

# Clinical Article

## CROSS-SECTIONAL STUDY

### Barriers to Pediatricians' Adherence to American Academy of Pediatrics Oral Health Referral Guidelines: North Carolina General Dentists' Opinions

C. Marshall Long, DDS, MS<sup>1</sup> • Rocio B. Quinonez, DMD, MS, MPH<sup>2</sup> • R. Gary Rozier, DDS, MPH<sup>3</sup> • Ashley M. Kranz, PhD<sup>4</sup> • Jessica Y. Lee, DDS, MPH, PhD<sup>5</sup>

**Abstract: Purpose:** The purposes of this study were to: (1) assess knowledge, attitudes, and behaviors of North Carolina general dentists (GDs) regarding American Academy of Pediatrics (AAP) dental referral guidelines; and (2) determine factors that influence pediatricians' ability to comply with AAP guidelines. **Methods:** One thousand GDs were surveyed to determine barriers toward acceptance of physician referrals of infants and toddlers. The primary outcome using ordered logistic regression was GDs' acceptance of children described in five case scenarios, with different levels of risk and oral health status. **Results:** GDs believed pediatricians should refer patients at risk for caries to a dentist. While 61 to 75 percent of GDs were willing to accept low caries risk referrals of infants and toddlers, only 35 percent would accept referrals when caries was present. Predictors of referral acceptance were correct knowledge about AAP guidelines (OR=2.0, 95%CI=1.2-3.3), 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). **Conclusions:** This study identified factors influencing acceptance of pediatrician referrals for the age one dental visit among North Carolina GDs and highlighted challenges pediatricians face in referring young children for dental care. (*Pediatr Dent* 2014;36:309-15) Received September 19, 2013 | Last Revision December 23, 2013 | Accepted December 23, 2013

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The delivery of oral health services in the medical home has improved access to preventive oral health services in early childhood for those without access to dental care.<sup>1,2</sup> Before 2003, the American Academy of Pediatrics (AAP) recommended that the first dental visit occur at three years old.<sup>3</sup> Since then, the AAP policy has been more in line with the American Academy of Pediatric Dentistry (AAPD), recommending an oral health risk assessment in the first year of life and referral to a dental home by the first birthday.<sup>4,5</sup>

The medical guideline differs from the dental guideline only in geographic areas with limited dental workforce, defined by the AAP as a dentist being unavailable to accept a referral.<sup>5</sup> In this situation, the AAP recommends that children at high risk for dental disease should receive a dental referral by one year old and low-risk children should remain in the medical home to receive preventive oral health services until a dental referral is possible.<sup>4,7</sup> Despite the medical and dental guidelines, only 53 percent of pediatric dentists (PDs) report routinely providing examinations for children by 12 months old and less than half of general dentists (GDs) report routinely providing care for children younger than two years old.<sup>8-12</sup> Consequently, physicians report difficulty in completing dental referrals for young patients according to AAP guidelines.<sup>6,7,13</sup>

While barriers have been reported in the dental literature regarding implementation of dental guidelines for the age one visit, no studies have assessed dental providers' knowledge and opinions regarding pediatrician guidelines for provision of early preventive oral health services to children younger than

three years old.<sup>8-12</sup> For collaboration between medicine and dentistry to be effective in promoting change in provider practice behaviors and oral health outcomes, it is important to understand how dental providers view the changing role of pediatricians and other medical child-care providers in oral health. The ability of pediatricians to adhere to dental referral guidelines depends partly on dentists' agreement with these guidelines and their acceptance of patients who are referred by pediatricians according to AAP guideline recommendations. This knowledge can help inform strategies that will better assist the linkage of the medical and dental home to improve children's oral health.

The purposes of this study were to: (1) assess the knowledge, attitudes, and behaviors of general dentists in North Carolina regarding American Academy of Pediatric guidelines for oral health; and (2) determine barriers in accepting dental referrals from pediatricians for young children.

#### Methods

This cross sectional study surveyed GDs in North Carolina (N.C.) to determine barriers to acceptance of dental referrals by pediatricians for infants and toddlers. This study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill, Chapel Hill, N.C.

**Sample.** We randomly selected 1,000 GDs currently practicing in N.C. from a list of licensed GDs maintained by the State Board of Dental Examiners. Inclusion criteria were: current license to practice dentistry in N.C.; practice of clinical dentistry in private practice for more than 10 hours per week; no current or previous participation in a postdoctoral residency program, with the exception of general practice residency or advanced education in general dentistry; and acceptance of children younger than 12 years old to capture practices with a pediatric focus.

**Survey design.** We relied on the comprehensive framework proposed by Cabana et al. for assessing barriers to guideline adoption in clinical practice to select variables for our study and to group them into domains (see Figure 1).<sup>14</sup> The final

<sup>1</sup>Dr. Long is a pediatric dentist in Charlotte, N.C. <sup>2</sup>Dr. Quinonez is an associate professor, and <sup>3</sup>Dr. Lee is a professor and department chair, Department of Pediatric Dentistry, School of Dentistry; and <sup>4</sup>Dr. Rozier is a professor, Department of Health Policy and Management, Gillings School of Global Public Health; and <sup>5</sup>Dr. Kranz is a postdoctoral research trainee, Department of Dental Research; all at the University of North Carolina at Chapel Hill, Chapel Hill, N.C., USA.  
Correspond with Dr. Long at [mlong819@gmail.com](mailto:mlong819@gmail.com)

survey instrument was five pages, with 63 items including case scenarios and questions requiring Likert scale responses.

**Procedures.** The survey was pilot tested by five GDs and five PDs and subsequently mailed to all study subjects using the Dillman total design survey methodology.<sup>15</sup> Inclusion criteria were confirmed on the questionnaire. All surveys were coded numerically, allowing for returned surveys to be anonymous, and a postage-paid, preaddressed envelope was included for return. The first mailing occurred in November 2010, with data collection completed by March 2011.

**Dependent variable.** The dependent variable provided a measure of GDs' referral acceptance of infants and toddlers and was based on dentists' responses to five case scenarios de-

scribing the patients' age, disease status, and presence of risk factors (Figure 2). For each case, respondents were asked if they would accept this infant or toddler as a patient if referred to them by a pediatrician ("yes," "no," or "not sure"). We summed the number of responses of "yes" (range equals 0-5) and constructed three categories of referral acceptance based on the variable distribution (low equals 0-1; moderate equals 2-3; high equals 4-5).

**Independent variables.** Independent variables measuring barriers to guideline adoption were constructed for each of three categories (knowledge of the guideline, attitudes toward the guideline, and behavior regarding the guideline) specified in Cabana's framework (Figure 1). Additional independent variables were used to control for practice characteristics and demographic information; most were obtained from the N.C. Board of Dental Examiners licensure files.

**Barriers affecting knowledge of guidelines.** Following descriptions of each patient case scenario, respondents were asked their opinion about how a pediatrician should address each child's oral health needs with an adequate and a limited dental workforce, respectively. For each workforce scenario, five response options were provided: (1) refer the child to a dentist now; (2) wait and refer the child at three years old but continue dental screenings during well-child visits; (3) wait and refer the child at three years old but provide counseling and fluoride varnish during medical visits; (4) not sure; or (5) other. We summed the number of responses that agreed with existing referral guidelines for each workforce scenario and constructed two binary variables indicating that the GD almost always agreed (i.e., four or five responses in guideline agreement) with pediatrician guidelines when the dental workforce was adequate and when it was limited. Additionally, we constructed a binary variable to indicate that the GD was aware of the 2003 or 2008 AAP oral health guidelines and, if so, how familiar he or she was with them.

**Barriers affecting attitudes toward guidelines.** Nine questions assessed lack of agreement with different aspects of the AAP guidelines and pediatrician involvement in infant oral health care. GDs were asked if: they agree that pediatricians play an important role in infant and toddler oral health; pediatricians should perform oral health risk assessments beginning at six months old; pediatricians should refer all children to a dentist by the first birthday or if they should refer based on caries risk assessment or only if disease is present; pediatricians should apply fluoride varnish in adequate or limited workforce; and pediatricians should prescribe dietary fluoride supplements. These questions used one to five Likert-type responses, recoded to binary variables indicating responses of "strongly (dis)agree" or "(dis)agree." In addition, we used eight items from a survey instrument originally developed by Tunis et al. and commonly included in surveys to assess providers' attitudes about practice guidelines in general.<sup>16,17</sup> The five-point Likert-type responses to each item (strongly disagree to strongly agree) were summed to construct a continuous scale measuring overall general support for guidelines, with higher values indicating greater support (range equals 10 to 40; mean equals 29; Cronbach's alpha equals 0.70).

Three binary variables were constructed measuring GDs' outcome expectancy toward AAP guidelines using answers to questions asking if: dental referrals by pediatricians are effective in increasing the percentage of infants with a dental home; caries risk assessment, counseling, and fluoride varnish application by pediatricians decreases dental disease in infants and toddlers; and the age one dental visit is effective in preventing

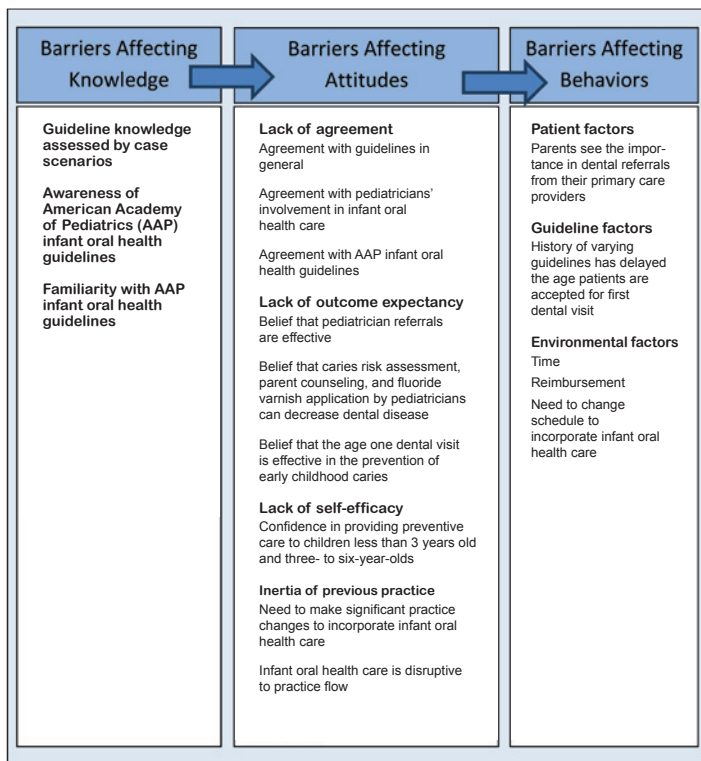


Figure 1. Barriers to guideline adoption based on sequence to behavior change (adapted from Cabana et al.<sup>14</sup>).

CASE NO.	DESCRIPTION (AGE, DISEASE LEVEL, CARIES RISK FACTORS)	CARIES RISK
1	18-month-old with no pathology or risk factors	Low
2	30-month-old with no pathology or risk factors	Low
3	18-month-old with: (1) frequent exposure to sweetened drinks; (2) no tooth brushing; and (3) family history of "bad teeth"	High
4	18-month-old with: (1) white spot lesions; (2) frequent exposure to sweetened drinks; and (3) no tooth-brushing	High
5	18-month-old with: (1) cavitated lesions; (2) frequent exposure to sweetened drinks; (3) no tooth-brushing; and (4) family history of "bad teeth"	High

Figure 2. Description of case scenarios used to assess general dentists' knowledge of American Academy of Pediatrics infant oral health guidelines and appropriate referral acceptance.

early childhood caries (ECC). Two binary variables measuring confidence (self-efficacy) of GDs were constructed using answers to questions asking if they have confidence in providing preventive care to children younger than three years old and between three to six years old. To measure inertia of previous practice, two binary variables were constructed using answers to questions asking if they would have to make significant changes to incorporate infant oral health care in their practice and if infant oral health care is disruptive to current practice flow.

**Barriers affecting behaviors regarding guidelines.** We included five survey items from the questionnaire that used a one to five Likert-type response scale to assess barriers to behaviors, with higher values indicating stronger agreement with the statement. These questions asked if: the respondent believes that parents see the importance in dental referrals from their primary care providers; historically varying guideline recommendations have delayed the age of accepting children for the first dental visit; the respondent has time in their schedule to provide infant oral health care; they believe reimbursement is adequate for infant oral health care; and they would need to make changes in their schedule to incorporate infant oral health care. We constructed five binary variables indicating agreement with each statement if the GDs responded “strongly agree” or “agree.”

**Practice characteristics.** GDs were asked if they cared for infants and toddlers in their practice and if so, the age in years for a first visit. Responses were aggregated into a categorical variable (zero to one year old, two to five years old, or not at all [reference group]). Two questions were used to determine the percent of Medicaid-insured patients seen within each practice and the percent of referrals received from pediatric or family medicine practices. Based on the response distribution, binary variables were constructed to indicate care of Medicaid-insured patients and when 10 percent or more of referrals received by the GD were from pediatric or family medicine practices.

**Analytical approach.** Descriptive statistics were calculated for the scenarios and all variables. An ordered logistic regression model with robust standard errors was used to predict the odds of a GD accepting a pediatrician referral for a child (three categories), while holding all other variables constant.<sup>18</sup> Use of this regression model was confirmed by our failure to reject the proportional odds assumption ( $P=.68$ ). Z tests were used to examine the association between independent variables and odds of having greater referral acceptance. Analyses were performed using Stata/IC 12.0 software (Stata-Corp, College Station, Texas, USA) using  $P<.05$ .

## Results

A total of 493 surveys were received, yielding a response rate of 49 percent, with 423 respondents (86 percent) meeting inclusion criteria for which descriptive statistics were reported (Table 1). Of these, complete data for the outcome variable were available for 78 percent, yielding 328 surveys for inclusion in the multivariate analysis.

**Descriptive statistics.** A majority of the sample was male (74 percent), Caucasian (87 percent), and graduated from the University of North Carolina at Chapel Hill School of Dentistry (66 percent). Most GDs reported accepting infants and toddlers in their practice (67 percent), but less than half of these (47 percent) and only one third of responding dentists overall accepted patients at one year old or younger.

Table 2 primarily illustrates GDs' responses regarding how they believed pediatricians should proceed after their oral assessment for each child depending on workforce availability. For

Table 1. DEMOGRAPHIC AND PRACTICE INFORMATION

Demographic information	N (%)	Missing
<b>Gender</b>		
Male	312 (74)	1
Female	110 (26)	
<b>Race</b>		
Caucasian	366 (87)	3
Other	54 (13)	
<b>Dental school attended</b>		
University of North Carolina at Chapel Hill	277 (66)	1
Other	145 (34)	
<b>Dental school graduation year</b>		
Prior to 1980	94 (22)	1
1980-1989	96 (23)	
1990-1999	89 (21)	
2000-2009	121 (29)	
<b>Practice information</b>		
<b>Level of business</b>		
Not busy	30 (7)	1
Average	154 (37)	
Busy	238 (56)	
<b>Medicaid patients (%)</b>		
0	149 (37)	
1-9	103 (26)	19
≥10	152 (38)	
<b>Referrals from physicians (%)</b>		
0	168 (43)	
1-9	158 (40)	28
≥10	69 (18)	
<b>Accepts infants and toddlers</b>		
Yes	279 (67)	9
No	135 (33)	
<b>If yes, at what age (ys)?</b>		
≤1	137 (47)	
2	45 (15)	0
≥3	110 (38)	

children with disease (Case 4 with white spot lesions and Case 5 with cavitated lesions), 92 percent and 98 percent of GDs, respectively, felt that the pediatrician should refer a one-year-old to a dentist with an adequate workforce. For a high-risk child with no disease but multiple behavioral risk factors (Case 3), 75 percent believed a referral should be made at one year old to a dentist with an adequate workforce. Finally, for a low-risk child (Cases 1 and 2), regardless of age and available workforce, approximately 50 percent of providers believed that the child should be referred to a dentist at three years old with no preventive services provided by the pediatrician.

Table 2 also illustrates GDs' willingness to accept referrals for each case scenario. GDs were most likely to accept the 30-month-old with low risk (75 percent), followed by the 18-month-old with low risk (61 percent). Only 35 percent would accept an 18-month-old with cavitation. The results from Table 2 were used to construct the primary outcome variable, acceptance of patients referred by a pediatrician. Among the 328 GDs included in the analytical sample, 43 percent ( $N=141$ ) demonstrated a high level, 20 percent ( $N=64$ ) demonstrated a moderate level, and 38 percent demonstrated a low level ( $N=124$ ) of acceptance of referrals from pediatricians.

**Table 2. CASE SCENARIO RESULTS OF GENERAL DENTISTS' KNOWLEDGE OF AMERICAN ACADEMY OF PEDIATRICS (AAP) INFANT ORAL HEALTH GUIDELINES AND REFERRAL ACCEPTANCE ACCORDING TO AAP GUIDELINES\***

Case no.		Refer to dentist N (%)	Refer at age 3 N (%)	Refer at age 3 with counseling + fluoride N (%)	Unsure/ other N (%)	Accept referral N (%)
1	Adequate workforce	138 (33)	201 (48)	67 (16)	13 (3)	Yes: 255 (61) No: 118 (28) Not sure: 43 (10)
	Limited workforce	88 (21)	204 (49)	106 (25)	21 (5)	
2	Adequate workforce	252 (60)	112 (28)	47 (11)	7 (2)	Yes: 316 (75) No: 68 (16) Not sure: 35(8)
	Limited workforce	177 (42)	144 (34)	87 (21)	11 (3)	
3	Adequate workforce	316 (75)	46 (11)	53 (13)	8 (2)	Yes: 225 (54) No: 134 (32) Not sure: 61 (15)
	Limited workforce	218 (52)	55 (13)	131 (31)	17 (4)	
4	Adequate workforce	390 (92)	8 (2)	17 (4)	8 (2)	Yes: 183 (44) No: 163 (39) Not sure: 68 (16)
	Limited workforce	302 (72)	16 (4)	78 (19)	24 (6)	
5	Adequate workforce	415 (98)	2 (1)	1 (<1)	4 (1)	Yes: 146 (35) No: 220 (60) Not sure: 53 (13)
	Limited workforce	408 (97)	2 (1)	5 (1)	7 (2)	

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

**Guideline knowledge, attitudes, and behaviors.** Knowledge of oral health guidelines was low, with 32 percent (N=134) reporting awareness of 2003 or 2008 AAP oral health guidelines, and only 35 percent (N=147) reporting awareness of AAPD guidelines. Among the former, 53 percent were not familiar or slightly familiar, 33 percent were familiar, and 15 percent were very or extremely familiar with them.

Overall, agreement with pediatrician involvement in infant oral health was high (Table 3). However, 36 and 72 percent, respectively, believe that pediatricians should be referring by the first birthday and based on risk assessment. Over 70 percent disagreed that three-year-olds and younger should be referred only when disease was present. More GDS agreed that pediatricians should apply fluoride varnish in communities with a limited workforce than in those with an adequate workforce; however, over 80 percent support pediatricians providing dietary fluoride supplementation. Outcome expectancy was high: 78 percent agreed that caries risk assessment, counseling, and fluoride varnish application by pediatricians decreases dental disease; 72 percent agreed that dental referrals by pediatricians are effective in increasing the percentage of infants with a dental home; and 62 percent agreed that the age one dental visit is effective in preventing ECC. Regarding self-efficacy or confidence in providing preventive oral health

services to infants, toddlers, and three- to six-year-olds, nearly all GDS (95 percent) are confident in providing these services for three- to six-year-olds but fewer are confident (60 percent) when it comes to infants and toddlers.

Concerning previous practice and external barriers, approximately 50 percent agreed that: they would not have to make changes in their practice or schedule to incorporate infant oral health; infants are not disruptive to their practices; and varying guidelines have not delayed the age children are accepted for the first dental visit. A similar percentage (55 percent) 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.

**Results of multivariate analysis.** Results of the regression analysis are displayed in Table 4. GDS accepting zero- to five-year-olds had significantly greater odds of having more referral acceptance compared to GDS who did not report seeing infants and toddlers. While awareness of guidelines was not a significant predictor, those who gave guideline-appropriate responses when asked how the pediatrician should proceed when there is an adequate workforce had two times greater odds of having more referral acceptance compared to those with non-compliant 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 (odds ratio [OR]=0.5,  $P=.04$ ). Other significant predictors of having more referral acceptance included: support for guidelines in general (OR=1.1,  $P<.01$ ); confidence in providing preventive oral health care to infants and toddlers (OR=2.6,  $P<.01$ ); agreement that parents see the importance in dental referrals from their primary care providers (OR=2.0,  $P<.01$ ); and agreement that there is time in the schedule to provide infant oral health care (OR = 1.8,  $P<.05$ ).

**Discussion**

This study sought to assess the knowledge, attitudes, and behaviors of GDS in N.C. regarding AAP oral health guidelines and determine barriers among these dentists in accepting referrals from pediatricians for young children. Results indicate that GDS support pediatrician involvement in infant oral health; however their knowledge of and agreement with AAP and AAPD infant oral health guidelines are lacking, thus diminishing the ability for pediatricians to fully comply with their recommended referral guidelines for establishing a dental home for infants.

Responses to case scenarios revealed a critical discrepancy between GDS' beliefs and actions about dental referrals from a medical home. Most GDS (75 to 99 percent) believed that one-year-olds at high risk for ECC, including those with or without existing disease, should be referred to a dentist. But fewer than half of GDS would accept these children in their practices if they were referred by a physician, particularly those with cavitated lesions. By contrast, two thirds of GDS indicated that low-risk children should not receive a referral until three years old, but reported willingness to accept them in their practice at one year old. It appears that, currently in N.C., an increase in demand for dental visits to GDS because of referrals from primary medical care providers would present a challenge for infants and toddlers receiving recommended care, particularly for those at highest risk.



Table 3. BARRIERS AFFECTING ATTITUDES REGARDING PHYSICIANS' ROLE IN CHILDREN'S ORAL HEALTH (N=423)

	Strongly agree/agree N (%)	Unsure N (%)	Disagree/ strongly disagree N (%)	Missing (N)
<i>Agreement</i>				
Physicians play an important role in infant and toddler oral health	<b>358 (86)</b>	26 (6)	33 (8)	6
Physicians should perform oral health risk assessments beginning at 6 months old	<b>382 (92)</b>	24 (6)	10 (2)	7
Physicians are capable of identifying children in need of a dental referral	<b>286 (69)</b>	90 (22)	40 (9)	7
Physicians should refer all children to a dentist by the first birthday	150 (36)	59 (14)	<b>207 (50)</b>	7
Physicians should refer children younger than 3 years old to a dentist based on caries risk assessment	<b>301 (72)</b>	28 (7)	88 (21)	6
Physicians should refer children under 3 to a dentist only if disease is present	81 (20)	35 (8)	<b>300 (72)</b>	7
Physicians should apply fluoride varnish at well child visits when dental workforce is sufficient in the community	151 (36)	82 (20)	<b>185 (44)</b>	5
Physicians should apply fluoride varnish at well child visits when dental workforce is NOT sufficient in the community	<b>304 (73)</b>	61 (15)	53 (13)	5
Physicians should prescribe dietary fluoride supplementation for children when indicated	<b>339 (81)</b>	33 (8)	46 (11)	5
<i>Outcome expectancy</i>				
Caries risk assessment, parent counseling, and fluoride varnish application by physicians decreases dental disease in infants and toddlers	<b>326 (78)</b>	76 (18)	16 (4)	0
Dental referrals by physicians are effective in increasing the % of infants with a dental home	<b>300 (72)</b>	103 (24)	15 (4)	0
The age one dental visit is effective in the prevention of early childhood caries	<b>255 (62)</b>	115 (28)	43 (10)	4
<i>Self-efficacy</i>				
I am confident in providing preventive oral health care to infants and toddlers	<b>247 (59)</b>	67 (16)	103 (25)	1
I am confident in providing preventive oral health care to children 3-6 years old	<b>395 (95)</b>	11 (3)	11 (3)	1
<i>Inertia of previous practice</i>				
I have to make significant changes in my practice to incorporate infant oral health care	143 (34)	58 (14)	<b>217 (52)</b>	0
Infant oral health care is disruptive to my current practice flow	146 (35)	66 (16)	<b>205 (49)</b>	1

\* Bold indicates a majority response.

This study further identified several significant barriers that provide insight into why GDs are reluctant to accept referrals of infants and toddlers, including lack of knowledge of guidelines, lack of confidence in providing preventive oral health care for children younger than three years old, and the 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 continuing education. In 2001, six percent of patients treated in predoctoral dental programs were three years old or younger and only 27 percent of dental schools provided opportunities to perform oral health examinations on infants.<sup>19</sup> In the past decade, some dental schools have enhanced or created programs to increase education and hands-on experience with infants. Participants in these programs report that, after their completion, not only were they more confident in treating children younger than age three, but they were more likely to care for children at this age in their future practice.<sup>20,21</sup>

To increase confidence among GDs in providing care for infants and toddlers, it is necessary to increase experience with this age group during dental school training. New standards of the Commission on Dental Accreditation emphasizing inter-professional education provide an opportunity to promote early

childhood oral health in dental education while encouraging other primary health care providers in training to promote the early establishment of a dental home.<sup>22</sup> Also, because those who are already in practice may be less likely to change, providing new GDs with 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 are 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 of strategies to increase the availability of dental homes in the future, the problem still exists that some general dentists are not willing to accept the patients they believe should have dental referrals. An aspect of this problem that this study did not address is the role of PDs in infant and toddler oral health care. While PDs receive specialty training in providing preventive and restorative care to infants and toddlers, the number of PDs in N.C. is not large enough nor geographically distributed in a way that can accommodate all children.<sup>23,24</sup> With GDs outnumbering PDs 24 to one, the role of general dentistry in early childhood is imperative to increasing access to oral health care for this young population.<sup>23</sup> While this study found that GDs are

Table 4. MULTIVARIATE ANALYSIS OF THE ASSOCIATION BETWEEN BARRIERS WITH INCREASED REFERRAL ACCEPTANCE (N=328)

Variable name	Odds ratio	95% confidence interval
<b>Demographic information</b>		
Male	1.17	0.63-2.18
Female (reference group)		
Dental school graduation 2000-2009	0.86	0.45-1.62
Dental school graduation before 2000 (reference group)		
Practice is busy or extremely busy	1.32	0.78-2.22
Practice is not busy, somewhat busy, or average (reference group)		
<b>Practice information</b>		
Referrals from pediatric or family medicine practices (%)		
0-9 (reference group)		
≥10	2.35*	1.24-4.46
Medicaid-insured patients (%)		
0	1.15	0.68-1.93
≥1 (reference group)		
Age at which dentist will see child for first visit (ys)		
0-1	9.51*	4.02-22.51
2-5	2.72*	1.42-5.23
Does not see infants and toddlers (reference group)		
<b>Knowledge</b>		
Aware of American Academy of Pediatric Dentistry guidelines	0.9	0.50-1.62
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)	2.02*	1.17-3.50
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)	1.57	0.77-3.12
<b>Attitudes</b>		
Scale measuring support for guidelines	1.12*	1.05-1.20
Agrees that the age one dental visit is effective in prevention of early childhood caries	0.45*	0.25-0.80
Agrees that physicians should perform oral health risk assessment beginning at 6 mos	1.79	0.78-4.09
Agrees that physicians should refer children younger than 3 years old to a dentist based on caries risk assessment	0.65	0.36-1.20
Agrees that I am confident in providing preventive oral health care to infants and toddlers	2.57*	1.26-5.23
Agrees that I have to make significant changes in my practice to incorporate infant oral health care	0.5*	0.26-0.95
Agrees that infant oral health care is disruptive to my current practice flow	0.66	0.35-1.24
<b>Behaviors</b>		
Agrees that the historically varying guideline recommendations have delayed the age at which I accept children for the first dental visit	1.46	0.75-2.90
Agrees that parents see the importance in dental referrals from their primary care providers	2.02*	1.14-3.56
Agrees that I have time in my schedule to provide infant oral health care	1.84*	1.01-3.35

\* Odds ratio is statistically significant if P<.05.

more confident in providing preventive care to three- to six-year-olds compared to children younger than three years old, it is a positive finding that 60 percent 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 percent of dentists in this study willing to accept a child with existing caries.

Because GDs report more confidence and willingness to provide care for infants and toddlers without existing disease than with disease, one strategy to increase referral success might be to more clearly define and triage dental referrals in the medical home and align these referrals with more specification about the care GDs are expected to provide. Pediatricians should be encouraged to refer all children to a GD or PD by one year old but refer children with existing cavitated lesions to dentists with special training in treating young children. 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 was recently implemented in N.C., where a partnership was established between pediatricians and dentists to increase the number of children with a dental home.<sup>25</sup> Part of this initiative, known as the Carolina Dental Home project, has been the creation of a Priority Oral Health Risk Assessment and Referral Tool (PORRT) that aids primary care physicians in referring infants and toddlers based on the presence or absence of caries risk factors. Results from this current study highlight the need for such a tool; while research on the effectiveness of PORRT is ongoing, it is promising that triaging referrals may result in more children being accepted by a dental provider who is willing to deliver necessary care, which can help increase the number of children with a dental home. Similar efforts are underway nationally with the development of caries risk assessment tools to facilitate risk-based referrals.<sup>26</sup>

**Strengths and limitations.** A strength of this study is the conceptual framework used to provide a systematic assessment of barriers to guideline adherence. The generalizability of the sample was a further strength, given its similarities to the statewide demographics.<sup>27</sup> Our study had a similar percentage of females (26 percent), and similar racial distribution (87 percent Caucasian) compared to the population of dentists practicing in N.C. The demographics of the sample provide generalizability. However, due to a low response rate and exclusion of GDs who do not see children younger than 12 years old, access to dental care is overestimated in this study. Other limitations also included those inherent in cross sectional designs that do not allow conclusions to be drawn about cause-and-effect relationships. In addition, 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 respondents' own community workforce supply. Also, although widely used in simulating clinical practice, we did not specify patients' financial status in the case scenarios, which could influence responses.

## Conclusions

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

1. General dentists had positive opinions regarding pediatrician involvement in infant oral health.
2. A discrepancy exists between children who GDs believe should receive a dental referral by a pediatrician and children who they will accept in their practice.
3. Key predictors toward acceptance of referrals by pediatricians for the first dental visit are:
  - a. acceptance of patients younger than three years and especially zero- to one-year-olds;
  - b. increased percentage of referrals from pediatric or family medicine practices;
  - c. more knowledge of referral guidelines;
  - d. agreement with guidelines in general;
  - e. greater confidence in providing preventive care to infants and toddlers;
  - f. less of a need to make changes in practice to incorporate infant oral health care; and
  - g. belief that parents see the value in dental referrals from their pediatricians.

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