

# Evaluation of Knowledge and Preparedness of Pedodontists and Residents to Prevent and Treat Pediatric Medical Emergencies during Dental Treatments

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## ABSTRACT

**Objective:** To evaluate the knowledge of pedodontists and residents in the face of pediatric medical emergencies. **Material and Methods:** This descriptive-analytical study was conducted on pedodontists and residents participating in the Congress. The knowledge evaluation tool was a researcher-made questionnaire with acceptable validity and reliability. The questionnaire consisted of seven sections on information and education, prevention, office staff readiness, practical abilities, cardiopulmonary resuscitation skills and intravenous access, medicines, and emergency treatment equipment. After completing the questionnaires, the data were analyzed using SPSS 21. Chi-squared test, t-test, ANOVA, correlation test, and linear regression were used for data analysis ( $P < 0.05$ ). **Results:** The study examined 150 specialists, 88 residents, and 62 pedodontists. The level of knowledge of specialists and pedodontic residents in the face of pediatric medical emergencies was 35.3% (moderate) and 31.7 (weak), respectively. The specialists' scores on the entire questionnaire and areas of information, medicine, and equipment were significantly higher than those of residents. Moreover, participation in lectures and reading papers significantly increased general awareness. **Conclusion:** The results indicated that specialists' awareness and pedodontic residents about pediatric medical emergencies during dentistry were at a different level, necessitating more practical and theoretical training.

**Keywords:** Emergency Treatment; Quality of Health Care; Clinical Competence.

## Introduction

A medical emergency is defined as a sudden and unexpected event of the expected natural pattern (natural physiology) [1]. Although these medical emergencies are uncommon in dentistry, they might be life-threatening [2]. Accurate information about the prevalence of emergencies helps the dentist understand the cause and prevent their occurrence much more effectively [3]. All types of medical emergencies could happen during dental procedures. In the case of age <26, the major emergencies are medicine side effects and respiratory and airway problems. Children <5 years of age have a major risk of medicine-related complications [4]. Deaths from airway involvement might happen quickly, and the therapist must have sufficient knowledge and be prepared to deal with such conditions [5].

Fear, anxiety, and pain are often associated with the surgical specialty of pediatric dentistry. Acute stress reactions increase endogenous catecholamines. The physiological response might exacerbate the medical emergency. Moreover, vasoactive medicines, local anesthetics, and vasoconstrictors, used in almost all pediatric dental procedures, increase the likelihood of medical emergencies [6]. The difference between children and adults in body size and shape is reflected by emotional and cognitive puberty, but the differences in physiology, like the respiratory system, cardiovascular system, and immune system, are essential, too. The pharmacokinetics of medicines in the child's body must also be considered [7] to manage medical emergencies.

Studies have shown that complete evaluation of all dental patients can eliminate approximately 90% of emergency conditions [1,8]. Therefore, dentists can acquire an accurate description and examination and change treatment methods to prevent approximately 90% of the emergencies [9].

Unfortunately, the remaining 10% of emergencies will continue to happen despite the best preventive measures [1]. The dentist's ability to start the initial management is vital in minimizing complications and mortality [3]. The ability to manage and treat patients during emergencies depends on their medical information and preparedness [9]. Therefore, the aim of medical emergency management training is to prevent mortality [7].

A pedodontist's responsibilities include prevention, preparation, basic life support, basic emergency medical procedures, and asking for help. The patients might need to be transferred by emergency medical services (EMS) to a suitable medical facility for definitive diagnosis and treatment. After recognizing a medical emergency, the pedodontist must try to keep the patient's condition stable. Undoubtedly, preventing medical emergencies is emphasized [10].

Despite the significant advances in pediatric dental treatments in recent decades, we still witness the death of some children each year because of the occurrence, and possibly poor management, of medical emergencies during dental procedures. Thus, pedodontists must have accurate and thorough knowledge about the prevention and treatment of common medical emergencies in children to control the situation with the correct diagnosis, correct decisions, and quick actions along with the use of emergency equipment and save the child from life-threatening conditions. Pedodontists must have sufficient knowledge and awareness of medical emergencies to protect children. Studies to date have evaluated general dentists and specialists in adult medical emergencies, and no studies have assessed the awareness of pedodontists about medical emergencies in the pediatric age group. Therefore, the present study aimed to evaluate the knowledge and preparedness of pedodontists and pedodontics residents in pediatric medical emergencies. According to this study, proper planning for the education of pedodontists to reduce the risk of morbidity and mortality due to medical emergencies during dentistry could be possible.

## Material and Methods

### Study Design and Ethical Clearance

The present descriptive-analytical cross-sectional study was registered in Kerman University of Medical Sciences, Iran, under the code IR.KMU.REC.1398.509.

### Population and Data Collection

The study population consisted of pedodontists and pediatric dentistry residents participating in the 18th Congress of the Pediatric Dentistry Association in 2019.

The data collection tool in the study was a researcher-made questionnaire whose questions were collected from reference books and papers [11,12]. These questions were designed to be quite simple and clear. The validity of the questionnaire was determined using content validity. To achieve the above goal, the questionnaire was submitted to 10 pedodontists, oral specialists, pediatricians, maxillofacial surgeons, and emergency medicine specialists to determine the appropriateness of the content. According to their opinions, one question was removed, and five questions were reviewed and corrected. After reviewing its validity based on the content validity index (CVI), it was obtained at the desired level (CVI = 0.9). The questionnaire was submitted to 20 pedodontists with an interval of three weeks, and after the test-retest method, the intraclass correlation coefficient (ICC) was 0.91%, i.e., at the desired level.

The questionnaire had two general sections. The first part of the questionnaire consisted of eight questions about the demographic data and professional status, including age, gender, educational level, duration of professional activity, the initial location of starting the professional activity, the study of scientific papers, and participation in training courses, as well as participation in more advanced courses.

The second part of the questionnaire consisted of 26 questions in seven areas associated with the level of knowledge and preparedness of pedodontists and residents to prevent and treat pediatric medical emergencies. Questionnaire areas were information and education (four 4-choice questions), prevention (three 3-choice questions), the preparedness of office staff (two 3-choice questions), practical ability (three 3-choice questions), cardiopulmonary resuscitation skills and intravenous access (eight 3-choice questions), medications (three 3-choice questions), and emergency treatment equipment (three 3-choice questions). After obtaining informed consent from the participants, they were given information about the questionnaire's confidentiality and the answers. The objectives of the study were explained to them, too.

During the Congress, 250 questionnaires were randomly distributed among the pedodontists and residents participating in the 18th Congress of the Iranian Pediatric Dental Association in 2019 by a pediatric resident who was aware of evaluating the validity and reliability of the questionnaire. The participants were free to refuse to complete the questionnaire or to cancel the questionnaire at any stage.

The questionnaires were scored after being completed by the participants. Thus, in the questions with four choices: choice one (high knowledge) received 3 points, choice two (moderate knowledge) received 2 points, choice three (low knowledge) received 1 point, and choice four (no knowledge) received no point. The same method was applied to the three-choice questions. The total score of the questionnaire ranged from zero to 66. The scores were then classified into three levels: poor, moderate, and good. Scores ranging from 0 to 22 (0 to 33%) indicated poor preparedness, 22.1 to 44 (33.1% to 66%) indicated moderate preparedness, and 44.1 to 66 (66.1% to 100%) showed good preparedness.

### Data Analysis

The data were analyzed with SPSS 21. First, descriptive statistics (frequency and percentages, means and standard deviations) was calculated. Then, the Chi-squared test, t-test, ANOVA, correlation test, and linear regression analysis were used to analyze data at  $P < 0.05$  as the significance level.

## Results

Of the 250 questionnaires distributed, 20 refused to complete the questionnaire, and another 30 were filled out incorrectly. Of the questionnaires received, 150 (75%), including 88 pedodontists (58.7%) and 62 residents (41.3%) of pediatric dentistry, were evaluated (23 were unwilling to cooperate, and 27 questionnaires were discarded for reasons like distorted answers). Eighteen participants were male (12%), and 132 were female (88%). The demographic features of the participants are presented in Table 1.

**Table 1. Distribution of participants according to demographic characteristics.**

Variables	N (%)
<b>Gender</b>	
Male	18 (12.0)
Female	132 (88.0)
<b>Age (Years)</b>	
20-30	66 (44.0)
31-40	67 (44.6)
41-50	13 (8.7)
51-60	3 (2.0)
60 and over	1 (0.7)
<b>Education</b>	
Pediatric Dentistry Resident	62 (41.3)
Pediatric Dentist	88 (58.7)
<b>Work Experience (Years)</b>	
0-5	95 (63.3)
6-10	32 (21.3)
11-15	13 (8.7)
15 and over	10 (6.7)
<b>Place of Starting Work</b>	
Public Centers	135 (90.0)
Private Clinic	13 (8.7)
Both	2 (1.3)
<b>Read Papers</b>	
Weekly	50 (33.3)
Monthly	33 (22.0)
Sometimes	66 (44.0)
Never	1 (0.7)
<b>Participating in Training Courses</b>	
Yes	104 (63.3)
No	46 (30.7)
<b>Willingness to Participate in More Advanced Courses</b>	
I am very interested	127 (84.7)
I have no idea	15 (10.0)
I have no desire	8 (5.3)

The mean and standard deviation of the subjects' knowledge was  $33.8 \pm 8.61$ . The knowledge of pedodontists and residents in pediatric medical emergencies was estimated at 35.3% (moderate) and 31.7 (poor), respectively. Information on the scores of each area of the questionnaire is presented in Table 2.

Table 3 compares the scores of the areas and the whole questionnaire. The scores of dentists specializing in information and education ( $p=0.0001$ ), medicine ( $p=0.015$ ), equipment ( $p=0.003$ ), and total ( $p=0.012$ ) were significantly higher than those of the residents.

**Table 2. Means and standard deviations of the scores in each area of the questionnaire.**

Area	Mean	SD
Information and Training	6.5	1.85
Prevention	8.4	0.99
The readiness of Office Staff	2	1.54
Medicine	2.6	1.43
Equipment	8	3.19
Practical ability	3.1	1.92
Cardiopulmonary Resuscitation Skills and Intravenous Access	3.2	1.7
Total	33.8	8.61

**Table 3. Comparison of the area scores and total questionnaire based on education.**

Areas	Education	N	Mean	SD	p-value
Information and Training	Pediatric Dental Resident	62	5.8	1.6	0.0001*
	Pediatric Dentist	88	7	1.88	
Prevention	Pediatric Dental Resident	62	8.4	1.17	0.962
	Pediatric Dentist	88	8.4	0.83	
Preparedness of Office Staff	Pediatric Dental Resident	62	2	1.5	0.729
	Pediatric Dentist	88	2	1.6	
Practical Ability	Pediatric Dental Resident	62	2.6	1.51	0.657
	Pediatric Dentist	88	2.7	1.4	
Cardiopulmonary Resuscitation Skills and Intravenous Access	Pediatric Dental Resident	62	7.5	2.91	0.171
	Pediatric Dentist	88	8.3	3.3	
Medicine	Pediatric Dental Resident	62	2.7	1.84	0.015*
	Pediatric Dentist	88	3.5	1.92	
Equipment	Pediatric Dental Resident	62	2.6	1.74	0.003*
	Pediatric Dentist	88	3.4	1.6	
Total	Pediatric Dental Resident	62	31.7	8.3	0.012*
	Pediatric Dentist	88	35.3	8.57	

\*Statistically Significant.

Moreover, the relationship between the total score and demographic variables was examined by performing multivariate regression analysis (linear regression) (Table 4). According to this table, participation in training courses ( $B=5.27$ ,  $P=0.001$ ) and reading papers ( $B=0.49$ ,  $P=0.001$ ) significantly increased overall awareness. Additionally, multivariate analysis in various areas showed that, unlike univariate analysis, education affected only information and prevention, and specialists had significantly better scores than residents in these two areas. However, overall, it did not affect the total score of the questionnaire. The relationship between the variables and the area was as follows.

**Table 4. Simultaneous effect of independent variables on the total score of the questionnaire by multivariate linear regression analysis.**

Independent Variables	Regression Coefficient B	p-value
Education	2.04	0.213
Work Experience	0.04	0.97
Place of Starting Work	1.42	0.442
Gender	1.38	0.54
Age	0.89	0.517
Reading Papers	0.49	0.0001*
Participating in Training Courses	5.27	0.0001*
Willingness to Participate in More Advanced Courses	1.06	0.452

\*Statistically Significant.

Increased education ( $B=1.25$ ,  $p=0.0001$ ), reading papers ( $B=0.52$ ,  $p=0.0001$ ) and a high score of cardiopulmonary resuscitation skills, and gaining intravenous access ( $B=0.17$ ,  $p=0.001$ ) significantly increased the score of information area.

Increased education ( $B=0.37$ ,  $p=0.055$ ), reading papers ( $B=0.22$ ,  $p=0.013$ ), willingness to participate in training courses ( $B=0.69$ ,  $p=0.000$ ), and high equipment score ( $B=0.16$ ,  $p=0.024$ ) significantly increased the score of the prevention area. Participation in marginal training courses ( $B=0.33$ ,  $p=0.06$ ) was reported to be significant.

Being a man ( $B=2.3$ ,  $p=0.002$ ), willingness to participate in more advanced training courses ( $B=1.02$ ,  $p=0.041$ ), and a high score on practical ability ( $B=0.42$ ,  $p=0.014$ ) significantly increased the score of cardiopulmonary resuscitation and intravenous access.

Being male ( $B=1.02$ ,  $p=0.001$ ), having high scores on medicines ( $B=0.57$ ,  $p=0.000$ ), and having prevention ( $B=0.24$ ,  $p=0.024$ ) significantly increased equipment range scores. Being a woman ( $B=1.25$ ,  $p=0.000$ ), aging ( $B=0.47$ ,  $p=0.021$ ), willingness to participate in more advanced training courses ( $B=0.59$ ,  $p=0.011$ ), a high score of preparedness of office staff ( $B=0.24$ ,  $p=0.001$ ) ( $B=1.02$ ,  $p=0.053$ ), cardiopulmonary resuscitation skills and intravenous access ( $B=0.08$ ,  $p=0.053$ ), and equipment ( $B=0.73$ ,  $p=0.000$ ) significantly increased medicine area score.

A high score of office staff preparedness ( $B=0.16$ ,  $p=0.050$ ), information ( $B=0.18$ ,  $p=0.016$ ), and cardiopulmonary resuscitation skills and intravenous access ( $B=0.09$ ,  $p=0.035$ ) significantly increased the score of practical ability.

An increase in work experience ( $B=0.48$ ,  $p=0.013$ ), willingness to participate in more advanced training courses ( $B=0.68$ ,  $p=0.013$ ), a high score in the medicine area ( $B=0.32$ ,  $p=0.001$ ), and practical ability ( $B=0.19$ ,  $p=0.050$ ) significantly increased the score of the office staff preparedness.

## Discussion

This study showed that the level of knowledge and preparedness of pedodontists and residents in pediatric medical emergencies were estimated at 35.3% (moderate) and 31.7% (weak), respectively, comparable to previous studies. For instance, previous studies in Iran [13], in Tehran [14], in Qom [15], in Shiraz [16], in the UK [17], in India [18,19], in Brazil [20] and in Jordan [21,22] reported that dentists' awareness of dealing with medical emergencies is moderate and inadequate and deficient. However, the following studies in Iran reported results that differed from those of the present study. Behnia et al. [23] examined the knowledge and attitudes of dentists participating in the Dental Association Congress toward dealing with medical emergencies, with the results revealing that 56.7% of the dentists had an excellent or good level of knowledge. Moreover, Mollashahi et al. [24] and Amir Chakhmaghi et al. [25] reported that 96.8% and 86% of specialists had moderate to good medical emergency knowledge. Morowati Sharifabad et al. [26] reported that the knowledge of general dentists about medical emergencies was 89.4%, deemed as good and moderate. The discrepancy in the results might be attributed to different sample sizes, the period of the study, the selected sample, and data measurement tools.

The results indicated that specialists' knowledge level was more than that of pediatric dentistry residents in information, medicine, equipment, and significant overall. This is acceptable considering the academic training course during the specialty studies. Babaei et al. [13] showed that specialists' knowledge level was significantly higher than that of general dentists, which is somehow consistent with the present study.

Moreover, Al-Iryani et al. [27] in Saudi Arabia reported that specialists were more knowledgeable about treating and managing medical emergencies than residents.

Unlike this study, Birang et al. [28] studied and compared knowledge about medical emergencies between general dental practitioners and specialists (in all domains) and reported a moderate level of knowledge with no differences between them.

However, an increase in work experience only significantly increased the preparedness score of the office staff in the present study. Akbari et al. [29] showed that more experience and years of dental care are associated with lower knowledge of medical emergency management. On the other hand, as in the study by Azad et al. [16], there were no relationships between work experience and overall knowledge, and also Mehdizadeh et al. showed no significant relationship between age and years of clinical experience with the knowledge level [15], which could be because of the age differences or work experience of dentists participating in the studies.

Although in the present study, the women received significantly higher scores in medicines and men in the areas of cardiopulmonary resuscitation skills and access to venous equipment, there was no significant difference between male and female dentists [19,21,23,24,30] in the overall awareness in this study, similar to previous studies [13,14,26,28], which seems to be due to their similar training during the dental course.

The results of the present study indicated that the dentists participating in 12.7% and did not have enough information about items and necessary equipment and medicines for the treatment of medical emergencies in their offices. Additionally, they did not have enough knowledge to use them during a dental emergency. Lack of adequate training about the use and method of using emergency medications might explain the lack of tendency to keep them in dentists' offices. Like the present study, Birang et al. [28] reported that 59.7% of the dentists did not have any equipment in their office. Bayat et al. [31] reported that only 40% of dentists had one of the four necessary devices in their office in Karaj. Moreover, Tariq et al. point out that every clinical specialty needs to ensure the availability of equipment and medication to avoid an unfavorable outcome [32].

Restrictions on the dentists' access to medicines and equipment needed by emergency therapists reveal that emergency clinics do not consider the need to have access to emergency equipment as seriously as the medicines needed. Furthermore, with the lack of equipment in the office, one can conclude that, most likely, dentists do not know how to work with the equipment, and the emergency equipment of the offices is much less than the recommended values.

In this study, 84.7% of the dentists were willing to participate in advanced training courses related to medical emergencies in dentistry, 63.3% had participated in programs, courses, or lectures related to medical emergencies in dentistry and participation in lectures and reading papers significantly increased all participants' awareness. Additionally, the results showed that those willing to participate in more advanced training courses had significantly higher scores in information, prevention, and office staff training. Similarly, in the study by Babaei et al. [13], >90% of the general dentists agreed on the need to hold workshops and continuing medical education courses with the content of medical emergencies in the dental office and 70% of the dentists participating in the cardiopulmonary resuscitation workshops had a significantly higher level of awareness. Moreover, in the study by Birang et al. [28], 94% of the dentists were willing to participate in retraining courses related to emergencies and patient resuscitation.

The results of a systematic review indicated that structured BLS and ME training should be a significant component of undergraduate dental curricula, and repeated BLS/ME training during postgraduate and undergraduate courses is essential, too. Their study showed that resuscitation skills decreased after six weeks of

training [24]. Furthermore, a study in Poland [4] showed that dental health professionals should attend BLS courses every two years to maintain cardiopulmonary resuscitation skills and follow guidelines to be updated.



On the other hand, most studies have shown that theoretical and practical training in medical emergency management is insufficient while studying and does not meet all dentists' needs. However, it is important to participate in regular theoretical and practical medical emergency sessions during a student's life and a dentist's career. Emphasis should be placed on strengthening emergency education (diagnosis and treatment) in dental education, workshops and continuing education programs.

There were various methodological limitations to this study. The first relates to sample size, which suggests that further studies be conducted in a larger statistical community. Second, the participants were assessed based on multiple-choice questions. Preset answer choices may narrow perceptions in comparison to real-life events. Although open-ended questions could have been more realistic by enabling participants to answer in a short essay format, this approach would have created methodological challenges to abstracting data into a quantifiable format. Third, the assessment lacked a time restriction. Time is a critical factor during medical emergencies. A timed option could have allowed evaluation of the readiness of the students to act.

## Conclusion

The knowledge of specialists, especially pediatric dentistry residents, about pediatric medical emergencies during dental procedures needed to be improved, and more practical and theoretical training is needed in this regard. It is recommended that more attention be paid to this issue in postgraduate and general education courses. Besides, training courses for dentists regarding emergency medical approaches in dental offices improve dentists' knowledge about these accidents. Emergency courses have to be mandatory in the dental education curriculum, too.

## Authors' Contributions

FJ		<a href="https://orcid.org/0000-0003-0990-5386">https://orcid.org/0000-0003-0990-5386</a>	Conceptualization, Investigation, Writing - Review and Editing.
FM		<a href="https://orcid.org/0000-0003-1166-7452">https://orcid.org/0000-0003-1166-7452</a>	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Writing - Review and Editing and Project Administration.

All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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## Conflict of Interest

The authors declare no conflicts of interest.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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