

Accuracy of Pediatricians' Screening and Referral for Early Childhood Caries after a Training Program

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ABSTRACT

Background: Training of pediatricians on early childhood caries (ECC) screening and referral during their medical pediatric practice has been suggested to promote childhood dental care. **Objective:** To assess the accuracy of pediatricians in detection of ECC and trauma and to estimate the rate of referral after being trained by a pedodontist. **Methods:** The study was conducted at pediatric outpatient clinics of a governmental pediatric hospital in Alexandria, Egypt. Dental examination of 137 children- six to thirty six months of age was carried out independently by a pedodontist and pediatricians to identify cases of ECC and trauma after a training program for physicians about diagnosis of dental caries and referral needs. **Results:** Fifty dental conditions were detected among 33.6 % of the children (46 children) with a rate of 36.5%. The rate of ECC among children was 27.7% with pre-cavitated caries as the most common type (16.1%). The mean age of children with ECC is significantly higher than that of children without ECC ($t=3.23$, $P=0.002$). The rate of dental trauma was 9%. The positive predictive value of pediatricians' detection of ECC was 100%, the sensitivity was 94.74% and the specificity was 100%. The children referred for dental care by pediatricians represented 88 % of those referred by the pedodontist. **Conclusion:** Pediatricians can achieve high accuracy of identification of cases with ECC and of cases in need for dental referral through inservice training.

Key words: Early Childhood Caries (ECC), Pediatrician Training, Screening

INTRODUCTION

Tooth decay is the single most common chronic childhood disease.⁽¹⁾ Early childhood caries is defined as the presence of one or more decayed teeth, missing teeth (resulting from caries), or filled tooth surfaces in any primary tooth in a child under the age of six.⁽²⁾ It is an infectious disease that can begin as early as the teeth begins to emerge (around 6 months or so), often progresses rapidly, and can cause great pain to the child.⁽¹⁾ In USA, more than 40% of children have caries by the time they reach kindergarten.⁽³⁾ The prevalence of dental caries among

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preschool children in Mosul City, Iraq was found to be 83.13%.⁽⁴⁾ In Egypt, a prevalence rate of ECC of 8.02% among children attending the pediatric dentistry department at Cairo University throughout the year 2003-2004 was reported.⁽⁵⁾ Meanwhile it was found to be 60.4% among a total sample of 999 Egyptian children at nurseries in El-Kalubia Governorate.⁽⁶⁾

Consequences of ECC include a higher risk of new carious lesions in both the primary and permanent dentitions,⁽⁷⁾ hospitalizations and emergency room visits,^(8,9) increased treatment costs,⁽¹⁰⁾ risk for delayed physical growth and development,⁽¹¹⁾ loss of school days and increased days with restricted activity,⁽¹²⁾ and diminished oral health-related quality of life.⁽¹³⁾ Many children with ECC require costly restorative treatment in an operating room under general anesthesia. This disease affects the general population but is 32 times more likely to occur in infants

who are of low socioeconomic status.⁽²⁾

The American Academy of Pediatric Dentistry (AAPD)⁽¹⁴⁾ recommends that dental visits begin with the appearance of a child's first tooth, typically around six months but not later than one year. Early risk assessment allows for identification of infant groups who are at risk for ECC and would benefit from early preventive intervention.

The ultimate goal of early assessment is the timely delivery of educational information to populations at high risk for developing caries in order to prevent the need for later surgical intervention.⁽¹⁵⁾ Although early preventive care is a sound health and economic investment, some parents avoid taking children to the dentist to save money.⁽¹⁶⁾ Children most at risk for ECC face the greatest barriers to accessing health care in general, and dental care in particular.⁽¹⁷⁾

Since physicians, nurses, and other health care professionals are far more

likely to see new mothers and infants than are dentists, it is essential that they be aware of the infectious etiology and associated risk factors of ECC and make appropriate decisions regarding timely and effective intervention.⁽¹⁸⁾

Although pediatricians agree that they have an important role in identifying dental problems, many pediatricians lack the current scientific knowledge needed to promote children's oral health and have no previous training in dental health issues during medical school or residency.⁽¹⁹⁾ Continuing medical education (CME) on provision of preventive dental services for primary care physicians showed that a relatively high proportion of medical practices appear capable of adopting these preventive dental services.⁽²⁰⁾ Training of pediatricians as well as clinic nurses in Boston, USA, on ECC counseling practices for parents/caregivers of children aged 6 months to no older than 5 years attending well-child visits resulted in attenuated

incidence of ECC on follow up through increased provider knowledge.⁽¹⁷⁾ The accuracy of pediatric primary care providers' dental screening has been studied in North Carolina. They were provided one-hour training session on dental screening, oral health education, and fluoride varnish application. Their accuracy was evaluated by subjecting each child to two dental screenings, one performed by pediatric primary care providers and another performed by the pediatric dentist. The pediatric primary care providers achieved an adequate level of accuracy in identifying children with one or more cavitated carious teeth and referred 70% of them for dental care.⁽³⁾

In this study we aimed to assess the accuracy of pediatricians in detection of ECC and trauma after being trained by a dentist and to estimate the rate of referral after that training.

MATERIALS AND METHODS

A Post test-only study was conducted in

pediatric outpatient clinics of a governmental pediatric hospital in Alexandria. In this hospital, there are 7 outpatient clinics of different specialties staffed with 13 pediatric specialists, and a dental clinic. The dental clinic is staffed with 7 dentists, of whom only one is a pedodontist.

The study population included all children under 36 months with erupted teeth and attending for pediatric care.

Sampling Design:

Based on previous studies,⁽³⁾ assuming a sensitivity of 0.85 and specificity of 0.95, an alpha level of 0.05 and power 80%, a minimum sample size required was calculated to be 130 children.⁽²¹⁾ On every working day in the above mentioned hospital, one of the seven clinics was chosen by simple random sampling technique. Children within age 6–36 months attending the selected clinic between 11 am to 7 pm for medical care were included consequently until completion of the required sample size (the sample size was completed within 20 days).

Intervention

One of the researchers (a senior consultant in pediatric dentistry of Ministry of Health) provided training for physicians about dental screening and infant oral health. The training included:

- orientation to all aspects of the program (dental screening, oral health education)
- Importance of early childhood dental screening and fluoride varnish application.
- Definition and diagnostic signs of dental caries. Specific instructions were given to the providers on how to recognize a carious lesion, which was defined as a cavitation with a definite break in the enamel surface. A smooth surface pre-cavitated lesion was defined as a white, chalky, opaque area with loss of luster on an intact enamel surface.^(22,23) A pit or fissure pre-cavitated lesion was defined as a lesion with significant staining, discoloration, or rough spots in

the enamel without a visible break in the enamel surface.⁽²³⁾ This definition included pits and fissures that were light or dark brown at the base with a chalky, white demineralization along the sides.

- Signs of dental trauma.
- Importance and causes of referral to dental care (physicians were instructed to refer any child with: one or more cavitated carious lesions, early stage caries (chalky appearance), or evidence of trauma to the teeth or mouth.

Training was provided through one hour lecture on 2 different days. The lecture was repeated to be sure that most physicians attended. Power point presentations showing clinical slides illustrating caries in various stages of progression were used for demonstration accompanied by comment of the pedodontist. Physicians who missed these lectures were provided special meeting with the pedodontist researcher to repeat

the lecture on convenient times.

Lectures were followed by on job training to diagnose caries and dental trauma: the pedodontist attended each clinic for one day to provide practical training for the physicians. At least two cases for each pediatrician were used for training and questions were invited.

Treatment for starting caries was performed when needed and fluoride varnish was applied in the pre-cavitated teeth in the dental clinic.

Data collection:

Dental examination of 6 – 36 months children was carried out by physicians to detect ECC and trauma (Position of examination is with child lying on the examination table). Each child was re-examined by the researcher to detect the dental signs in the same setting (after the pediatrician). As specified by the World Health Organization guidelines⁽²⁴⁾, the providers used a well directed light source

and reflected light with a disposable dental mirror. The providers used light finger pressure to open the child's mouth, dried the teeth with gauze, and examined all teeth in a systematic fashion.

Both the pediatrician and the researcher recorded his findings on separate predesigned forms. These forms included serial number, dental signs, and need for referral.

The sociodemographic data of included children were collected before leaving the clinic by an assistant including; age, sex, parental education, mothers' work, crowding index and income.

Data Analysis

Descriptive statistics were displayed as frequencies and percents for qualitative variables or means and standard deviation for quantitative variables. Data were analyzed using Statistical Package for Social Sciences (SPSS) – version 17 software. Significance level was set at 5%. Accuracy was assessed in terms of

sensitivity, specificity, and positive predictive value.

Positive predictive value is the proportion of patients with positive test results who are correctly diagnosed.⁽²⁵⁾

Positive predictive value=True positives/All positives
All positives=true & false +ve detected by pediatricians

The sensitivity and specificity were measured using the following formulae:⁽²⁶⁾

Sensitivity =

$$\frac{\text{No. of true positives} \times 100}{\text{All persons in the population with the condition (ECC)}}$$

Specificity =

$$\frac{\text{No. of true negatives} \times 100}{\text{All persons in the population without the condition (ECC)}}$$

RESULTS

In this study 137 children, were examined with a total number of 1530 examined teeth. Table 1 shows the distribution of the study sample according to dental conditions as diagnosed by the pedodontist. ECC was identified among 38 children representing 27.7% of the sample. The most common type of ECC was pre-cavitated caries which

affected 22 children (16.1%), followed by cavitated caries which affected 15 children (10.9%). Only one child had both cavitated and pre-cavitated lesions (0.7%). The table

also shows that 12 children had trauma (8.8%). Out of the total sample of 137 children, 46 children (representing 33.6 % of the sample) had 50 dental conditions.

Table 1. Distribution of the study sample according to dental conditions diagnosed by pedodontist

Dental conditions	Total (n=137)	
	No.	%
ECC^(a)		
Children with cavitated lesions only	15	10.9
Children with pre-cavitated lesions only	22	16.1
Children with cavitated & pre-cavitated lesions	1	0.7
Subtotal	38	27.7
Dental trauma	12	8.8
Total ^(b)	46	33.6

^(a) ECC: Early childhood caries

^(b) one child may have more than one condition

Table 2 shows the distribution of the study sample according to ECC and socio-demographic characteristics. This table shows that males and females were nearly equally represented (49.6%, 50.4 % respectively) with no significant difference between the two groups as regards the presence of ECC. The table also shows that 46% of children were in the age group 24-36 months, 32.1% of the age group 12-<24 months and 21.9% less than 12 months. The mean age of children with ECC (2.54 ± 0.61) is significantly higher

than that of children without ECC (2.12 ± 0.824) ($t=3.23$, $P=0.002$).

Table 2 also shows that the highest percentage of mothers and fathers had preparatory to secondary education (55.5% and 48.9% respectively). Parents' education was not significantly associated with the presence of ECC. The table also shows that the monthly family income was ≤ 499 LE in 30.0% of cases, 500-1000 LE in 54.7% of cases, and 1001- 1500 in 15.3% of cases; that was enough to save in only 5.8% of cases,

just enough in 86.1% of cases and was not enough in 8.1% of cases. There was no significant difference among the groups as regards the presence of ECC. Crowding index was < 2 in most of the cases (61.3%), with no significant difference among the different groups as regards the presence of ECC.

Table 2. Distribution of the study sample according to ECC and socio- demographic characteristics

Characteristics	ECC				Total (n=137)		Test of significance p-value
	Present (n= 38)		Absent (n=99)		No.	%	
	No.	%	No.	%			
Sex							
Male	17	44.7	51	51.5	68	49.6	$\chi^2 = 1.327$ $P = 0.515$
Female	21	55.3	48	48.5	69	50.4	
Age (month)							
<12	2	5.3	28	28.3	30	21.9	$t = 3.23$ $P = 0.002^*$
12<24	10	26.3	34	34.3	44	32.1	
24-36	26	68.4	37	37.4	63	46.0	
Mean \pm SD	2.54 \pm 0.61		2.12 \pm 0.82		1.96 \pm 0.81		
Mother's education							
Illiterate, write & read-Primary	11	28.9	23	23.2	34	24.8	$\chi^2 = 1.880$ $P = 0.930$
Preparatory-Secondary	21	55.3	55	55.6	76	55.5	
University	6	15.8	20	20.2	26	19.0	
Not applicable(died)	0	0	1	1.0	1	0.7	
Father's education							
Illiterate, write & read-Primary	10	26.3	19	19.2	29	21.1	$\chi^2 = 4.892$ $P = 0.558$
Preparatory-Secondary	18	47.4	49	49.5	67	48.9	
University	10	26.3	29	29.3	39	28.5	
Not applicable(died)	0	0	2	2.0	2	1.5	
Monthly family income (LE)							
≤ 499	12	31.6	29	29.3	41	30.0	$\chi^2 = 3.683$ $P = 0.451$
500-1000	19	50.0	56	56.6	75	54.7	
1001-1500	7	18.4	14	14.1	21	15.3	
Sufficiency of family income							
enough to save	1	2.6	7	7.1	8	5.8	$\chi^2 = 1.513$ $P = 0.824$
enough	33	86.9	85	85.8	118	86.1	
not enough	4	10.5	7	7.1	11	8.1	
Crowding index							
<2	22	57.9	62	62.6	84	61.3	$t = 0.554$ $P = 0.563$
2-	10	26.3	28	28.3	38	27.7	
4+	6	15.8	9	9.1	15	11.0	
Mean \pm SD	1.54 \pm 0.73		1.46 \pm 0.66		1.96 \pm 1.08		

ECC: Early childhood caries

*statistically significant

Table 3 shows the sensitivity and specificity of dental screening by pediatricians. Out of 38 cases of ECC detected by the pedodontist, 36 cases were correctly identified by the pediatricians with 2 false negative cases. The sensitivity of detection of cases of ECC by the pedodontist was 94.74%, the specificity was 100.0%, and positive predictive value is 100.0%.

Table 3. Sensitivity and specificity of dental screening by pediatricians

Pediatricians	Pedodontist			
	No.	ECC %	No ECC No.	No ECC %
ECC	36	94.74	0	0.00
No ECC	2	5.26	99	100.0
Total	38	100.0	99	100.0

* ECC: Early childhood caries
Sensitivity: 94.74 %
Specificity: 100.0%
Positive predictive value: 100.0%

Table 4 shows frequency of children receiving referral by reason and provider type. The pediatricians referred 44 children to the dentistry; 36 due to caries and 8 due to trauma. The pedodontist referred 50 children to the dental clinic; 38 due to caries and 12 due to trauma. The children referred for dental care by pediatricians represented 88 % of those referred by the pedodontist.

Table 4. Frequency of children receiving referral by reason and provider type

Dental Conditions	Cases referred by pedodontist No.	Cases referred by pediatrician No.	% ^(a)
ECC	38	36	94.7
Trauma	12	8	66.7
Total	50	44	88.0

^(a)Percent of cases referred by pediatrician out of those referred by the pedodontist

DISCUSSION

Access to dental care and unmet dental health needs are serious and under addressed problems for poor and minority children. In promoting preventive oral health, pediatricians benefit all children and particularly the underserved.⁽¹⁹⁾ In our study, ECC was diagnosed among 27.7% of the total sample. Meanwhile, it increased significantly with age where 68.4% of cases were 18-36 months old. With older age the number of erupted teeth increases so the possibility of caries increases and also there will be a longer contact between cariogenic substances and tooth substance. Other studies in Egypt showed that ECC ranged between 8% and 60.4% with increasing prevalence among older

children.^(6,7) ECC increased from 5.3% among children < 12 months to 68.4% among 24 to 36 months aged children. The prevalence of ECC in Turkey,⁽²⁷⁾ was 18.3% among 520 children aged 2.5 – 6 years and 17.36% in Kosovo,⁽²⁸⁾ among 1008 preschool children.

Concerning socioeconomic characteristics examined such as, mother's work, parental education, income, and crowding index, no significant relationship was found with ECC. This may be explained if we consider the low income of most of the sample where 84.7% of the families had monthly income less than 1000 pounds and the study setting is a governmental public hospital which mainly provides services

with low fees. So, most of the sample are of low socio-economic status. Accordingly, we need to repeat the same study in different settings that serve different socioeconomic levels to test this difference as the preventive dental care in Egypt needs enhancement and education even among higher socio-economic status.

Twelve of the children had dental trauma (8.8%). Both ECC and trauma affected 33.6% of the children which means that the percent of dental conditions was 36.5%. To express the percent of dental conditions was considered to be important as each condition is equal to needed time and cost.

The most prevalent type of ECC was the pre-cavitated lesions where alone it affected 16.1% of the children and combined with cavitation affected one child. In North Carolina, screening of ECC among 258 children 6 - 36 months showed that 0.8% of children had cavitated lesions

only, 18.2% had pre-cavitated lesions only, and 8.9% had both cavitated and pre-cavitated carious lesions. Thus, a total of 27.1% had pre-cavitated lesions.⁽³⁾ This represents a value for the dental screening by physicians as this stage is easier to manage and gives a chance for prevention of progression and affection of the permanent teeth.

The sensitivity of dental screening by pediatricians was 94.7% and the specificity was 100% and the positive predictive value was 100%. Our value is higher than that reported by Pierce et al,⁽³⁾ where the sensitivity was 76% and the specificity was 95%. These values were for detected cases of cavitated lesions only, when the cases of pre-cavitated lesions were taken into consideration the sensitivity was 83%.⁽³⁾ False-negatives can be of concern because these children with disease may not receive needed dental care. In our study, two children fell into this category.

On the other hand false positives, that was not recorded in our case, are not a concern if present. The oral examination is intended as a screening tool only and not a comprehensive dental examination. The sensitivity and specificity of dental screening in this study were as high as those of other accepted physical screening done by primary care physicians such as screening for hearing and vision.^(29,30)

Identification of ECC was much better than identification of trauma. The pediatricians missed 4 cases of dental trauma which represented one third of the trauma cases identified by the pedodontist. These children were not referred too, so identification of trauma needs more training. The results of this intervention are high and very encouraging. Accurate determination of its cost and its comparison to cost of treatment of caries and its complications is beneficial. We did not measure the physician attitude and

opinions towards this program. It is important to seek their opinions before further replication of this program to achieve the ultimate benefit and ensure their cooperation.

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