, 1999). This, in turn, may cause a wide array of negative consequences involving learning potential and development (Centers for Disease Control and Prevention, 2014). A study by Acs, Lodolin, Kaminsky, and Cisnero (1992) found that three year old children with dental caries weigh an average of one kg less than children of the same demographic population without caries (Acs, Lodolin, Kaminsky, & Cisnero, 1992). Other studies have shown that children with dental caries have difficulty with education, such as missing school days and homework completion (Guarnizo-Herreno & Weby, 2012). The CDC reports that over fifty one million hours of school has been missed per year due to dental appointments (CDC, 2014). Studies have also shown a link between dental caries and negative self-image in children that may lead to decreased social interactions (Guarnizo-Herreno & Weby, 2012). The CDC continues to state that children from lower-income families often do not receive timely treatment for dental caries, and they are more likely to suffer from these problems (CDC, 2014). In short, complications from untreated dental caries in children can lead to negative consequences that can affect oral health into adulthood (Tinanoff & Reisine, 2009).

Attempts have been made in the last several decades to use basic oral hygiene instruction (OHI) as a way to reduce plaque and caries prevalence. Plaque is a bacterial biofilm that is associated with caries risk. A review of current literature in 1996 on the effectiveness of OHI by Kay and Locker (1996) found an increase in knowledge, a small short term improvement in plaque levels, but no reduction in caries prevalence. It was found that basic OHI was not enough to change behavior. Parent interviews from an ethnic minority population in British Columbia, Canada, by Amin and Harrison (2007) revealed insights into possible barriers to OHI. The parents described traditional OHI as "complicated", "unrealistic", and as a "lecture" (Amin & Harrison, 2007). It was also reported that parents of children returning to the operating room for a second time felt they did not have the confidence or the capability to improve oral health behaviors. A study by Strippel in 2010 had similar findings in German caregivers of seven month olds and twenty-four month olds that were given OHI by pediatric dentists. The caregivers' knowledge increased by 23%, but their children's tooth brushing frequency did not increase (Strippel, 2010). These results were attributed to the mother's lack of self-efficacy. The author reported that the caregivers did not believe in their own ability to improve oral health behaviors (Strippel, 2010). The purpose of this study was to determine the effectiveness of the Healthy Smiles: Oral Health Education Program in changing caregiver knowledge in Southern Nevada.

Methods

Caregivers (N=85) with children between three and fourteen years of age were recruited from the University of Nevada, Las Vegas School of Dental Medicine (UNLV SDM) Pediatric Dental Clinic

(PDC) and the Saturday Morning Children's Clinic (SMCC) between September 2013 and March 2014. A total of 90 caregivers were asked to participate with 5 stating they didn't want to participate in the study. Exclusion criteria included any caregiver involved in a dental occupation and anyone who did not speak English or Spanish. The term caregiver in this study is used to represent the parent, relative, or guardian of the child attending the clinic. All consents for participation in the program, surveys, and plaque indicator were reviewed with the caregiver by trained research team members (RTM) prior to consenting to participate in the study. Each child gave a verbal assent for the inclusion of their plaque index to be involved in the study. Consent forms, surveys, and the educational program were offered in Spanish and English. Caregivers and children were given the opportunity to discontinue the study at any time. If caregivers or children chose not to participate in the study the children still received planned treatments. Surveys at each time period were to be completed by the same caregiver that signed the consent form. All surveys and plaque index photos were tracked by a code number to maintain confidentiality. All research methods and materials were approved by the University of Nevada, Las Vegas (UNLV) Institutional Review Board (IRB) (Protocol # 1308-4537, Appendix 1).

The Healthy Smiles: Oral Health Education Program (HSP) for parents used in this study was formed as a way to empower parents regarding their ability to control the oral health of their children. An eight minute PowerPoint (Microsoft, Redmond, WA) presentation was offered to the caregiver that consented to participate in the study. The first part of the presentation identified the purpose of primary teeth, the etiology of caries, and the consequences of untreated caries. This was followed by instruction in prevention methods, ensuring each caregiver was adequately informed that they have the ability to prevent caries in their children. The PowerPoint contained anticipatory guidelines from the American Academy of Pediatric Dentistry (AAPD) with pictures to allow visualization of each topic. Anticipatory guidelines include best practices for a variety of topics relating to children's health that prepare parents for the milestones that will be reached during their child's development. Topics that are recommended by AAPD and were presented to parents include oral hygiene, dietary habits, nonnutritive habits and prevention. One of the seven RTM trained to offer the PowerPoint presentation provided the presentation with family members that presented for treatment using a laptop and live commentary. The presentation was offered in English and Spanish with questions being addressed as they arose by the RTM.

Plaque indicator (GC America Alsip, IL Triplaque indicator) was used and a documenting photo was taken for each child before and after the presentation to evaluate changes in plaque over time. Poor caregiver oral hygiene supervision was anticipated to be associated with higher levels of visible plaque in the children. The RTM associated the visible plaque on the child with the etiology of caries by referencing the PowerPoint presentation in the one-on-one encounter with the caregivers. Hands-on oral hygiene instruction was then provided, with feedback from the RTM, to allow the caregiver to remove the plaque indicator with a toothbrush and floss. The caregiver was then given a toothbrush/toothpaste packet for their use at home.

The effectiveness of the HSP was measured by changes in caregiver knowledge over time determined by evaluations given immediately prior to (T1 or Time 1) and after (T2 or Time 2) the presentation and an evaluation given one to four months later (T3 or Time 3). The visualized plaque was used by the RTM to judge oral hygiene behavior and to guide oral hygiene instructions for the caregivers and child.

Instrumentation

An identical fourteen-item questionnaire survey was completed by a single caregiver at T1, T2, and T3 to evaluate changes in parent knowledge of oral health in children. The first nine questions of the survey were single answer response questions, while the last five questions were multiple response questions where more than one answer could be marked by the caregiver. Each multiple response question had four possible responses. The single and multiple response sections added up to twenty-nine total responses to be evaluated. If a caregiver left a question blank or chose more than one answer to a question requiring only one answer the question was marked as incorrect. Any caregiver that completed all portions

of the study was compensated with a $5.00 gift card to a local retail store.

All survey results were analyzed using *SPSS 21(IBM*, Inc., SPSS Software, Chicago, IL). Descriptive statistics were used to demonstrate mean (standard deviation) and frequencies (N-values and percentages) from survey results. Dependent T-tests were used to assess statistical differences between T1, T2, and T3.

Results

A total of eighty-five caregiver-child pairs began the study and only sixty returned at T3 for the follow-up visit. Of the sixty, nine were excluded for a variety of reasons including: missing surveys, different caregivers filling out tests at each time period, and one caregiver that did not fluently speak English or Spanish. Thus, a total of fifty-one surveys were analyzed for this study.

The study population was composed primarily of Hispanics (72.5%, N=37), the majority of caregivers filling out the survey were mothers (82.4%, N=42), and a large majority of their children (94.1%, N=48) had visited the dentist previously. The children's ages were between three and fourteen years old and the majority of the caregivers (80.4%, N=41) were thirty years of age or greater. Forty nine percent (N=25) of the study population had an income below $25,000, 25.4% (N=13) made between $25,000 and $50,000, and 25.5% (N=13) chose not to respond to this question.

Findings from the surveys are outlined in Table 1 and Table 2. Each of the variables listed was discussed in the PowerPoint presentation. The mean correct scores (out of a possible 29) were as follows for each testing period: T1 (x=17.92), T2 (x=25.06), and T3 (x=23.69). The increase in knowledge, as noted by the number of correct answers on the survey, between the initial test (T1) and subsequent tests (T2 or T3) were found to be statistically significant ($p<0.01$). Although plaque scores were not evaluated as part of the study, they were used by RTM to illustrate changes in caregiver behavior between T2 and T3. It was noted by the RTM that absence or presence of plaque did not change in a substantial proportion of the study population between T2 and T3.

Table 1. Results of Single Response Survey at Three Time Points

Variable	T1 N (%)	T2 N (%)	T3 N (%)
1. Origin of caries			
No answer/multiple answers	0	4 (7.8)	1(2)
They are born with the bacteria	16 (31.4)	0	5(9.8)
*Sharing with Parents	29 (56.9)	47 (92.2)	45(88.2)
Air	2 (3.9)	0	0
Water	4 (7.8)	0	0
2. Amount of juice			
No answer/multiple answers	0	0	0
*0.5 cup	13 (25.5)	46 (90.2)	30(58.8)
1 cup	35 (68.6)	4 (7.8)	19(37.7)
3 cups	3 (5.9)	1 (2)	1(2)
4 cups	0	0	1(2)
3. Discontinue bottle			
No answer/multiple answers	0	0	0
*1 year old (correct)	43 (84.3)	49 (96.1)	47(92.2)
2 years old	7 (13.7)	2 (3.9)	4(7.8)
3 years old	1 (2)	0	0
4 years old	0	0	0
4. Discontinue sippy cup			
No answer/multiple answers	0	0	0
*1 year old	15 (29.4)	39 (76.5)	31(60.8)
3 years old	36 (70.6)	12 (23.5)	19(37.3)
5 years old	0	0	1(2)
6 years old	0	0	0
5. Brushing frequency			
No answer/multiple answers	2 (3.9)	0	0
Once a day	2 (3.9)	0	1(2)
*Twice a day	47 (92.2)	51 (100)	50(98)
Once a week	0	0	0
Twice a week	0	0	0
6. Flossing frequency			
No answer/multiple answers	0	0	0

*Once a day (correct)	14 (27.5)	32 (62.7)	25(49)
Twice a day	34 (66.7)	19 (37.3)	24(47.1)
Three times a week	1 (2)	0	2(3.9)
Flossing is not necessary in children	2 (3.9)	0	0
7. What is not true about caries?			
No answer/multiple answers	2 (3.9)	0	0
An infection caused by bacteria	9 (17.6)	10 (19.6)	6(11.8)
*All children have cavities	28 (54.9)	33 (64.7)	36(70.6)
They can be prevented	10 (19.6)	6 (11.8)	6(11.8)
It results in a hole in the tooth	2 (3.9)	2 (3.9)	3(5.9)
8. Who should brush child's teeth?	0	0	0
No answer/multiple answers	0	0	0
Sibling	16 (31.4)	5 (9.8)	8(15.7)
Parent until 5	31 (60.8)	46 (90.2)	42(82.4)
*Parent until 8	4 (7.8)	0	1(2)
Child should brush own teeth			
9. First dental visit			
No answer/multiple answers	2 (3.9)	0	0
When they have a cavity	1 (2)	0	1(2)
When they have pain	2 (3.9)	1(2)	0
*1 year old	40 (78.4)	50(98)	47(92.2)
4years old	6 (11.8)	0	3(5.9)

T1- Test at time 1 - before intervention

T2- Test at time 2 - after intervention

T3- Test at time 3 - at 1-4 month follow up

*Correct Responses

Table 2. Results of Multiple Response Survey at Three Time Points

Variable	T1 N(%)	T2 N(%)	T3 N(%)
10a. Function of primary teeth			
Did not mark eating	16 (31.4)	12(23.5)	6(11.8)
*Eating important	35 (68.6)	39(76.5)	45(88.2)
10b. Function of primary teeth			
Did not mark talking	29 (56.9)	12(23.5)	17(33.3)
*Talking important	22 (43.1)	39(76.5)	34(66.7)
10c. Function of primary teeth			
Did not mark saving space for adult teeth	20 (39.2)	6(11.8)	10(19.6)
*Saving space for adult teeth important	31 (60.8)	45(88.2)	41(80.4)
10d. Function of primary teeth			
Did not mark esthetics	30 (58.8)	18(35.3)	25(49)
*Esthetics important	21 (41.2)	33(64.7)	26(51)
11a. Effects of untreated caries			
Did not mark infection can spread	10 (19.6)	4(7.8)	3(5.9)
*Infection can spread	41 (80.4)	47(92.2)	48(94.1)
11b. Untreated caries			
Did not mark can delay growth	44 (86.3)	12(23.5)	22(43.1)
*Can delay growth	7 (13.7)	39(76.5)	29(56.9)
11c. Untreated caries			
Cannot damage adult teeth	7 (13.7)	3(5.9)	4(7.8)
Can damage adult teeth	44 (86.3)	48(94.1)	47(92.2)
11d. Untreated caries			
Did not mark result in death	46 (90.2)	9(17.6)	10(19.6)
*Can result in death	5 (9.8)	42(82.4)	41(80.4)
12a. Caries etiology			
Did not mark sugar from drinks is involved in caries	3 (5.9)	2(3.9)	0
*Sugar from drinks is involved in caries	48 (94.1)	49(96.1)	51(100)
12b. Caries etiology			
Did not mark acid from drinks is involved in caries	18 (35.3)	4(7.8)	6(11.8)
*Acid from drinks is involved in caries	33 (64.7)	47(92.2)	45(88.2)

12c. Caries etiology			
Did not mark bacteria are involved in caries	25 (49)	19(37.3)	22(43.1)
*Bacteria are involved in caries	26 (51)	32(62.7)	29(56.9)
12d. Caries etiology			
Did not mark sugar from sweets is involved	9 (17.6)	4(7.8)	4(7.8)
in caries	42 (82.4)	47(92.8)	47(92.2)
*Sugar from sweets are involved in caries			
13a. Cariogenic beverages			
Did not mark juice can cause caries	5 (9.8)	3(5.9)	1(2)
*Juice can cause caries	46 (90.2)	48(94.1)	50(98)
13b. Cariogenic beverages			
Did not mark soda can cause caries	1 (2)	2(3.9)	0
*Soda can cause caries	50 (98)	49(96.1)	51(100)
13c. Cariogenic beverages			
Did not mark Gatorade can cause caries	15 (29.4)	2(3.9)	2(3.9)
*Gatorade can cause caries	36 (70.6)	49(96.1)	49(96.1)
13d. Cariogenic beverages			
Water can cause caries	1 (2)	1(2)	0
*Did not mark water can cause caries	50 (98)	50(98)	51(100)
14a. Caries prevention			
Caries cannot be prevented	1 (2)	2(3.9)	6(11.8)
*Did not mark caries cannot be prevented	50 (98)	49(96.1)	45(88.2)
14b. Caries prevention			
Did not mark diet can prevent caries	28 (54.9)	13(25.5)	22(43.1)
*Diet can prevent caries	23 (45.1)	38(74.5)	29(56.9)
14c. Caries prevention			
Did not mark brushing and flossing can prevent caries	1 (2)	2(3.9)	0
*Brushing and flossing can prevent caries	50 (98)	49(96.1)	51(100)
14d. Caries prevention			
Did not mark visiting the dentist can prevent caries	10 (19.6)	5(9.8)	5(9.8)
*Visiting the dentist can prevent caries	41 (80.4)	46(90.2)	46(90.2)
T1- Test at time 1 - before intervention			
T2- Test at time 2 - after intervention			
T3- Test at time 3 - at 1-4 month follow up			
*Correct Responses			

The study revealed noteworthy trends from responses over the time periods. The question with one of the highest correct caregiver responses at T1 was "how often should you brush your child's teeth" with 92.2% (N=47) choosing two times per day. This correct response remained high at T2 and T3 revealing that caregivers may have had previous knowledge of brushing practices. On the other hand, when asked, who should assist a child in brushing their teeth only 60.8% (N=31) of caregivers chose the correct response, at T1, that caregivers need to brush until the child is eight years old. At T1, 31.4% (N=16) of participants chose the incorrect response that caregivers should brush their child's teeth until they are five years old and 7.8% (N=4) caregivers chose that children should brush their own teeth. The correct response to this question increased to 92.2% (N=47) at T2 and fell slightly to 82.4% (N=42) at T3.

Another trend was found when evaluating parental knowledge of bottle and sippy cup use. At T1, a majority of the caregivers 84.3% (N=43) chose that the bottle should be discontinued at the age of one, while far fewer caregivers 29.4% (N=15) responded correctly that sippy cups should also be discontinued at the age of one. The majority of respondents selected the response that the sippy cup could be used until 3 years of age. By T2 76.5% (N=39) caregivers had chosen the correct answer on sippy cups, but from T2 to T3 eight fewer caregivers had chosen the correct answer leaving 60.8% (N=31). The amount of juice recommended for the child showed an even greater difference between time periods with an increase of thirty-three correct answers between T1, 25.5% (N=13) and T2, 90.2% (N=46) and a

decrease of sixteen correct answers at T3, 58.8% (N=30).

The caregivers were then surveyed on the timing of a child's first dental visit. At T1, 78.4% (N=40) responses were in line with AAPD, the American Dental Association (ADA) and the American Academy of Pediatricians (AAP) guidelines that state the first dental visit should occur at one year of age (American Academy of Pediatric Dentistry, 2013; American Dental Association, 2000; Academy of Pediatrics, 2014). At T2, 98% (N=50) responses were correct and T3 dropped slightly to 92.2% (N=47). Twenty one percent (N=11) of caregivers chose a response other than one year of age.

A question given in a multi response format to caregivers was, "why are baby teeth important?" In T1, only 68% (N=31) of caregivers marked saving space for adult teeth. At T2, this option was marked by 88.2% (N=45) of respondents and by T3 it had fallen to 80.4% (N=41).

When it came to transmission of caries, a large portion of caregivers incorrectly selected that children are born with cariogenic bacteria at T1, 31.4% (N=16). The correct response, that cariogenic bacteria can be transmitted from the caregiver to the child by sharing utensils did increase from T1, 56.9% (N=29) to T2, 92.2% (N=47) and was fairly well retained into T3, 88.2% (N=45).

Later in the multiple response section caregivers were evaluated with the question, "What can untreated cavities in baby teeth do?" The majority of caregivers marked "can damage permanent teeth" T1, 86.3% (N=44), while very few parents initially marked that untreated caries could lead to delayed growth T1, 13.7% (N=7) or death T1, 9.8% (N=5). There was a significant increase in correct responses 62.7% (N=32) for delayed growth to reach 76.5% (N=39) at T2. There was an even greater increase in correct responses 72.5% (N=37) for the possibility of death to T2, 82.4% (N=42). Then by T3, the correct response rate for delayed growth had dropped by 19.6% (N=10) to 56.9% (N=29). The correct response rate for the possibility of death only fell by 1.9% (N=1) to T3 80.4% (N=41).

Discussion

Findings from this study demonstrate that individualized oral hygiene education with visual examples and hands-on instruction can improve caregiver knowledge. The majority (94.1%, N=48) of caregiver-child pairs had visited the dentist previously, yet at T1, the median survey score was only 17.92 out of 29. Thus, previous OHI from dental providers may not have been given or may not have been effective. One explanation for this initial lack of knowledge from caregivers may be due to inconsistent messages from different healthcare providers. A study of healthcare providers in Virginia found that a majority of general dentists and pediatricians recommended that the first dental visit occur at three years of age (Brickhouse, Unkel, Kancitis, Best & Davis, 2008). In other surveys, caregivers have reported similar inconsistent messages from healthcare providers (Amin & Harrison, 2007; Kulkarni, 2013). The increase in knowledge in this study at T2 may have been due to the one-on-one instruction with visual aids.

The results also revealed a decrease in knowledge over time from T2 to T3. The decrease in knowledge at the follow-up visit may have been due to lack of follow-up and repetition of the program. Repetition and follow up have been incorporated into successful OHI programs (Feldens, Vitolo, & Drachler, 2007). These programs resulted in children that had fewer caries than children from similar backgrounds that did not receive OHI. Follow-up in the form of additional education sessions or phone calls should be incorporated into future OHI to assure long term retention of knowledge. Visual aids should also be used to reinforce oral health education. Another possible explanation for decreased knowledge over time may be from the influence of deeply held personal or cultural beliefs. In this study the questions on juice and sippy cup practices had a substantial decrease in correct responses from T2 to T3. Caregivers have been shown to be resistant in changing culturally accepted beliefs and behaviors, including dietary habits, despite being educated about the advantages of change. (Feldens, Vitolo, & Drachler, 2007).

This study revealed that many caregivers who participated in the program lacked knowledge of the importance of primary teeth to the child's future well-being. Amin & Harrison reported that parents of children with new caries within six months of completed treatment under general anesthesia were less likely to understand the importance of primary teeth than parents of children with no new caries (Amin & Harrison, 2007).

Some of the most significant increases in correct responses between T1 and T2 occurred in the survey question on possible consequences of untreated caries such as delayed growth and death. These significant changes in correct responses may have been a fear response of the caregivers learning serious consequences that can result from lack of adequate oral healthcare. Fear, when used correctly, has been shown to promote health education and behavior change (Witte & Allen, 2009).

The responses to the above question on consequences of untreated caries varied between T2 and T3. A greater percentage of caregivers chose death than delayed growth at the T3 follow-up. This difference in retention of the information may confirm the importance of using visual aids with knowledge based instruction. In this case a picture of Deamonte Driver was used as an example of a child that has died from complications of untreated caries due to a lack of access to dental care and the progression of the bacterial infection caused by untreated cavities (Friedman, 2012). On the other hand, the picture representing delayed growth in children was not used due to copy right restrictions.

This study suggested that caregivers had a good initial knowledge of basic oral hygiene practices, but may have lacked knowledge of their own responsibility in caring for their children's oral health. This corresponds to the plaque findings reported by the RTM that suggested little change in caregiver behavior after oral hygiene instruction was provided. This may have been due to brushing that was ineffective or inefficient. Several recent studies have shown additional methods to OHI that have resulted in positive changes in health behavior. Some of these methods include Motivational Interviewing (Martins & McNeil, 2009) and

using Fear Appeals (Witte & Allen, 2000). Successful programs have also included elements such as follow-up sessions and telephone calls (Harrison & Wong, 2003). Studies have shown that successful oral hygiene programs given to parents can result in saved time and costs by avoiding expensive treatments. The costs of oral hygiene programs have been shown to be less than extensive treatment with general anesthesia (Kowash, Toumba, & Curzon, 2006). In addition, starting preventive visits at the recommended one year of age has also been shown to reduce future treatment costs (Savage, Lee, Kotch, & Vann, 2004).

Conclusions

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

1. Quality OHI , that includes evidence-based healthcare knowledge and visual aids, should be used to educate caregivers of high risk children in Health Professional Shortage Areas (HPSAs).
2. High risk caregiver populations in Nevada should be evaluated for specific barriers to long term retention of OHI knowledge and behavior change.
3. Dental and non-dental healthcare professionals in Nevada should be evaluated for consistent evidence-based knowledge of oral health guidelines.
4. OHI programs should be focused on improving caregiver knowledge, retention, and increasing oral health outcomes of high risk children in Nevada.

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