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ORIGINAL ARTICLE

Provision of Preventive Oral Health Services to Infants and Toddlers: North Carolina General Dentists' Readiness

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ABSTRACT

Objectives: Stage of readiness can contribute to providers' clinical behavioral patterns, but little is understood about its impact in dentistry. The purpose of this investigation is to (1) describe the stage of readiness of general dentists in North Carolina (NC) to deliver preventive oral health services to infants and toddlers and (2) assess factors that may be associated with stage of readiness.

Methods: Utilizing a survey study design, 1,010 surveys were distributed to NC General Dentists. The outcome variable, stage of readiness, was categorized into three stages: pre-contemplation, contemplation/preparation and action/maintenance. Explanatory variables included comfort, knowledge, and demographic characteristics. Univariate, bivariate, and proportional odds modeling was performed using SAS 9.1. Level of significance was set at $p<0.05$.

Results: A 40% (N=406) response rate was achieved. Over half (58%, N=235) of providers reported delivering preventive services to infants and toddlers, 12% (N=48) were considering delivering these services, and 30% (N=119) reported no involvement with this age group. Comfort was significantly associated with general dentists' stage of readiness. As practitioners' comfort increased, the likelihood of practitioners performing these services (action stage) was 3.4 (2.1, 5.5; $p<.0001$) and 5.8 (3.9, 8.6, 8.25; $p<.0001$) times greater when compared to those contemplating and those not willing to perform these services, respectively. Increased comfort also increased the likelihood that practitioners would consider providing these services, versus those who were not considering it (1.7 [1.0, 2.7] $p=0.03$).

Conclusions: Strategies to increase general practitioners' comfort levels could positively affect the likelihood of providing care to infants and toddlers.

Keywords: Stage of readiness, Infant and toddler oral health, Dental home, General dentist, Dentist's practice patterns

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INTRODUCTION

Recent reports indicate a rise in dental disease among preschool aged children, while caries rates for the population across the life span have declined (1). In the past decade, a number of national organizations have embraced the concept of a dental home by a child's first birthday, a concept introduced by the American Academy of Pediatric Dentistry in 1986 (2-4). This broad consensus encourages the promotion of disease prevention in early childhood and has been further supported by emerging evidence of the effectiveness of early preventive oral health in both the dental and medical arena (5, 6). There exist, however, a number of impediments to the implementation of this policy, including a lack of practitioner training to care for young children and a willingness of providers to deliver these services (7-9).

The question of how best to motivate providers and encourage them to care for young children is of particular importance for general dentists, as they play a critical role as the safety net for children, given the limited accessibility for many children to a pediatric dentist. Little data exists on the impact that the training of the dental workforce (general practitioners and dental hygienists) has on increasing access to care for the very young, or the factors that may influence behavior change. Seale *et al.* (10) reported hands on clinical experiences in dental education as a way to increase willingness to care for young children, but this study lacked a theoretical framework to explain such change.

Modifying dental provider practice

Table 1: Descriptive Statistics for North Carolina General Dentist Survey Respondents [IQR = interquartile range (P_{25}, P_{75})]

	CATEGORICAL VARIABLE	N	Total N	Percentile (%)	CONTINUOUS VARIABLE	Median N	IQR*
Outcome Variables	Stage of Readiness Pre-Contemplation	119	402	29.60			
	Contemplation/ Preparation	48	402	11.94			
	Action/Maintenance	235	402	58.46			
Explanatory Variables	Accessibility To Pediatric Dentist				Comfort	3.9	3.4,4.5
	Very accessible	214	396	54.04	Knowledge	2.7	2.3,2.8
	Somewhat accessible	86	396	21.72	Hours Worked/wk	38.0	34.0,40.0
	Not accessible	96	396	24.24			
	CE Course Taken						
	Yes	89	397	22.42			
	No/Not Sure	308	397	77.58			
Covariates	Gender				Years Since Graduation	8.0	5.0,10.0
	Female	170	398	42.71			
	Male	228	398	57.29			
	Race						
	Caucasian	303	398	76.13			
	Non-Caucasian	95	398	23.87			
	County Type						
	Metro	317	398	79.65			
	Non-Metro	81	398	20.35			
	Practice Type						
	Adult	345	397	86.90			
	Pre-adult (child/adolescent)	52	397	13.10			
	Value Preventive Care to Infants & Toddlers						
	Very Important	157	393	39.95			
	Somewhat Important	145	393	36.90			
	Not very important	91	393	23.16			

behaviors toward acceptance of the age 1 dental visit is complex. The transtheoretical model of behavior change framework (11-14) introduced by Prochaska and colleagues suggests that the process of modifying human behavior is continuous, moving through various stages of pre-contemplation, contemplation, preparation, action, and maintenance of change (9, 13, 14). Most readiness for change studies have focused on personal health issues such as smoking and weight gain (11, 15-17). Less common has been the use of the transtheoretical model of change to explore providers' clinical behaviours (18-21). In dentistry, Cruz *et al* (2005) investigated providers' stage of readiness to deliver oral cancer related services. The authors reported that the majority of dentists were in the action/maintenance stage for performing oral cancer examination (82%), but few delivered tobacco (12%) or alcohol (2%) cessation information, thus highlighting the missed opportunity for disseminating preventive oral health messaging (22). No studies to date have examined stage of readiness of general dentists with respect to clinical practice behaviors.

The purpose of this study was to assess factors that may influence general dentists' stage of readiness with respect to providing preventive oral health services for infants and toddlers. While this study was mainly exploratory in nature, the identification of factors that are associated with the stage of readiness could lead to more tailored intervention strategies, with the goal of increased implementation of and adherence to the age 1 dental visit policy.

METHODS

Study Design and Population

A survey was developed to assess providers' oral health practices, knowledge, comfort, and stage of readiness to provide preventive care to infants and toddlers. The sampling frame contained over three thousand general dentists registered with the North Carolina (NC) Dental Society as active licensed providers in the state. Specialists who were noted as general practitioners in the sampling frame were excluded. Nearly one third of the practicing general dentists in the state (N = 1010) were identified as having graduated in the last ten years and were selected to participate in the survey. Survey respondents who self-identified as specialists were also excluded.

Survey Development

A two page, 12 item survey was designed to assess the practices, comfort, knowledge, and stage of readiness related to infant and toddler oral health of NC general dentists. This survey was modified from a previous survey that examined a number of these constructs related to infant and toddler oral health in a dental educational setting (23). The survey took approximately 10 minutes to complete. Stage of readiness, the outcome of interest, was categorized into three stages: action/maintenance, contemplation/preparation and pre-contemplation (24-26). Stage of readiness was ascertained utilizing responses to two questions. The first was "Do you care for infants and toddlers in your practice?" with a positive response indicating active stage of readiness. If the respondent answered no, a second question was utilized to further distinguish stage of readiness. The second question used a Likert scale and read, "How ready are you to implement a preventive infants and toddlers oral health program in your practice?" Values ranged from one to ten with one indicating "very ready" and 10 "not ready" to change. The contemplation/preparation stage was defined as responses from 1 to 6 and pre-contemplation as responses from 7 to 10. The categorization was based on the median (rounded up) of the scale not from the distribution of responses.

Explanatory variables were considered as primary or secondary (Table 1). The primary explanatory variables were comfort and knowledge, categorization of the accessibility of pediatric dentists, Continuing Education (CE) course taken in the past 24 months, and hours worked per week. Comfort and knowledge were assessed by a 5 point Likert scale of 8 and 6 items, respectively. For comfort, 1 represented "very comfortable", and 5 represented "very uncomfortable". The responses to the comfort items were reverse keyed so that higher scores indicated greater comfort. The responses to the six knowledge items were 1 "strongly agree" to 5 "strongly disagree". Two of the knowledge items were "false" according to professional guidelines so a higher score indicated greater knowledge. Four of the six knowledge items were "true" according to professional guidelines and were reversed keyed so that higher scores indicated stronger agreement and therefore greater knowledge (Table 2). Average comfort and

Table 2: Survey items for comfort and knowledge in delivering preventive care to infants and toddlers (reversed keyed *)

COMFORT QUESTIONS
- Performing an infant or toddler oral health examination?*
- Properly positioning an infant or toddler (0-36 months old) for an examination?*
- Dealing with crying infants or toddlers?*
- Diagnosing dental caries in infants or toddlers?*
- Explaining the infectious nature of early childhood caries and bacterial transmissibility from caregiver to child?*
- Providing preventive services such as fluoride varnish on infants or toddlers?*
- Discussing proper infants or toddlers feeding practice with caregivers?*
- Recognizing dental/orals abnormalities.*

KNOWLEDGE QUESTIONS
- Only bottle-fed children are at risk of early childhood caries.*
- Infants less than 6 months old should receive fluoride supplements is not fluoride water source is available.*
- Fluoride varnish is safe and effective and is recommended for infants and toddlers.
- Pediatric patients are recommended to receive the first dental exam by three years of age.*
- Pacifier use is protective against Sudden Infant Death Syndrome.
- Pediatric patients' ages 1-6 years are recommended to drink 8-12 ounces of juice per day.*

knowledge scores were calculated for each respondent assuming an underlying continuity of the averaged responses. Average scores rather than sums were used to aid in interpretation using the original anchor words. The secondary explanatory variables were gender, year since graduation, categorized race, and categorized county location (Table 1). All geographic data were linked based on zip code information to determine metropolitan vs non-metropolitan practice location.

The survey was pilot tested by six general dentists prior to dissemination. Each dentist was asked about item readability, content validity, and ease of understanding. Modifications were made based on their feedback.

PROCEDURES

Following IRB approval at the University of North Carolina at Chapel Hill, the survey was mailed in the Spring of 2008 to all potentially eligible respondents (N=1010) with a stamped return envelope. The survey was mailed up to three times to non-respondents, with intervals of 6 weeks between mailings. Of those that responded (N= 417), eleven of the responses were discarded: specialists identified in the sampling frame as general practitioners. Data from the 406 usable surveys were entered twice into Microsoft Access (Microsoft, Inc, Redmond, Wash) to ensure accuracy. Insufficient information was available to assess non-responder bias.

STATISTICAL ANALYSIS

The approximately 400 returned surveys represented an adequate sample size to detect medium effect sizes with power=0.80 and alpha d" 0.05 (27). The outcome variable was general practitioners' stage of readiness (pre-contemplation, contemplation/preparation, action/maintenance) to provide treatment to infants and toddlers in their practices. Univariate, bivariate, and proportional odds models were performed using SAS 9.1 (SAS Institute, Inc., Cary, NC) with level of significance set at $p \leq 0.05$ (28). For the bivariate analysis, chi square test was used for nominal variables and one-way ANOVA was used for continuous variables. To assess the association of demographic, practice, and provider characteristics with stage of readiness (pre-contemplation, contemplation/preparation, and action/maintenance), a proportional odds approach using a generalized logits model with main effects was used. In the first model, the primary explanatory variables were forced to be included in the model and a forward selection process was used to assess whether any of the secondary explanatory variables added significantly to the explanation of the outcome. None of the secondary explanatory variables were statistically significant and were removed from the model. A backward selection was then used on the primary explanatory variables in the reduced model to produce a final model.

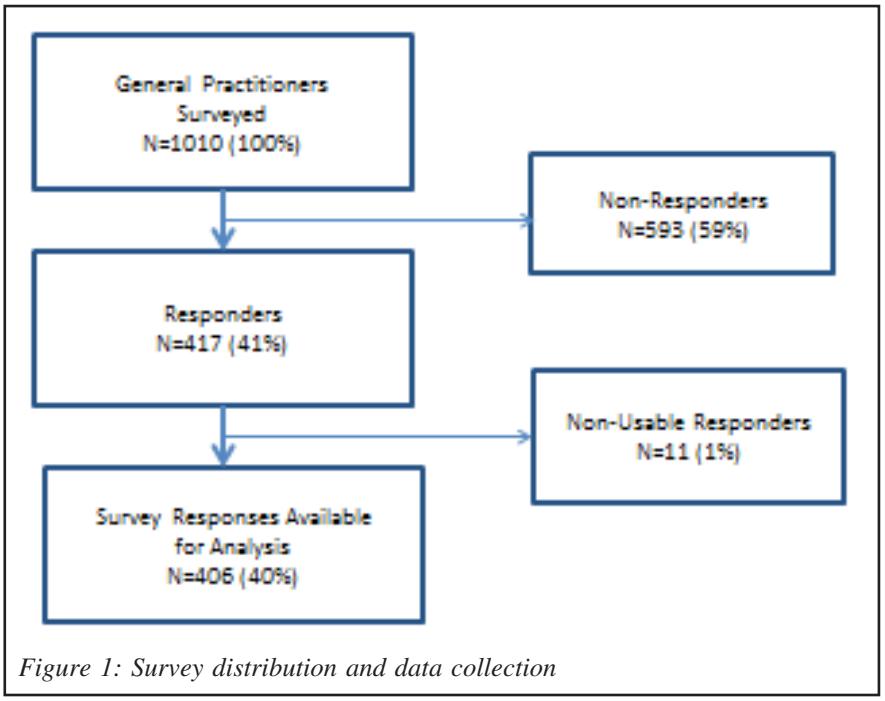

Figure 1: Survey distribution and data collection

RESULTS

Provider response rate was 40% (N=406) (Figure 1). Table 1 provides descriptive statistics for all variables of interest. The total numberof subjects ranged from 393-402, varying based on whether or not the respondent answered the related question. The value that respondents placed on delivering preventive services to infants and toddlers varied from very important (40%) to not very important (23%). On average, practitioners were quite comfortable (median = 3.9) and moderately knowledgeable (median = 2.7). Regarding stage of readiness, 30% of providers indicated not providing services to infants and toddlers (pre-contemplation), 12% were considering it (contemplation/preparation), and 58% were caring for infants and toddlers (action/maintenance).

The bivariate analysis (Table 3) indicated that almost none of the respondents identified as in the pre-contemplation stage had taken a CE course in the past 24 months related to infant and toddler oral health, while approximately 30% of those in the action stage had participated in a CE course ($P<0.0001$). Respondents who chose pre-adult (adolescents, children, and/or infants and toddlers) as their practice type were more likely to be in the action stage than those who chose adult as practice type ($p<0.01$). As might be expected, the majority of practitioners in the active stage thought that the value of preventive care to infants and toddlers was "very important" while only about 12% of those in the pre-contemplation stage thought the value of preventive care was "very important."($p<0.0001$) This variable was excluded in the final analysis, however, because value could be considered as a surrogate for readiness.

Table 3: Bivariate analysis

Categorical Variable	Active		Contemplative		Pre-Contemplative		P value
	N	%	N	%	N	%	p
Accessibility to Pediatric Dentist							
Very accessible	120	51.28	39	54.93	57	60.00	0.33
Somewhat accessible	53	22.65	15	21.13	19	20.00	
Not accessible	61	26.07	17	23.94	19	20.00	
CE Course taken							
Yes	74	31.49	11	15.49	6	6.32	**<.0001 ***
No/Not Sure	161	68.51	60	84.51	89	93.68	
UNC Graduate							
Yes	137	58.30	46	63.89	56	58.95	0.69
No	98	41.70	26	36.11	39	41.05	
Gender							
Female	103	43.83	36	50.00	35	36.84	0.23
Male	132	56.17	36	50.00	60	63.16	
Race							
Caucasian	176	74.89	58	80.56	72	75.79	0.61
Non-Caucasian	59	25.11	14	19.44	23	24.21	
County Type							
Metro	188	80.00	58	80.56	75	78.95	0.96
Non-metro	47	20.00	14	19.44	20	21.05	
Practice type							
Adult	193	82.48	67	93.06	88	92.63	**0.01***
Pre-adult	41	17.52	5	6.94	7	7.37	
Value Preventive Care to I&T							
Very Important	124	53.22	22	31.43	11	11.70	**<.0001***
Somewhat important	85	36.48	33	47.14	30	31.91	
Not very important	24	10.30	15	22.30	53	56.38	

Continuous Variable	Active		Contemplative		Pre-Contemplative		P value
	Median	IQR	Median	IQR	Median	IQR	
Years since graduation	8.00	5.00, 10.00	8.00	5.00, 10.00	8.00	6.00, 10.00	0.66
Comfort	4.3	3.6,4.9	3.8	3.2,4.0	3.4	2.9,3.9	**<.001***
Knowledge	2.7	2.3, 3.00	2.7	2.5, 3.0	2.7	2.3, 2.83	0.14
Hours worked/wk	40.0	35.0, 40.0	38.0	34.0, 40.0	36.0	32.0, 40.0	**0.01***

Table 4 gives the Type III Sum of Squares results from the full proportional odds model. The forward selection process indicated that none of the secondary covariates were statistically significant ($p > 0.15$). The backward selection process indicated that of the primary explanatory variables, only comfort ($p<0.0001$) was statistically significant. For every unit increase in comfort (i.e. as individuals become more comfortable treating infants/toddlers), individuals are 3.42 times more likely to be in the action stage than in the contemplation stage ($p<.0001$), 5.79 times more likely to be in the action stage than in the pre-contemplation stage ($p<0.0001$), and 1.69 more likely to be in the contemplation stage than in the pre-contemplation stage ($p = 0.03$) (Table 5).

DISCUSSION

This study explored factors believed to be related to recently graduated NC general dentists' willingness to deliver preventive

Table 4: Proportional odds model

Type	Variable	DF	Unadjusted		Adjusted after the forward selection		Adjusted after the backward selections	
			Wald $\div^2$	P	Wald $\div^2$	P	Wald $\div^2$	P
Basicexplanatoryvariable	Comfort	2	77.43	<.001	67.54	<.001	77.43	<.001
	Knowledge	2	3.10	0.212	1.83	0.401	Remeoved by the backward selection	
	Access to Pediatric Dentist	4	4.97	0.291	4.12	0.391		
	Continuing Education	2	4.00	0.135	5.64	0.060		
	Hours in Practice	2	0.14	0.933	0.66	0.718		
Potentialexplanatoryvariable	Gender	2	3.74	0.154	Not included by the forward selection		(Already excluded the forward selection)	
	Race	2	1.07	0.585				
	County Type	2	1.11	0.574				
	Years Since Graduation	2	0.80	0.670				

Table 5: Odds Ratios for Comfort

Variable	Action/Maintenance *vs* Contemplation/Preparation		Action/Maintenance *vs* Pre-Contemplation		Contemplation/Preparation *vs* Pre-contemplation	
	OR (95% C.I.)	p	OR (95% C.I.)	P	OR (95% C.I.)	P
Comfort	3.4 (2.1, 5.5)	<.0001	5.8 (3.9, 8.6)	<.0001	1.7 (1.0, 2.7)	0.03

oral health services to infants and toddlers. While it was encouraging that over half (58%) of these NC general dentists who graduated within the past ten years reported delivering oral health services to infants and toddlers in their practices, 30% indicated not providing these preventive services, and an additional 12% were only considering initiating these services. Given the current shortage of pediatric dentists, developing strategies to shift general dentists and their dental team's stage of readiness to deliver preventive care to preschoolers is critically important, and can help expand the safety net for children's oral health. For example, transitioning the estimated 12% of contemplators into the action stage equates to approximately 121 additional dentists that could deliver preventive oral health services to preschoolers in the state. Such an increase is not inconsequential, and could impact the early establishment of a dental home that could lead to increased utilization of preventive services and decreased future treatment costs (5).

Not to be dismissed are the 30% of providers not engaged in this process, the precontemplators. While many may continue to choose to exclude delivering oral health services to this younger population in their practices, it remains important that the precontemplation group be aware of current policy and guidelines related to early childhood oral health so that their patients are equally informed. A recent position statement by the Canadian Dental Association on Early Childhood Caries notes that all dentists should recognize the importance of the age 1 dental visit, and those who choose not to perform the preventive service themselves have a professional responsibility to ensure that children are connected with dentists providing these services to this age group (29).

When considering developing oral health strategies to transition providers through the various stages of readiness, how best to increase comfort should be considered. In our study, comfort emerged as the only statistically significant explanatory variable when comparing all levels of providers' stage of readiness (OR ranging from 1.69 to 5.79). Comfort is a complex construct and is likely influenced by multiple and diverse factors, including providers' training and previous experiences. It is noteworthy that in the bivariate analysis, participation in continuing education was significantly related to the stage of readiness. Thirty-one percent of those in the action stage reported having taken continuing education courses related to infant and toddler oral health, twice the percentage in the contemplation group and five times the percentage in the pre-contemplation group. Sohn *et al* (2004) has indicated that continuing medical education/lecture alone is not a significant predictor of providers' practice behaviours (30). It is possible, however, that in combination with other techniques and when appropriately focused, CE may help promote change and increase comfort. In considering interventions using stage of readiness to promote early childhood oral health care among general dentists, research in the medical arena is promising. Shirazi *et al.* (21) demonstrated that implementing different educational formats that best fit the various categorical staging of readiness among family physicians led to a change to a higher behavioral

stage of readiness related to diagnosing and treating depressive disorders. Their strategies were more time intensive than traditional continuing education courses, including small group workshops with standardized patients, role playing, and buzz group techniques; the latter referring to student groups engaging in short, informal discussions, often in response to a particular sentence starter or question.

Specific to oral health, the literature suggests that efforts to increase provider confidence/self-efficacy that utilize hands-on experiences could further improve a provider's comfort in caring for younger children (2). How best to do this has received limited investigation. In a study by Fein *et al.* (23) fourth year DDS students were exposed to the Baby Oral Health Program (bOHP) and received a series of lectures on infant and toddler oral health, followed by hands on clinical experience in preventive oral health services for this age group. Students exposed to bOHP showed a significant increase in knowledge, confidence, opinions and behaviors reported when compared to the control group. Students who had participated in a rotation caring for children less than three years of age prior to bOHP had higher adjusted average post-confidence scores than their counterparts. These findings suggest that multiple hands on experiences can help increase provider comfort. Consideration of these types of strategies may assist providers in moving towards a more desirable stage of readiness. Similar models of interventions exist in the medical arena as it relates to early childhood oral health, including the American Academy of Pediatrics Chapter Oral Health Advocate (COHA) program. Its impact is currently under investigation (31).

An additional barrier to consider in the implementation of future interventions is the relatively limited understanding by general practitioners of child development and child behavior. Santos *et al.* (7) reported "children too young to cooperate" as the main reason by cited by general dentists for not seeing children 0-2 years of age. In reality, a child crying may facilitate the examination process as the mouth is open, and is an age appropriate reaction in early childhood to lying back in the knee to knee position. Similar work in adolescent medicine reported that providers perceived teenagers as difficult and uncommunicative, and therefore, a main barrier to delivering their care. Participants in this study desired resources and training to increase their efficacy on how to engage with adolescents, which requires an understanding of their development (32).

This study should be considered in the context of its limitations. The Transtheoretical Model continues to be a popular method of studying stage of readiness and behavior change by clinicians and researchers alike (12). The model has received criticism in recent years, however, due to conflicting study results; which are thought to have arisen due to a lack of concordance between varying methods of stage classification and a lack of compatible definitions (33). No formal stage definitions exist, particularly as the model relates to dentistry, as studies in this field are so few. For the purposes of this study, the five stages described by Prochaska *et al.* (11) were collapsed into three stages, thus providing a potential limitation. Other considerations include the limited generalizability of the findings since only recent graduates (less than 10 years in practice) were surveyed, as well as the inherent bias of survey methodology and cross-sectional study design. Although the overall response rate of 40% was low, it is comparable to other surveys of general dentists (7,10). Specific to the survey, the majority of questions were taken from previous surveys assessing this issue and the content validity was reviewed through pilot testing.

In summary, this study supports considerations of using stage of readiness as a key element when developing interventions to encourage general dentists and their teams to implement infant and toddler oral health into clinical practice. Specific recommendations include: First, tailoring interventions to the various stages of readiness; second, identifying learning tools that can be used to encourage clinicians to offer preventive oral health services to young children; and third, including in the development of interventions other aspects of the Transtheoretical Model such as processes of change, self-efficacy and decisional balance. Emphasis on those most ready to become active providers of infant and toddler care (i.e. contemplators) should be an important policy agenda with the greatest potential to increase access to care for this cohort of the population and assist in early establishment of a dental home. Finally, examining factors beyond the individual provider and focusing on more systems approaches to change could further assist in effective provider behavior modifications.

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