

# **The First Dental Visit: Knowledge, Attitudes, and Behaviors of North Carolina Dentists Regarding Physician Referral Guidelines**

C. Marshall Long, DDS

A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Masters of Science in the Department of Pediatric Dentistry (School of Dentistry)

Chapel Hill  
2012

Approved by:

Rocio B. Quinonez, DMD, MS, MPH

R. Gary Rozier, DDS, MPH

Jessica Y. Lee, DDS, MPH, PhD

©2012  
C. Marshall Long, DDS  
ALL RIGHTS RESERVED

## **ABSTRACT**

C. MARSHALL LONG, DDS: The First Dental Visit: Knowledge, Attitudes, and Behaviors of North Carolina Dentists Regarding Physician Referral Guidelines (Under the direction of Dr. Rocio Quinonez, Dr. Gary Rozier, and Dr. Jessica Lee)

The purpose of this cross-sectional study was to (1) assess the knowledge, attitudes and behaviors of North Carolina (NC) dentists regarding infant and toddler dental referral guidelines of the American Academy of Pediatrics, and (2) to determine factors among this population that influence embracement of these guidelines. One thousand general dentists in NC were randomly selected to participate. The primary outcome variable was acceptance of children referred for the age one dental visit, therefore allowing physicians to comply with referral guidelines. Significant predictors of referral acceptance included correct knowledge about the guideline (OR = 2.0, 95%CI 1.2-3.3), increased confidence in providing preventive care to infants and toddlers (OR = 2.6, 95%CI 1.3 – 4.9), and agreement that parents see importance in dental referrals (OR = 2.1, 95%CI 1.2-3.6). This study identifies factors that influence acceptance of physician referrals for the age one dental visit among NC dentists, that can lead to development of interventions to maximize availability of a dental home for young children.

## **ACKNOWLEDGEMENTS**

I would like to acknowledge: My thesis advisor Dr. Rocio Quinonez for her invaluable guidance and mentorship throughout this project and over the past five years; My committee members, Dr. Gary Rozier and Dr. Jessica Lee, for their support, encouragement, and guidance in research technique and design; Dr. Ceib Phillips and Debbie Price for their help in survey design and data collection; Ashley Kranz and John Cantrell for their expertise in statistical analysis; and 3M ESPE, Healthy Smiles/Healthy Children and the NC Dental Society for their support of our project.

## TABLE OF CONTENTS

	Page
LIST OF TABLES .....	vi
LIST OF FIGURES .....	vii
INTRODUCTION .....	1
LITERATURE REVIEW .....	3
METHODS .....	6
RESULTS .....	11
DISCUSSION .....	16
SUMMARY.....	21
TABLES.....	22
FIGURES.....	28
REFERENCES.....	30

## LIST OF TABLES

Table 1: Case Scenario Descriptions .....	22
Table 2: Demographic and Practice Information .....	23
Table 3a: Case Scenarios – Guideline Knowledge .....	24
Table 3b: Case Scenarios – Referral Acceptance .....	25
Table 4: Agreement and Outcome Expectancy Regarding Physicians’ Role in Children’s Oral Health.....	26
Table 5: Association of Barriers with Increased Referral Acceptance.....	27

**LIST OF FIGURES**

Figure 1: Barriers to Guidelines Adoption Based on Sequence to Behavior Change..... 28

Figure 2: Confidence in Providing Preventive Oral Health Care .....29

## INTRODUCTION

Early childhood caries (ECC) has been identified as the “single most common chronic childhood disease” in America according to the Surgeon General’s report, affecting over 40% of children by the time they enter kindergarten.<sup>1,2</sup> While caries in children greater than age 5 has decreased in the past decade, primary tooth decay in children ages 2-5 is on the rise with an estimated 72% of surfaces remaining untreated.<sup>3</sup> Data suggest that preschool-aged children receiving an early preventive dental visit are more likely to use subsequent preventive services and experience lower dentally related costs. Thus, the early establishment of a dental home becomes an important aspect of providing access to preventive services to help decrease the prevalence of disease burden.<sup>4,5</sup> Currently, dental guidelines recommend the establishment of a dental home for all children by the first birthday.<sup>6-8</sup>

In the past decade, there have been many advances in the medical field that help to address oral health in the medical home, prior to the establishment of a dental home, or for those without access to a dentist.<sup>9,10</sup> Prior to 2003, medical guidelines recommended the first dental visit occur at age 3, however, pediatric medicine has now developed a policy statement similar to dental guidelines to embrace early childhood oral health and increase access to dental care for young children. Current medical guidelines from the American Academy of Pediatrics (AAP) recommend an oral health risk assessment by 6 months of age and referral to a dental home by the first birthday, with risk based referral in areas of limited work force.<sup>8,11</sup> This guideline differs from dental guidelines only in areas with limited access to a dentist, where children with high caries risk should receive a dental referral by age 1, and



children with low risk for dental disease may remain in the medical home and receive preventive counseling until a dental referral is possible.<sup>6-8,11</sup> In addition, Medicaid programs in a majority of states, including North Carolina (NC), have begun to reimburse physicians for application of fluoride varnish at well child visits for children under the age of 3, a program that complements oral health preventive services for families unable to link to a dental home.<sup>12</sup>

With these promising policy changes, difficulty in successfully obtaining dental referrals for young patients is a commonly reported barrier for pediatricians nationally, despite the national dental guidelines recommending the age 1 visit as the point for all children to establish a dental home.<sup>6,7,13</sup> While barriers have been reported in the dental field regarding dental policies and guidelines for the age one visit, no studies have assessed dental providers' knowledge and opinions regarding the changes in medical guidelines, including physicians providing early preventive oral health services to children under 3 years of age. In order for collaboration between medicine and dentistry to be effective in promoting change in practice behaviors and oral health outcomes, it is important to understand how currently practicing dental providers view the changing role of physicians in infant oral health. This can help the development of strategies that will better assist in the linking of the medical and dental home for the oral health of children.

Therefore, this study aims to (1) assess the knowledge, attitudes and behaviors of general dentists in NC regarding physician guidelines for infant oral health and (2) determine barriers among this population in accepting referrals from physicians for young children.

## **LITERATURE REVIEW**

The concept of disease control and prevention in early childhood was first established by the American Academy of Pediatric Dentistry (AAPD) in 1986, with current dental guidelines recommending establishment of a dental home for all children by the first birthday.<sup>6-8</sup> The age one dental visit can be provided by a pediatric or general dentist, and should include thorough medical and dental histories, an oral examination, caries risk assessment, establishment of a prevention plan, anticipatory guidance, comprehensive treatment planning and referral for specialized care as necessary.<sup>6</sup> While these guidelines are in place, it is known that compliance is lacking, with only 53% of pediatric dentists routinely providing examinations for children by 12 months of age and less than half of general practitioners providing care for children under age 2.<sup>14-18</sup>

In the medical literature, Cabana et al propose a comprehensive framework for assessing lack of guideline adoption in clinical practice. Barriers are grouped into three main categories representing obstacles to behavior change, including knowledge of the guideline, attitude towards the guideline and behavior regarding the guideline.<sup>19</sup> In the dental literature, barriers towards guideline compliance with the age one dental visit have been reported in all three categories from this framework.

Barriers affecting knowledge include lack of awareness and lack of familiarity of a guideline. Lack of awareness refers to the practitioner not knowing of the existence of the guideline, therefore preventing adherence, while lack of familiarity occurs when the

practitioner is aware but does not have complete knowledge of the guideline.<sup>19</sup> Surveys of general dentists in Connecticut and Iowa found that 59% and 24% ,respectively, were not aware of AAPD guidelines for the age one visit.<sup>16,17</sup> Familiarity has not been reported among general dentists, however, a national survey of AAPD members 2006 found that while 84% reported agreement with the guidelines, 53% routinely saw children by the age of 12 months. However, 29% of those who began initial visits after 18 months reported that they do provide oral health examinations for infants. The authors attribute this finding to a potential lack of familiarity of the exact recommendations of the guidelines specifying that children should have their first dental visit by age 12 months.<sup>14</sup>

Lack of agreement, lack of self-efficacy, lack of outcome expectancy and inertia of previous practice are barriers affecting attitude.<sup>19</sup> In 2006, it was reported that only 36% of general dentists in Iowa agreed that children should be seen before age 2.<sup>17</sup> Similarly, in 2008, 26% of Connecticut general dentists did not agree that children as young as 1 year needed to see the dentist.<sup>16</sup> Lack of self-efficacy presents when providers do not believe they can perform the recommended treatment. This is a common barrier, with 40% of Connecticut general dentists and 14% of Iowa general dentists reporting they are not comfortable examining infants.<sup>16,17</sup> Lack of outcome expectancy refers to a belief that the guideline will not yield the expected outcome, in this case prevention of ECC, and is a barrier that has not been reported in the dental literature.<sup>19</sup> Inertia of previous practice reflects lack of willingness or inability to change current practice and adhere to a new guideline.<sup>19</sup> This barrier becomes evident regarding the age 1 dental visit as several studies have found that younger practitioners with less years of clinical practice are more likely to adopt the

guideline.<sup>14,16,17,20</sup> Also, the belief that infant oral health care is disruptive to current practice flow is a commonly reported barrier.<sup>15,17</sup>

External barriers affecting provider behavior comprise the third group of barriers in the framework and can include factors related to the patient, the guideline itself or environmental factors.<sup>19</sup> Patient related factors that have been reported include parents not seeing the value in the age one visit, and parents not requesting appointments.<sup>16,17,21</sup> Guideline factors have not been specifically reported, however this is a potential barrier regarding the age one dental visit, as guidelines from the AAPD, ADA and AAP have varied from each other in the past, with the latter two organizations embracing the age one visit in the past decade.<sup>6-8</sup> In 2008, a study of general dentists, pediatric dentists and pediatricians in Virginia found that a majority of pediatric dentists recommended the age one visit, however a majority of general dentists and pediatricians recommended the first visit occur at age 3, which is likely due to the history of differing guidelines.<sup>20</sup> Finally, environmental barriers reported include lack of time to incorporate infant oral health due to busy practice, and that financial reimbursement is not adequate for infant examinations.<sup>15-17</sup>

## METHODS

This cross sectional study surveyed general dentists in NC to determine barriers towards acceptance of dental referrals by physicians for infants and toddlers. This study was approved by the Institutional Review Board of the University of North Carolina, Chapel Hill, NC.

Sample: One thousand general dentists currently practicing in NC were randomly selected to participate from a list of licensed dentists maintained by the NC Board of Dental Examiners. Inclusion criteria were: (1) current license to practice dentistry in NC; (2) current full time practice of clinical dentistry in private practice, defined as >10 hrs/week; (3) no current or previous participation in a postdoctoral residency program, with the exception of general practice residency (GPR) or advanced education in general dentistry (AEGD); and (4) acceptance of children <12 years of age in their practice.

Survey Design: The barriers assessed in the questionnaire were based upon the comprehensive framework proposed by Cabana et al for assessing lack of guideline adoption in clinical practice. In this framework, barriers are grouped into three main categories representing sequence towards behavior change, including barriers affecting knowledge of the guideline, attitude towards the guideline and behavior regarding the guideline.<sup>19</sup> The barriers evaluated in this study based on this framework are listed in Figure 1. The final survey instrument was 5 pages with 63 items including case scenarios and questions requiring likert scale responses.

Procedure: The survey was pilot tested by 10 dentists who practice outside of NC, and mailed to all selected subjects using the Dillman Total Design Survey Method.<sup>22</sup> The first mailing to all subjects took place in November 2010, with a reminder postcard 1 week later, and second and third survey mailings to non-respondents at 3 and 6 weeks. Inclusion criteria was outlined and confirmed on the survey, with request for providers who did not meet inclusion criteria to return the survey uncompleted with documentation of their exclusion. All surveys were coded numerically, allowing returned surveys to be anonymous, and a postage-paid, preaddressed envelope was included for return. Data collection was completed in March 2011.

Variable Construction:

**Dependent Variable:** The dependent variable was referral acceptance of infants and toddlers based on answers from patient case scenarios. Patient descriptions from the case scenarios, including age, disease status, and presence of risk factors, are described in Table 1. Dentists read five patient case scenarios and were asked if they would accept this infant or toddler as a patient if they were referred to them. Dentists could respond with “yes,” “no,” or “not sure.” We summed the number of responses that agreed with existing referral guidelines (i.e., responses of “yes”) (range=0-5, mean= 2.65) and constructed three categories of adherence to guidelines based on the distribution of the variable (Low=0-1; Moderate=2-3; High=4-5).

**Independent Variables:** Demographic information included gender, race, dental school attended and graduation year. This data was obtained from information provided by the NC Board of Dental Examiners. Demographic and practice variables are shown in table 2.

*Practice characteristics.* Dentists were asked if they cared for infants and toddlers in their practice and if so, at what age (in years) they will see a child for a first visit. Responses were aggregated to a three group categorical variable, indicating that the dentist first sees children at ages 0-1 years old, 2-5 years old, or not at all (reference group). Two questions were used to determine for each dentist the percent of Medicaid insured patients seen and the percent of referrals received from pediatric or family medicine practices. Based on the distribution of responses, binary variables were constructed to indicate that the dentist sees some Medicaid insured patients and to indicate that 10% or more referrals received by the dentist were from pediatric or family medicine practices.

*Barriers Affecting Knowledge of Guidelines.* After reading each case scenario, dentists were asked for their opinion about how a pediatrician should address the child's oral health needs with an adequate and limited dental workforce, respectively. For each workforce scenario, the following five response options were provided for each case: refer the child to a dentist now; wait and refer the child at 3 years of age, but continue dental screenings during well-child visits; wait and refer the child at 3 years of age, but provide counseling and fluoride varnish during medical visits; not sure; or other (please specify). We summed the number of responses that agreed with existing referral guidelines for each workforce scenario (adequate workforce: range=0-5, mean=3.57 ; limited workforce: range=0-5, mean=2.61). We summarized this information by constructing two binary variables indicating that the dentist almost always followed existing guidelines about how a pediatrician should address the child's oral health needs with an adequate or limited dental workforce, respectively (i.e., the dentist had 4 or 5 responses in agreement with guidelines). For both binary variables, the reference group was composed of dentists having 3 or fewer responses in agreement with

existing referral guidelines within each workforce scenario. Additionally, we constructed a binary variable to indicate that the dentist reported being aware of the 2003 or 2008 American Academy of Pediatrics (AAP) guidelines on infant oral health care.

*Barriers Affecting Attitudes Towards Guidelines.* Five survey questions were used to assess dentists' attitudes towards the AAP infant oral health guidelines. These questions used 1-5 Likert-type response scales, which were recoded to binary items indicating responses of "strongly (dis)agree" or "(dis)agree." Of these questions, three binary variables measuring dentists' agreement with positive attitudes towards guidelines were constructed using answers to questions that asked if an age one dental visit is effective in prevention of ECC, if physicians should perform oral health risk assessment beginning at six months, and if the dentist is confident in providing preventive oral health care to infants and toddlers. Two binary variables measuring dentists' disagreement with negative attitudes towards guidelines were constructed using answers to questions that asked if the dentist has to make significant changes to incorporate infant oral health care in their practice and if infant oral health care is disruptive to their current practice flow. In addition, 8 questions were used to construct a scale measuring overall support for guidelines in general.<sup>23</sup> Questions used 1-5 Likert-type scale responses ranging from "strongly disagree" to "strongly agree," with higher values indicating greater support for guidelines. We summed responses to construct a multi-item continuous variable measuring support for guidelines (range=10-40; mean=29; Cronbach's alpha=0.70).

*Barriers Affecting Behavior Regarding Guidelines.* Five survey items were used to assess barriers that affect dentists' behavior regarding the guidelines. These items used a 1-5 Likert-type response scale ranging from "strongly disagree" to "strongly agree," with higher values



indicating great support for physician's involvement in the promotion of children's oral health. We constructed a scale variable by summing responses to these survey items, but obtained a low Cronbach's alpha value indicating low internal consistency. We decided to exclude this scale variable from analysis and instead explored this construct by examining all items individually. For the regression analysis, we focused on three questions that asked if the dentist has time in their schedule to provide infant oral health care, if parents see the importance in dental referrals from their primary care providers, and if historically varying guideline recommendations have delayed the age at which I accept children for the first dental visit. For these items, we constructed three binary variables indicating agreement with each statements if the dentists responded "strongly agree" or "agree." For all three binary variables, the reference group is composed of dentists responding with "unsure," "disagree," or "strongly disagree."

**Analytical approach.** Descriptive statistics were calculated for the case scenarios and all variables. Because ordinary least squares regression poorly predicts outcomes with a small number of categories, an ordered logistic regression model with robust standard errors was used to predict the odds of a dentist accepting a physician referral for a child who was referred according to AAP guidelines, using a three group categorical outcome variable to measure referral acceptance (Low=0-1; Moderate=2-3; High=4-5), and holding all other variables constant.<sup>24</sup> Use of this regression model was confirmed by our failure to reject the proportional odds assumption ( $p=0.680$ ). Z-tests were used to examine the association between independent variables and odds of having greater referral acceptance. Analyses were performed using STATA 12, and tests were conducted using a significance level of 0.05.<sup>25</sup>

## **RESULTS**

Of the 1000 surveys mailed, 493 were returned, giving a response rate of 49.3%. Of these, 423 (85.8%) met the inclusion criteria, and for these descriptive statistics are reported. Complete data for the outcome variable was available for 74.7%, yielding a total of 328 surveys to be included in the multivariate analysis.

### **Descriptive Statistics**

#### *Demographic and Practice Information*

Demographic information is presented in Table 2, with a majority of the sample being male (73.9%), Caucasian (87.1%) and graduates of the University of North Carolina at Chapel Hill School of Dentistry (65.6%). Dental school graduation years were evenly distributed throughout the decades. A majority reported that they accept infants and toddlers in their practice (67.4%), but of these only 46.9% accept patients at age one or younger.

#### *Case Scenarios*

Results from the case scenarios are presented in tables 3a and 3b. Table 3a shows how the dentist thinks the pediatrician should proceed after their oral assessment of each child, demonstrating knowledge of the guideline, and the correct response according to 2008 AAP guidelines is indicated. For children with disease present (Case 1 with white spot lesion and Case 5 with cavitated lesion), almost all dentists, 92% and 98% respectively, felt that the pediatrician should refer to a dentist in cases of adequate workforce. However in areas of limited workforce, the majority (97%) still felt the child

with a cavitated lesion should be referred, but only 72% believed the child with a white spot lesion should be referred. For a high risk child with no disease, but multiple risk factors (Case 2), 75% believed a referral should be made with adequate workforce. This number decreased to 52% in a limited workforce setting. For a low risk child (Cases 3 and 4), regardless of age and available workforce, approximately 50% of providers believed that the child should be referred to a dentist at age 3 with no preventive services provided. For these same children, only 21-25 % made the correct guideline recommendation that the child should be referred to a dentist at age 3, while receiving counseling and fluoride varnish from the pediatrician in areas of limited workforce. Table 3b illustrates if the dentist would ultimately accept each patient from case 1-5 in their practice if the child was referred to them. Not surprisingly, dentists were most likely to accept the 30 month old child with low risk (75%), followed by the 18 month old child with low risk (61%). Only 35 % would accept an 18 month old child with a known cavitated lesion.

#### *Guideline Knowledge, Attitudes, and Behaviors*

Knowledge of infant oral health guidelines overall was low, with 32% (N = 134) reporting that they were aware of the 2003 or 2008 AAP infant oral health guidelines, and only 35% (N = 147) aware of the AAPD guidelines. Of those who were aware of the AAP guideline, 53% were not familiar or slightly familiar, 33% were familiar, and 15% were very or extremely familiar.

Table 4 shows agreement with physician involvement in infant oral health and the AAP infant oral health guideline, as well as outcome expectancy. Agreement with physician involvement in infant oral health was overall high, however only 50% believe

that physicians should be referring by the first birthday, and 72% believe that they should refer based on risk assessment. Over 70% disagree that children 3 and under should be referred only with disease present. Also, regarding fluoride varnish and supplementation, more dentists agree that physicians should apply fluoride varnish only in communities with limited workforce when compared to adequate workforce, however, over 80% agree with physicians providing dietary fluoride supplementation. Outcome expectancy was high, with 62% agreeing that the age one dental visit is effective in prevention of ECC, 72% agreeing that dental referrals by physicians are effective in increasing the percentage of infants with a dental home, and 78% agreeing that caries risk assessment, parent counseling and fluoride varnish application by physicians decreases dental disease in infants and toddlers.

Figure 2 demonstrates self-efficacy, or confidence, in providing preventive oral health services to infants and toddlers, and to children ages 3-6. Nearly all (95%) of general dentists are confident with children 3-6 years of age, however the number decreased to 60% reporting confidence in caring for infants and toddlers.

Regarding previous practice and external barriers, approximately 50% agreed that they would not have to make changes in their practice or schedule to incorporate infant oral health, that infants are not disruptive to their practice, and that varying guidelines with different recommendations have not delayed the age children are accepted for the first dental visit. A similar percentage (55%) agreed they have time in their schedule to provide infant oral health care, and that parents see the importance in dental referrals from primary care providers. Regarding financial compensation for infant oral health examinations, 18% agree that it is adequate, 54% were unsure, and 28% disagree.

### *Outcome Variable*

The results from Table 3b were used to construct the primary outcome variable- acceptance of patients referred by a physician. Analysis was limited to dentists with no missing responses, therefore respondents included in the analytical sample (N=328) were a subset of the 423 respondents. Of these respondents, 42.9% (N=141) demonstrated high, 19.5% (N=64) moderate, and 37.7% low (N=124) acceptance of referrals from physicians who referred according to AAP guidelines.

### **Multivariate Analysis**

Results of the ordered logistic regression analysis are listed in Table 5. No demographic variables were found to be significant, and were excluded from the table. We observed that dentists accepting of children ages 0-1 year old and children ages 2-5 had significantly greater odds of having more referral acceptance compared to dentists who did not report seeing infants and toddlers. Dentists who attribute over 10% of their practice to referrals to medical practices had 2.31 times greater odds of accepting more referrals ( $P < .01$ ). While awareness of the guideline was not a significant predictor, those who gave guideline appropriate responses in the case scenarios to how the pediatrician should proceed in adequate workforce had 2 times greater odds of having more referral acceptance compared to those who gave incorrect responses ( $P < .01$ ). Providers needing to make significant changes in their practice to incorporate infant oral health care had significantly lower odds of accepting more referrals (OR = 0.5,  $P = .04$ ). Those who agreed that the age one dental visit is effective in prevention of ECC were less likely to accept referrals as well (OR = .5,  $P < .01$ ). Other significant predictors include support for

guidelines in general (OR = 1.1, P<.01), confidence in providing preventive oral health care to infants and toddlers (OR = 2.6, P<.01), and agreement that parents see the importance in dental referrals from their primary care providers (OR = 2.0, P<.01).

## DISCUSSION

This study sought to (1) assess the knowledge, attitudes and behaviors of dentists in NC regarding AAP infant oral health guidelines and (2) determine barriers among this population in accepting referrals from physicians for young children.

Results from this study indicate that general dentists do support physician involvement in infant oral health, however knowledge and agreement regarding AAP and AAPD infant oral health guidelines are lacking. In fact, the majority of NC dentists (72%) support the concept of triaging dental referrals based on caries risk for all children under age 3, regardless of available dental workforce in the area. The use of case scenarios was perhaps the most telling part of this study, revealing a discrepancy between children that dentists believe should receive a referral, and the children they will actually accept in their practice. While most dentists (75 – 99%) believe that 1 year old children at high risk for ECC, including those with or without existing disease, should be referred to a dentist, less than half would accept these children in their practice if they were referred, particularly those with cavitated lesions. On the other hand, two-thirds of dentists indicated that a low risk child should not receive a referral until age 3, but they were willing to accept this child in their practice at age 1. The discrepancy between dentist and physician behavior regarding early childhood oral health is highlighted by evidence suggesting that physicians are more likely to refer high risk than low risk infants

and toddlers, especially those with existing disease, thus further contributing to this dilemma.<sup>26,27</sup>

An assumption of this study is that physicians are following their own guidelines and referring all children by age 1 when dental workforce allows, however we know that full compliance with these guidelines is unlikely. In fact, a national survey of pediatricians in 2008 found that only 7% were recommending a dental visit by age 1 for all of their patients.<sup>13</sup> It has been documented that medical school education on infant oral health care is lacking, however we know that physicians who receive training in preventive oral health care and referral, especially hands on training, are capable of determining appropriate referral, and implementing preventive oral health services in their practice.<sup>13,28,29</sup> Also, initiatives such as the AAP Chapter Advocacy Training on Oral Health (CATOOH), where pediatricians are trained to become Chapter Oral Health Advocates (COHA) and teach preventive oral health care to other pediatricians in their state, show promise as a best-practice model to engage providers in clinical practice.<sup>30</sup> Providing necessary training to physicians will continue to increase the number of infants and toddlers who are receiving appropriate referrals to a dental home, and is a key component in bridging the gap between medicine and dentistry for these young children. In this study, dentists who received referrals of infants and toddlers from physicians were more likely to accept these young patients in their practice, showing the importance of collaboration between medicine and dentistry. However, as collaboration continues in an effort to increase the number of young children with a dental home, it appears that currently in NC, dentists may not be equipped to handle an increase in demand.



This study identified several significant barriers that provide insight into why dentists are reluctant to accept referrals of infants and toddlers, including lack of knowledge, lack of confidence in providing preventive oral health care for children under age 3, and need to make significant practice changes to incorporate infant oral health care. One way to target these barriers is through professional education, both during training and in the form of continuing education. In 2001 only 6% of patients treated in predoctoral dental programs were age 3 or younger, and only 27% of schools provided opportunities to perform infant oral health examinations on a patient.<sup>31</sup> In the past decade, some schools have enhanced or created programs to increase education and hands on experience with infants, with the participants in these programs reporting that after their completion, not only were they more confident in treating children under age 3, they were more likely to care for children this age in their future practice.<sup>32,33</sup> In order to increase confidence among general dentists in providing care for infants and toddlers, it is necessary to increase experience with this age group during dental school training. Also, because those who are already in practice may be less likely to change, providing new dentists with the education and experiences that focus on increasing their confidence to provide infant oral health care should be considered. While the reasons why providers may choose to not care for young children is complex, this approach can help address some of these issues and increase the number of dental homes available for this population.

While education is a key component to increase the availability of dental homes in the future, currently the problem still exists that dentists are not willing to accept the patients they believe should have dental referrals. An aspect this study did not address is the role of the pediatric dentist in infant and toddler oral health care. While pediatric dentists

receive specialty training in providing preventive and restorative care to infants and toddlers, the number of pediatric dentists in NC is not large enough to accommodate all children.<sup>34,35</sup> With general dentists outnumbering pediatric dentists 24:1, the role of general dentistry in early childhood is imperative to increasing access to oral health care for this young population.<sup>34</sup> While this study found that general dentists are more confident in providing preventive care to children ages 3-6 compared to children less than 3 years old, it is a positive finding that 60% of dentists felt confident with the younger age group. Confidence with restorative care was not measured directly, however we can speculate that it is lower with only 35% of dentists in this study willing to accept a child with existing caries.

With general dentists showing increased confidence and willingness to provide care for infants and toddlers without existing disease, a strategy to increase referral success may be to more clearly define and triage dental referrals from the medical home, and what specific care general dentists should be expected to provide. With this model, pediatricians should be encouraged to refer all children to a general or pediatric dentist by age 1, but refer children with existing cavitated lesions to a pediatric dental specialist. In areas of limited workforce, this recommendation should remain the same when possible, however it may be necessary for infants and toddlers at low risk for dental disease to receive preventive care in the medical home. An example of this model currently in NC is the Carolina Dental Home project where a partnership has been created between physicians and dentists to increase the number of children with a dental home.<sup>27</sup> Part of this initiative has been the creation of a Priority Oral health Risk assessment and Referral Tool (PORRT) that aids physicians in the appropriate referral for infants and toddlers

based on the presence or absence of caries risk factors. Results from this study highlight the need for such a tool, and while research on the effectiveness of PORRT is ongoing, it is promising that triaging referrals in this manner may result in more children being accepted by a dental provider who is able and willing to deliver necessary care, which can help increase the number of children with a dental home.

### *Strengths and Limitations*

A main strength of this study was the conceptual framework used to provide a thorough, systematic assessment of barriers towards guideline adherence. Because there are many barriers towards dentists' acceptance of referrals for infants and toddlers, this allows identification of the most important barriers to focus on. Also, this study had a large statewide sample, making results generalizable across the state. Limitations included those inherent in cross-sectional designs that do not allow conclusions to be drawn about cause and effect relationships. Also, our outcome variable, referral acceptance measured by case scenarios, had potential for misclassification due to self-reported data that potentially does not measure referral acceptance in actual practice, and was not based on community workforce supply.

## **SUMMARY**

In conclusion, this study reported knowledge, attitudes and behaviors of NC general dentists towards physician involvement in infant oral health and referral guidelines. We determined that NC dentists have positive opinions regarding physician involvement in infant oral health, however there is a discrepancy between children that dentists believe should receive a dental referral, and the children they will actually accept in their practice. Key predictors towards acceptance of referrals for the age one dental visit were identified. These include: (1) acceptance of patients younger than 3 years, and especially ages 0-1 year, (2) increased percentage of referrals from pediatric or family medicine practice, (3) increased knowledge of referral guidelines, (4) agreement with guidelines in general, (5) increased confidence in providing preventive care to infants and toddlers, (6) less need to make changes in practice to incorporate infant oral health care, and (7) belief that parents see the value in dental referrals from their primary care provider. This provides us with valuable information to develop targeted strategies to bridge the gap between medicine and dentistry and better assist in linking the medical and dental home for young children.

## Tables

Table 1: Case Scenario Descriptions

Case #	Description (Age, disease level, caries risk factors)	Caries Risk
Case 1	18 month old with (1) white spot lesions (2) frequent exposure to sweetened drinks and (3) no tooth brushing	High
Case 2	18 month old with (1) frequent exposure to sweetened drinks (2) no tooth brushing and (3) family hx of “bad teeth”	High
Case 3	18 month old with no pathology or risk factors	Low
Case 4	30 month old with no pathology or risk factors	Low
Case 5	18 month old with (1) cavitated lesions (2) frequent exposure to sweetened drinks (3) no tooth brushing and (4) family hx of “bad teeth”	High

Table 2: Demographic and Practice Information

Demographic Information	N	%	Missing
<b>Gender</b>			
Male	312	73.9	1
Female	110	26.1	
<b>Race</b>			
Caucasian	366	87.1	3
Other	54	12.9	
<b>Dental School Attended</b>			
UNC	277	65.6	1
Other	145	34.4	
<b>Dental School Graduation Year</b>			
Prior to 1980	94	22.3	
1980-1989	96	22.8	1
1990-1999	89	21.1	
2000-2009	121	28.7	
<b>Practice Information</b>			
<b>Level of Business</b>			
Not Busy	30	7.1	1
Average	154	36.5	
Busy	238	56.4	
<b>% Medicaid Patients</b>			
0%	149	36.9	
1-9%	103	25.5	19
≥10%	152	37.6	
<b>% Referrals from Physicians</b>			
0%	168	42.5	
1-9%	158	40	28
≥10%	69	17.5	
<b>Accepts infants and toddlers</b>			
Yes	279	67.4	9
No	135	32.6	
<b>If yes, at what age?</b>			
≤ 1 year	137	46.9	
2 years	45	15.4	0
≥ 3 years	110	37.67	

Table 3a: Case Scenarios – Guideline Knowledge

Case Scenario		Refer to Dentist		Refer at age 3		Refer at 3 w/ counseling + FI		Unsure/Other	
		N	%	N	%	N	%	N	%
1	Adequate Workforce	390	92.2	8	1.9	17	4.0	8	1.9
	Limited Workforce	302	71.9	16	3.8	78	18.6	24	5.7
2	Adequate Workforce	316	74.7	46	10.9	53	12.5	8	1.9
	Limited Workforce	218	51.6	55	13.3	131	31.0	17	4.0
3	Adequate Workforce	138	32.9	201	48.0	67	16.0	13	3.1
	Limited Workforce	88	21.2	204	48.6	106	25.2	21	5.0
4	Adequate Workforce	252	60.3	112	27.8	47	11.2	7	1.7
	Limited Workforce	177	42.2	144	34.4	87	20.8	11	2.6
5	Adequate Workforce	415	98.3	2	0.5	1	0.2	4	1.0
	Limited Workforce	408	96.7	2	0.5	5	1.2	7	1.7

\*Yellow indicates correct answer based on 2008 AAP infant oral health guidelines

Table 3b: Case Scenarios - Referral Acceptance

Accept Referral	Case 1		Case 2		Case 3		Case 4		Case 5	
	N	%	N	%	N	%	N	%	N	%
Yes	183	44.2	225	53.6	255	61.3	316	75.4	146	34.8
No	163	39.4	134	31.9	118	28.4	68	16.2	220	52.5
Not Sure	68	16.4	61	14.5	43	10.3	35	8.4	53	12.7



Table 4: Agreement and Outcome Expectancy Regarding Physicians' Role in Children's Oral Health

	Strongly Agree/ Agree	Unsure	Disagree/ Strongly Disagree
<b>Agreement</b>			
Physicians play an important role in infant and toddler oral health	<b>85.9%</b> <b>(N=358)</b>	6.2% (N=26)	7.9% (N=33)
Physicians should perform oral health risk assessments beginning at 6 months of age	<b>91.8%</b> <b>(N=382)</b>	5.8% (N=24)	2.4% (N=10)
Physicians are capable of identifying children in need of a dental referral	<b>68.8%</b> <b>(N=286)</b>	21.6% (N=90)	9.2% (N=40)
Physicians should refer all children to a dentist by the first birthday	36.1% (N=150)	14.2% (N=59)	<b>49.8%</b> <b>(N=207)</b>
Physicians should refer children younger than 3 years of age to a dentist <u>based on caries risk assessment</u>	<b>72.2%</b> <b>(N=301)</b>	6.7% (N=28)	21.1% (N=88)
Physicians should refer children under 3 to a dentist <u>only</u> if disease is present	19.5% (N=81)	8.4% (N=35)	<b>72.1%</b> <b>(N=300)</b>
Physicians should apply fluoride varnish at well child visits when dental workforce is sufficient in the community	36.1% (N=151)	19.6% (N=82)	<b>44.3%</b> <b>(N=185)</b>
Physicians should apply fluoride varnish at well child visits when dental workforce is NOT sufficient in the community	<b>72.7%</b> (N = <b>304)</b>	14.6% (N=61)	12.7% (N=53)
Physicians should prescribe dietary fluoride supplementation for children when indicated	<b>81.1%</b> <b>(N=339)</b>	7.9% (N=33)	11.0% (N=46)
<b>Outcome Expectancy</b>			
Dental referrals by physicians are effective in increasing the % of infants with a dental home	<b>72.1%</b> <b>(N=305)</b>	24.3% (N=103)	3.6% (N=15)
Caries risk assessment, parent counseling, and fluoride varnish application by physicians decreases dental disease in infants and toddlers	<b>77.8%</b> <b>(N=329)</b>	18.4% (N=78)	3.8% (N=16)
The age one dental visit is effective in the prevention of ECC	<b>61.7%</b> <b>(N=259)</b>	28.0% (N=117)	10.3% (N=43)

\*Bold indicates majority response

Table 5. Association of Barriers with Increased Referral Acceptance

Variable Name	Odds Ratio	P value	95% Confidence Interval	
<b>Practice Information</b>				
% of referrals from pediatric or family medicine practices				
0-9% (reference group)				
10% or more	<b>2.31</b>	<b>&lt;.01</b>	1.24	4.33
% of Medicaid insured patients				
0%	1.10	0.71	0.66	1.85
1% or more (reference group)				
Age at which dentist will see child for first visit				
Ages 0-1	<b>8.62</b>	<b>&lt;.01</b>	3.81	9.49
Ages 2-5	<b>2.52</b>	<b>&lt;.01</b>	1.35	4.71
Does not see infants and toddlers (reference group)				
<b>Knowledge</b>				
Aware of AAP guidelines	0.85	0.58	0.47	1.52
Frequency with which dentist made a guideline appropriate recommendation about how a pediatrician should proceed with an ADEQUATE dental workforce				
Infrequently or Occasionally (=0-3) (reference group)				
Always (=4-5)	<b>2.08</b>	<b>&lt;.01</b>	1.22	3.56
Frequency with which dentist made a guideline appropriate recommendation about how a pediatrician should proceed in a limited dental workforce				
Infrequently or Occasionally (=0-3) (reference group)				
Always (=4-5)	1.80	0.12	0.87	3.74
<b>Attitudes</b>				
Scale measuring support for guidelines	<b>1.11</b>	<b>&lt;.01</b>	1.04	1.19
Agrees that the age one dental visit is effective in prevention of ECC	<b>0.47</b>	<b>&lt;.01</b>	0.27	0.83
Agrees that physicians should perform oral health risk assessment beginning at 6 months	1.79	0.17	0.78	4.08
Agrees that physicians should refer children younger than 3 years old to a dentist based on CRA	0.68	0.22	0.37	1.25
Agrees that I am confident in providing preventive oral health care to infants and toddlers	<b>2.68</b>	<b>&lt;.01</b>	1.36	5.28
Agrees that I have to make significant changes in my practice to incorporate infant oral health care	<b>0.51</b>	<b>0.04</b>	0.27	0.96
Agrees that infant oral health care is disruptive to my current practice flow	0.67	0.21	0.36	1.25
<b>Behaviors</b>				
Agrees that the historically varying guideline recommendations have delayed the age at which I accept children for the first dental visit	1.54	0.2	0.79	2.99
Agrees that parents see the importance in dental referrals from their primary care providers	<b>2.02</b>	<b>&lt;.01</b>	1.18	3.46
Agrees that I have time in my schedule to provide infant oral health care	1.70	0.08	0.94	3.08

\*Odds ratio is statistically significant if p-value is less than 0.05

## Figures

Figure 1: Barriers to Guideline Adoption Based on Sequence to Behavior Change (Adapted from Cabana et al<sup>19</sup>)

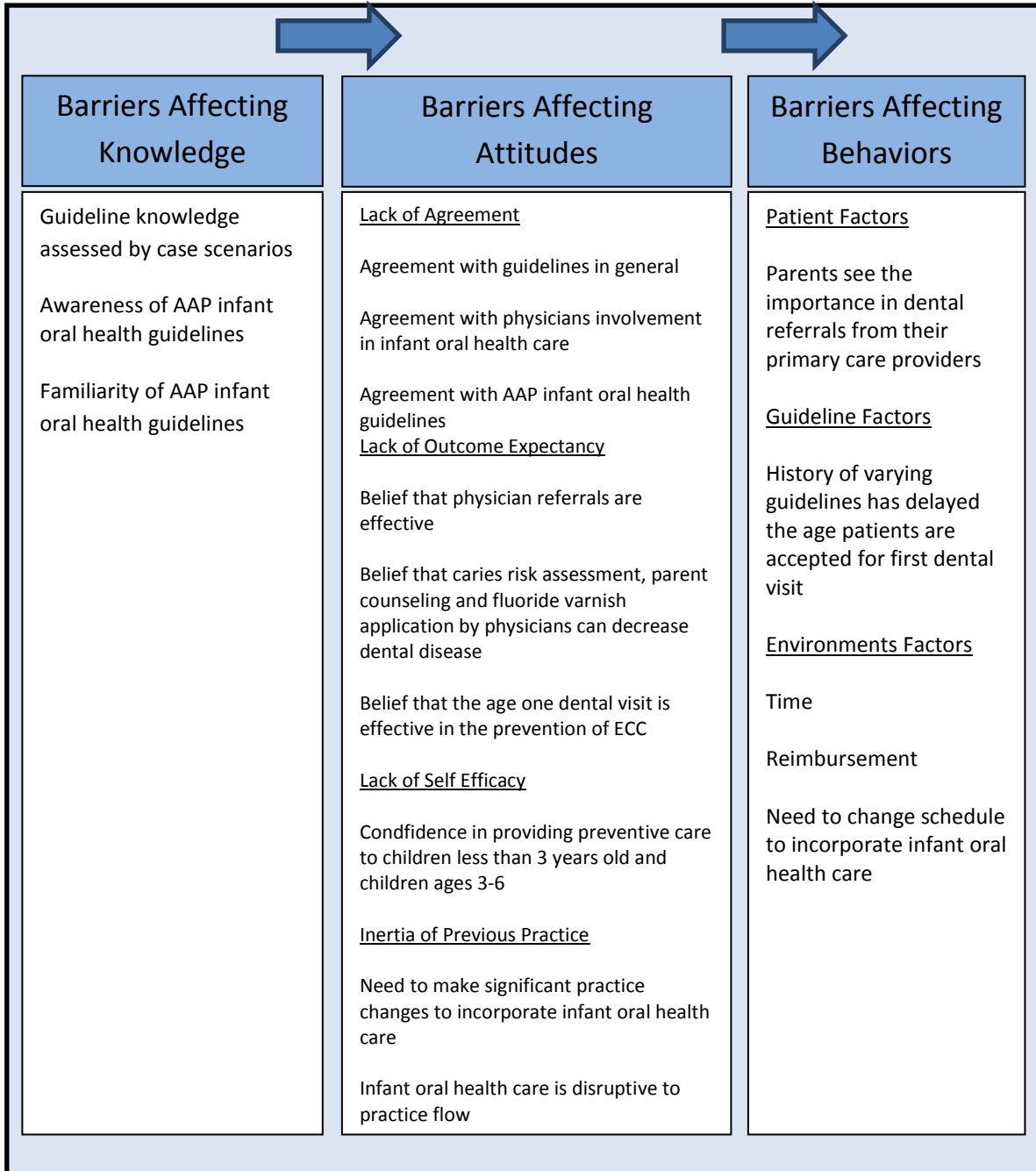
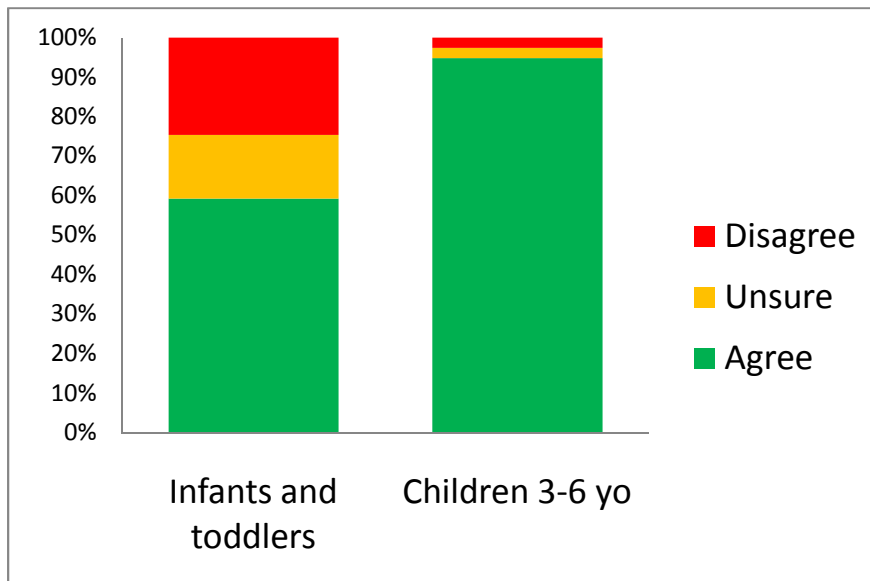


Figure 2: Confidence in Providing Preventive Oral Health Care



## RERERENCES

1. US Department of Health and Human Services. Oral Health in America: A report of the Surgeon General. Rockville, Md: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; 2000.
2. Drury TF, Horowitz AM, Ismail AI, Maertens MP, Rozier RG, Selwitz RH. Diagnosing and reporting early childhood caries for research purposes. A report of a workshop sponsored by the National Institute of Dental and Craniofacial Research, the Health Resources and Services Administration, and the Health Care Financing Administration. *J Public Health Dent*. 1999 Summer;59(3):192-7.
3. Dye BA, Tan S, Smith V, Lewis BG, Barker LK, Thornton-Evans G, Eke PI, Beltrán-Aguilar ED, Horowitz AM, Li CH. Trends in oral health status: United States, 1998 – 1994 and 1999-2004. *Vital Health Stat*. 11.2007 Apr;(248);1-92.
4. Savage MF, Lee JY, Kotch JB, Van n WF Jr. Early preventive dental visits: effects on subsequent utilization and costs. *Pediatrics*. 2004 Oct;114(4):e418-23.
5. Nowak AJ and Casamassimo PS. The dental home: A primary care oral health concept. *J Am Dent Assoc* 2002;133;93-98.
6. American Academy of Pediatric Dentistry. Guideline on infant oral health care. Reference Manual 2006-2007. *Pediatr Dent* 2006;28(suppl):73-6.
7. American Dental Association. ADA statement on early childhood caries. Available at: <http://www.ada.org/prof/resources/positions/statements/caries.asp>. Accessed on 3/10/2010.
8. Hale KJ. American Academy of Pediatrics Section on Pediatric Dentistry. Oral health risk assessment timing and establishment of the dental home. *Pediatrics* 2003 May; 111(5 pt 1): 1113-6.
9. Pahel BT, Rozier RG, Stearns SC, Quiñonez RB. Effectiveness of preventive dental treatments by physicians for young Medicaid enrollees. *Pediatrics*. 2011 Mar;127(3): e682-9. Epub 2011 Feb 28.
10. Rozier RG, Stearns SC, Pahel BT, Quinonez RB, Park J. How a North Carolina Program boosted preventive oral health services for low-income children. *Health Aff (Millwood)*. 2010 Dec;29(12):2278-85.
11. American Academy of Pediatrics. Preventive Oral Health Intervention for Pediatricians. Section on Pediatric Dentistry and Oral Health. *Pediatrics* 2008 Dec; 122(6): 1387-1393.

12. American Academy of Pediatrics. Fluoride Varnish Reimbursement Table. Available at : <http://www.aap.org/oralhealth/pdf/OH-Reimbursement-Chart.pdf> Updated 4/2010. Accessed 5/20/2010.
13. Lewis CW, Boutler S, Keels MA, Krol DM, Mouradian WE, O'Connor KG, Quinonez RB. Oral health and pediatricians: results of a national survey. *Acad Pediatr*. 2009 Nov-Dec; 9(6):457-61.
14. Malcheff S, Pink TC, Sohn W, Inglehart MR, Briskie D. Infant oral health examinations: pediatric dentists' professional behavior and attitudes. *Pediatric Dent*. 2009 May-Jun;31(3):202-9.
15. Seale NS, Casamassimo PS. Access to dental care for children in the United States: a survey of general practitioners. *J Am Dent Assoc* 2003 Dec; 134(12): 1630-40.
16. Santos CL, Douglass JM. Practices and opinions of pediatric and general dentists in Connecticut regarding the age 1 dental visit and dental care for children younger than 3 years old. *Pediatr Dent*. 2008 Jul-Aug;30(4):348-51.
17. Wolfe JD, Weber-Gasparoni K, Kanellis MJ, Qian F. Survey of Iowa general dentists regarding the age 1 dental visit. *Pediatr Dent*. 2006 Jul-Aug;28(4):325-31.
18. Shulman ER, Ngan P, Wearden S. Survey of treatment provided for young children by West Virginia general dentists. *Pediatr Dent*. 2008 Jul-Aug;30(4): 352-7.
19. Cabana MD, Rand CS, Powe NR. Why don't physicians follow clinical practice guidelines?: A framework for improvement. *JAMA* 1999;282(15): 1458-1465.
20. Brickhouse TH, Unkel JH, Kancitis I, Best AM, Davis RD. Infant oral health care: a survey of general dentists, pediatric dentists and pediatricians in Virginia. *Pediatr Dent* 2008 Mar-Apr;30(2):147-53.
21. Erickson PR, Thomas HF. A survey of the American Academy of Pediatric Dentistry membership: infant oral health care. *Pediatr Dent* 1997 Jan-Feb; 19(1): 17-21.
22. Dillman, Don A. 1978. Mail and Telephone Surveys: The Total Design Method. New York: Wiley-Interscience. 375pp.
23. Tunis SR, Hayward RS, Wilson MC, et al. Internists' attitudes about clinical practice guidelines [see comments]. *Ann Intern Med* 1994; 120: 956-963.
24. Long SL, Freese J. Chapter 5: models for ordinal outcomes. Regression models for categorical dependent variables using Stata. 2nd ed. ed. College Station, TX: StataCorp LP; 2006:183-213.

25. StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP.
26. dela Cruz GG, Rozier RG, Slade G. Dental Screening and Referral of Young Children by Pediatric Primary Care Providers. *Pediatrics*. 2004 Nov;114(5):e642-52.
27. Long CM, Quinonez RB, Beil HA, Close K, Myers LP, Vann WF, Rozier RG. Pediatricians' assessments of caries risk and need for a dental evaluation in preschool aged children. To be published in *BMC Pediatrics* 2012.
28. Pierce KM, Rozier RG, Vann WF. Accuracy of Pediatric Primary Care Providers' Screening and Referral for Early Childhood Caries. *Pediatrics*. 2002 May;109(5):e82-2.
29. Close K, Rozier RG, Zeldin LP, Gilbert AR. Barriers to the Adoption and Implementation of Preventive Dental Services in Primary Medical Care. *Pediatrics*. 2010 Mar;125(3):509-17.
30. American Academy of Pediatrics. Chapter Oral Health Advocates. Available at: <http://www2.aap.org/oralhealth/COHA.html>. Accessed on 4/4/2012.
31. Seale NS, Casamassimo PS. U.S. Predoctoral Education in Pediatric Dentistry: Its impact on Access to Dental Care. *J Dent Educ* 2003 Jan; 67(1):23-30.
32. Weber-Gasparoni K, Kanellis MJ, Qian F. Iowa's Public Health-Based Infant Oral Health Program: A Decade of Experience. *J Dent Educ* 2010 April;74(4):363 – 371.
33. Fein JE, Quinonez, RB, Phillips C. Inroducing Infant Oral Health into Dental Curricula: A Clinical Intervention. *J Dent Educ* 2009 Oct;73(10):1171 – 1177.
34. North Carolina: Professionally Active Dentists by Specialty Field, February 2012. Available at: <http://www.statehealthfacts.org/profileind.jsp?ind=444&cat=8&rgn=35>. Accessed on 3/25/2012.
35. U.S. Census Bureau, 2008-2010 American Community Survey. Available at: <http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk#>. Accessed on 3/25/2012.