Educating Physicians to Detect Dental Caries: Evaluating a Simple Teaching Method

Glenn Canares

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science in Dentistry

University of Washington

2013

Committee:

Joel H. Berg

Travis M. Nelson

Heather A. McPhillips

Program Authorized to Offer Degree:

Pediatric Dentistry

University of Washington

Abstract

Educating Physicians to Detect Dental Caries: Evaluating a Simple Teaching Method

Glenn Canares

Chair of the Supervisory Committee:
Dean, Joel H. Berg
Office of the Dean

Purpose: The primary objective of this study is to evaluate the effect of a fifteen minute educational intervention on the ability of pediatric medical residents to detect caries during a thirty second oral exam. The secondary objective of this study is to evaluate attitudes and opinions regarding the training and integration of dentistry into medicine among the participating pediatric medical residents.

Methods: Physicians enrolled in pediatric residency were recruited to participate in a survey and teaching intervention. The survey was administered to 38 first year residents. A total of 7 pediatric residents participated in the intervention. For the intervention each performed a preliminary oral examination of 2 different child volunteers, identifying the number of carious teeth. A 15 minute teaching intervention was then administered to participants by the primary researcher. Afterwards, each participant performed an oral examination on 2 different children with the use of a dental mirror, identifying the number of carious teeth. Descriptive statistics were calculated for resident survey responses pre and post intervention. Carious lesions detected

pre and post intervention were also assessed (Stata 12.1). Additionally, descriptive survey statistics were calculated for first year residents who did not participate in the intervention and only completed the survey.

Results: There was a reduction in net difference of carious teeth identified after the intervention, however participants misidentified carious lesions before and after the intervention. Survey responses indicated that major barriers to dental mirror use include inadequate training and lack of availability of mirrors.

Conclusions: The dental mirror training intervention did not appear to have an impact on the accuracy of identification of dental caries by pediatric residents. Attitudes and opinions regarding oral health may affect the acceptance of limited and focused dental education training. Multiple barriers exist to the integration of dentistry into medicine. Educational efforts should focus on improving cross-disciplinary training and interprofessional collaboration.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Figure number Page

LIST OF TABLES

Table number Page

ACKNOWLEDGEMENTS

I wish to express my deepest thanks and appreciation to my thesis committee: Drs. Joel Berg, Travis Nelson and Heather McPhillips. Thank you to Dr. Joanna Scott for your invaluable help with data analysis. Additionally, thanks to each one of my co-residents for the support throughout my project.

DEDICATION

I dedicate this thesis to my wife, Therese, who has always supported my dreams in life, no matter how lofty. Your love and support these last two years helped make me a better person for you and me.

Introduction:

Pediatric oral health education is not optimally integrated into pediatric residency programs in the United States. As a result, pediatricians are inadequately trained to assess children's oral health status. Nationwide, it is recognized that medical education must integrate the disciplines of pediatric medicine and pediatric dentistry to more comprehensively care for children. Integration of disciplines has a multi-factorial etiology that includes knowledge levels, attitudes and opinions regarding various aspects of oral health, barriers to implementation and the types of interventions used to enact change. A significant body of research has been performed to investigate these factors, suggesting multiple areas upon which to further the understanding of them.

The current state of pediatrics encourages integration with other health disciplines, and policies have been set in place to create a framework to achieve this. Leaders in medical education have undertaken initiatives to integrate medicine and dentistry which can serve as a model to other programs throughout the United States. Medical school faculty interviews and course analysis indicated need for development of five learning themes including dental public health, caries, periodontal disease, oral cancer, and oral-systemic interactions.[1] Pediatric policy papers recommend mandated physician education, quality teaching and educational content, outcome evaluation, and medical-dental collaboration. These policies suggest that that researchers, program developers, and funders should incorporate an evaluation component into each of these efforts, including assessment of the effects on the oral and overall health of the children they serve.[2] The official policy statement from American Academy of Pediatrics (AAP) in December 2008 states that it is critical that pediatricians be knowledgeable about dental caries, prevention of the disease, and interventions available to the pediatrician and the family.[3] A cross-sectional study concluded that

"medical education needs to address self-efficacy in providing risk assessment, early detection, and referral services. Traditionally, didactic instruction does not fulfill these requirements, but instructional methods for teaching medical providers oral health care, particularly confidence-building aspects, is untested and controlled evaluations are necessary. Indeed, it has been stated that effective and appropriate involvement of pediatric primary care clinicians can be expected only after they receive the appropriate training and the referral system is addressed".[4]

In order to enforce these policies, pediatricians' knowledge and attitudes towards oral health must be assessed, and barriers to implementation have to be addressed.

Knowledge levels regarding oral health vary depending on the demographics and educational climate of a region. In 2009, a national survey was sent to the US medical school deans, resulting in the finding that US medical schools offer very little oral health education.[5] Another study assessed basic knowledge of infant oral health of dental and medical students. It revealed variances in knowledge levels, which resulted in inconsistencies in desired outcomes of educational and clinical experiences.[6] Therefore, lack of knowledge of oral health can be an issue. In an attempt to increase the oral health knowledge and skills of physicians, a number of educational interventions have been targeted at medical students, residents, and practicing clinicians. One study provided a 60 minute oral health education slide show presentation and video to family medicine residents. Another study intervened at an outpatient practice of an academic medical center by testing a 1-hour training session for physician and nurses that focused on three dimensions of oral health: diet, hygiene, and development of dental caries. Both studies resulted in an increase in knowledge represented by significant changes in pre and post test scores.[7] Research analyzing short-term retention of this newly acquired knowledge is encouraging and has typically resulted in increased comprehension rates. On the other hand, a long term retention study that tested medical students showed immediate improvement in knowledge in pre and post-testing across a range of oral health topics, however long-term knowledge retention was more limited.[8]

Research has also assessed opinions and attitudes of health care providers regarding the incorporation of oral health into daily practice. These attitudes can have an impact on the ability to integrate the medical and dental disciplines as well. This research addresses multiple topics which include perceived importance of training, confidence in screening and counseling, and the inclusion of oral health in well child visits. One study evaluated attitudes of graduating pediatrics residents toward performing basic oral health screenings. 71% thought that they had too little oral health training and only 21% thought that their residency was very good or excellent in preparing them to perform oral health risk-assessments. They felt confident in their ability to offer anticipatory guidance but less so with performing more technical oral health screenings.[9] A national sample of 1600 pediatricians was surveyed to assess pediatricians' knowledge, attitudes, and professional experience regarding oral health. More than 90% of the respondents agreed that they had an important role in identifying dental problems and counseling families on the prevention of caries.[10] Thus, attitudes are varied and play an important role in the acceptance of oral health education and treatment with medical providers.

Barriers to integration of the medical and dental disciplines can be expected. Some barriers that have been identified are the lack of defined leadership roles regarding oral health, time/work overload in a busy pediatric clinic, lack of real-time tracking systems that determine children's dental needs, and billing/medical record concerns.[11] Other barriers have included difficulty in applying fluoride varnish, resistance among office personnel, and difficulties in referring children to the dentist. The medical offices most successful in adding oral health services to their practices made important changes to their office procedures, including training everyone in the practice, designating a staff person responsible for each of the clinical services, keeping supplies in a central location, and checking patient eligibility at every encounter.[7] Another survey indicated that the most common barrier to participation in oral health-related

activities was lack of training.[12] Strong impediments to integration have been identified and must be addressed in order to properly incorporate oral health as part of the routine pediatric exam.

Medical practices are capable of integrating oral health regardless of knowledge discrepancies, attitudes towards oral health, and barriers. A study based in North Carolina showed that regardless of the method used for incentive or follow-up, a relatively high proportion of practices appeared capable of adopting preventative dental services.[13] However, prior to providing preventive dental services it is critical that pediatric health care providers master the skills of caries identification and appropriate referral of children to a dentist. At health care maintenance visits pediatricians routinely perform a full physical exam but may not include an assessment of the oral health. The available research demonstrates both promising and discouraging results. In one investigation, a full group of pediatricians received Web-based training and then received no hands-on education by a dentist, that group was compared to another that received hands on training. Results included increased self-confidence regarding counseling, risk assessment and referral in both groups, but there were no significant changes for documentation of referral or anticipatory guidance. Approximately four months later at the end of the study, there was a significant overall decline in resident opinions concerning the value of incorporating preventative dental care in well child visits with the greater decline in the hands-on training group.[14] An additional research investigation studied the accuracy of pediatric primary care providers' screening and referral for early childhood caries. These pediatricians were exposed to a two hour training session for detection of caries and referral. Results suggest that participants tended to under-count the number of teeth with carious lesions as well as under-refer children to a dentist.[15] The results of these investigations suggest that physicians can be taught to integrate various aspects of oral health into exams after training. However, following the

training, intervention opinions regarding the importance of oral health decline as did performance of these actions in practice.

It can be concluded that the integration of the oral health examinations by primary care providers into a routine well child checkup is currently not optimal. Multi-factorial influences such as knowledge discrepancies, differences in attitude, and barriers to integration reinforce the concept that further research is needed to reconcile the gap between training and incorporation into practice. It is essential for primary care medical providers to identify early caries so that an early referral to a dental provider can be made. An overarching goal of the pediatric dental community is to promote earlier referral of a child to a dentist, consequently reducing complications from caries including need for restoration (i.e. 'fillings') or abscess formation. Dental caries may appear on any surface of the tooth, however when only using direct visualization, much of a tooth cannot be seen during the oral examination. When used correctly, a dental mirror serves as a simple tool which can substantially increase the visualization of hard to see tooth surfaces. The dental mirror aids a clinician in viewing the difficult to visualize lingual (posterior) surface of teeth, thus aiding the physician in detecting more early lesions during the screening process.

Purpose:

The purpose of this study is to investigate the effect of an educational module for pediatric medical residents at the University of Washington on the ability to detect carious lesions.

1) Primary goal: To evaluate the effect of a 15 minute educational intervention applied to pediatric medical residents on detection of caries.
2) Secondary goal: To evaluate pediatric residents' attitudes and opinions regarding the training and integration of dentistry into medicine.

Null Hypothesis: There is no difference in the number of primary dentition carious lesions detected by pediatric medical residents prior to and after completing a fifteen minute teaching intervention in the use of a mouth mirror.

Methods:

This study protocol was reviewed and approved by the Institutional Review Board (IRB) at the University of Washington.

Study Design: Cross sectional pilot study. The study consisted of a hands-on educational intervention for pediatric residents at the University of Washington, paired with an additional survey component.

Population: The study population was first year pediatric residents at the University of Washington. The number of potential providers totaled 38. There were two major residency groups:

1. First year pediatric medical residents at the University of Washington Roosevelt continuity care clinic. There were 12 active residents at this location. They served as participants in the intervention and survey component of the study.
2. First year pediatric medical residents at the University of Washington (other than the Roosevelt clinic). These residents had a continuity clinic in the WWAMI (Washington, Wyoming, Alaska, Montana, and Idaho) region. These residents consisted of the remaining 26 participants and were only eligible to participate in the survey component of the study.

Patients of record at the Center for Pediatric Dentistry (CPD), a University of Washington pediatric dental outpatient clinic that primarily serves low to middle income class families in Seattle, participated as volunteers for the intervention exams.

Inclusion and Exclusion Criteria: First year pediatric residents at the University of Washington who agreed to participate were included in the study. Second or third year residents were excluded as they may already have received integrated oral health training through the residency or from a dental community health rotation at the Center for Pediatric Dentistry.

Inclusion criteria for patient volunteers were presence of at least 4 primary teeth in the dentition, age younger than 7 years, and parent/guardian willing to have their child examined up to 6 times during one visit. Age 7 was chosen as the age threshold because a majority of children have naturally exfoliated the primary maxillary central incisors by this age (i.e. "baby teeth"), and early referral to dentists for early caries is essential in preschool to early school-aged children.

Enrollment of Subjects and Patient Volunteers: IRB approved recruiting emails asking for participation in the either the intervention (Roosevelt) or survey-only component (Other) were sent to first year pediatric residents, respectively. Institutional email addresses for each resident were obtained from the pediatric residency director. Participation was voluntary. For intervention subjects that agreed to participate, the residency director and clinic manager helped coordinate dates and times that did not interfere with clinical duties. Consent forms were signed on the day of the intervention.

Existing patients of the Center for Pediatric Dentistry were eligible to participate in the study as volunteers. During the principal investigator's (GC) continuity dental clinic, children were screened by convenience for inclusion criteria. If a child qualified for the study, the parent(s) of the child was approached after a routine dental examination to determine if they would like to participate in the study. Parents were approached by a research assistant, a dental assistant, or the investigator (GC) using an IRB approved recruiting script. Regardless of the response, the dental care provided to the child was not affected. If the parent(s) agreed to participate in the study, written informed consent was obtained. The parent(s) was emailed instructions, a copy of the consent form, given logistic information for participation at the Roosevelt continuity care clinic. They were informed that if their child was unable to tolerate the oral examinations they could take breaks as needed or stop participation at any time.

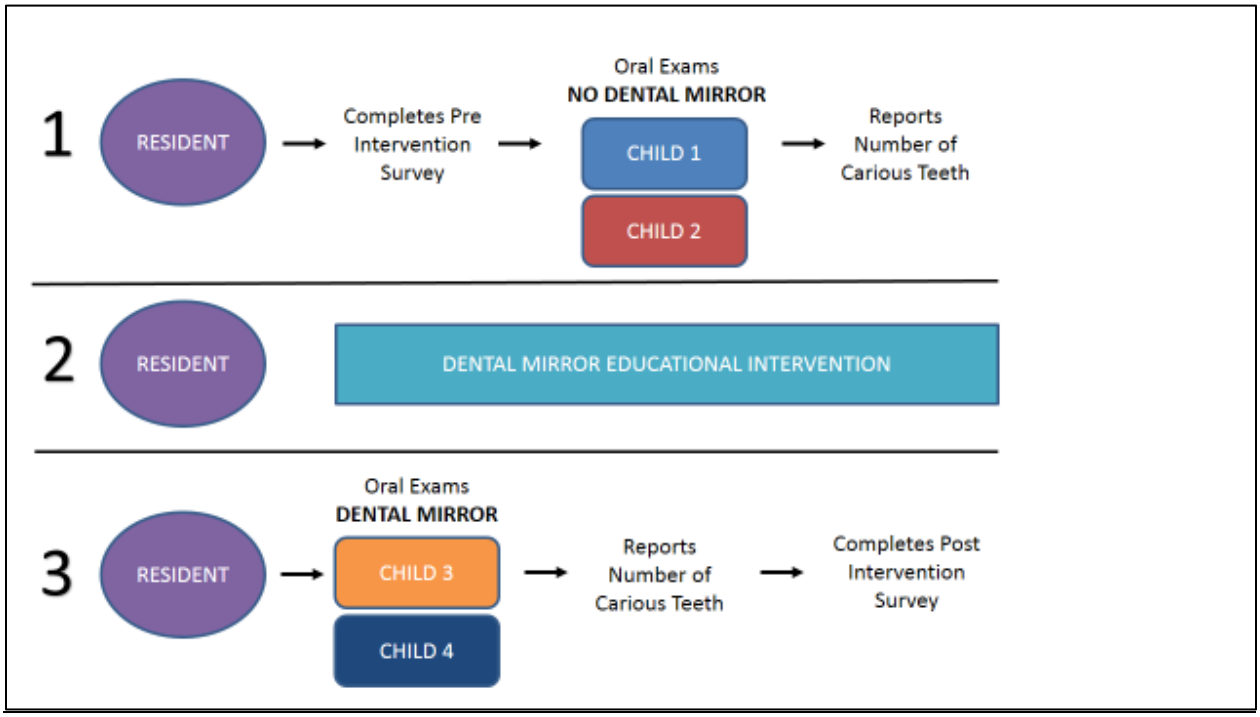
Intervention: The dental caries identification intervention consisted of a fifteen minute Powerpoint lecture and live demonstration that focused on recognizing carious lesions using a dental mirror. The intervention discussed the following concepts: importance of detecting caries, definition of caries, etiology of caries, detection method, exam positioning, and technique demonstration. Participants were taught to detect the full range of carious lesions (early to late), with a particular focus on the maxillary primary incisors and posterior primary molars. These teeth were chosen because they are difficult to visualize without the use of a mirror. This intervention was developed based on established educational content developed by pediatric dental faculty at University of Washington. Additionally, a prototyping session with two pediatricians was performed to gather feedback and tailor the mirror usage skills to fit into a typical health care maintenance visit. Factors such as clinical setting, regularly available clinical tools, and time constraints were taken into consideration. The result totaled approximately 10 to 15 minutes which included lecture and mirror usage demonstration. Figure 1 summarizes the methodology for the intervention.

The teaching intervention took place at a University of Washington Roosevelt pediatric continuity care clinic. Residents participated in batches of 3 to 4 people with 4 recruited patient volunteers at 2 different sessions. Two examination rooms were designated as spaces to perform oral examinations. The educational intervention and mirror demonstration took place in the educational conference room. Compatible dates for the 2 clinic sessions were designated for this study in coordination with the clinical manager, pediatric residency program director, pediatric residents, and patient volunteers.

Each resident was assigned a unique identification number and performed oral examinations of 2 different child volunteers, resulting in a total score that included the number of carious lesions detected and the corresponding teeth. The 15 minute dental caries identification

intervention was then administered to the residents by the primary researcher (GC). Afterwards, each resident performed oral examinations on 2 different children with the use of a disposable dental mirror. The primary researcher was present at each exam to observe each of the pediatric residents' oral examinations and record the number of carious lesions identified for each tooth. The initial dental examination at the Center for Pediatric Dentistry was approved by the attending dentist and provided the "correct" number and location of caries lesions for comparison. After completion of the examinations, parents of the child volunteers were provided with gift cards as a token of appreciation for participating.

Figure 1. Intervention Methodology



Survey Implementation: Each participating resident at the Roosevelt continuity care clinic completed a survey assessing participant demographics and opinions. This survey was labeled "pre-training" to indicate that it was administered prior to the teaching intervention. At the end of the teaching intervention and application of the exam skills, each of these residents completed the remainder of the survey labeled "post-training." This component asked participants to evaluate the training that was received. Both surveys were based on questions derived from previous research.[16]

Residents that qualified for the survey-only component of the study received an initial recruitment email. It contained a brief description of the study and a link to a University of Washington's online electronic survey program, Catalyst. Catalyst was used for confidential survey delivery and collection of data. Each respondent was assigned a unique identification number. Reminders to participate were sent every 2 weeks during a six week window.

Data Analysis: Descriptive statistics were calculated for survey responses for all respondents, survey responses for intervention participants post intervention, and number of caries detected pre and post intervention (Stata 12.1).

Results:

Survey Responses: There were a total of 38 first year residents in the University of Washington pediatric training program during the study period, each with active email addresses. After a six week time window to take the electronic survey, the final response rate was 50% (N = 19).

Provider Demographics (Table 1): Of the 19 respondents, 12 (63%) were female. All respondents were under the age of 35, the majority being 25-29 years old (63%). The most prevalent racial background was White (84%) followed by Hispanic (11%) and Black or African American (5%). All residents were graduates of a medical school in the United States.

Most residents (90%) had visited a dentist in the last year and only 2 (12%) had received some form of restorative dental treatment at that visit. Almost half (47%) had experienced dental caries themselves in the last five years. Only one respondent had children under the age of 18. This respondent's child or children visited a dentist in the last year for restorative treatment and had a history of dental caries in the last five years.

Table 1. Demographic Characteristics of Respondents to Oral Health Questionnaire at the University of Washington Pediatric Resident Program

	N	%
All	19	100%
Gender		
Male	7	37%
Female	12	63%
Age groups		
20-29	12	63%
30-39	7	37%
Racial Background		
American Indian or Alaska Native	0	0%
Asian	0	0%
Black or African American	1	5%
Hispanic	2	11%
Native Hawaiian or Other Pacific Islander	0	0%
White	16	84%
Other		
U.S. Medical School Graduate	19	100%
Visited Dentist in Last Year	17	90%
Received Dental Treatment	2	12%
Had Dental Caries in Last Five Years	9	47%
Have Children Less than 18 Years Old	1	5%
Child Visited Dentist in Last Year	1	100%
Child Received Dental Treatment	1	100%
Child Had Dental Caries in Last Five Years	1	100%

Confidence in Screening and Counseling (Table 2): Eleven (58%) respondents were not very confident in identifying white spot lesions (early caries) followed by 6 (32%) who were somewhat confident. For confidence in identifying cavitated lesions (late caries), 13 (68%) respondents were somewhat confident and 4 (21%) were very confident. Ten (53%) were not very confident in examining for tooth decay without a mirror and 12 (63%) were not very confident in examining for tooth decay with a mirror, respectively. Confidence in evaluating caries risk at high, moderate, or low resulted in 10 (53%) respondents as not very confident followed by 8 (42%) as somewhat confident. The most common response to confidence in

referring children to the dentist was “very confident” with 13 (68%) participants expressing this opinion.

A majority of respondents (68%) were not very confident in providing caregivers with information about their child’s dental development such as eruption timing and sequence. Ten (53%) were somewhat confident in providing counseling on explaining the caries process to these caregivers. For confidence in recommending dietary practices to prevent dental caries, 15 (79%) residents were either somewhat confident or very confident. Most respondents (63%) were somewhat confident in providing guidance in cessation of oral habits which included thumb sucking and pacifier use. Seventeen (89%) were either somewhat confident or very confident in recommending oral hygiene practices to prevent dental caries. Seven (37%) residents were not very confident in providing appropriate guidance for fluoride use, while 8 (42%) were somewhat confident. Similarly, 8 (42%) respondents were not very confident in providing guidance on prevention of dental injuries, while 9 (47%) were somewhat confident.

Table 2. Residents' Responses to Individual Confidence Items				
	Uncertain About My Confidence N (%)	**Not Very Confident N (%)**	**Somewhat Confident N (%)**	**Very Confident N (%)**
Screening:				
Identifying tooth decay				
White spot lesions (early caries)	1 (5%)	11 (58%)	6 (32%)	1 (5%)
Cavitated lesions (late caries)	1 (5%)	1 (5%)	13 (68%)	4 (22%)
Examining for tooth decay without a mirror	1 (5%)	10 (53%)	8 (42%)	0 (0%)
Examining for tooth decay with a mirror	14 (22%)	12 (63%)	3 (15%)	0 (0%)
Evaluating caries risk (high, moderate, or low)	1 (5%)	10 (53%)	8 (42%)	0 (0%)
Referring children to the dentist	0 (0%)	2 (11%)	4 (21%)	13 (68%)
Counseling				
Providing caregivers with information about their child's dental development	2 (11%)	13 (68%)	4 (21%)	0 (0%)
Explaining the caries process to caregivers	1 (5%)	6 (32%)	10 (53%)	2 (10%)
Recommending dietary practices to prevent dental caries	0 (0%)	4 (21%)	9 (47%)	6 (32%)
Providing guidance in cessation of oral habits	1 (5%)	5 (27%)	12 (63%)	1 (5%)
Recommending oral hygiene practices to prevent dental caries	0 (0%)	2 (11%)	11 (58%)	6 (31%)
Providing appropriate guidance for fluoride use	1 (5%)	7 (37%)	8 (42%)	3 (16%)
Providing guidance on prevention of dental injuries	1 (5%)	8 (42%)	9 (48%)	1 (5%)

Inclusion of Dental Practices in Well-Child Visits (Table 3): Most respondents either somewhat or strongly agreed (95%) with inclusion of evaluation of a child's teeth for decay in pediatric well-child visits. Slightly less than half (47%) strongly agreed that the visit should include examination of the mouth for soft tissue pathology. Strong agreement responses for counseling on the following dental problems were: dietary risk factors (63%), oral hygiene instructions (63%), fluoride use (37%), non-nutritive mouth habits (47%), and trauma to the oral cavity (26%). A majority of the respondents somewhat or strongly agreed that the well-child visit should include risk assessment of dental problems (95%), application of fluoride varnish to moderate or high caries risk children (90%), and a referral to a dentist at the age of 12 months (79%).

Table 3. Residents' Responses to Inclusion of Dental Practices in Well-Child Visits				
	Strongly Disagree N (%)	**Somewhat Disagree N (%)**	**Somewhat Agree N (%)**	**Strongly Agree N (%)**
Evaluation of the child's teeth for decay	0 (0%)	1 (5%)	6 (32%)	12 (63%)
Examination of the mouth for soft tissue pathology	1 (5%)	4 (21%)	5 (26%)	9 (48%)
Prevention of the following dental problems:				
Dietary risk factors	0 (0%)	0 (0%)	7 (37%)	12 (63%)
Oral hygiene instructions	0 (0%)	0 (0%)	7 (37%)	12 (63%)
Fluoride use	0 (0%)	2 (11%)	10 (53%)	7 (36%)
Non-nutritive mouth habits	0 (0%)	4 (21%)	6 (32%)	9 (47%)
Trauma to the oral cavity	0 (0%)	5 (26%)	9 (48%)	5 (26%)
Risk assessment of dental problems	0 (0%)	1 (5%)	10 (53%)	8 (42%)
Application of Fluoride varnish to moderate and high risk caries risk patients	0 (0%)	2 (11%)	11 (58%)	6 (31%)
Referral to a dentist at 12 months old	0 (0%)	0 (0%)	4 (21%)	15 (79%)

Areas of Importance in Oral Examinations (Table 4): All respondents somewhat or strongly agreed that the evidence of disease or infection was of high importance during an oral exam. Residents strongly agreed that the health of the tonsils and posterior oropharynx (63%) and the health of the teeth and gums (58%) were highly important.

Use of Dental Mirrors in Oral Examinations (Table 4): The majority (90%) of respondents strongly or somewhat disagreed with the statement "I have the time to perform a mirror exam during well child exams." Additionally, all respondents strongly or somewhat disagreed with having adequate training to perform a mirror exam. Most (73%) residents somewhat or strongly agreed that they would use dental mirrors routinely if readily available in the clinic. Six (31%) somewhat agreed, while five (26%) somewhat disagreed whether they would use a dental mirror to assess the posterior oropharynx instead of a tongue depressor. Respondents somewhat or strongly agreed that the following were barriers to using a dental mirror regularly: convenience (95%), training (100%), availability (100%), institutional support (84%), reinforcement from attending physicians (84%), accountability for use (63%), and relationship with dentists (52%).

Table 4. Residents' Responses Regarding Oral Examinations and Dental Mirror Usage				
	Strongly Disagree N (%)	**Somewhat Disagree N (%)**	**Somewhat Agree N (%)**	**Strongly Agree N (%)**
Have the time to perform a mirror exam during well child exams	5 (26%)	1 (63%)	2 (11%)	0 (0%)
Have adequate training to perform a mirror exam during well child exams	14 (74%)	5 (26%)	0 (0%)	0 (0%)
High importance during an oral exam:				
Evidence of disease or infection	0 (0%)	0 (0%)	5 (26%)	14 (74%)
Health of tonsils and posterior oropharynx	0 (0%)	5 (26%)	2 (11%)	12 (63%)
Health of the teeth and gums	1 (5%)	4 (21%)	3 (16%)	11 (58%)
Would use dental mirrors routinely if readily available in the clinic	1 (5%)	4 (21%)	9 (48%)	5 (26%)
Would use a dental mirror to assess posterior oropharynx instead of a tongue depressor	3 (16%)	5 (26%)	6 (32%)	5 (26%)
Strong barriers to using dental mirrors regularly:				
Convenience	0 (0%)	1 (5%)	10 (53%)	8 (42%)
Training	0 (0%)	0 (0%)	4 (21%)	15 (79%)
Availability	0 (0%)	0 (0%)	5 (26%)	14 (74%)
Institutional Support	1 (5%)	2 (11%)	9 (47%)	7 (37%)
Reinforcement from Attendings	1 (5%)	2 (11%)	8 (42%)	8 (42%)
Accountability for Use	2 (11%)	4 (21%)	4 (21%)	8 (42%)
Relationship with Dentists	2 (11%)	6 (32%)	5 (26%)	5 (26%)

Educational Intervention (Tables 5 and 6): In the pre-intervention exams, 2 residents underestimated the total number of teeth with dental caries while 5 of them overestimated the total. Only 3 residents correctly identified some of the teeth with caries, and none of them identified all the carious teeth. All 7 residents either missed a tooth with dental caries or identified a non-carious tooth as carious by a factor of 5 or more teeth. During the post-intervention exams, 3 residents underestimated the total number of teeth with dental with dental caries, 3 overestimated it, and 1 had the correct number. A majority (6 residents) correctly identified at least 2 carious teeth. All participants either missed a tooth with dental caries or identified a non-carious tooth as carious by a factor of 2 or more teeth.

Table 5. Number of Carious Teeth Identified by Pediatric Residents (Pre-Intervention)							
	Total Number of Teeth						
PR*	True Number With Cavities	Correctly Identified	Not Identified	Misidentified	Net Difference**	Total Percentage Correct	Total Number Incorrect (Not Identified or Misidentified)
1	6	0	6	3	-3	0%	9
2	6	4	2	5	3	67%	7
3	6	5	1	5	4	83%	6
4	6	1	5	0	-5	17%	5
5	0	0	0	6	6	0%	6
6	0	0	0	7	7	0%	7
7	0	0	0	10	10	0%	10

* Pediatric Resident ID

** Negative number = underestimation; Positive number = overestimation

Table 6. Number of Carious Teeth Identified by Pediatric Residents (Post-Intervention)							
	Total Number of Teeth						
PR*	True Number With Cavities	Correctly Identified	Not Identified	Misidentified	Net Difference**	Total Percentage Correct	Total Number Incorrect (Not Identified or Misidentified)
1	6	4	2	3	1	67%	5
2	6	3	3	1	-2	50%	4
3	6	6	0	7	7	100%	7
4	6	0	6	1	-5	0%	7
5	5	2	3	4	1	40%	7
6	5	4	1	1	0	80%	2
7	5	2	3	1	-2	40%	4

* Pediatric Resident ID

** Negative number = underestimation; Positive number = overestimation

Post-intervention Survey Responses (Table 7): Six residents (86%) agreed that the mirror training was helpful to their role as a pediatrician. All participants agreed that the education presentation was easy to understand. Regarding the training time, 6 (86%) somewhat or strongly agreed that the time was adequate, 2 (29%) somewhat agreed that it was too short, and 4 (57%) somewhat or strongly disagreed that it was too long. The residents somewhat or strongly agreed that the training would be described as simple (100%), memorable (72%), intuitive (72%),

practical (86%), and novel (58%). Most (84%) participants would like to have more oral health training, all (100%) thought that the mirror training was enhanced with the use of a live child, and a majority (72%) disagreed that the use of a mirror felt invasive.

Respondents were given an opportunity to write in responses to 11 additional questions. Some noteworthy responses to the question, "How did you feel about using a mirror for the oral exam?," were:

"Much better"

"Plus/minus. Helpful probably in older child; not helpful in younger child"

"Helpful and cooperative child"

"Great now"

Another set of answers to "How did you feel using a mirror on a child that may cry?" were:

"I won't"

"Worried they may injure themselves when biting down in comparison to wood tongue depressors"

"Not a useful tool"

"Nervous"

"Fine".

Table 7. Residents' Post-Intervention Responses				
	Strongly Disagree N (%)	**Somewhat Disagree N (%)**	**Somewhat Agree N (%)**	**Strongly Agree N (%)**
Thinks mirror training was helpful to role as a pediatrician	0 (0%)	1 (14%)	4 (57%)	2 (29%)
The presentation was easy to understand	0 (0%)	0 (0%)	1 (14%)	6 (86%)
Training time was:				
adequate	0 (0%)	0 (0%)	3 (43%)	3 (43%)
too short	0 (0%)	3 (43%)	2 (29%)	0 (0%)
too long	1 (14%)	3 (43%)	0 (0%)	0 (0%)
Would describe the training as:				
Simple	0 (0%)	0 (0%)	3 (43%)	4 (57%)
Memorable	0 (0%)	1 (14%)	3 (43%)	2 (29%)
Intuitive	0 (0%)	2 (29%)	3 (43%)	2 (29%)
Practical	0 (0%)	1 (14%)	3 (43%)	3 (43%)
Novel	0 (0%)	2 (29%)	2 (29%)	2 (29%)
Would like to have more oral health training	1 (14%)	0 (0%)	4 (57%)	2 (29%)
The mirror training was enhanced with the use of live child volunteers	0 (0%)	0 (0%)	5 (71%)	2 (29%)
Using the mirror for examination felt invasive	2 (29%)	3 (43%)	2 (29%)	0 (0%)

Discussion:

The results of this study are divided into analysis of the pilot educational intervention and the responses to the oral health survey. The primary discussion points for the dental mirror training involve efficacy in identification of carious teeth, the impact of hands on training versus knowledge based training, and the potential for replication of this training model in pediatric training curriculums. The survey results are generally interpreted on confidence levels, attitudes on oral health integration into training, and dental mirror usage.

In both the pre-intervention and post-intervention, the residents had a tendency to underestimate or overestimate the number of carious teeth in the dentition. Furthermore, when the analysis is further dissected into the identification of the specific teeth with dental caries, the research participants were even less accurate. There was generally an improvement in the net difference amongst all the residents, but overall the residents could not reliably recognize dental caries.

The literature suggests that oral health knowledge test scores tend to improve after some sort of interventional education training.[16] Therefore, one expects that the residents would have an enhanced understanding of the dental caries identification process. In the post-intervention survey, participants overwhelmingly agreed that the training could be described as simple, memorable, intuitive and practical. This suggests that information presented was processed and understood. However, the results of the intervention demonstrated that there did not appear to be an impact on the accuracy of identification. One study that compared web based training versus web based training plus hands-on training found that hands-on training improved skills, but was associated with a decrease in residents' enthusiasm for integration of oral health into their medical practice.[14] Similarly in this project, there may have been a technical improvement in the

oral examination process when a dental mirror was used. However, participants did not indicate that they would be more likely to use a dental mirror because of the training.

It is unclear what factors primarily influenced the low accuracy in caries identification. One hypothesis is that the issue is more upstream in the educational process. "Providing oral health training to health care professionals in residency and overall health care training to dentists in graduate programs may "be too little, too late"."[14] The qualitative post-intervention survey responses did not suggest difficulty of visualization, but rather of accuracy of identification of dental caries. In a private practice, caries identification improved after a two hour infant oral health training session.[15] Due to the reduced training time in this project, it may have been more effective to restrict the training to the identification of "any caries" versus "no caries".

There is a very limited amount of research that has analyzed what hands-on educational training models would be most effective for teaching pediatric residents. Of the few documented provider training interventions [14-16] each was longer than the focused, short 15 minute education training of this study. Although there are benefits of this type of educational model which is short and focused, a brief training may not be enough to effectively produce improvement in caries identification accuracy. In situations where time is limited, these types of trainings may have to be disseminated in a format other than hands-on training.

The confidence levels of pediatric residents regarding the integration of oral health examinations into their daily practice were consistent with the literature.[9] This sample of residents generally felt confident with oral health counseling and referrals to appropriate providers. However, they were not confident with the technical aspects of oral health screening such as identifying dental caries and caries risk assessment. Attitudinally, there was majority agreement on the items related to inclusion of oral examinations during well-child visits. For

this population, this suggests a positive opinion regarding the importance of oral health screenings and inclusion of a dental examination into the well-child visit. Lastly, there has been no literature looking into the use of dental mirrors in the pediatric clinical setting. The survey respondents generally disagreed that they have adequate training or time to perform mirror exam. The majority agreed that they would use dental mirrors if readily available in clinic, but that there are multiple barriers to acceptance of the use of dental mirrors. The three most cited barriers were low convenience, lack of training, and availability for use. Future educational intervention models should address these key areas.

There were several limitations that should be considered when interpreting the results of this study. One of them was the small sample size of the project for both the educational intervention and the survey. This limited both the generalizability of the study and conclusions that can be drawn from the data. While it is a pilot study, no testing of significance could be performed. Therefore, the results reported were only observed trends and associations. Also, there was no follow-up due to the design of the study. Thus, we were unable to analyze a participant's learned ability to identify caries over a longer period. For the survey reporting, all data was obtained by self-report, and was subject to reliability and recall bias. The methodology of the research also limits the scalability and replication of this educational model. In order to limit the number of oral examinations that a child volunteer had to undergo to a reasonable amount, it was not possible for the same child to be examined prior to and after the intervention. In addition, there were many logistical constraints related to pediatric residency schedules and volunteer participation limits. If the intervention was expanded beyond a pilot project, it might not be feasible or cost effective to coordinate it logistically. Considering these limitations, this model for resident education may not be an ideal model for large scale replication.

Conclusion:

This study demonstrated that the dental mirror training intervention did not appear to have an impact on the accuracy of identification of dental caries by pediatric residents. Attitudes and opinions regarding oral health may affect the acceptance of limited and focused dental education training. In this study population, it was generally agreed that oral health examinations can and should be integrated into routine pediatric clinical care. However, multiple barriers exist to the integration of dentistry into medicine and reduction of these barriers should focus on an increased convenience and adequate training.

Follow-up studies should evaluate alternatives to this educational intervention model. As part of that evaluation, focus should be placed on the length of the training, intended competency of skills, and logistical scalability of the model. Continued efforts should be made to improve cross-disciplinary training and interprofessional collaboration.

BIBLIOGRAPHY

1. Mouradian WE, Reeves A, Kim S, Evans R, Schaad D, Marshall SG, Slayton R. An oral health curriculum for medical students at the University of Washington. Acad Med 2005:80(5):434-42.
2. Douglass AB, Douglass JM, Krol DM. Educating pediatricians and family physicians in children's oral health. Acad Pediatr 2009:9(6):452-6.
3. Health SoPDaO. Preventive oral health intervention for pediatricians. Pediatrics 2008:122(6):1387-94.
4. dela Cruz GG, Rozier RG, Slade G. Dental screening and referral of young children by pediatric primary care providers. Pediatrics 2004:114(5):e642-52.
5. Ferullo A, Silk H, Savageau JA. Teaching oral health in U.S. medical schools: results of a national survey. Acad Med 2011:86(2):226-30.
6. Chung MH, Kaste LM, Koerber A, Fadavi S, Punwani I. Dental and medical students' knowledge and opinions of infant oral health. J Dent Educ 2006:70(5):511-7.
7. Krol DM. Children's oral health and the role of the pediatrician. Curr Opin Pediatr 2010:22(6):804-8.
8. Silk H, O'Grady Stille S, Baldor R, Joseph E. Implementation of STFM's "Smiles for Life" oral health curriculum in a medical school interclerkship. Fam Med 2009:41(7):487-91.
9. Caspary G, Krol DM, Boulter S, Keels MA, Romano-Clarke G. Perceptions of oral health training and attitudes toward performing oral health screenings among graduating pediatric residents. Pediatrics 2008:122(2):e465-71.
10. Lewis CW, Grossman DC, Domoto PK, Deyo RA. The role of the pediatrician in the oral health of children: A national survey. Pediatrics 2000:106(6):E84.
11. Graham E, Negron R, Domoto P, Milgrom P. Children's oral health in the medical curriculum: a collaborative intervention at a university-affiliated hospital. J Dent Educ 2003:67(3):338-47.
12. Lewis CW, Boulter S, Keels MA, Krol DM, Mouradian WE, O'Connor KG, Quinonez RB. Oral health and pediatricians: results of a national survey. Acad Pediatr 2009:9(6):457-61.
13. Slade GD, Rozier RG, Zeldin LP, Margolis PA. Training pediatric health care providers in prevention of dental decay: results from a randomized controlled trial. BMC Health Serv Res 2007:7:176.
14. Talib N, Onikul R, Filardi D, Simon S, Sharma V. Effective educational instruction in preventive oral health: hands-on training versus web-based training. Pediatrics 2010:125(3):547-53.
15. Pierce KM, Rozier RG, Vann WF. Accuracy of pediatric primary care providers' screening and referral for early childhood caries. Pediatrics 2002:109(5):E82-2.
16. Schaff-Blass E, Rozier RG, Chattopadhyay A, Quinonez R, Vann WF, Jr. Effectiveness of an educational intervention in oral health for pediatric residents. Ambul Pediatr. United States, 2006:157-64.

Appendix A: Pre-training Survey

Assigned ID# _____

Dental Mirror Training Survey

What is your gender?
- ☐ Male
- ☐ Female

What is your current age?
_____ years old

Which of the following best describes your racial background? Mark all that apply.
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Hispanic
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Other _____

Did you graduate from a U.S. Medical School?
- ☐ Yes
- ☐ No

Have you visited a dentist in the last year?
- ☐ Yes
- ☐ No
- ☐ I do not recall

If yes, did you receive treatment (e.g. fillings, crown, root canal treatment)?
- ☐ Yes
- ☐ No
- ☐ I do not recall

Have you ever had dental caries or a dental cavity in the last five years?
- ☐ Yes
- ☐ No
- ☐ I do not recall

We would like input from physician-parents. Do you have any children less than age 18?
- ☐ Yes
- ☐ No

If no, please go onto the next page.

If yes, has he or she seen a dentist in the last year?
- ☐ Yes
- ☐ No
- ☐ I do not recall

If yes, did he or she receive treatment (e.g. fillings, crown, root canal treatment)?
- ☐ Yes
- ☐ No
- ☐ I do not recall

If you have any children less than age 18, have any of them had dental caries or a dental cavity in the last five years?
- ☐ Yes
- ☐ No
- ☐ I do not recall

Pre-Training Survey (Part 1)

	Uncertain About My Confidence	Not Very Confident	Somewhat Confident	Very Confident
Rate your confidence in screening:				
Identifying tooth decay				
White spot lesions (early caries)				
Cavitated lesions (late caries)				
Examining for tooth decay **without** a mirror				
Examining for tooth decay **with** a mirror				
Evaluating caries risk (high, moderate, or low)				
Referring children to the dentist				

Rate your confidence in counseling on:				
Providing caregivers with information about their child's dental development (eruption timing, sequence, etc.)				
Explaining the caries process to caregivers				
Recommending dietary practices to prevent dental caries				
Providing guidance in cessation of oral habits (thumb sucking, pacifier use, etc.)				
Recommending oral hygiene practices to prevent dental caries				
Providing appropriate guidance for fluoride use (varnish, toothpaste, water)				
Providing guidance on prevention of dental injuries				

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
I think well-child visits should include:				
Evaluation of the child's teeth for decay				
Examination of the mouth for soft tissue pathology				
Counseling on prevention of the following dental problems:				
Dietary risk factors				
Oral hygiene instructions				
Fluoride use				
Non-nutritive mouth habits				
Trauma to the oral cavity				
Risk assessment of dental problems				
Application of Fluoride varnish to moderate and high risk caries risk patients				
Referral to a dentist at 12 months old				

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
Please rate your agreement with the following:				
I have the time to perform a mirror exam during well child exams				
I have adequate training to perform a mirror exam during well child exams				
I consider the following of **high importance** during an oral exam:				
Evidence of disease or infection (pharyngitis, thrush, etc.)				
Health of tonsils and posterior oropharynx				
Health of the teeth and gums				
I would use dental mirrors routinely if readily available in the clinic				
I would use a dental mirror to assess posterior oropharynx (to gag) instead of a tongue depressor				
I consider the following item to be a **strong barrier** to using dental mirrors regularly:				
Convenience				
Training				
Availability				
Institutional Support				
Reinforcement from Attendings				
Accountability for Use				
Relationship with Dentists				
Other:				

Appendix B: Post-training Survey

Post-Training Survey (Part 2)

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
I think mirror training was helpful to my role as a pediatrician				
The presentation was easy to understand				
Training time was:				
adequate				
too short				
too long				
I would describe the training as:				
Simple				
Memorable				
Intuitive				
Practical				
Novel				
I would like to have more oral health training				
The mirror training was enhanced with the use of live child volunteers				
Using the mirror for examination felt invasive				

If any, what are the barriers to referring children to the dentist?

How do you find dental providers for your patients?

To which dental providers do you usually refer your patients?

I would use the knee-to-knee position to perform the following aspects of the exam (e.g. HEENT, Respiratory, CV, Abdomen, etc.):

What are other ways might you incorporate a dental mirror into a well child exam?

How did you feel using a mirror on a child that may potentially cry?

How did you feel about using a mirror for the oral exam?

What could have been done differently to enhance the power of the training?

Please list any strengths of the training.

Please list any weaknesses of the training.

Please list any other comments regarding the training.

Appendix C: Educational Intervention Powerpoint Slides

Detecting Dental Decay in Pediatric Patients

Alexa Canady, DDS
Resident
Pediatric Dentistry
University of Washington

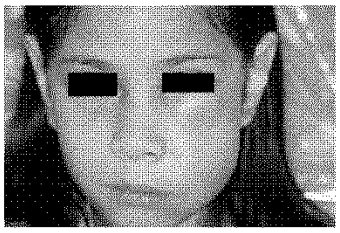
Why are we here?

The application of knowledge is power

Helping and caring for families works best when we work together

We need your help to keep these children healthy

Why is Caries Detection Important?



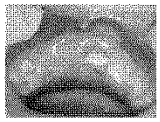
The Importance of Detecting Caries

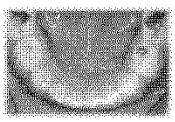
- It is a chronic **preventable** disease that affects millions of children (more common than **asthma**!)
- The end of result of caries can cause **painful infections, premature tooth loss, feeding problems, and speech issues**
- Physicians can be the **first person** to recognize it
- Physicians have **more opportunities** to recognize it the first 3 years of life than a dentist
  - **(80%** have medical well child visits vs **26%** have dental well child visits) [1]

Pediatricians can help prevent thousands of hours of pain, suffering, and psychological distress.

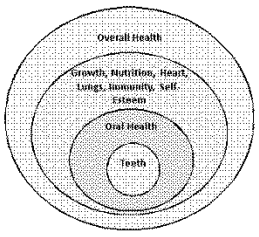
What is Caries?

Caries is another term for **dental decay.**
And you may think it only looks like this:



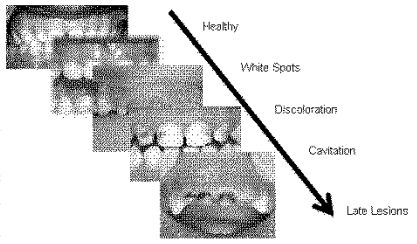


Oral Health and Overall Health



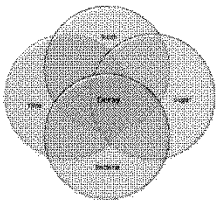
UNIVERSITY of WASHINGTON

Caries is a Disease **PROCESS**



UNIVERSITY of WASHINGTON

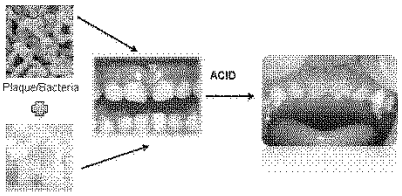
What Causes Caries?



UNIVERSITY of WASHINGTON

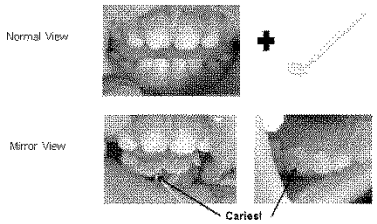
Disease Pathway

It's all about **ACID** breakdown!



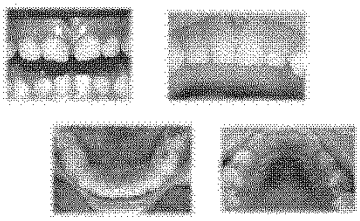
UNIVERSITY of WASHINGTON

Detection with a Mirror



UNIVERSITY of WASHINGTON

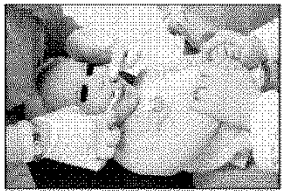
Examples of Dental Decay



UNIVERSITY of WASHINGTON

Positioning

Lap Exam / Knee to Knee Position



UNIVERSITY of WASHINGTON

DEMONSTRATION

UNIVERSITY of WASHINGTON

Questions?

Photos from presentations by
Dr. Travis Nelson, Dr. Simon Lin and Dr. Glenn Canares