

RESEARCH ARTICLE

Examining US Pediatric Residents' Oral Health Care Knowledge, Training, Practices, and Perceptions

Authors

Prithwjit Das, MSED¹, Miriam Singer, BA¹, Haelynn Gim¹, Nicol Awadalla, MD¹, Meng'ou Zhu, BA¹, Ruth Milanaik, DO¹

Affiliations

¹Division of Developmental and Behavioral Pediatrics, Steven and Alexandra Cohen Children's Medical Center of New York, Lake Success, New York

Correspondence

Ruth Milanaik, DO, Division of Developmental and Behavioral Pediatrics, Steven and Alexandra Cohen Children's Medical Center of New York, 1983 Marcus Ave, Suite 130, Lake Success, NY 11042,
Email: rmilanai@northwell.edu
Phone: 516-802-6100

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Abstract

Pediatric residents nationwide (n=187) completed an anonymous survey designed to assess their confidence and knowledge surrounding oral health topics, level of oral health training in residency, attitudes regarding pediatricians' role in oral health care, and likelihood of performing specific oral health tasks. On average, pediatric residents reported feeling "moderately knowledgeable" about preventive oral health topics and "slightly knowledgeable" about developmental oral health topics. Overall, residents answered 62% of preventive oral health questions and 46% of developmental oral health questions correctly. Residents reported receiving low levels of oral health training, with 5 out of 9 oral health topics covered by fewer than 50% of respondents. Most residents agreed that pediatricians play an important role in oral health care but fewer residents routinely performed oral health tasks. Increased emphasis on this subject in residency education is essential for the promotion of children's oral health.

Keywords: oral health; pediatric resident; medical education; dental; oral hygiene

1. Introduction

Over a decade ago, the United States Surgeon General urged the nation to recognize oral health as an integral aspect of overall health.¹ Poor oral health is not an isolated problem and its consequences extend well beyond the confines of the mouth. For example, dental caries (tooth decay) is the most common chronic disease among American children and has been shown to have a negative impact on the social, functional, physical, and psychological well-being of children.^{2,3} Despite the importance of oral health, previous studies have demonstrated that approximately a quarter of children nationwide do not receive preventive dental visits each year.⁴ The issue is particularly severe for low-income and minority children, who are far less likely than other groups to receive preventive dental care.⁵

In light of the many obstacles to dental care, it is essential that primary care providers integrate oral health care into their practice. Pediatricians in particular play an important role in promoting oral health among children. The American Academy of Pediatrics (AAP) recommends that pediatricians provide oral health screening, oral health anticipatory guidance, and fluoride varnish to children. Additionally, the AAP recommends that pediatricians be knowledgeable about the disease process of dental caries, prevention of tooth decay, and emergent dental interventions.⁶ While previous studies have explored the extent to which oral health is covered in clinical instruction and pediatric residents' attitudes surrounding their role in oral health, pediatric residents' knowledge and confidence surrounding oral health topics remain largely unknown.⁷ The few studies that exist on this topic exclusively focus on oral health concepts for children under the age of three, as opposed to general preventive and developmental areas.⁸

This study provides updated insights into pediatric residents' training and attitudes surrounding oral health, as well as new information on their knowledge and confidence regarding preventive and developmental oral health topics.

2. Methods

This study was approved by the institutional review board of the North Shore-Long Island Jewish Health System. An anonymous survey was distributed via email to coordinators and chief residents of 206 different pediatric residency programs nationwide. Coordinators and chief residents were requested to forward to their residents a Web link to the survey along with information regarding the study. Survey administrators were notified when chief residents opened the initial survey email, ensuring that all surveys had been received. Follow-up emails were sent to chief residents and coordinators in order to further encourage them to distribute the survey to their residents. Pediatric residents were eligible to complete the survey if they were currently enrolled in a pediatric residency program in the U.S.

The survey first solicited respondents' postgraduate year (PGY) and demographic information such as their self-identified gender and race. PGY-1, PGY-2, and PGY-3+ (PGY-3 and PGY-4) pediatric residents were then asked which oral health topics they covered as part of their residency curricula at their respective programs. The percentage of residents who reported receiving training was compared across PGY for each topic using chi-squared tests. Then, to determine residents' confidence surrounding oral health topics, residents were asked to self-rate their knowledge of developmental and preventive oral health on a 5-point Likert scale (1=Not Knowledgeable At All, 2=Slightly Knowledgeable, 3=Moderately

Knowledgeable, 4=Very Knowledgeable, 5=Extremely Knowledgeable). Developmental oral health is a subcategory of oral health that focuses on tooth development in children and adolescents. Preventive oral health is another subcategory focused on interventions aimed at preventing oral disease and provides early risk assessment for oral diseases/conditions, anticipatory guidance, and timely referral to establish a dental home.

Pediatric residents were then asked a series of multiple-choice questions (MCQ) to determine the residents' knowledge of specific developmental and preventive oral health topics. The questions were designed based on the "Oral Health Practice Tools" resource developed by the AAP to help provide pediatricians and other medical professionals with the information needed to promote oral health in children.⁹ Questions regarding developmental and preventive oral health topics are displayed in Table 2 and Table 3, respectively. To assess the progression of oral health knowledge acquisition during residency training, correct response rates for each question were compared across residency years using analyses of variance (ANOVA) and, where applicable, pairwise Bonferroni tests.

Finally, pediatric residents rated their level of agreement with the incorporation of oral health assessment, counseling, and referral services into routine well-child visits on a 5-point Likert scale (1=Strongly Disagree, 2=Somewhat Disagree, 3=Neither Agree Nor Disagree, 4=Somewhat Agree, 5=Strongly Agree). They also rated their likelihood of performing four oral health tasks related to topics noted by the AAP's Pediatric Guide to Children's Oral Health on a 5-point Likert scale (1=Extremely Unlikely, 2=Somewhat Unlikely, 3=Neither Likely Nor Unlikely, 4=Somewhat Likely, 5=Extremely Likely).

At the end of the survey, pediatric residents were provided with the correct answers to the preventive and developmental oral health MCQs. Participants also received a digital oral health fact sheet consisting of charts and diagrams summarizing major oral health concerns as well as providing answers to frequently asked questions regarding pediatric oral health care. Pediatric residents can use this fact sheet as an additional resource to ensure that more oral health topics are covered during patient visits.

3. Results

A total of 187 pediatric residents across 35 states completed the survey (63 PGY-1, 54 PGY-2, 66 PGY-3 and 4 PGY-4). Pediatrics residents from 65 different pediatric residency programs, out of 206 total pediatric residency programs contacted, completed the survey. This yielded a response rate of 31.6% for the number of programs with at least one response. Approximately 71% of all respondents were female; 56% of respondents identified as Caucasian, 28% identified as Asian, 12% identified as Black, and 4% identified as "Other."

Table 1 depicts the percentage of pediatric residents who reported receiving training in specific oral health topics during their pediatric residency. Pediatric residents reported receiving the highest level of training in clinical oral health screening (65%), dental disease prevention and early treatment (53%), and dietary practices to promote good oral health (53%). Residents reported receiving the lowest level of training in the relationship between oral and systemic health (28%) and the development of human dentition (14%). There was no significant difference across PGYs in the percentage of residents who reported having received training in 5 out of 9 oral health topics.

Table 1. Reported Coverage of Oral Health Topics in Pediatric Residency Curricula across Postgraduate Years of Training

Oral Health Residency Curriculum Topics	Overall % (95% CI)	PGY-1 % (95% CI)	PGY-2 % (95% CI)	PGY-3 % (95% CI)	P Value*
Clinical Oral Health Screening	65 (57 – 72)	48 (35 – 61)	72 (58 – 84)	74 (62 – 84)	0.002**
Dental Disease Prevention and Early Treatment	53 (46 – 60)	43 (30 - 56)	59 (45 – 72)	57 (45 – 69)	0.14
Dietary Practices to Promote Good Oral Health	53 (46 – 61)	41 (29 – 54)	67 (53 – 79)	54 (42 – 66)	0.023**
Conditions in which Dental Surgery Requires Prophylactic Antibiotics	52 (44 – 59)	52 (38 – 64)	56 (41 – 69)	50 (38 – 62)	0.81
Oral Habits and Early Orthodontic Problems	33 (26 – 40)	25 (15 – 38)	35 (23 – 49)	37 (26 – 50)	0.32
Dental Injuries and Trauma	32 (25 – 39)	17 (9 – 29)	33 (21 – 47)	44 (32 – 57)	0.004**
Dental Caries as Infectious Diseases	32 (25 – 39)	25 (15 – 38)	29 (18 – 44)	39 (27 – 51)	0.25
Relationships Between Oral and Systemic Health	28 (22 – 35)	25 (15 – 38)	28 (16 – 42)	30 (20 – 42)	0.84
Development of Human Dentition	14 (10 – 20)	6 (2 – 15)	22 (12 – 36)	16 (8 – 26)	0.048**

*Results of chi-squared test

**Significant difference across PGYs in percentage of residents reporting coverage

Table 2. Correct Response Rate of Pediatric Residents to Developmental Oral Health Multiple-Choice Questions by †PGY

Developmental Oral Health Question	Overall % (95% CI)	PGY-1 % (95% CI)	PGY-2 % (95% CI)	PGY-3+ % (95% CI)	P Value*
Is variation in the order in which a child's primary teeth come in unusual? <i>Answer: No</i>	91 (86 – 95)	89 (78 – 95)	93 (82 – 98)	91 (82 – 97)	0.77
When do infants typically begin teething? <i>Answer: 4-7 months</i>	82 (76 – 88)	79 (67 – 89)	83 (71 – 92)	84 (74 – 92)	0.74
When do children typically begin losing primary teeth and getting permanent teeth? <i>Answer: 6-7 years</i>	70 (63 – 77)	68 (55 – 79)	63 (49 – 76)	77 (66 – 86)	0.22
How many primary teeth does a child usually have? How many permanent teeth? <i>Answer: 20 primary; 32 secondary</i>	37 (30 – 44)	33 (22 – 46)	37 (24 – 51)	40 (28 – 52)	0.73
What is the order in which a child's primary teeth come in? <i>Answer: Central incisors, first molars, canines</i>	32 (25 – 39)	35 (23 – 48)	30 (18 – 44)	31 (21 – 44)	0.82
Nonnutritive sucking should be discouraged because it can adversely affect teeth alignment. By what age should this behavior end? <i>Answer: 4 years</i>	6 (0 – 11)	10 (4 – 20)	7 (0 – 18)	3 (0 – 10)	0.28
Average Developmental Oral Health Score	53 (51 – 56)	52 (49 – 56)	52 (47 – 57)	55 (51 – 59)	0.69

*Results of ANOVA with PGY as between-subjects factor

†PGY=Postgraduate Year

Table 3. Percentage Correct Response Rate of Pediatric Residents to Preventive Oral Health Multiple-Choice Questions by †PGY

Preventive Oral Health Question	Overall % (95% CI)	PGY-1 % (95% CI)	PGY-2 % (95% CI)	PGY-3+ % (95% CI)	P Value*
How should parents maintain good oral hygiene in infants who have not begun teething? <i>Answer: wipe infant's gums with clean moist gauze pad or washcloth after feeding</i>	88 (83 – 92)	84 (73 – 92)	94 (85 – 99)	87 (77 – 94)	0.21
When should a child begin using fluoride toothpaste? <i>Answer: As soon as first tooth appears</i>	82 (76 – 88)	81 (69 – 90)	87 (75 – 95)	80 (69 – 89)	0.56
What is the risk of excessive fluoride ingestion in children whose teeth are still developing? <i>Answer: Dental fluorosis, or hypomineralization of tooth enamel that can lead to mild white discoloration of the teeth.</i>	77 (70 – 83)	67 (54 – 78)	80 (66 – 89)	84 (74 – 92)	0.047*
Children should transition from using bottles/Sippy cups to regular cups, since drinking from regular cups causes less liquid to collect around the teeth. By when should this occur? <i>Answer: 12-15 months of age</i>	58 (51 – 65)	59 (46 – 71)	54 (40 – 67)	61 (49 – 73)	0.69
How should children under the age of 3 clean their teeth after their first tooth has erupted? <i>Answer: Brush twice a day with a soft nylon-bristle toothbrush and a rice grain-sized smear of fluoride toothpaste</i>	57 (50 – 64)	56 (42 – 68)	56 (41 – 69)	60 (48 – 72)	0.84
What is the earliest stage that children typically can receive dental sealants? <i>Answer: As soon as the first</i>	51 (43 – 58)	44 (32 – 58)	52 (38 – 66)	54 (42 – 66)	.51

<i>permanent molars come in</i>					
Which of the following is the best course of action to take if a child's tooth gets knocked out? <i>Answer: Pick up tooth by crown, rinse gently in water if dirty, reposition tooth in the socket and hold in place by biting down on a piece of gauze</i>	29 (23 – 37)	22 (13 – 34)	28 (16 – 42)	37 (26 – 50)	0.16
Does a child living in a municipality with a fluoridated water supply who exclusively drinks bottled water need fluoride supplements? <i>Answer: No; the child is exposed to fluoride through brushing and food that is cooked in fluoridated water</i>	25 (19 – 31)	22 (13 – 34)	26 (15 – 40)	26 (16 – 38)	0.87
Average Preventive Oral Health Score	58 (56 – 61)	54 (50 – 59)	60 (55 – 64)	61 (58 – 65)	0.054

*Results of ANOVA with PGY as between-subjects factor

** Significant difference in correct response rate across PGY

†PGY=Postgraduate Year

On average, pediatric residents ranked themselves as “slightly knowledgeable” in developmental oral health topics and answered 46.2% of developmental oral health MCQs correctly. Table 2 presents correct response rates for specific questions related to developmental oral health. For all questions regarding developmental oral health, there were no statistically significant differences in correct response rates across pediatric residency years. Residents were least likely to respond accurately when asked about nonnutritive sucking, the order in which a child’s primary teeth come in, and the number of primary and permanent teeth children usually have. They were most likely to respond

accurately when asked whether variation in the order of primary teeth development is unusual and about the age at which infants typically begin teething.

On average, pediatric residents ranked themselves as “moderately knowledgeable” on preventive oral health topics and answered 62% of preventive oral health questions correctly. Table 3 depicts their correct response rates for specific questions related to preventive oral health topics. There was no statistically significant difference in correct response rates across pediatric residency years for all but one question (the risk of excessive fluoride ingestion in children with developing teeth). Specifically,

PGY-3+ residents achieved a significantly greater ($P=0.047$) correct response rate (84%) compared to PGY-1 residents (67%) on this question. There was no statistically significant difference in correct response rates on any question between PGY-1 and PGY-2 residents or between PGY-2 and PGY-3+ residents. Pediatric residents were least likely to respond correctly when asked about the necessity of fluoride supplementation, the best course of action to take if a child's tooth gets knocked out, and the earliest age at which children typically can receive sealants. They were most likely to respond correctly when asked about the ways parents can maintain good oral hygiene in infants who have not yet begun teething, the age at which a child should begin using fluoride

toothpaste, and the risk of excessive fluoride ingestion in children whose teeth are still developing.

Figure 1 depicts residents' average perceptions on the incorporation of oral health services into well-child visits. The majority of pediatric residents agreed that oral health services such as routine assessment for early signs of dental problems, counseling on the prevention of dental problems, and referral to a dentist by 12 months of age should be incorporated into well-child visits. There was no statistically significant difference in perceptions of the pediatrician's role in oral health services between PGY-1, PGY-2, and PGY-3+ pediatric residents.

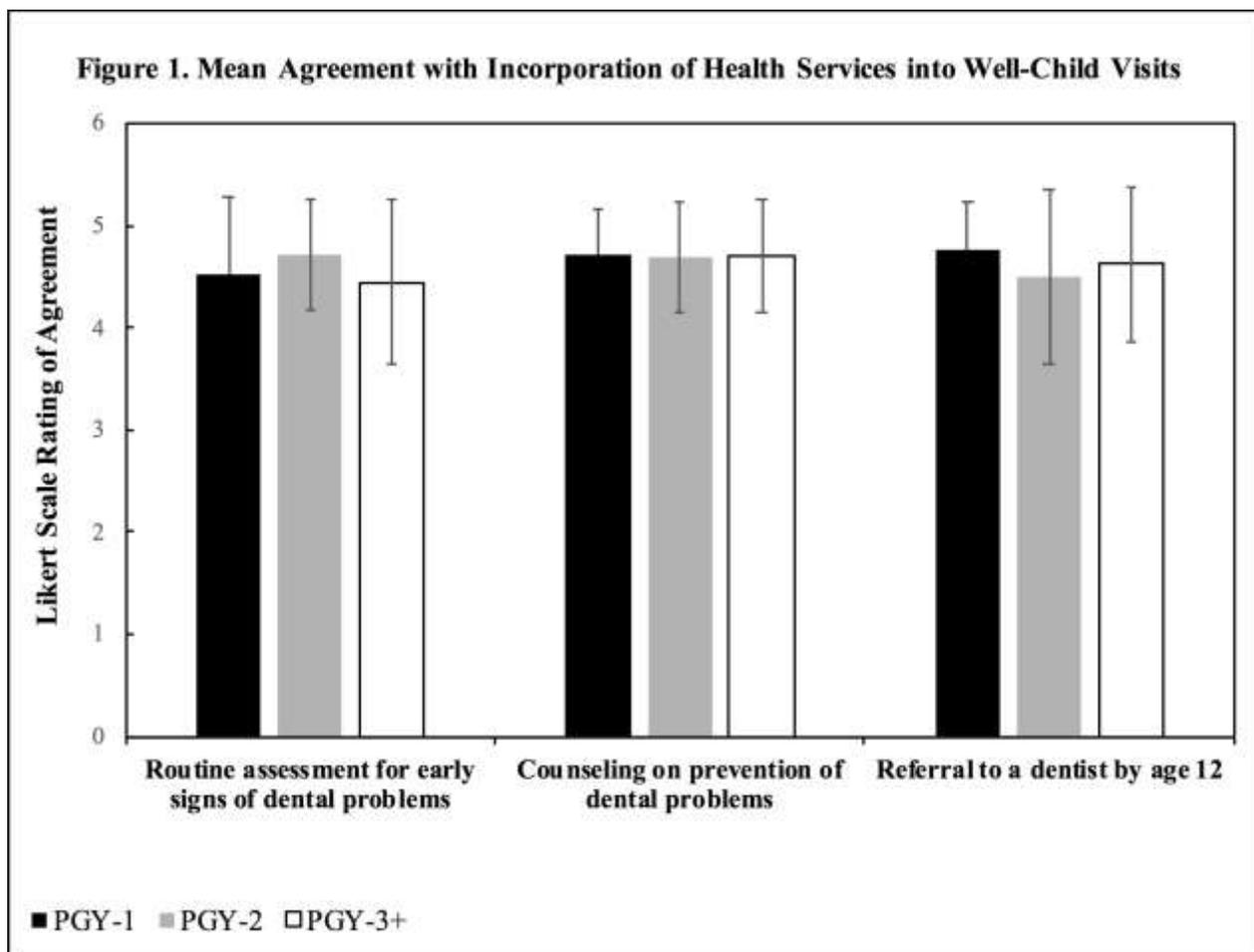
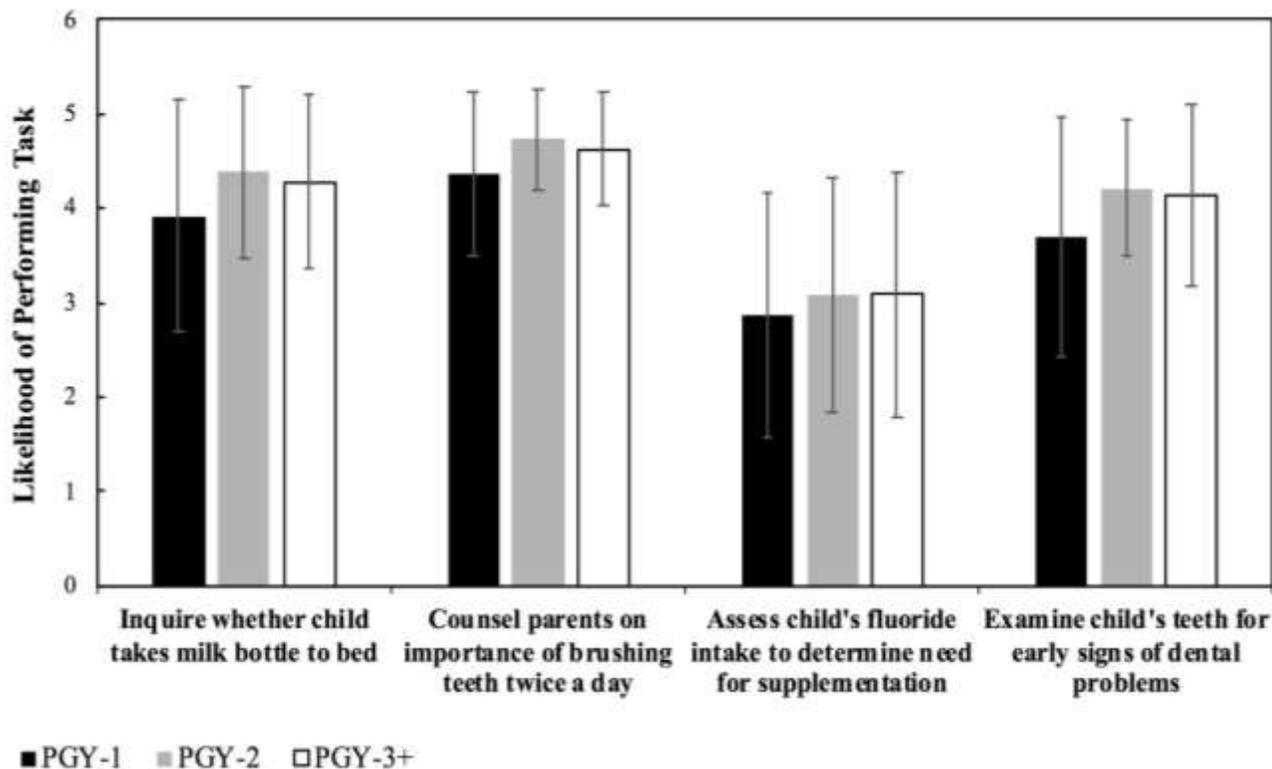


Figure 2 shows pediatric residents' likelihood of performing certain oral health tasks in pediatric practice. During all years of training, pediatric residents were most likely to report

counseling parents on the importance of brushing teeth twice a day and least likely to report assessing a child's fluoride intake to determine the need for supplementation.

Figure 2. Mean Likelihood of Performing Oral Health Tasks in Pediatric Practice



4. Discussion

Every year, millions of children in the United States do not receive dental care.¹⁰ There are numerous barriers to early preventive dental care in the United States. For example, approximately 45 million Americans live in "dental shortage areas" where there is a scarcity of dentists relative to the population, making it difficult to access dental services.¹¹ Even in areas with a sufficient number of dentists, other obstacles frequently prevent children from receiving routine dental care. For example, low reimbursement rates and burdensome administration requirements have resulted in many dentists choosing not to accept publicly

insured patients, making it difficult for low-income children to obtain oral health services.^{12,13} Furthermore, even though the American Academy of Pediatric Dentistry recommends that children visit a dentist by one year of age, many dentists will not see children under the age of two or three years old.¹⁴

This dental care gap can have significant consequences on the oral health and overall well-being of infants and children. For example, without preventive dental care, children are far more likely to experience dental caries, a condition that affects approximately 24% of children two to four years of age and 53% of children six to eight years of age.¹⁵ Dental caries

can make it painful to eat, causing children to lose weight and experience reduced nutritional status that can result in lifelong consequences.^{16,17} Additionally, children with poor oral health are approximately three times more likely than their peers to miss school due to dental pain; each year, over 51 million school hours are lost because of dental-related illness. This can result in lower school performance and impaired academic development.¹⁸ Finally, without proper dental screening and treatment, minor oral health problems may deteriorate into severe conditions that can lead to serious systemic disease and require expensive medical care in the emergency department.¹⁹ In 2012, more than 212,000 children visited the emergency room for dental reasons.²⁰ These oral health crises are dangerous for children and can be costly and traumatic for their families.

Given the dental care gap and the wide-ranging consequences of poor oral health, primary care providers, including family physicians, nurse practitioners, and physician assistants play an essential role in the promotion of oral health.²¹ Pediatricians, in particular, are at the frontlines of children's health and must play a major role in caring for their dental health needs. For example, while 89% of infants and one-year-olds have visited a pediatrician, only 1.5% have visited a dentist.^{18,22} Overall, pediatricians have the opportunity to identify oral health problems seven times more frequently than dentists in children under the age of three years old.²³ Thus, it is crucial that pediatricians are equipped with the knowledge necessary to prevent and address oral health problems.

However, our results are consistent with previous studies suggesting that pediatric residents receive little oral health education during their residency training.²⁴ Less than 50% of PGY-3+ pediatric residents surveyed reported having received training in the following areas:

oral habits and early orthodontic problems, dental injuries and trauma, dental caries as infectious diseases, relationship between oral and systemic health, and development of human dentition. Furthermore, the percentage of residents who reported having received training did not increase across PGY for 5 out of 9 oral health topics surveyed, which suggests that residents may not be incurring training as they progress through the curriculum. This is particularly significant given that residents may have not covered these topics during medical school either, as 70% of U.S. medical schools offer under five hours of oral health education per year and 10% offer no oral health curriculum at all.²⁵

The lack of oral health training during residency may help explain the residents' lack of confidence surrounding oral health topics and significant deficit of knowledge in this area. On average, pediatric residents rated themselves as only "slightly knowledgeable" on the topic of developmental oral health and only "moderately knowledgeable" on the topic of preventive oral health. Their MCQ scores confirmed this lack of knowledge. Particularly concerning is the fact that there was little or no significant difference across residency years in oral health MCQ scores, further suggesting that there was little acquisition of oral health knowledge over the course of residency training. Together, the pediatric residents' lack of confidence and knowledge may explain the fact that while the pediatric residents surveyed agreed that oral health services should be a part of routine well-child visits, they were far less likely to actually provide these services. While pediatric residents acknowledged the important role that they play in oral health care, without adequate preparation and training, they may not feel prepared to deliver essential oral health services to children.

The results demonstrate the importance of enhanced oral health training of pediatric residents – our nation’s future pediatricians – during residency. Pediatric residents often experience busy schedules, with little room for additional instruction. However, studies have shown that just a 30-minute Web-based training session can significantly improve residents’ knowledge surrounding preventive oral health subjects.²⁶ Thus, Web-based training provides the opportunity to disseminate oral health information to pediatric residents in a manner compatible with their busy schedules. These programs are widely accessible and include online educational tools such as *Smiles for Life: A National Oral Health Curriculum*.²⁹ Moreover, previous studies have demonstrated that an interprofessional approach to oral health training involving an oral health professional can be extremely effective. Thus, pediatric residency programs should also consider collaborating with oral health professionals, such as dentists or dental hygiene educators, in order to promote oral health training.²⁷

One limitation of this study is the non-response bias of pediatric residents that may have resulted in a sample that is not fully representative of the overall pediatric resident population. Moreover, while responses were gathered from the majority of states throughout the country, only 187 pediatric residents completed the survey. This relatively small sample size may limit the generalizability of the

data. Additionally, pediatric residents were asked about their likelihood of performing oral health tasks, but they may have been more inclined to report performing specific tasks than they actually perform in practice due to social desirability bias. Finally, it is important to note that pediatric residents are still learning, and that their provision of oral health care services could change as they gain more experience. Despite these limitations, this study is an important step towards understanding pediatric residents’ perceptions and attitudes regarding the role of the pediatrician in oral health care, their oral health training during residency, and their confidence and knowledge surrounding oral health.

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