

## Early Childhood Caries: Knowledge, Attitudes, and Practice Behaviors of Maryland Dental Hygienists

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### Introduction

Early Childhood Caries (ECC) is a rapid form of caries.<sup>1</sup> The Surgeon General's Report cites ECC as one of the most important public health diseases facing our nation.<sup>2</sup> This condition remains prevalent in young children of low socioeconomic backgrounds. Healthy People 2010 described ECC as affecting the primary teeth of infants and young children 1 to 6 years of age. ECC results in pain, trauma, health risks and costly treatment because of the nature of ECC on primary teeth.<sup>1</sup>

The etiology of ECC is multifactorial. Establishment of bacteria, behavioral and dietary practices, host specific factors, caregiver's oral health, enamel hypoplasia, preventive care, dental literacy and socioeconomic status (SES) all play a part in the development of ECC.<sup>3</sup> The bacteria associated with ECC are mutans streptococci (MS), which can be found as early as 12 to 24 months of age.<sup>4</sup> MS bacteria are acquired from the infant's caregiver, establishing that caries is transmissible and infectious.<sup>5</sup> The major reservoir of MS is the mother's saliva.<sup>6</sup> Infants and toddlers are at a greater risk of acquiring MS when the mother has high levels of MS because of untreated carious lesions.<sup>7</sup> MS bacteria is only one of a number of potential etiological agents involved in ECC.

ECC differs from general dental caries in that this particularly invasive form of caries begins not on pits and fissures, but on smooth surfaces such as the labial, lingual and proximal surfaces of primary maxillary

### Abstract

**Purpose:** Early Childhood Caries (ECC) is a rapid and rampant form of dental caries that can compromise a child's self esteem, nutritional intake, oral development and quality of life. ECC affects approximately 20% of American infants and toddlers annually. The purpose of this study was to determine dental hygienists' knowledge, attitudes and practice behaviors regarding ECC.

**Methods:** Seven hundred and fifty randomly sampled licensed Maryland hygienists were surveyed using a mailed questionnaire consisting of 42 items including knowledge, attitudes and practice behaviors of dental hygienists related to ECC. A 41% response rate was achieved (n=308). To assess differences in knowledge, attitudes and practice behaviors among Maryland hygienists, characteristics such as age, degree earned, years since graduation, primary practice type, percentage of children in practice, percentage of Medicaid patients treated, hours practiced and membership status in the American Dental Hygienists' Association were included.

**Results:** Knowledge of ECC and the current use of appropriate treatment protocols were mixed. Practicing Maryland dental hygienists were correct only 50 to 60% of the time. In addition, results show that treating more children enrolled in Medicaid made it more likely that hygienists knew about the appropriate timing of the first dental visit and its relationship to ECC. Results also show that dental hygienists with more experience were more likely to know of the appropriate treatment protocols than hygienists with less experience.

**Conclusion:** The study results suggest that certain characteristics of dental hygienists do make a difference in knowledge, attitudes and practice behaviors about ECC. This baseline study also reveals that there is a need to enhance dental hygienists' knowledge, attitudes and prevention efforts about ECC through further education courses.

**Keywords:** Early childhood caries, access to care, Dental Hygienists, oral health

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incisors, and proceeds rapidly to involve the molars and canines.<sup>8</sup> Behavioral practices influencing ECC are difficult to change. Dietary practices that include frequent and continuous ingestion of liquids containing fermentable carbohydrates bathe

the smooth surfaces of the teeth. Frequent bottle feeding at night, breastfeeding on demand and continuous use of "sip" cups increase the risk of ECC. Changing feeding practices is a difficult task. Most mothers follow the patterns their mother used, thus

carrying on such practices as bottle feeding or feeding on demand.<sup>8</sup> Early intervention programs targeting parents of young children at risk may reduce the number of children experiencing ECC.<sup>9</sup> Prenatal programs targeting expectant mothers may also reduce the number of children experiencing ECC.<sup>10</sup>

SES has been identified as the most significant predictor of ECC.<sup>11</sup> Children of low SES who are unable to access dental care are at the greatest risk for developing ECC, and mothers from low SES levels are often unable to care for themselves or their children because they lack the material, social and financial access to care.<sup>12</sup>

The American Academy of Pediatric Dentistry and the American Academy of Pediatrics recommend that the first dental visit should be on or before the infant's first birthday.<sup>13,14</sup> Primary prevention should begin prenatally and continue with screening of both mother and infant.<sup>6</sup> This will enhance the establishment of a dental home before birth and possibly reduce the incidence of ECC.

Fluoride varnishes and the use of chlorhexidine have been shown to be effective in the treatment of ECC. Research shows that applying fluoride varnish is effective in reducing ECC in children 9 to 42 months old.<sup>15</sup> Adding fluoride varnish in conjunction with caregiver counseling is recommended as effective in reducing ECC.<sup>16</sup> Varnish is the fluoride of choice for this young population, because of its lengthy retention time, ease of application, low ingestion potential and superiority to other topical fluoride applications.<sup>11,17</sup> Fluoride varnish is considered an "off label" use by the Food and Drug Administration (FDA) for caries prevention, however, the FDA considers this off label approach an acceptable treatment for caries control.<sup>18</sup>

Chlorhexidine 0.12% can reduce MS levels, and combining it with fluoride usage may significantly reduce caries activity.<sup>19,20</sup> Concerns with compliance due to taste, staining and

numerous applications suggest that further studies are needed to develop a better delivery system.<sup>20</sup> Study results on the use of chlorhexidine varnish as a delivery system only found initial effects on reducing MS, thus the caries reducing effect has not been proven.<sup>20</sup> Use of chlorhexidine varnish to block the transmission of MS from mother or caregiver to infant has been suggested.<sup>17</sup> However, while reducing MS, chlorhexidine needs to be carefully considered. It may not be a reasonable preventive procedure in young children, and may be more appropriate for older children or adults.

Dental hygienists can and should be instrumental in reducing ECC. Weintraub and Ismail recommend that dental hygienists should be utilized to educate parents in preventive efforts and provide clinical procedures to reduce ECC.<sup>17,21</sup> Additionally, Weintraub recommends increasing opportunities for dental hygienists in the public health sector to conduct community based interventions. This may stimulate hygienists to become more involved in public health dentistry and place them in a unique position of being the primary preventive provider to reduce incidences of ECC.<sup>21</sup>

Despite this validation of dental hygienists as preventive specialists, a study by Forrest et al revealed that dental hygienists need more education concerning caries etiology, epidemiology and evidence based preventive techniques.<sup>22</sup> The literature rarely discusses dental hygienists' role in caries prevention or, more specifically, ECC.

The purpose of this study was to establish baseline data of dental hygienists' knowledge and understanding of appropriate treatment protocols and to determine influencing factors regarding ECC in the state of Maryland.

## Methodology

This descriptive study utilized a cross-sectional survey design that quantitatively measured practicing Maryland dental hygienists' knowl-

edge, attitudes and practice behaviors regarding prevention of ECC. A random sample of 750 dental hygienists who practiced full or part-time was selected from a list obtained from the Maryland State Board of Dental Examiners. Hygienists not practicing in Maryland and incomplete surveys were excluded. The sampling design was sufficient at providing a generalization of practicing Maryland dental hygienists regarding ECC.

To achieve a sample size that is representative of hygienists actively practicing in Maryland, assuming a sampling error of  $\pm 5\%$ , ( $p < 0.05$ ) with a confidence level of 95%, a final sample size of approximately 345 respondents was projected. Anticipating a 50% response rate, 750 questionnaires were mailed. The mailing included a cover letter, an assurance of confidentiality, a survey instrument of 42 questions and a stamped return envelope. A follow up postcard was mailed to participants approximately 3 weeks later, requesting they respond to the survey.

Indicator measurements were incorporated into the survey instrument. Attributes were collectively exhaustive in nature and mutually exclusive. Responses were categorized as dichotomous or assessed according to a Likert scale. Demographic variables of interest included year of graduation, degree attained, membership in the American Dental Hygienists' Association (ADHA) and employment setting.

Questions on knowledge were adapted from the questionnaire used by Forrest et al.<sup>22</sup> ECC knowledge indicators included ECC etiology, the caries process and bacteria which cause ECC. Other questions were adapted from a study surveying hygienists and nutritionists regarding nutrition and the caries process.<sup>23</sup> Asking respondents about their attitudes about ECC helped gain insight toward knowledge, practice behaviors and possible needed interventions, if gaps existed. Some attitude questions were adapted from a study conducted by Ismail.<sup>17</sup> Practice behavior questions dealt with ECC protocol in

private practice, including questions about nutrition and preventive procedures utilized by hygienists to prevent ECC.

Before the survey was sent, pilot testing was completed to assure reliability and validity. Reliability was measured by adapting information from previous surveys.<sup>17,22,23</sup> Pilot testing was also done to ensure consistency and stability of the instrument. Validity was assessed at face, content, criterion and construct. Face validity assured the questions made sense in terms of the concept.<sup>24</sup> Reviewed and selected indicators were available to ensure content validity. Other studies were used to compare questions assuring criterion validity. Finally, the variables related logically, assuring construct validity. A convenience sample of 15 dental hygienists was selected to pilot test the survey. Twelve surveys were completed and returned. After the surveys were collected, the results were discussed and changes made as necessary. After analyzing the pilot data and making the necessary revisions, a final questionnaire was developed and a random sample was obtained.

The Institutional Review Board at the University of Maryland approved the study prior to the start of the project. Participation in this study was voluntary - a completed and returned survey was considered consent to participate. There were no known risks or benefits to participate in the study. Cover letters included with the survey assured respondents that all information would remain confidential and would be reported in group form only.

The surveys were coded using an identifier number on the survey only. The coded surveys were then analyzed by using Epi-info® software, which tabulated and analyzed the results.<sup>25</sup> Data were in nominal, ordinal and interval form. Frequency testing was used to develop Confidence Interval at 95% and ( $p < 0.05$ ). In order to assure sufficient numbers to produce reliable estimates, variable categories were combined when necessary. Independent variables were age, type of

practice, years practicing since graduation, amount of education, highest degree earned, percentage of children in practice, percentage of Medicaid patients treated, membership with ADHA and years of membership with ADHA.

## Results

The total number of respondents was 308 ( $n=308$ ) for a 41% response rate. Ninety percent of all respondents were from Maryland and practiced in Maryland. Five percent practiced outside of Maryland (not included in the results) and 5% of surveys were returned unanswered. Results revealed that 55% of those surveyed were between 19 and 44 years of age, 45% were 45 and over. Fifty-five percent had graduated less than or equal to 20 years ago from an entry level dental hygiene program, and 45% graduated more than 20 years ago. Fifty-four percent of Maryland hygienists obtained a certificate or Associate's Degree, while 46% earned a Baccalaureate or Master's Degree. Sixty-two percent of respondents practiced less than or equal to 20 years while 38% practiced more than 20 years. Eighty-seven percent practiced in a general practice, 5% practiced in pediatric dentistry and 7% practiced in a format described as "other." Forty-eight percent practiced less than 30 hours per week and 52% practiced greater than or equal to 30 hours per week. While 90% of respondents practiced in a facility with few Medicaid patients (0 to 5%), only 10% practiced in a facility with more than 5% of patients enrolled in Medicaid. Forty-three percent of responding hygienists were members of ADHA. Of those who were members, 74% had been members less than or equal to 5 years and 26% had been members for greater than 5 years.

Overall, results regarding knowledge, attitudes and practice behaviors of Maryland dental hygienists were mixed. Practicing Maryland dental hygienists were correct only 50 to 60% of the time, regardless of the knowledge characteristics mea-

sured. Forty-five percent did not know that caries is an infectious, transmissible disease. Eighty-eight percent believed ECC prevention efforts should start at tooth eruption.

The use of appropriate treatment protocol varied as well. This current study revealed that respondents used oral hygiene instruction (81%), topical fluoride (77%), home applied fluoride (73%), nutritional counseling (65%) and sealants (65%) as preventive behaviors to reduce ECC. Only 25% of those surveyed are using fluoride varnish for caries control.

Figure 1 shows variable labels by characteristic type (knowledge, attitude or practice behavior). While knowledge, attitudes and practice behaviors for ECC are mixed, experience appears to matter. Dental Hygienists that treat more children enrolled in Medicaid made it more likely ( $p < 0.05$ ) for them to reflect current attitudes regarding the timing of the first dental visit and its relationship to ECC.

Table I shows that dental hygienists treating a higher number of children were more likely ( $p < 0.05$ ) to know of the appropriate use of sealants and the use of topical fluoride than hygienists treating fewer children. Dental hygienists with more working hours per week were also more likely ( $p < 0.05$ ) to know of the appropriate use of sealants, nutritional counseling, use of topical fluoride and the importance of a referral to a pediatric dentist than dental hygienists working fewer hours. Dental hygienists who have been ADHA members for a longer period of time were more likely ( $p < 0.05$ ) to know of the appropriate use of topical fluoride or home applied fluoride than hygienists who were members for a shorter amount of time.

## Discussion

Dental hygienists are an important part of dental provider teams dedicated to the prevention of ECC. Hygienists are uniquely positioned to help implement office based and community based prevention programs. Prevention as intervention involving hygienists could involve efforts to re-



duce and eliminate this harmful form of caries. However, before planning or developing such a program, an understanding of the current state of hygienists' involvement and the level of hygienists' knowledge, attitudes and practice behaviors regarding ECC is needed. This study provides baseline information necessary to better understand the current level of dental hygienist knowledge, attitudes and behavior practices concerning ECC in the state of Maryland.

Results indicate that fluoride varnish may be under-utilized to control, treat and prevent ECC. Only 25% of Maryland hygienists are using varnish, which was limited to desensitization. Fluoride varnish is an easy, safe way to apply topical fluoride to teeth. The low usage of varnish for ECC could be attributed to the fact that varnish has not yet been approved by the FDA as an anti-caries prevention agent. However, European countries have been using varnish effectively for over 30 years with positive results.<sup>26</sup> Increased uses of primary care physicians applying fluoride varnish have highlighted the benefits of applying varnish to high risk children. Currently, 34 states provide Medicaid reimbursement for physicians applying varnish to children in need.<sup>27</sup> Maryland dental hygienists may need more information about the off label use of fluoride varnish and its effectiveness on ECC reduction. Similarly, only 20% of Maryland dental hygienists currently use chlorhexidine to prevent ECC. Recent evidence suggests that chlorhexidine can be effective when used by a parent or caregiver with high levels of MS.<sup>20</sup> However, most protocols do not recommend rinses in children less than 6 years of age, as they are likely to swallow large amounts. With the alcohol content of most chlorhexidine rinses, this is an area of concern in child patients. Dental hygienists attitudes about prevention suggested that efforts should be initiated at the first sign of tooth eruption. However, the literature suggests that efforts need to be initiated well before tooth eruption, actually at the prenatal level.<sup>6,8,28,29</sup> In addition,

only 45% of respondents correctly answered that caries is an infectious transmissible disease, suggesting a need to update and educate hygienists on caries, ECC, prevention methodology and protocols.

In this study, the most frequently used preventive approach was oral hygiene instruction, with the lowest being nutritional counseling. Poor dietary habits are one of the major factors involved with ECC and were of least concern by Maryland dental hygienists. Given the critical role of nutrition and ECC occurrence, these results suggest a need to update and educate dental hygienists on the role nutrition plays in ECC to further stress nutrition's critical role.

The results also showed that treating more children enrolled in Medicaid made it more likely that hygienists were current with the timing of the first dental visit and its relationship to ECC. The literature shows that lower SES patients were affected by ECC in greater numbers.<sup>11</sup> These patients typically depend on the Medicaid program to receive dental treatment. Thus, those hygienists who treat higher numbers of Medicaid patients should be more familiar and knowledgeable with the disease, as this research reflected. It should be noted that pediatric dental hygienists typically see these higher number of Medicaid patients, thus dental hygienists working with children in the Medicaid system will have an increased level of knowledge regarding ECC.

Dental hygienists with more experience were also more likely to be aware of ECC appropriate treatment protocols. Dental hygienists working more hours per week were more likely to know of the appropriate use of sealants, nutritional counseling, use of topical fluoride and the importance of a referral to a pediatric dentist. This could be attributed as an outcome of "practicing" and becoming more comfortable and familiar with treatment protocols. Membership in ADHA also proved to be beneficial in an understanding of appropriate protocols for treatment of ECC. Those hygien-

ists who were members for more than 5 years in ADHA were more likely to provide nutritional counseling and home fluoride applications to control ECC. Membership with ADHA may suggest a history of reading the literature available in the association's journal. Given the number of ECC relevant articles presented in the *Journal of Dental Hygiene*,<sup>19,30-33</sup> it is not surprising that ADHA membership would make it more likely that a member would be aware of appropriate ECC treatment protocols.

While providing insight and useful baseline data, limitations to this study must be taken into account. The research was limited to dental hygienists only practicing in Maryland, and the results can therefore be attributed only to the state of Maryland. A further limitation was that the addresses provided by the Maryland State Board of Dental Examiners contained inconsistencies, which may have lowered the response rate and caused some distortions in the results. Speculation exists that response bias may have also had an effect on our results. For example, those hygienists who only treat adults may have felt that the study did not relate to their scope of practice. Also, those that were not familiar with ECC may have declined to participate in the study because their answers may have not been as accurate.

The data indicated that dental hygienists can benefit from continuing education courses regarding caries and specifically ECC. Dental hygienists in Maryland will encounter ECC in practice and should be current on the latest techniques and information to enhance their preventive role. Overall, 95% of Maryland hygienists agree and would like to take a course regarding ECC.

While this study provided important results and insight into dental hygienists' knowledge, attitudes and practice behaviors regarding ECC, results of this study also reveal a need for additional education of Maryland dental hygienists about ECC and possibly curriculum changes to integrate more knowledge regarding ECC while in school. Thus, additional re-

search is needed to determine how to increase the knowledge of dental hygienists in the area of ECC and thus impact positive attitudes and practice behaviors.

### Conclusion

Dental hygienists are qualified health care professionals who can educate parents regarding ECC and be an active part of the team dedicated to the prevention of ECC. This study revealed that there is a need to decrease gaps in knowledge, attitudes and practice behaviors regarding ECC by dental hygienists in the state of Maryland. This research suggests a need for additional information about ECC through dental hygiene curricula and/or continuing education courses. Since 95% of surveyed hygienists indicated an interest in taking a continuing edu-

cation course about ECC, the results of this study suggest that additional education in this area would be well received.

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Figure 1. Variable Label By Characteristic Type

Variable Characteristic Label	Variable Characteristic Type
Knows that ECC is a transmissible disease	Knowledge
Know that ECC is an infectious disease	Knowledge
Prevention efforts should start at eruption	Attitude
Oral hygiene instruction as treatment	Practice Behavior
Nutritional counseling as treatment	Practice Behavior
Fluoride varnish as treatment	Practice Behavior
Home applied Fluorides as treatment	Practice Behavior
When to refer to a pediatric dentist	Attitude
Sealants as treatment	Practice Behavior
Timing of the first dental visit	Attitude

Table I. Current off

	Total Sample	P
Sample characteristic	Sample Size (N)	P
Total	308	100%
Children in Practice		
0-24	160	52%
25-100	148	48%
Hours Practice		
Less than 30	148	48%
30 and above	60	19%
Years Member		
5 or less	228	74%
Greater than 5	80	26%

a Sample size and sample percentage  
b Treatment protocol significance

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# Fluoride treatment protocol for ECC<sup>b</sup>

Percentage	Sealant		Nutritional counseling		Topical Fluoride		Referral to a Pedodontist		Home applied fluorides	
	Sample Size (N)	Percentage	Sample Size (N)	Percentage	Sample Size (N)	Percentage	Sample Size (N)	Percentage	Sample Size (N)	Percentage
100	201	65.3	200	64.9	236	76.6	141	45.8	225	73.0
80.0	87	54.4	93	58.1	106	66.3	70	43.8	100	62.5
83.1	114	77.0	107	72.3	130	87.8	71	48.0	125	84.5
83.1	84	56.8	82	55.4	100	67.6	51	34.5	98	66.2
82.0	117	73.1	118	73.8	136	85.0	90	56.3	127	79.4
84.0	141	61.8	137	60.1	164	71.9	99	43.4	156	68.4
86.0	60	75.0	63	78.8	72	90.0	42	52.5	69	86.3

Percentage for each characteristic shown as shaded area

Significance at the .05 level shown as inverted area (black background white numbers)

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