

Evaluation of change in knowledge, attitude, and practice of medical students towards early childhood oral health following educational intervention: a cohort study

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Editor: Dr. Altair A. Del Bel Cury

Received: July 27, 2023

Accepted: January 9, 2024



Medical health professionals have the opportunity to influence the oral health of children, as they are the first health professionals to come in contact with expectant mothers and parents of infants and toddlers. **Aim:** To evaluate and compare undergraduate medical students' knowledge, attitude, and practice about early childhood oral health care before and after educational intervention. **Methods:** A cohort study was conducted among undergraduate medical students during their course. The baseline knowledge and attitude of 80 medical students were evaluated using a validated questionnaire (Phase I). Following, they completed 8 hours of educational intervention and their change in the knowledge and attitude was reassessed (Phase II). The intervention continued through web-based learning till they reached their residency. The students' knowledge, attitude, and practice were again reassessed at the end of their residency (Phase III). **Results:** Knowledge: There was a significant increase in the knowledge about the term gum pads, from 70% in Phase I to 90% in Phase III. Only 30% of medical students knew that the oral cavity of a newborn was devoid of microorganisms during Phase I, but this knowledge improved to 86% in Phase III. Almost 58 to 90% of the medical students had a basic knowledge of the influence of high caries on mothers, the importance and benefit of antenatal counselling, and the effect of poor maternal health. In Phase I, although 92% were aware of the multifactorial pattern of dental caries, only 42% and 53% knew the causative organism and transmissibility of it from mother to child, respectively. Around 77% and 62% agreed that antenatal counselling and counselling on feeding and weaning, respectively, will prevent ECC. Attitude: The attitude towards treating primary teeth was less (66%) in Phase I, subsequently increasing to 100% at the end of Phase III. Practice: Following Phase III, most of them (88%) examined the child's oral cavity during routine medical checkups in the Knee-to-Knee position (93%) and counted the number of teeth present (91%), and they were able to identify the dental carious teeth (88%). **Conclusion:** The medical curriculum should include a module on early childhood oral health.

Keywords: Caries. Infant. Oral health. Students, medical.

Introduction

Infant oral health care forms one of the foundations on which dental care and preventive education are built so that the child has an opportunity in its lifetime to be free from preventable oral disease¹, one such disease being Early Childhood Caries (ECC). Preventive intervention for ECC must be initiated within the first year of life¹. Medical health professionals have the opportunity to influence children's oral health, as they are the first health professionals to come in contact with expectant mothers and parents of infants and toddlers. Therefore, medical professionals can play a critical role in improving the dental health of children and directing parents to seek dental care when needed. Hence, integrating the prevention of oral disease and promotion strategies into primary healthcare professionals' practice would improve oral healthcare. Thus, medical professionals need to be aware of the infectious nature of dental caries and its associated risk factors, make appropriate decisions regarding timely and effective intervention and facilitate the establishment of a dental home at one year of age²⁻⁴.

Previous studies have shown that a physician's body of knowledge in early childhood oral health is less than adequate, and it needs to be clarified to what degree these healthcare professionals are knowledgeable about preventive dental care⁵⁻¹¹. Further, there are lacunae in the literature reporting the tailor-made oral health educational programs for health care providers, and they have yet to carry out long-term follow-up and assess the change in their practice^{6,12-15}. Therefore, the purpose of the study was to evaluate and compare 1. the knowledge, attitude, and practice of undergraduate medical students about early childhood oral health care before and after educational intervention and 2. the impact of educational intervention on the graduating medical students on the long-term retention of knowledge of early childhood oral health care and change in their practice.

Methods

This research proposal was approved by the Institutional Ethics Committee (IEC/HIMS/RR25/02-11-2018). The participating graduating medical students were given the "Rights of Research Patients" information and completed the appropriate consent forms.

Sample size calculation: All the graduating medical students (100) in their third year were invited to participate. The confidence level and margin of error was set at 95% and 5%, respectively. Hence the sample size was estimated was 80 students.

The nature and purpose of the research were explained to participants, its voluntary nature was emphasized, and guaranteed anonymity. Any students who self-reported with previous knowledge about early childhood oral health were not included. Eighty students were willing to participate in the study. Written informed consent was obtained from them.

The tool for data collection was a self-administered questionnaire developed by adapting the works of previous studies¹⁶⁻²⁰, which a group of 4 pediatric dentists fur-

ther validated. The final questionnaire was tested for its validity and reliability. The questionnaire consisted of closed-ended questions with multiple-choice answers. This study was carried out in three phases (Phase I, II, and III).

Phase I - Evaluation of baseline knowledge and attitude toward early childhood oral health

On a specific day and time, all the participating students were requested to assemble in a common hall, and they were asked to complete the questionnaire within 1 hour. The questionnaire was categorized into the following domains: **A. Knowledge** of 1. Infant oral anatomy and chronology of tooth eruption. 2. Infant oral health care. 3. Relationship between mother's oral health and child's oral health. 4. Early childhood caries. 5. Effect of fluoride on dental caries. **B. Attitude** towards 1. Infant oral health care. 2. Dental and oral health training in the medical curriculum. **C. Practice** of 1. Early childhood oral health care during their residency. The questionnaire also included demographic information that included respondents' gender, age, and whether they had had any formal or informal training in examining an infant or toddler before the educational intervention. To ensure that the students completed the survey form anonymously without consulting their colleagues, they were made to sit far away from each other and the three investigators waited until they handed over the completed questionnaire.

Phase II - Mid-evaluation of knowledge and attitude towards early childhood oral health following educational intervention

Following Phase I, a multifaceted educational intervention was implemented for the students to address the barriers to effective use of early childhood oral health prevention practice. The strategies included a series of didactic expository lectures, Power-Point presentations, short videos, workshop/ role play from the students, and case-based discussion by a single experienced pediatric dentist.

Eight sessions of educational intervention were held, each consisting of 1 hour. The educational intervention provided concise information about oral care in pregnancy, infant and toddler oral health, how to perform an infant and toddler oral screening, what to look for during an oral examination, how to recognize incipient and gross carious lesions, how to identify infant/toddler who are at increased risk for oral health problems, early childhood caries and various methods of managing them, need and timing of appropriate referrals to oral health professionals, the timing of first dental visit, importance of establishing a dental home by the age of one, proper use of fluoride supplementation and guidance of parents with appropriate feeding and oral hygiene practices during early childhood. Additionally, they emphasized the importance and role of medical professionals in preventing oral diseases. A video was used to demonstrate the procedure for applying dental varnish. A pediatric dentist did the educational intervention for 45min followed by a 15-minute question and answer session.

Following the educational intervention, a second assessment was done using the same baseline questionnaire to evaluate the improvement in students' knowledge and attitudes. To reinforce the learning and to change their mindset and

practice, following Phase-II intervention, an electronic social group was created, and the PowerPoint presentations of lecturers and short videos used for educating them were shared once in 15 days. Further, live demonstrations of oral diseases and hands-on experience in their prevention and management were provided to the students during their two weeks of clinical posting in the Department of Dentistry.

Phase III - Final evaluation of knowledge, attitude, and practice towards early childhood oral health following educational intervention at the end of the residency

At the beginning of their residency, the students were again reinforced with information about early childhood oral health and emphasized changing their traditional practice during the examination of children. They were informed about the importance of timely referrals and their role in preventing oral diseases. During their entire period of residency, which consisted of 1 year, the information about early childhood oral health was shared promptly in the electronic social media group, similar to the method followed after the phase-II intervention (web-based learning). At the end of their residency, a third assessment of students' knowledge, attitudes, and practice was evaluated using the baseline questionnaire.

A booklet containing concise information on oral health care during pregnancy, infants and toddlers' oral health, and other topics covered during the training session was prepared and given to all participants at the end of phases I, II, and III.

The data obtained from phases I, II, and III were subjected to statistical analysis using the student t-test and Chi-square test. Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp. was used to perform statistical analyses.

Results

A total of 80 (41 (51.25%) male and 39 (48.75%) female) medical students participated in this study. The mean ages of the participants, males and females, were 22.84 ± 1.31 and 22.66 ± 0.28 , respectively. All the study participants were available until the completion of the study.

Knowledge of medical students towards early childhood oral health

There was a significant increase in the knowledge about the term gum pads, from 70% in Phase I to 90% in Phase III. A similar percentage of change of knowledge about the eruption of the first primary teeth, total number of teeth, and time of eruption of all primary teeth was observed. The poor knowledge about natal teeth and their observed effects in Phase I was significantly improved in Phase III (Table 1).

Table 1. Knowledge of oral anatomy and chronology of tooth eruption

SI no	Questions and options	Phase I n (%)	Phase II n (%)	Phase III n (%)	P value
1	Dental arches of newborn are called				<0.001**
	Gum Pads	56(70)	66(82.5)	72(90)	
	Mucosa	10(12.5)	0	04(5)	
	Gingiva	12(15)	12(15)	03(3.75)	
	Don't know	02(2.5)	02(2.5)	01(1.25)	
2	At what age does the first baby tooth does appear in the mouth?				0.042*
	6-8 mon	57(71.25)	68(85)	78(97.5)	
	8-12 mon	17(21.25)	8(10)	2(2.5)	
	12-16 mon	04(5)	2(2.5)	0	
	Don't known	02(2.5)	2(2.5)	0	
3	The complete set of baby teeth consists of how many teeth				<0.001**
	20	60(75)	73(91.25)	78(97.5)	
	32	10(12.5)	02(2.5)	2(2.5)	
	16	5(6.25)	03(3.75)	0	
	Don't known	5(6.25)	02(2.5)	0	
4	A complete set of baby teeth appear by				<0.001**
	9-12 month	4(5)	2(2.5)	2(2.5)	
	12-24 month	15(18.75)	8(10)	6(7.5)	
	36-40 month	57(71.25)	68(85)	72(90)	
	Don't known	4(5)	2(2.5)	0	
5	Tooth not present in the deciduous dentition				<0.001**
	Premolars	66(82.5)	75(93.75)	78(97.5)	
	Molars	12(15)	3(3.75)	01(1.25)	
	Canine	01(1.25)	0	01(1.25)	
	Don't known	01(1.25)	02(2.5)	0	
6	Natal teeth are present				<0.001**
	At birth	20(25)	21(26.25)	65(81.25)	
	Erupt within 1 month of birth	19(23.75)	19(23.75)	16(20)	
	Erupt at 6 months of birth	36(45)	36(45)	15(18.75)	
	Don't known	05(6.25)	04(5)	0	
7	Natal teeth are usually present in the area of				<0.001**
	Lower anterior	35(43.75)	55(68.75)	75(93.75)	
	Upper anterior	21(56.25)	20(25)	34(42.5)	
	Lower posterior	01(1.25)	01(1.25)	13(16.25)	
	Don't known	03(3.75)	02(2.5)	14(17.5)	
8	Natal tooth causes				0.061+
	Laceration of tongue	21(26.25)	65(81.25)	70(87.5)	
	Laceration of lips	31(38.75)	37(46.25)	46(57.5)	
	Laceration of palate	19(23.75)	17(21.25)	13(16.25)	
	Don't known	05(6.25)	05(6.25)	16(20)	

Only 30% of medical students knew that the oral cavity of a newborn was devoid of microorganisms during Phase I, but this knowledge improved to 86% in Phase III. Their knowledge was around 65% about 'when and what to use for cleaning an infant's teeth' in Phase I. However, this knowledge was significantly enhanced to almost 90% in Phase III.

The knowledge about tooth brushing and toothpaste improved significantly from Phase I to Phase III. In Phase I, only 62% of them knew the timing of the first dental visit, which was increased to 97% in Phase III. The knowledge of the frequency of visiting a dentist changed from 46% to 91%. The knowledge about introducing the child to cups and weaning increased from 75% to 93% and 48% to 97%, respectively (Table 2).

Table 2. Knowledge of infant oral health care

Sl no	Questions and options	Phase I n (%)	Phase II n (%)	Phase III n (%)	P value
1	Oral cavity of newborn is free of bacteria				
	Yes	24(30)	53(66.25)	69(86.25)	<0.001**
	No	46(57.5)	27(33.75)	11(13.75)	
Don't know	10(12.5)	0	0		
2	Should babies gums be cleaned after every feeding				
	Yes	54(67.5)	62(77.5)	72(90)	<0.001**
	No	24(30)	16(20)	8(10)	
Don't know	02(2.5)	02(2.5)	0		
3	When should a mother start cleaning her child's teeth?				
	When the first milk tooth erupts	54(67.5)	65(81.25)	76(95)	<0.001**
	When all milk teeth have erupted	24(30)	10(12.5)	02(2.5)	
	When the first permanent tooth erupts	0	03(3.75)	0	
Don't know	02(2.5)	02(2.5)	02(2.5)		
4	What should be used in cleaning babies' teeth?				
	Cotton wool and toothpaste	26(62.5)	10(12.5)	05(6.25)	0.245
	Cotton wool and salt	21(26.25)	05(6.25)	02(2.5)	
	Soft toothbrush (finger brush) and toothpaste	31(38.75)	63(78.75)	73(91.25)	
Don't know	02(2.5)	02(2.5)	0		
5	What is the amount of toothpaste should be placed on a babies child's toothbrush?				
	Smear	18(22.5)	66(82.5)	73(91.25)	<0.001**
	Pea size	55(68.75)	10(12.5)	05(6.25)	
	Half the length of a toothbrush	06(7.5)	02(2.5)	01(1.25)	
The entire length of a toothbrush	01(1.25)	02(2.5)	01(1.25)		
6	At what age should a child start be brushing unassisted?				
	1–3 years	20(25)	10(12.5)	06(7.5)	0.052+
	4–6 years	54(67.5)	65(81.25)	70(87.5)	
	7–9 years	05(6.25)	03(3.75)	4(5)	
Do not know	01(1.25)	02(2.5)	0		

Continue

Continuation

Accidental swallowing of little toothpaste while brushing is not harmful to child's health					
7	Yes	60(75)	65(81.25)	75(93.75)	<0.001**
	No	17(21.25)	09(11.25)	03(3.75)	
	Don't know	03(3.75)	06(7.5)	02(2.5)	
When should a child go for the first dental visit?					
8	When there is toothache/tooth decay?	07(8.75)	02(2.5)	0	0.073+
	On or before the age of 1 year	50(62.5)	75(93.75)	78(97.5)	
	When all the baby teeth have erupted	19(23.75)	03(3.75)	02(2.5)	
	Do not know	04(5)	0	0	
How often should a child visit the dentist?					
9	Once a year	23(28.75)	10(12.5)	05(6.25)	<0.001**
	Twice a year	37(46.25)	59(73.75)	73(91.25)	
	When a dental problem is noticed	15(18.75)	08(10)	02(2.5)	
	Do not know	05(6.25)	03(3.75)	0	
Right age to introduce the child to drink from cup is as they approach 1 year?					
10	Yes	60(75)	65(81.25)	75(93.75)	0.302
	No	12(15)	10(12.5)	03(3.75)	
	Don't know	08(10)	05(6.25)	02(2.5)	
What is the right age to wean the child from the bottle?					
11	6 months	05(6.25)	02(2.5)	01(1.25)	0.065+
	1 year to 11/2 year	39(48.75)	68(85)	78(97.5)	
	2 years	23(28.75)	10(12.5)	01(1.25)	
	3 years	13(16.25)	0	0	

Almost 58 to 90% of the medical students had a basic knowledge of the influence of high caries on mothers, the importance and benefit of antenatal counselling, and the effect of poor maternal health. However, their knowledge about modes of transmission of bacteria from mother to child and the importance of chewing sugar-free gums were 30% and 25%, respectively. The knowledge about the relationship between mother's and infant oral health was increased to almost 98% at the end of Phase III (Table 3).

Table 3. Relationship between mother's and infant oral health

Sl no	Questions and options	Phase I n (%)	Phase II n (%)	Phase III n (%)	P value
Children of mothers who have caries are more likely to have caries too					
1	Yes	47(58.75)	72(90)	75(93.75)	0.27
	No	28(35)	06(7.5)	04(5)	
	Don't know	05(6.25)	02(2.5)	01(1.5)	

Continue

Continuation

Routine dental checkup for an expecting mother is very important					
2	Yes	73(91.25)	74(92.5)	79(98.75)	<0.001**
	No	05(6.25)	03(3.75)	0	
	Don't know	02(2.5)	03.753	1(1.25)	
Antenatal counselling of parents on infant oral health is beneficial					
3	Yes	72(90)	73(91.25)	76(95)	<0.001**
	No	05(6.25)	06(7.5)	04(5)	
	Don't know	03(3.75)	01(1.25)	01(1.25)	
Poor maternal health may lead to low weight babies/pre-term labor					
4	Yes	76(95)	77(96.25)	79(98.75)	<0.001**
	No	03(3.75)	03(3.75)	01(1.25)	
	Don't know	01(1.25)	0	0	
Caries to child is transmitted via mother by kissing and sharing utensils					
5	Yes	24(30)	67(83.75)	76(95)	<0.001**
	No	50(62.5)	10(12.5)	03(3.75)	
	Don't know	06(7.5)	03(3.75)	01(1.25)	
Chewing sugar-free chewing gums decreases the rate of transmission of caries causing organism from mother to child					
6	Yes	20(25)	73(91.25)	78(97.5)	<0.001**
	No	51(63.75)	05(6.25)	02(2.5)	
	Don't know	09(11.25)	02(2.5)	0	

In Phase I, although 92% were aware of the multifactorial pattern of dental caries, only 42% and 53% knew the causative organism and transmissibility of it from mother to child, respectively. However, this knowledge improved significantly to more than 95% at the end of Phase III. In Phase I, around 89%, 65%, 73%, and 65% of medical students knew that sweetened pediatric liquid medicaments, pacifiers dipped in sugary syrups, prolonged bottle feeding, and faulty feeding habits caused dental caries, respectively. The knowledge was increased from 90 to 98% at the end of Phase III. Very few (25%) knew that ECC can develop as soon as they erupt, and maxillary incisors are the first teeth to be affected (43%). Students' knowledge was improved from 91 to 96% at the end of Phase III. Around 77% and 62% agreed that antenatal counselling and counselling on feeding and weaning, respectively, will prevent ECC. However, only 31% believed that cessation of demand feeding would decrease the ECC and that demand feeding should be stopped as soon as the first tooth erupts. This poor knowledge significantly increased positively at the end of Phase III (Table 4).

Table 4. Knowledge about early childhood caries

SI no	Questions and options	Phase I n (%)	Phase II n (%)	Phase III n (%)	P value
1	Dental caries is a multifactorial disease				<0.001*
	Yes	74(92.5)	77(96.28)	80(100)	
	No	05(6.25)	02(2.5)	0	
	Don't know	01(1.25)	01(1.25)	0	
2	Early tooth loss causes malocclusion and hampers growth				0.118
	Yes	36(45)	67(83.75)	79(98.75)	
	No	35(43.75)	10(12.5)	01(1.25)	
	Don't know	09(11.25)	03(3.75)	0	
3	Causative organism of dental caries is				<0.001*
	Lactobacillus	17(21.25)	08(10)	05(6.25)	
	Streptococcus mutans	28(35)	17(21.25)	10(12.5)	
	Both	34(42.5)	55(68.75)	65(81.25)	
	Don't know	01(1.25)	0	0	
4	Is dental caries is an infectious and transmissible from mother to child?				<0.001*
	Yes	43(53.75)	69(86.25)	76(95)	
	No	31(38.75)	07(8.75)	04(5)	
	Don't know	06(7.5)	04(5)	0	
5	More cariogenic sugar and least cariogenic sugar, respectively, are sucrose and lactose				0.652
	Yes	61(76.25)	67(83.75)	71(88.75)	
	No	12(15)	13(16.25)	09(11.25)	
	Don't know	07(8.75)	0	0	
6	Frequently exposure to sweetened liquids including pediatric liquid medicaments causes ECC				0.530
	Yes	71(88.75)	73(91.25)	79(98.75)	
	No	06(7.5)	03(3.75)	01(1.25)	
	Don't know	04(5)	04(5)	0	
7	Use of sweetened pacifier (with sugar syrup/ honey/any other) will cause ECC				0.020*
	Yes	52(65)	65(81.25)	72(90)	
	No	20(25)	08(10)	06(7.5)	
	Don't know	08(10)	07(8.75)	02(2.5)	
8	Can bottle feeding for too long and too often causes ECC?				0.002**
	Yes	58(72.5)	67(83.75)	77(96.25)	
	No	17(21.25)	10(12.5)	02(2.5)	
	Don't know	05(6.25)	03(3.75)	01(1.25)	
9	Putting a baby to bed with a bottle or fruit juice or milk causes ECC				0.451
	Yes	52(65)	62(77.5)	78(97.5)	
	No	22(27.5)	13(16.25)	02(2.5)	
	Don't know	6(7.5)	05(6.25)	0	

Continue

Continuation

	ECC can develop as early as the first tooth erupts and cavity can be visible by 10 months of age				
10	Yes	20(25)	68(85)	77(96.25)	0.017*
	No	48(60)	08(10)	03(3.75)	
	Don't know	12(15)	02(2.5)	0	
	Which teeth are first affected by ECC?				
11	Maxillary incisors	25(31.25)	63(78.75)	73(91.25)	<0.001*
	Mandibular incisors	35(43.75)	07(8.75)	05(6.25)	
	All teeth are equally affected	18(22.5)	10(12.5)	02(2.5)	
	Don't know	02(2.5)	0	0	
	Does cessation of demand feeding will decrease the ECC?				
12	Yes	25(31.25)	63(78.75)	73(91.25)	0.122
	No	45(56.25)	10(12.5)	07(8.75)	
	Don't know	10(12.5)	07(8.75)	0	
	Can antenatal counselling will prevent ECC in infants?				
13	Yes	62(77.5)	72(90)	78(97.5)	0.233
	No	10(12.5)	05(6.25)	02(2.5)	
	Don't know	08(10)	03(3.75)	0	
	Can counselling on feeding and weaning practices decrease ECC?				
14	Yes	50(62.5)	73(91.25)	76(95)	<0.001*
	No	23(28.75)	04(5)	04(5)	
	Don't know	07(8.75)	03(3.75)	0	
	Cessation of demand feeding should be stopped after the first tooth has erupted in the oral cavity				
15	Yes	25(31.25)	57(71.25)	69(86.25)	<0.001*
	No	47(58.75)	20(25)	09(11.25)	
	Don't know	08(10)	03(3.75)	02(2.5)	

In Phase I, almost 86% of the medical students knew that fluoride decreases dental caries and its optimal level in drinking water. Although 62% knew that fluoridated toothpaste should not be used in toddlers, only 16% knew other forms of fluorides used in a child. The knowledge about the effect of fluoride on teeth increased significantly to around 88% at the end of Phase III (Table 5).

Table 5. Knowledge of effect of fluoride on teeth

Sl no	Questions and options	Phase I n (%)	Phase II n (%)	Phase III n (%)	P value
	Does fluorides decrease dental caries?				
1	Yes	69(86.25)	71(88.75)	80(100)	<0.001**
	No	10(12.5)	09(11.25)	0	
	Don't know	01(1.25)	0	0	

Continue

Continuation

Beneficial level of fluoride in water is					
2	0.8ppm	06(7.5)	02(2.5)	01(1.25)	<0.001**
	1ppm	69(86.25)	78(97.5)	79(98.75)	
	1.2ppm	05(6.25)	0	0	
	1.6ppm	0	0	0	
Whether your water supply is fluoridated?					
3	Yes	56(70)	07(8.75)	07(8.75)	<0.001**
	No	11(13.75)	63(78.75)	73(91.25)	
	Don't know	13(16.25)	10(12.5)	0	
Can fluoride tooth paste be used for toddlers?					
4	Yes	17(21.25)	11(13.75)	09(11.25)	<0.001**
	No	50(62.5)	59(73.75)	67(83.75)	
	Don't know	13(16.25)	10(12.5)	04(5)	
What are the other forms of fluoride used in a child?					
5	Varnish	19(23.75)	03(3.75)	02(2.5)	<0.001**
	Wipes	17(21.25)	05(6.25)	02(2.5)	
	Gels & foams	31(38.75)	07(8.75)	05(6.25)	
	All of the above	13(16.25)	65(81.25)	71(88.75)	

The attitude of medical students toward early childhood oral health and dental training in the medical curriculum

In Phase I, approximately 90% of medical students agreed that oral examination should be done during medical checkups, and along with teeth, the tongue, and adenoids examination should also be included. Their attitude towards treating primary teeth was less (66%) in Phase I, subsequently increasing to 100% at the end of Phase III. A higher percentage (88%) agreed to refer a child with severe tooth decay to a pediatric dentist. Attitudes toward the importance of children seeing a dentist at an early age changed from 33% to 93% from phase I to III, respectively (Table 6).

Table 6. Attitude towards infant oral health care

SI no	Questions and options	Phase I n (%)	Phase II n (%)	Phase III n (%)	P value
Every medical checkup should include oral examination					
1	Yes	73(91.25)	74(92.5)	80(100)	0.446
	No	05(6.25)	04(5)	0	
	Don't know	02(2.5)	02(2.5)	0	
A routine oral examination should include teeth along with examination of tongue and adenoids					
2	Yes	58(90)	78(97.5)	80(100)	0.216
	No	20(25)	03(3.75)	0	
	Don't know	02(2.5)	01(1.5)	0	

Continue

Continuation

It is important to treat milk teeth					
3	Yes	53(66.25)	69(86.25)	80(100)	<0.001**
	No	18(22.5)	08(10)	0	
	Don't know	09(11.25)	03(3.75)	0	
First line of treatment for patients with severe tooth problems is necessary medication and referral to paediatric dentist					
4	Yes	71(88.75)	74(92.5)	80(100)	<0.001**
	No	04(5)	05(6.25)	0	
	Don't know	05(6.25)	01(1.25)	0	
How important do you think it is for a child to see a dentist at an early age?					
5	Very important	27(33.75)	60(75)	75(93.75)	<0.001**
	Important	43(53.75)	15(18.75)	05(6.25)	
	Not important	05(6.25)	03(3.75)	0	
	Don't know	05(6.25)	02(2.5)	0	

Most (83%) of students agreed that they lack knowledge of a child's oral health and that it is crucial for them for efficient medical practice. Their attitude significantly increased to 88% in Phase III. In Phase I, 75% responded positively to improving their knowledge, and 31% agreed that they spent an insufficient number of hours on dental training. However, 77% reacted negatively to incorporating early childhood oral health modules into their curriculum in Phase I. These negative attitudes significantly changed from 88% to 95% at the end of Phase III (Table 7).

Table 7. Attitude towards dental training in medical curriculum

Sl no	Questions and options	Phase I n (%)	Phase II n (%)	Phase III n (%)	P value
Do you think you have/had an adequate knowledge of oral health of children?					
1	Yes	10 (12.5)	66(82.5)	71(88.75)	<0.001**
	No	67 (83.75)	10(12.5)	05(6.25)	
	Don't know	3(3.75)	4(5)	04(5)	
Do you think that knowledge on oral health is important to be an efficient medical practitioner?					
2	Yes	11(13.75)	67(83.75)	74(92.5)	0.013*
	No	64(80)	06(7.5)	21(26.25)	
	Don't know	05(6.25)	07(8.75)	01(1.25)	
Do you like to increase your knowledge on oral health of children?					
3	Yes	60(75)	74(92.5)	76(95)	<0.001**
	No	13(16.25)	03(3.75)	04(5)	
	Don't know	07(8.75)	03(3.75)	0	

Continue

Continuation

Do you think the number of hours on dental training in medical curriculum is insufficient?					
4	Yes	25(31.25)	69(86.25)	71(88.75)	0.007**
	No	50(62.5)	09(11.25)	08(10)	
	Don't know	05(6.25)	02(2.5)	01(1.25)	
Do you want infant oral health module to be incorporated in your curriculum?					
5	Yes	11(13.75)	59(73.75)	71(88.75)	0.011*
	No	62(77.5)	16(20)	09(11.25)	
	Don't know	07(8.75)	05(6.25)	0	
How important do you think it is for you to be taught about recommendations of child's oral health?					
6	Very important	32(40)	50(62.5)	65(81.25)	<0.001**
	Important	41(51.25)	25(31.25)	15(18.75)	
	Not important	01(1.25)	5(6.25)	0	
	Don't know	06(7.5)	0	0	

The practice of early childhood oral health care by medical students

Following Phase III, most of them (88%) examined the child's oral cavity during routine medical checkups in the Knee-to-Knee position (93%) and counted the number of teeth present (91%), and they were able to identify the dental carious teeth (88%). Around 99% of them practised prenatal counselling for expecting mothers, including prescribing xylitol chewing gum (86%), modes of transmission of microorganisms (91%), cleaning of gum pads (98%), methods of prevention of ECC (93%), brushing the child's teeth as soon they erupt (95%) and proper feeding habits (96%). A significantly smaller percentage (19%) of medical students practised the application of dental varnish to the children. All of them (100%) referred a child to a dentist when required, and they were confident and liked to be actively involved in providing early childhood oral health care (Table 8).

Table 8. Practice of early childhood oral health care

Sl no	Questions and options	n (%)	P value
Did you examine the child's oral cavity?			
1	Yes	71(88.75)	<0.001**
	No	09(11.25)	
Did you examine the child in Knee-to-Knee position?			
2	Yes	75(93.75)	<0.001**
	No	05(6.25)	
If yes, did you count the number of teeth present?			
3	Yes	73(94.25)	<0.001**
	No	07(8.75)	

Continue

Continuation

	Were you able to identify the dental carious teeth from normal teeth?		
4	Yes	71(88.75)	<0.001**
	No	09(11.25)	
	Did you do prenatal counselling for expecting mothers regarding oral health?		
5	Yes	79(99.75)	<0.001**
	No	01(1.25)	
	Did you prescribe xylitol chewing gums to the mother?		
6	Yes	69(86.25)	<0.001**
	No	11(13.75)	
	If no, why?		
7	Not available	02(2.5)	0.241
	Patient not interested	07(8.75)	
	It is not important	02(2.5)	
	Did you tell the parents about modes of transmission of caries causing microorganisms?		
8	Yes	73(91.25)	<0.001**
	No	07(8.75)	
	Did you ask the parents to clean the gum pads of the infant?		
9	Yes	79(98.75)	<0.001**
	No	01(1.25)	
	Did you apply the fluoride varnish?		
10	Yes	19(23.75)	<0.001**
	No	61(76.25)	
	If no, why?		
11	Don't know to apply	11(13.75)	<0.011*
	Varnish was not available	37(46.25)	
	Not important	13(16.25)	
	Did you tell the parents about methods of prevention of early childhood caries?		
12	Yes	75(93.75)	<0.001**
	No	05(6.25)	
	Did you ask the parent to brush the child's teeth as soon as they erupt?		
13	Yes	76(95)	<0.001**
	No	04(5)	
	If yes, how?		
14	For infant-use finger brush with smear of tooth paste	76(95)	<0.001**
	For toddler-assisted tooth brushing with pea sized tooth paste	76(95)	
	Did you counsel the mother about feeding habits for the child?		
15	Yes	77(96.25)	<0.001**
	No	03(3.75)	

Continue

Continuation			
	Did you refer the child/mother to a pediatric dentist/dentist for further needful?		
16	Yes	80(100)	<0.001**
	No	0	
	Are you confident to provide primary oral health care to mother and children?		
17	Yes	80(100)	<0.001**
	No	0	
	Do you like to be actively involved in providing primary oral health care to mothers and children?		
18	Yes	80(100)	<0.001**
	No	0	

Discussion

A child is seen by medical professionals more than ten times for health screenings before its first birthday²¹. Thus, it is essential for medical professionals to be knowledgeable and trained about the fundamentals of early childhood oral health³. Most students had adequate knowledge of oral anatomy and the chronology of teeth eruption. In addition, they were aware of the absence of premolars in primary dentition and the association between natal teeth and Riga-Fede disease. In a study by Thomas et al.¹⁹, 64.9% of medical students had a good knowledge of infant oral anatomy²⁰. However, such knowledge was seen only in 32% of medical students from another part of India¹⁷. Among Malaysian undergraduate medical students, around 59% knew the correct age of first tooth eruption²¹.

The oral cavity of the child is sterile. Healthy oral hygiene practice should start before the teeth erupt, i.e., cleaning of gum pads after each feed. In the present study, most students were unaware that a child is born free of bacteria, and 67% agreed to clean the gum pad after every feed. This is comparable to reports of Bhat et al.²². Oral hygiene measures for an infant should start not later than the eruption of the first tooth. A soft toothbrush with a smear of fluoridated toothpaste should be used for children under three years^{18,19}. Responses of more than 65% of students agreed with this. The knowledge of the correct age of unassisted brushing was seen only in 6% of medical students. On the contrary, a higher percentage (40%) of Nigerian medical students knew about unassisted brushing¹⁹.

AAPD recommends that the first dental visit be within six months of the eruption of the first primary tooth and no later than 12 months of age²³. In the present study, more than half were aware of the timing of cleaning a child's teeth, first dental visit, and frequency of dental visit. This finding is in accordance with previous studies^{18,22}. However, in another study, a significantly smaller percentage (32%) of medical students agreed with the correct timing for a child's first dental visit, but 69% of them agreed to visit a dentist twice a year, and 70.5% agreed for the correct timing of cleaning of teeth¹⁹. These findings suggest that emphasis on preventive aspects is needed.

The child should be introduced to semisolid foods at six months of age. The most preferred semisolid foods are iron-fortified cereals, pureed meats, breast milk, or infant formula²⁴. As the child approaches 12 to 18 months, the child should be slowly weaned from the breast/bottle. Parents should help their children and encourage them to drink from the cup as they approach one year of age. Further, counselling on feeding and weaning practices reduces the risk of ECC²⁵. Most of the students agreed with the guidelines laid out by the various associations of pediatric health care. This observation is in accordance with previous reports^{18,20,22}. In contrast, Mani et al.²¹ reported poor knowledge of the recommended age of weaning, and they attributed this to inadequate exposure to guidelines on the age of weaning and other preventive aspects, differences in cultural practices, and more emphasis on operative management of ECC.

Transient bacteremia seen in expecting mothers as a result of gingivitis or marginal periodontitis produces inflammatory mediators that can pass through the placental barrier and induce pre-term labour²⁵. Further, in pre-term children, it is common to see enamel defects predisposing the teeth to be vulnerable to ECC²⁶. Almost 58 to 90% of the medical students had a basic knowledge of the influence of high caries in mothers, the importance and benefit of antenatal counselling, and the association between poor maternal health and low-weight babies/pre-term babies. A high percentage (91%) of them thought it was vital for expecting mothers to have a routine dental checkup. This heightened awareness may be because, in our country, expecting mother visiting public hospital is provided with a "Mother and child protection card" by the Government, which is used to record their health status throughout the pregnancy. According to this policy, oral health examination has been made mandatory during their antenatal visit. Thus, all the medical students were made aware of the importance of dental visits during their training period in women and child health care. Kumari et al.¹⁶ reported that 48% of the participating medical students knew the association between mother's and infant oral health, but only 3% knew the benefits of antenatal counselling. Other previous studies have reported a higher percentage of awareness about the benefits of antenatal counselling, especially on infant feeding and weaning habits^{18,22}. These varying results in the literature reveal that antenatal counselling of expecting parents should be actively practised in medical institutes/hospitals.

The overgrowth of *Mutans streptococci*, a normal commensal flora of the oral cavity, is the causative microorganism responsible for dental caries. In the present study, most medical students were knowledgeable about the multifactorial nature of dental caries, and half of them were aware of its infectious and transmissible nature from mother to child. This finding is in agreement with previous studies^{17,18}. In accordance with Kumari et al.¹⁶, only some participating medical students could correctly identify caries-causing microorganisms¹⁷. In contrast, Bhat et al.²², reported that almost 50% of medical students know the causative organism for ECC. Similar to a South Indian report¹⁷, the medical students had poor knowledge of modes of transmission of caries from mother to child and the reduction of transmission of *Streptococcus mutans* by chewing sugar-free chewing gum.

The faulty feeding practices such as high sugar diets, increased frequency of snacking with sugar-containing foods and drinking between meals, ad-libitum breast/bottle feeding, more so in the night, prolonged breast/bottle feeding, frequent use of sweetened pediatric liquid medicaments, putting the child to bed with a bottle with fruit juice or milk and use of pacifier sweetened with sugar syrup or honey have been associated with ECC^{27,28}. Most participating medical students were aware of these risk factors causing ECC. This finding is in accordance with the previous studies^{17-19,22}. The high knowledge of the participating medical students may be because of the training received about women and child health care in which they are made aware of malnutrition's causes, prevention, and management. During this training session, they are guided about the importance of primary teeth and the causation of dental caries as related to malnutrition.

Similar to the previous study¹⁸, most medical respondents were unaware of the type of teeth, time of early visibility, and severity of ECC. Most of them were unaware of the association between demand feeding and ECC and the correct timing of cessation of feeding. This may be because of their knowledge of the guidelines of pediatric associations about breastfeeding. For the best pediatric health outcomes, pediatric associations advocate breastfeeding the child for up to two years or beyond, along with complementary foods. Additionally, the associations state that to achieve emotional satisfaction, breastfeeding is much needed. Further, they emphasize breastfeeding at night for sustained lactation and optimum child development²⁹.

The optimal level of fluoride exposure is essential for preventing dental caries. In accordance with previous studies^{17,18,22}, a maximum percentage of medical students were knowledgeable about the optimum level of fluoride in drinking water, its beneficial effect on dental caries, and its toxicity. Additionally, most of them agreed not to use fluoridated toothpaste for toddlers. This may be because they are tutored about fluoride and its beneficial effects and toxicity during their Preventive and Social Medicine training. Further, it can be ascribed to their experience in pediatric posting during their clinical years.

Similar to the reports of Olatosi et al.¹⁸, a much higher percentage of participants agreed to examine oral cavities that include teeth, tongue, and adenoids during routine medical checkups. Further, more than half of them had a positive attitude towards the importance of milk teeth and agreed to refer a needy child to a dentist after the first line of treatment. In contrast to our findings, a poor attitude towards infant oral health care was reported by Thomas et al.¹⁹ In agreement with other studies, a relatively higher percentage of respondents agreed that they lack adequate knowledge of oral health and hence desired to improve their knowledge which is essential for their high-quality health care practice^{7,17,18,20}. Further, most of them agreed that the number of hours of early childhood oral health training was insufficient and expressed the willingness to include the oral health care module into their curriculum. The overburden of undergraduate students with many medical subjects and convincing themselves that dentistry is an unrelated speciality would have contributed to their negative attitude.

Although the participating medical students had a fair knowledge and attitude of early childhood oral health, there was unequal distribution of their learning. Therefore, an educational intervention program was implemented to improve their knowledge and bring a positive attitude towards early childhood oral health. The long-term retention of the acquired knowledge with the actual change in their behaviour/practice was further determined. In accordance to previous studies³⁰⁻³³, following educational intervention, the long-term results demonstrated the significant enhancement of medical students' knowledge, attitude, and practice toward early childhood oral health care. The result shows the effectiveness of the methods of educational intervention followed. Further, providing the educational booklet as a learner-centred method of self-study and an online PowerPoint presentation course could have motivated and supported them for long-term knowledge retention. These two methods were helpful to the medical students having a busy workday and would have positively contributed to their improved practice.

It has been reported that, although improved knowledge is observed following educational exposure, they need to gain hands-on experience with related preventive/minor procedures; hence, they should be provided with training in dental procedures^{31,32}. Therefore, the students were provided with direct knowledge of examining the child in the Knee-Knee position, identifying the normal and carious teeth, cleaning gum pads, and counselling the mother about preventing oral diseases during their clinical posting in our department. The educational intervention also included e-learning and hands-on experience with related preventive procedures, increased the student's ability to examine infants and young children, actively participate in preventive dentistry, educate the parents about antenatal care, and provide anticipatory guidance on oral hygiene and feeding practices.

At the end of their residency, the medical students exhibited a positive change in their confidence, opinions, and behaviour and were willing to actively participate in providing oral health care to mothers and children. Other researchers have also reported similar findings^{30,31,34}. Thus, integration of an early childhood oral health program into the medical curriculum is the need of the hour.

The study's limitation is the small sample size and the participants being from a single institution. Thus, the results cannot be generalized to all medical students worldwide. Future studies should be conducted to evaluate the impact of different educational interventional methods for providing the knowledge attitude and practice and long-term retention of the information.

In conclusion, medical students' knowledge, attitude, and practice improved significantly following educational intervention. The adapted educational methods were effective in bringing the desirable results.

The result implies that, for improved practice proficiency, a module on early childhood oral health should be included in the medical curriculum, and they should of recertification activities. Further, an interactive and informative program should be planned and implemented through e-learning for all graduating medical students so that they can learn at their own pace.

Ethics approval and consent to participate

Ethical clearance to conduct this study was obtained from our Institutional Ethics Committee (IEC/HIMS/RR25/02-11-2018). The procedure protocol of the study was explained to the participating students and their informed written consent was obtained.

Acknowledgments

None.

Funding

This study was not funded by any agency.

Conflict of interests

The authors declare that they have no competing interests.

Data availability

Datasets related to this article will be available upon reasonable request to the corresponding author.

Author Contribution

KL Girish Babu: conception of the work, acquisition, analysis, interpretation of data, drafted the work and substantively revised it. **C Jayalakshmi:** conception of the work, acquisition, analysis, interpretation of data, drafted the work and substantively revised it. **Rosamma George:** conception of the work, acquisition, analysis, interpretation of data, drafted the work and substantively revised it. All the authors have approved the submitted version of the manuscript and agrees that both are personally accountable for their own contributions and also ensure that questions related to the accuracy or integrity of any part of the work.

References

1. American Academy of Pediatric Dentistry. Clinical Affairs Committee--Infant Oral Health Subcommittee. Guideline on infant oral health care. *Pediatr Dent*. 2012 Sep-Oct;34(5):e148-52.
2. Harrison R. Oral health promotion for high-risk children: case studies from British Columbia. *J Can Dent Assoc*. 2003 May;69(5):292-6.
3. Hale KJ; American Academy of Pediatrics Section on Pediatric Dentistry. Oral health risk assessment timing and establishment of the dental home. *Pediatrics*. 2003 May;111(5 Pt 1):1113-6. doi: 10.1542/peds.111.5.1113.
4. US Public health service. Department of Health and Human Services. Oral health in America: a report of the surgeon general. Rockville, MD: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; 2000.
5. Lewis CW, Grossman DC, Domoto PK, Deyo RA. The role of the pediatrician in the oral health of children: A national survey. *Pediatrics*. 2000 Dec;106(6):E84. doi: 10.1542/peds.106.6.e84.

6. Douglass JM, Douglass AB, Silk HJ. Infant oral health education for pediatric and family practice residents. *Pediatr Dent*. 2005 Jul-Aug;27(4):284-91.
7. Ismail AI, Nainar SM, Sohn W. Children's first dental visit: attitudes and practices of US pediatricians and family physicians. *Pediatr Dent*. 2003 Sep-Oct;25(5):425-30.
8. Gonsalves WC, Skelton J, Heaton L, Smith T, Feretti G, Hardison JD. Family medicine residency directors' knowledge and attitudes about pediatric oral health education for residents. *J Dent Educ*. 2005 Apr;69(4):446-52.
9. Rabiei S, Mohebbi SZ, Patja K, Virtanen JI. Physicians' knowledge of and adherence to improving oral health. *BMC Public Health*. 2012 Oct 9;12:855. doi: 10.1186/1471-2458-12-855.
10. Sabbagh HJ, El-Kateb M, Al Nowaiser A, Hanno AG, Alamoudi NH. Assessment of pediatricians dental knowledge, attitude and behavior in Jeddah, Saudi Arabia. *J Clin Pediatr Dent*. 2011 Summer;35(4):371-6. doi: 10.17796/jcpd.35.4.8626721g8742102p.
11. Di Giuseppe G, Nobile CG, Marinelli A, Angelillo IF. Knowledge, attitude and practices of pediatricians regarding the prevention of oral diseases in Italy. *BMC Public Health*. 2006 Jul;6:176. doi: 10.1186/1471-2458-6-176.
12. Skelton J, Smith TA, Betz WT, Heaton LJ, Lillich TT. Improving the oral health knowledge of osteopathic medical students. *J Dent Educ*. 2002 Nov;66(11):1289-96.
13. Mouradian WE, Schaad DC, Kim S, Leggett PJ, Domoto PS, Maier R, et al. Addressing disparities in children's oral health: a dental-medical partnership to train family practice residents. *J Dent Educ*. 2003 Aug;67(8):886-95.
14. 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 Mar;67(3):338-47.
15. Pinkerton RE, Tinanoff N, Willms JL, Tapp JT. Resident physician performance in a continuing education format. Does newly acquired knowledge improve patient care? *JAMA*. 1980 Nov;244(19):2183-5.
16. Kumari NR, Sheela S, Sarada PN. Knowledge and attitude on infant oral health among graduating medical students in Kerala. *J Indian Soc Pedod Prev Dent*. 2006 Dec;24(4):173-6. doi: 10.4103/0970-4388.28072.
17. Shivaprakash PK, Elango I, Baweja DK, Noorani HH. The state of infant oral healthcare knowledge and awareness: disparity among parents and healthcare professionals. *J Indian Soc Pedod Prev Dent*. 2009 Jan-Mar;27(1):39-43. doi: 10.4103/0970-4388.50816.
18. Olatosi OO, Iwuala SO, Ojewola RW, Chukwudifu N, Oredugba FA, Sote EO. Undergraduate medical students' knowledge and attitude on early childhood caries and infant oral health. *J Pediatr Dent*. Jan-Apr 2016;4(1):8-13.
19. Thomas A, Habib R, Bekal KK, Shetty P, Shetty BS. Oral health for holistic health - Medical student's knowledge and attitude about infant oral health. *J Adv Oral Res*. 2015;6(3):34-8. doi: 10.1177/2229411220150.
20. Mouradian WE, Reeves A, Kim S, Evans R, Schaad D, Marshall SG, et al. An oral health curriculum for medical students at the University of Washington. *Acad Med*. 2005 May;80(5):434-42. doi: 10.1097/00001888-200505000-00004.
21. Mani SA, Burhanudin NA, John J. Malaysian undergraduates' knowledge and opinions on Early Childhood oral health. *Eur J Paediatr Dent*. 2012 Mar;13(1):64-8.
22. Bhat PK, Aruna CN, Badiyan BK, Alle R. Knowledge and Attitude on Infant Oral Health among graduating Medical Students in Bangalore City, India. *JIMSA*. 2014 Jan;27(1):13-4.
23. American Academy of Pediatric Dentistry. Perinatal and infant oral health care. The Reference Manual of Pediatric Dentistry. Chicago: American Academy of Pediatric Dentistry; 2022. p.277-81.

24. Nainar SM, Mohummed S. Diet counseling during the infant oral health visit. *Pediatr Dent*. 2004 Sep-Oct;26(5):459-62.
25. López NJ, Da Silva I, Ipinza J, Gutiérrez J. Periodontal therapy reduces the rate of preterm low birth weight in women with pregnancy-associated gingivitis. *J Periodontol*. 2005 Nov;76(11 Suppl):2144-53. doi: 10.1902/jop.2005.76.11-S.2144.
26. Seow WK. Enamel hypoplasia in the primary dentition: a review. *ASDC J Dent Child*. 1991 Nov-Dec;58(6):441-52.
27. Vadiakas G. Case definition, aetiology and risk assessment of early childhood caries (ECC): a revisited review. *Eur Arch Paediatr Dent*. 2008 Sep;9(3):114-25. doi: 10.1007/BF03262622.
28. Babu KL, Doddamani GM, Naik LR, Jagadeesh KN. Pediatric liquid medicaments - Are they cariogenic? An in vitro study. *J Int Soc Prev Community Dent*. 2014 May;4(2):108-12. doi: 10.4103/2231-0762.137637.
29. Ministry of Human Resource Development. Department of Women and Child Development. National Guidelines on Infant and Young Child Feeding. Food and Nutrition Board Government of India; 2004.
30. Bracho Pacheco A, Finkelman M, Choi A, Hinton D, Rich AP, Bagher SM, et al. Effectiveness of an oral health education seminar for paediatric and family medicine residents. *Eur J Paediatr Dent*. 2018 Sep;19(3):221-5. doi: 10.23804/ejpd.2018.19.03.10.
31. Schaff-Blass E, Rozier RG, Chattopadhyay A, Quiñonez R, Vann WF Jr. Effectiveness of an educational intervention in oral health for pediatric residents. *Ambul Pediatr*. 2006 May-Jun;6(3):157-64. doi: 10.1016/j.ambp.2006.02.006.
32. 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 Mar;125(3):547-53. doi: 10.1542/peds.2009-0470.
33. Mohebbi SZ, Rabiei S, Yazdani R, Nieminen P, Virtanen JI. Evaluation of an educational intervention in oral health for primary care physicians: a cluster randomized controlled study. *BMC Oral Health*. 2018 Dec;18(1):218. doi: 10.1186/s12903-018-0676-2.
34. Alhammad NS, Salama FS. Effectiveness of an infant oral health care educational intervention on knowledge of dental students. *Adv Med Educ Pract*. 2011 Aug;2:193-9. doi: 10.2147/AMEPS19415.