

Assessing Readiness to Manage Medical Emergencies Among Dental Students at Four Dental Schools

Charmi Solanki, BDS; Maria L. Geisinger DDS, MS; Paul G. Luepke, DDS, MS; Kinan Al-Bitar DDS, MDS; Leena Palomo, DDS, MSD; Wangsoo Lee DDS; Steven Blanchard, DDS, MS; Daniel Shin, DDS, MSD; Gerardo Maupome, DDS, MSc, PhD; George J. Eckert, MAS; Vanchit John, DDS, MSD.

Dr. Charmi Solanki was a resident at Indiana University School of Dentistry in the Department of Periodontology and is currently in private practice in Indiana; Dr. Maria Geisinger is the Director of the Advanced Education in Periodontology Program at the University of Alabama at Birmingham ; Dr. Paul G. Luepke is Chair, Department of Periodontology UTHSC, College of Dentistry; this study was conducted when he was Director at Marquette University School of Dentistry Department of Periodontology; Dr. Kinan Al-Bitar is in private practice in Waukesha, WI and is a former graduate student from Marquette University School of Dentistry; Dr. Leena Palomo is the Director at DMD Periodontics Program at Case Western School of Dental Medicine; Dr. Wangsoo Lee is a resident at DMD Periodontics Program the University of Alabama at Birmingham; Dr. Steven Blanchard is Director of Graduate Periodontology, Indiana University School of Dentistry; Dr. Daniel Shin is the Pre-Doctoral Periodontology Program Director, Indiana University School of Dentistry; Dr. Gerardo Maupome is Professor and Associate Dean of Research, Department of Social and Behavioral Sciences, Richard M. Fairbanks School of Public Health; Mr. Eckert is Biostatistician Supervisor, Department of Biostatistics, Indiana

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University School of Medicine and Dr. John is Chair, Department of Periodontology, Indiana University School of Dentistry.

Direct correspondence to Dr. Vanchit John, Department of Periodontology, Indiana University School of Dentistry, 1121 West Michigan Street, Indianapolis, IN 46202; 317-274-5124; vjohn@iu.edu

Abstract

Dentists treat a wide range of patients, including patients with compromised health conditions. While rendering treatment, various medical emergencies can and do occur. To help increase the knowledge required to manage such emergencies, dental students must be trained while in dental school. This study aims to assess the level of medical emergency preparedness and knowledge among dental students at four dental schools. The participating dental schools were Indiana University School of Dentistry (IUSD), Case Western Reserve University School of Dentistry (CWRU), Marquette University School of Dentistry (MU), and the University of Alabama School of Dentistry (UAB). Groups were designed to include twenty dental students from Years 1 to 4. Students were asked to fill out a survey and were then tested on ten clinical medical emergency scenarios. A total of 331 dental students participated in the study. The scores based on 10 case scenarios presented with a range of 4.35 to 8.02. There was no statistically significant difference in the level of preparedness when dental schools were compared. However, Year 1 and Year 2 dental students had significantly lower total scores than those of Years 3 and 4. The students in Years 1 and 2 demonstrated less confidence in their current knowledge to manage medical emergencies. Satisfaction with the training received ranged from 38% to 84%. The results from this study indicate that students' preparedness to manage medical emergencies at these four dental

schools is statistically similar. Additional yearly training could enhance students' preparedness in the management of medical emergencies in the dental setting.

Key words: Education dental, medical emergencies, dental school, data collection, emergency therapy, baseline survey.

Introduction

A wide variety of patients seek dental treatment at private dental offices and dental schools. They occasionally experience medical emergencies due to complications related to the dental treatment itself or to pre-existing systemic medical comorbidities.^{1,2} Such emergencies are not so infrequent, as described in a ten-year study by Fast et al³ who surveyed 4,309 dentists with 30,602 emergency occurrences. The most common medical emergencies that occur during dental treatment include vasovagal syncope, hypotension, and convulsions; however more severe emergencies, including cardiovascular events or adverse drug reactions, occur less commonly.⁴

Occurrences of medical emergencies in the dental office are higher **in** patients with increased age, unhealthy life styles, higher stress levels, decreased access to medical care, and under insurance levels; as well as in patients with chronic age-related medical comorbidities.⁵

Patients with unmonitored and/or poorly controlled systemic disease are more susceptible to experiencing a medical emergency; often, these patients seek dental care in academic dental settings where the services are more affordable.⁶ In academic settings, most care is delivered by dental students under faculty supervision. Given these factors, training dental students to effectively manage medical emergencies becomes even more important.

Identification of important predisposing factors and careful history taking and examination^{1,2} can help prevent emergencies. House and Stark⁷ reported that it is important to recognize stress and anxiety as common predisposing factors that contribute to a medical emergency. Accordingly, good communication, maintaining a high level of trust with patients, effective administration of local anesthesia, and proper use of stress reduction protocols all play a critical role in reducing medical emergency incidence.^{8,9} Dental schools play a pivotal role in training dental students to become skilled in managing stressful and emergent situations in their future dental practices. Developing and implementing universal standard educational protocols across all dental schools can better prepare students to become well-trained dentists for the future. Empirical evidence is lacking regarding how large the training deficiency may be in dental schools in the US.

Despite the paucity of evidence documenting dentists' emergency preparedness and management, available research highlights a need for improvement.¹⁰ Not all dentists and staff felt competent to handle medical emergencies in their offices.¹¹ Arsati et al.¹² reported dentists felt better prepared to handle the more common situations of syncope and hypotension. The cited reason for under-preparedness was lack of adequate CPR training. While 96% of the dentists in Australia agreed that CPR training was essential, only 55% of them felt they were competent to perform CPR properly in an emergency. Only 64% had received CPR training since graduation from dental school.⁹ In the US, dentists are expected to maintain CPR certification with updates every two years. However, these skills deteriorate rapidly for dentists.¹³

Continuing education may enhance the ability of practitioners to handle medical emergencies in clinical practice with more confidence.^{14,15} In a study assessing medical

emergencies and perceptions of training and competence among general dentists, 75% of the respondents reported receiving training as students, with this number rising to 95% upon graduation.¹⁶ Those that felt 'well' or 'fairly well' prepared to manage emergencies rose from 30% at graduation to 80% following graduation. The 20% that were in the 'not very well' or 'not at all' prepared group were less likely to possess medications and equipment to manage an emergency. Need for further training was expressed by 96% of the group, but only 3% felt no additional training was required.¹⁶ However, a group of dentists in New Zealand¹⁷ expressed contrasting trends with the Australian group.¹⁶ In this study, only 14.1% felt unprepared to manage emergencies in dental practice.¹⁷

It would appear that specific training to manage medical emergencies is an essential component of preparation for dental practice and its emphasis in dental school, together with reinforcement, in the clinical years are critical. However, the uniformity of training and preparedness is essential^{18, 19} The objectives of the present study were to assess dental students' knowledge base and to estimate their confidence in assessing and managing medical emergencies. The present study considers that while curriculum uniformity for training and preparedness has been deemed essential,^{18, 19} the reality is that it is suboptimal.

Dental schools vary widely in where this training is placed chronologically in the four-year curricula. There are also varying differences in the breadth and scope of training. Because of these, accurately assessing the level of preparedness for each year of training (D1 to D4) is not feasible.

Materials and Methods

The IUSD Institutional Review Board (IRB #201600563) approved this study. IRB approval was also obtained by the respective participating schools: Indiana University School of Dentistry (IUSD), Case Western Reserve University School of Dentistry (CWRU), Marquette University School of Dentistry (MU) and the University of Alabama School of Dentistry-Birmingham (UAB). Participants included 20 dental students from each year of training in three of the dental schools, while data were obtained only from students in Years 1 and 4 from UAB.

The dental students were recruited to participate in a voluntary, anonymous survey. Each class (D1-D4), was sent an invitation letter electronically by a staff member (to eliminate coercion) with a request for students to participate in the study. Student academic records were not considered or evaluated as part of the selection of the participants. A questionnaire was completed by the first 20 students that applied, identifying their year of training. The students then evaluated and responded to a set of multiple-choice questions in ten selected clinical scenarios with diagnosis and best treatment option. The cases in the scenarios were designed, tested, refined, and used in prior research studies.²⁰ No psychometrically accurate measures for overall test validity, reliability, nor discriminant validity are available. Scenarios were developed using an iterative process of improvement by multiple academic and private practice clinicians. The scenarios adhered purposefully to approaches used as professional standards for real-life clinical cases that participants may encounter in their practices. The ten scenarios included: syncope, seizure, mild to moderate allergic reaction, anaphylaxis, asthma, airway obstruction/choking, hyperventilation, myocardial infarction, cardiac arrest and hypoglycemia. Study participants were asked to

make a diagnosis and choose a management plan for each scenario. In addition, participants were able to express their satisfaction with the training they received in their dental programs along with their year of dental study and to describe how well prepared they felt about managing medical emergencies. Additionally, students reported on any medical emergencies that they may have witnessed. Overall participants took less than 60 minutes to answer the survey.

The present study was a follow up to another study conducted in 2017.²⁰ The same panel of experts established the clinical scenarios and accurate responses for each scenario used in the present study. The questions were designed to test the management skills of the participants. Answers were scored as either correct or incorrect. If the questions were unanswered or more than one answer was marked, the question was recorded as an incorrect response. A sample of representative clinical scenarios is listed in *Appendix 1*. A single examiner from IUSD assessed all the answers from the participating schools.

Participants were informed that there were no substantial risks associated with their participation in this research study. The risk was minimized through standard procedures of confidentiality, as well as through secure data access and collection. No compensation was provided to students for their participation.

Statistical Analysis

The survey's primary goal was to evaluate the participants' existing knowledge to manage medical emergencies. The answer choices had four treatment options which correlated with the intervention to manage the medical emergency in a dental setting, with one correct choice and other three being incorrect choices. The correct intervention, if

selected, was given 1 point. If more than one option of answer choices were selected, that response was disregarded and given no points. Therefore, each student could score a minimum of 0 points and a maximum of 10 points. The range and average of the scores were evaluated from each dental year and then compared with other included dental schools. Additionally, the survey compared the dental students to their respective dental school peers based on their average class scores.

Furthermore, the secondary goal of the survey was to highlight the students' perceptions regarding their confidence level and satisfaction with regards to the training at the dental school. The students also responded if they recorded vitals like blood pressure, pulse rate, respiratory rate, and body temperature. These were yes/no type questions, and the evaluation was done with the percentage of positive responses.

Diagnosis and intervention responses for each scenario were summarized by school and year of training. Two-way ANOVA was used to test for differences in the knowledge score due to year and school. A 5% significance level was used for all tests.

Results:

As only first and fourth year students from UAB were included in the study, the analyses were performed twice – once including UAB and analyzing all the first and fourth year students, and again excluding UAB and analyzing all four years of students. Both analyses showed no significant interaction between year and school ($p=0.63$ for the analysis including UAB, $p=0.42$ for the analysis excluding UAB).

The responses to the ten medical emergency scenarios indicated that first-year dental students had scores that ranged from 0 to 10, and their mean scores were 4.35 ± 1.46 , $4.35 \pm$

3.01, and 4.80 ± 1.58 at IUSD, CWRU and MU, respectively (Figure 1). At UAB, for a total of 42 first year students, the mean score was 6.69 ± 2.05 .

The responses from the second-year participants to the medical emergency scenarios had score ranges from 0-10 and the mean score of 4.75 ± 2.00 , 5 ± 2.38 , and 4.7 ± 2.00 at IUSD, CWRU, and MU, respectively. No data from second year participants was received from UAB.

The responses from the third-year dental students had scores that ranged from 1-9 and the mean score of 6.35 ± 1.69 , 5.05 ± 2.28 , and 6.40 ± 1.47 at IUSD, CWRU, and MU, respectively. No data was received from third year participants from UAB.

The responses from the fourth-year students displayed scores that ranged from 2-10 and the mean score of 6.40 ± 1.10 , 5.65 ± 2.03 , and 6.75 ± 1.16 at IUSD, CWRU, and MU, respectively. At UAB, for a total of 49 fourth year students, the mean score was 8.02 ± 1.52 .

There was no statistically significant difference among IUSD, CWRU, and MU ($p=0.09$), however the scores were higher for UAB than the other three schools when focused on first and fourth year students ($p<0.0001$). Years 1 and 2 did not differ significantly ($p=0.37$), nor did years 3 and 4 ($p=0.34$), however scores for years 1 and 2 were significantly lower than those for years 3 and 4 ($p\leq 0.002$).

The data showed that while dental schools do not have a standard protocol for measuring the vitals before the treatment, students also responded if they recorded vital signs (e.g., blood pressure, pulse rate, respiratory rate, and temperature-Table 1). The varying degree of instructions and emphasis could have some influence on how dental students perceive their comfort level and their satisfaction with the training they receive.

The percentage of first-year dental students that considered themselves comfortable with their knowledge was 5.3%, 20%, 25%, and 11.9% at IUSD, CWRU, MU, and UAB, respectively. The dental students at MU showed more affirmative responses. When comparing second-year dental students, a reverse trend was observed in the responses. Students at IUSD responded as being more confident with their knowledge (44.4%) when compared to CWRU (20%) and MU (10%). When the third-year dental students were compared, responses at IUSD and MU were similar (60%), and CWRU displayed an overall lower level of confidence (35%). The fourth-year dental students at UAB displayed more confidence in their knowledge to correctly diagnose and intervene in a medical emergency at the mean of 83.7%. The students at IUSD had a relatively lower mean percentage of 30%, followed by 35% at MU and 55% at CWRU as described in Figure 2.

Correspondingly, when questioned about their satisfaction with training at dental schools, 73.7% at IUSD, 84.2% at CWRU, 78.9% at MU, and 38.1% at UAB reported being satisfied. The first-year participants at UAB reported a relatively lower level of satisfaction with the training that they have received in their program when compared to their fourth-year peers, as presented in Figure 3. At the other schools, fourth-year students expressed a desire for more medical emergency training from their respective programs.

Discussion

The goal of this study was to establish a baseline assessment of the level of medical emergency preparedness for the four groups being evaluated. The baseline assessment helped us determine the knowledge base of dental students to provide appropriate treatment in case of a medical emergency. Therefore, the mean of correct responses was used to assess the

preparedness of the participating dental students. Our findings are consistent with studies done in Iran, New Zealand, and Brazil, which found deficient preparedness and less than expected confidence in the level of training and knowledge.^{17,21,22} Along the same lines, Fast et al reported that only 44% of practicing dentists were comfortable handling a medical emergency in their dental offices.³

Most dentists receive medical emergency training while in dental school. Dental schools have reported only 164 medical emergency incidents per million patient visits (0.016%). Therefore, the dental students would rarely be expected to witness or handle a medical emergency.²² This underscores the necessity to undergo additional training in emergency preparedness following graduation. The pre-doctoral training is not a substitute for further continuing education courses on the topic of medical emergency preparedness.²³ A study found that 23% of dentists participated once in emergency training education after graduating from dental school, and 68% took some form of training more than once.²⁴ Programs for teaching the diagnosis and management of medical emergencies are seriously underdeveloped in American dental schools.²⁵ Our findings are consistent with Clark et al,²⁵ in that fourth-year dental students at IUSD, CWRU, and MU were less satisfied with training than their junior peers.

This assessment strengthens the idea that dental schools should incorporate several curricular changes to purposefully and pointedly enhance the ability of dental students to manage medical emergencies. Regular mock drills to manage medical emergencies should be conducted with groups of students and clinical staff. This would enable them to better understand their exact roles in case of a medical emergency and to assign responsibilities to their staff in future. Such interactive sessions require specific allocated time in the dental

curriculum. Emergency drills must be scheduled on a regular basis as repetition of scenarios is essential to improve training outcomes. Additionally, dental schools need to incorporate continuing education courses which can be offered to recent graduates and to dental practitioners.

There were various methodological limitations to this study. The first relates to sample size. The sample size from UAB was different than that of the other three schools. At UAB, a delay in IRB approval led to the timing of the delivery of the scenarios being later in the year than at other institutions. The curriculum map of UAB's block-style curriculum was such that D1 students had completed their entry-level clinical skills (ELCS) course, but D2 and D3 students had not completed their systems-based and dental specialty-based courses, respectively. Therefore, the discernment between D1 and D4 students was considered most appropriate based upon their course design and timing within the year of the examination, and delay of scenario administration would have resulted in testing of redundant groups. Nevertheless, this did not reduce the robustness of the statistical results of the study.

Second, the participants were assessed based on multiple-choice questions. Preset answer choices may narrow perceptions in comparison to real-life events. It is also possible that the students wrongly understood the questions or may have found the answer choices confusing, resulting in an over or underestimation of students' knowledge. Although open-ended questions could have been more realistic, by enabling students to answer in a short essay format, this approach would have created methodological challenges to abstract data into a quantifiable format.

Third, the participants addressed a limited number of clinical scenarios. However, the ten most common medical emergencies were used to reflect their knowledge about the subject.

Additionally, 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. Finally, the four schools in this study presented significant variation with regards to when students were exposed to curricular information on medical emergency management. This is an empirically important issue, as the curriculum addressing emergency management is known to be loosely integrated in curricula across all schools – not only the four that participated in the present research. At UAB, students participate in an Entry Level Clinical skills course in Fall D1 and a Clinical Integration course in Fall D2 that covers didactic information about medical emergencies. They also have a small group based medical emergency simulation in the Spring of D2 year with calibrated instructors and a debrief discussion before their clinic entry objective structured clinical exam (OSCE). During clinical instruction, reinforcement of medical emergency protocols is reviewed and standardized clinical procedures, including medical emergencies, are reviewed in clinical groups. Early exposure to medical emergency management in the UAB curriculum could help explain the higher scores for their D1 students. At IUSD, students have emergency medical didactic sessions in their D2 year followed by sessions during clinical rounds in the D3 and D4 years. The medical emergency committee has also developed a manual with well-defined algorithms for emergency management to which all personnel in the school have access. At MU, students get their didactic training in the D3 year with a simulation final exam that follows. At CWRU, students get their instruction in the D3 year. In our study, the higher scores for D3 and D4 students on the medical scenarios likely reflect increased clinical experiences in patient management and careful attention to patient's medical histories prior to working on their patients. The one consistent among all the schools is in

CPR/BLS training. Clearly, purposeful standardization of curriculum is an aspect that ought to be addressed across schools.

Findings from our study serve as a preliminary assessment of information regarding the knowledge base and preparedness of dental students to manage medical emergencies. They also imply that a careful assessment of dental curricula as it relates to medical emergency preparedness must be conducted at dental schools and repetition of this important information must be reinforced throughout the four years of study.

Conclusion

Preparedness to manage medical emergencies among students across four dental schools was statistically similar. However, more training could better prepare students in the diagnosis and management of medical emergencies. This may be accomplished through additional didactic and clinical instruction, incorporating regular mock drills and simulations in the curriculum, and by adopting standardized protocols and through establishing additional continuing education courses during and after graduation.^{26,27}

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References

1. Greenwood M. Medical emergencies in the dental practice. *Periodontol* 2000. 2008;46:27-41. doi:10.1111/j.1600-0757.2008.00230.x
2. Narayan DP, Biradar SV, Reddy MT, Bk S. Assessment of knowledge and attitude about basic life support among dental interns and postgraduate students in Bangalore city, India. *World J Emerg Med.* 2015;6(2):118-122. doi:10.5847/wjem.j.1920-8642.2015.02.006
3. Fast TB, Martin MD, Ellis TM. Emergency preparedness: a survey of dental practitioners. *J Am Dent Assoc* 1986;112(4):499-501.
4. Talattof, Z. and A. Azad, An Evaluation of Knowledge, Attitude and Practice of Adverse Drug Reaction Reporting in Dental Practice. *Pakistan Journal of Nutrition*, 2015. 14(10): p. 712-715.
5. Vaughan M, Park A, Sholapurkar A, Esterman A. Medical emergencies in dental practice - management requirements and international practitioner proficiency. A scoping review. *Aust Dent J.* 2018;63(4):455-466. doi:10.1111/adj.12649
6. Dolan TA, Atchison K, Huynh TN. Access to dental care among older adults in the United States. *J Dent Educ.* 2005;69(9):961-974.
7. House A, Stark D. Anxiety in medical patients. *BMJ.* 2002;325(7357):207-209. doi:10.1136/bmj.325.7357.207
8. Facco E, Zanette G. The Odyssey of Dental Anxiety: From Prehistory to the Present. A Narrative Review. *Front Psychol.* 2017;8:1155. Published 2017 Jul 11. doi:10.3389/fpsyg.2017.01155
9. Chapman PJ. Medical emergencies in dental practice and choice of emergency drugs and equipment: a survey of Australian dentists. *Aust Dent J.* 1997;42(2):103-108. doi:10.1111/j.1834-7819.1997.tb00104.x
10. Marks LA, Van Parys C, Coppens M, Herregods L. Awareness of dental practitioners to cope with a medical emergency: a survey in Belgium. *Int Dent J.* 2013;63(6):312-316. doi:10.1111/idj.12046
11. Girdler NM, Smith DG. Prevalence of emergency events in British dental practice and emergency management skills of British dentists. *Resuscitation* 1999;41(2):159-67.
12. Arsati F, Montalli VA, Flório FM, et al. Brazilian dentists' attitudes about medical emergencies during dental treatment. *J Dent Educ.* 2010;74(6):661-666.
13. Nogami K, Taniguchi S, Ichiyama S. Rapid Deterioration of Basic Life Support Skills in Dentists with Basic Life Support Healthcare Provider. *Anesth Prog* 63:62–66 2016

14. Greenwood M. Medical emergencies in dental practice: Management of specific medical emergencies. *Dent Update*. 2009;36(5):262-268 doi:10.12968/denu.2009.36.5.262
15. McKernon SL, Kaura L, Taylor KH et al. A dental undergraduate course for the management of medical emergencies in dental practice. *Eur J Dent Educ*. 2008;12(4):239-246. doi:10.1111/j.1600-0579.2008.00525.
16. Atherton, G.J., J.A. McCaul, and S.A. Williams, Medical emergencies in general dental practice in Great Britain. Part 3: Perceptions of training and competence of GDPs in their management. *Br Dent J*, 1999. 186(5): p. 234-7.
17. Broadbent JM, Thomson WM. The readiness of New Zealand general dental practitioners for medical emergencies. *N Z Dent J*. 2001;97(429):82-86.
18. Roy E, Quinsat VE, Bazin O, Lesclous P, Lejus-Bourdeau C. High-fidelity simulation in training dental students for medical life-threatening emergency. *Eur J Dent Educ*. 2018;22(2):e261-e268. doi:10.1111/eje.12284
19. Kishimoto N, Mukai N, Honda Y, Hirata Y, Tanaka M, Momota Y. Simulation training for medical emergencies in the dental setting using an inexpensive software application. *Eur J Dent Educ*. 2018;22(3):e350-e357. doi:10.1111/eje.1230
20. de Bedout T, Kramer K, Blanchard S, et al. Assessing the Medical Emergency Preparedness of Dental Faculty, Residents, and Practicing Periodontists: An Exploratory Study. *J Dent Educ*. 2018;82(5):492-500. doi:10.21815/JDE.018.058
21. Azad A, Talattof Z, Deilami Z, Zahed M, Karimi A. Knowledge and attitude of general dentists regarding common emergencies in dental offices: A cross-sectional study in Shiraz, Iran. *Indian J Dent Res*. 2018;29(5):551-555. doi:10.4103/ijdr.IJDR_587_16
22. Gonzaga HF, Buso L, Jorge MA, Gonzaga LH, Chaves MD, Almeida OP. Evaluation of knowledge and experience of dentists of São Paulo State, Brazil about cardiopulmonary resuscitation. *Braz Dent J*. 2003;14(3):220-222. doi:10.1590/s0103-6440200300030001
23. Mutzbauer, Mutzbauer TS, Rossi R, Ahnefeld FW, Sitzmann F. Emergency medical training for dental students. *Anesth Prog*. 1996;43(2):37-40.
24. Muller MP, Hansel M, Stehr SN, Weber S, Koch T. A state-wide survey of medical emergency management in dental practices: incidence of emergencies and training experience. *Emerg Med J* 2008;25(5):296-300.
25. Clark MS, Heine CS, Fryer GE Jr. Medical emergency education in American dental schools. *J Dent Educ*. 1985;49(3):179-181.

26. King BJ, Elo JA, Herford AS. 2019. Management of medical emergencies. In: Elo JA, Herford AS, editors. Oral surgery for dental students: A quick reference guide. New York (NY): Thieme. P. 212-231.

27. Little JW, Miller CS, Rhodous NL. Little and Falace's Dental Management of the Medically Compromised Patient. Guide to Management of Common Medical Emergencies in the Dental Office. Appendix A 597-605; 9th Edition, Elsevier

Figures and Tables:

Figure 1: Knowledge score by school and dental student year. Mean \pm SD. IU=Indiana University. CWRU=Case Western Reserve University. MU=Marquette University. UAB=University of Alabama-Birmingham.

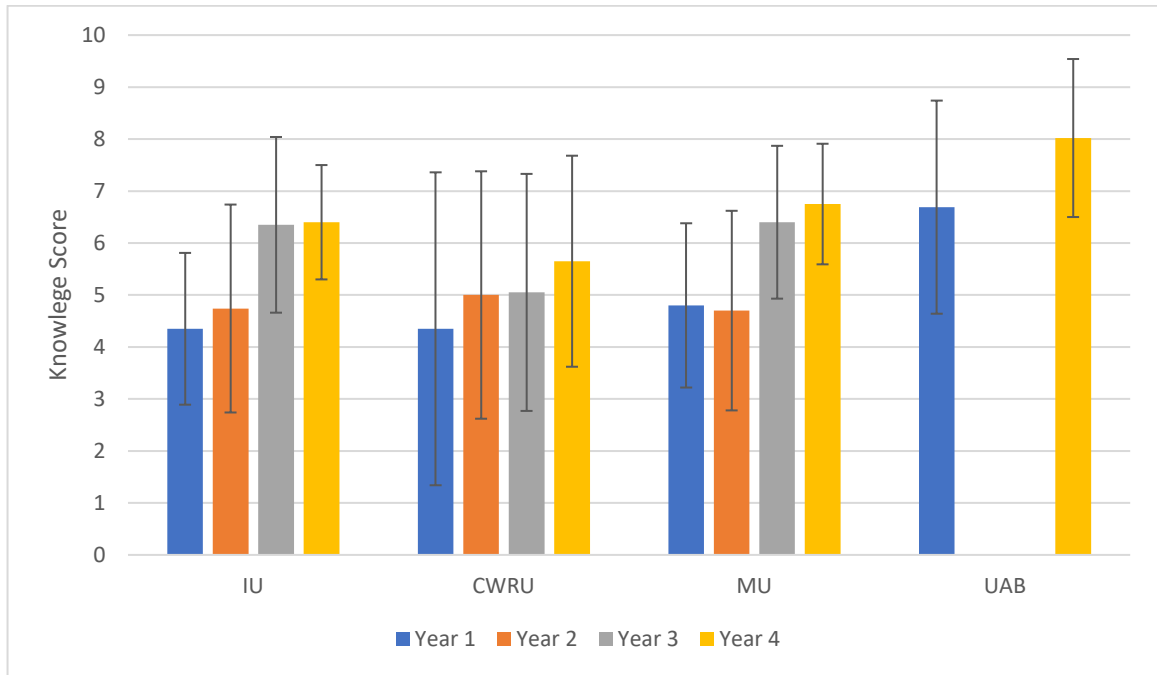


Figure 2: Student comfortable in their knowledge about medical emergencies.
IU=Indiana University. CWRU=Case Western Reserve University. MU=Marquette University. UAB=University of Alabama-Birmingham.

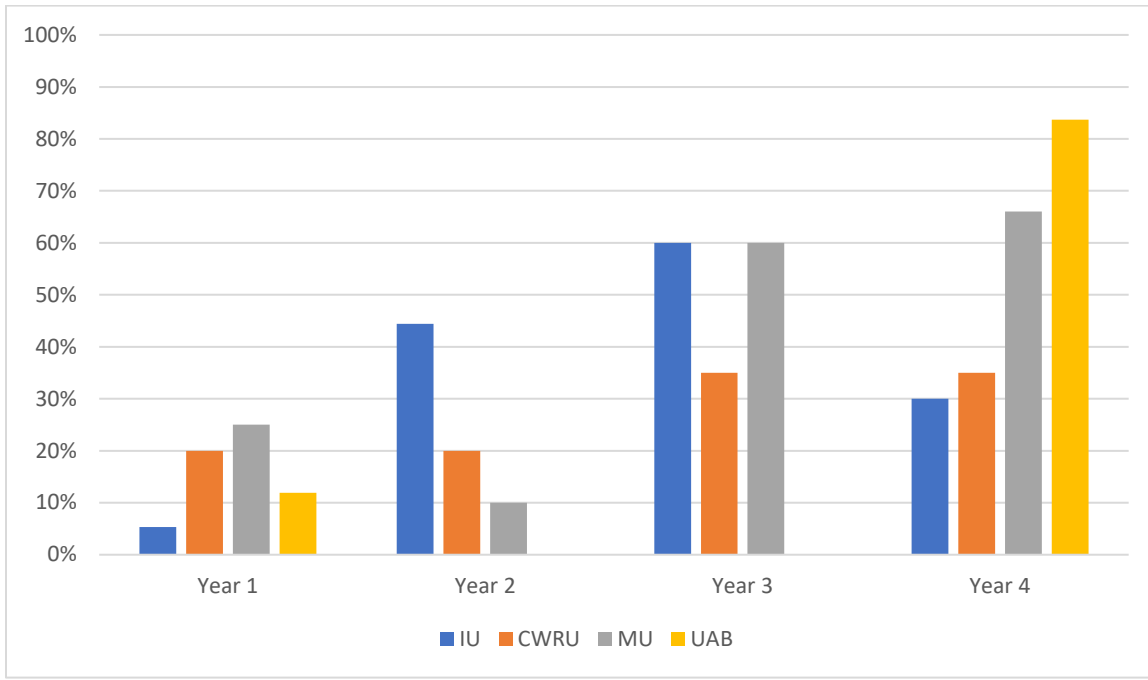


Figure 3: Student satisfied with training by student year and dental school.

IU=Indiana University. CWRU=Case Western Reserve University.

MU=Marquette University. UAB=University of Alabama-Birmingham.

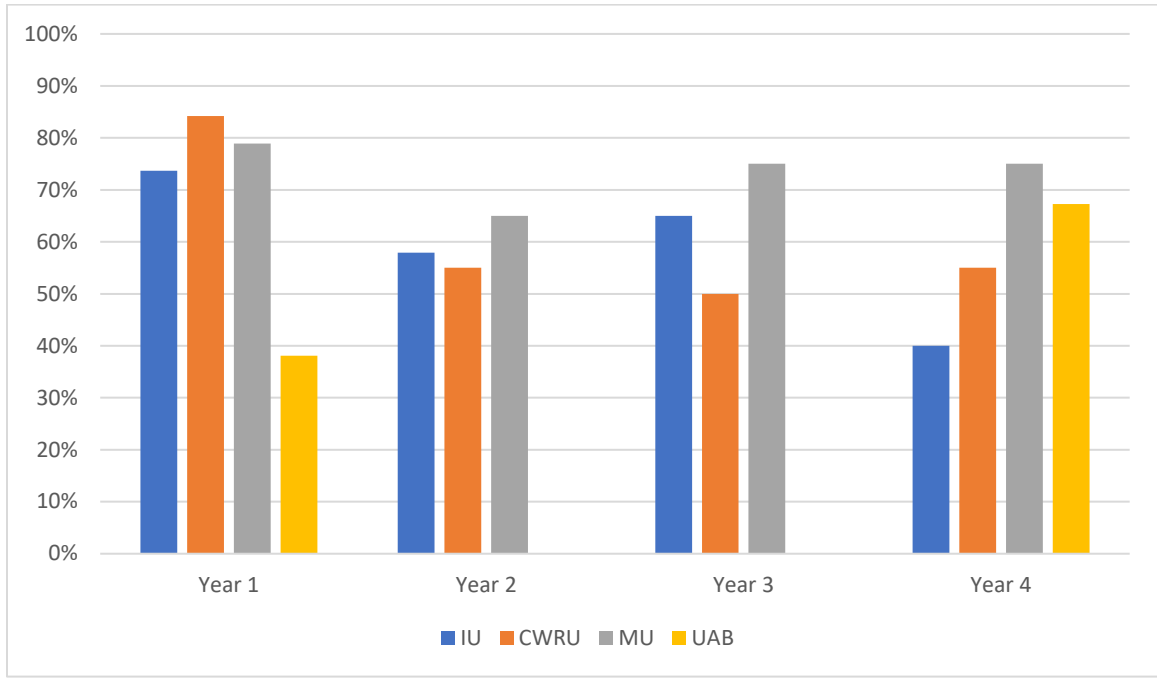


Table 1. Survey Results

Variable	Case Western				Indiana University				Marquette University				UAB	
	Yr 1 n (%)	Yr 2 n (%)	Yr 3 n (%)	Yr 4 n (%)	Yr 1 n (%)	Yr 2 n (%)	Yr 3 n (%)	Yr 4 n (%)	Yr 1 n (%)	Yr 2 n (%)	Yr 3 n (%)	Yr 4 n (%)	Yr 1 n (%)	Yr 4 n (%)
Comfortable with your knowledge														
No	16 (80)	16 (80)	13 (65)	13 (65)	18 (94.7)	10 (55.6)	8 (40)	14 (70)	15 (75)	18 (90)	8 (40)	9 (45)	37 (88.1)	8 (16.3)
Yes	4 (20)	4 (20)	7 (35)	7 (35)	1 (5.3)	8 (44.4)	12 (60)	6 (30)	5 (25)	2 (10)	12 (60)	11 (55)	5 (11.9)	41 (83.7)
Missing							3							
Satisfied with training														
No	3 (15.8)	9 (45)	10 (50)	9 (45)	5 (26.3)	8 (42.1)	7 (35)	12 (60)	4 (21.1)	7 (35)	5 (25)	5 (25)	26 (61.9)	16 (32.7)
Yes	16 (84.2)	11 (55)	10 (50)	11 (55)	14 (73.7)	11 (57.9)	13 (65)	8 (40)	15 (78.9)	13 (65)	15 (75)	15 (75)	16 (38.1)	33 (67.3)
Missing		1				2				1				
Blood Pressure														
No	1 (6.7)	0	0	1 (5)	2 (16.7)	0	0	1 (5)	8 (100)	20 (100)	20 (100)	20 (100)	0	0
Yes	14 (93.3)	20 (100)	20 (100)	19 (95)	10 (83.3)	19 (100)	20 (100)	19 (95)	0	0	0	0	0	49 (100)
Missing		5				9				12				42
Pulse Rate														
No	2 (16.7)	3 (15)	2 (10)	1 (5)	1 (9.1)	2 (10.5)	0	0	1 (12.5)	0	0	0	0	33 (67.4)
Yes	10 (83.3)	17 (85)	18 (90)	19 (95)	10 (90.9)	17 (89.5)	20 (100)	20 (100)	7 (87.5)	20 (100)	20 (100)	20 (100)	0	16 (32.6)
Missing		8				10				12				42
RR Pulse oximeter														
No	6 (54.6)	9 (45)	10 (50)	18 (90)	7 (63.6)	17 (89.5)	20 (100)	20 (100)	3 (37.5)	2 (10)	16 (80)	19 (95)	0	46 (93.9)
Yes	5 (45.5)	11 (55)	10 (50)	2 (10)	4 (36.4)	2 (10.5)	0	0	5 (62.5)	18 (90)	4 (20)	1 (5)	0	3 (6.1)
Missing		9				10				12				42
Temperature														
No	7 (63.6)	20 (100)	20 (100)	20 (100)	9 (81.8)	18 (94.7)	20 (100)	20 (100)	5 (62.5)	19 (95)	20 (100)	19 (95)	0	49 (100)
Yes	4 (36.4)	0	0	0	2 (18.2)	1 (5.3)	0	0	3 (37.5)	1 (5)	0	1 (5)	0	0
Missing		9				10				12				42
Glucose														
No	4 (44.4)	18 (90)	12 (60)	13 (65)	5 (45.5)	3 (15.8)	10 (50)	14 (70)	2 (25)	12 (70.6)	8 (40)	15 (75)	0	36 (73.5)
Yes	5 (55.6)	2 (10)	8 (40)	7 (35)	6 (54.5)	16 (84.2)	10 (50)	6 (30)	6 (75)	5 (29.4)	12 (60)	5 (25)	0	13 (26.5)
Missing		11				10				15				42

Appendix 1- Examples of Clinical Scenarios Used in the Study

Clinical Scenario 1

A young female patient is in the reception area waiting for her dental appointment. She begins to wheeze and becomes short of breath. Your receptionist notices that the patient is in distress and asked the patient “are you okay” then yells for assistance. The patient is beginning to have more difficulty breathing. You come out to the reception area and ask the staff, “Does she have any medical conditions or is taking any medicine?” Following a quick review of her records your assistant responds, “She uses an inhaler sometimes.” The patient starts to wheeze badly now. You notice that the patient’s skin color now has a bluish tinge to it.

Diagnosis and Basic Plan of Intervention

Diagnosis-

Best Basic Intervention Step:

- a) Administer 1 mg of epinephrine intramuscularly, call 911 and give oxygen via a nasal cannula at 4 l/min.
- b) Ask the patient if she has her inhaler, if not, provide her with one from emergency kit, and administer oxygen via non-rebreather mask 6-10 LPM.
Monitor patient's response
- c) After telling the receptionist to activate EMS, give the patient her albuterol (Proventil) inhaler.
- d) Call for EMS, give the patient 50 mg of oral diphenhydramine (Benadryl) followed by oxygen at 10 l/min using a non-rebreather.

Clinical Scenario 2

A 22-year-old anxious female presents to the dental office for a root canal procedure. She has been in pain for two days and is agitated. She continues to become more anxious while waiting in the reception area. After you seat her in the chair, you notice she appears very nervous and begins breathing fast. She says she cannot breathe and she is unable to slow her rapid rate of breathing. Pulse: 120 BPM, BP: 130/80 mmHg RAS, Respiratory Rate: 28 breaths/min. The patient indicates that she is beginning to feel faint. You attempt to begin calming by reassuring her things will be okay.

Diagnosis and Basic Plan of Intervention

Diagnosis-

Best Basic Intervention Step

- a) Administer oxygen using a nasal cannula at 4 l/min and call 911 if unresolved.
- b) Call 911 and provide a plastic bag for her to breathe into until she feels better.
- c) Have her breathe into a paper bag, monitor and call 911 if not resolved.
- d) Have her take several deep breaths, monitor, and call 911.

Clinical Scenario 3

A 28-year-old male is scheduled for periodontal surgery. Upon review of patient's chart, it is noted he has not been compliant taking Carbamazepine (Tegretol) as prescribed by his physician. While in your dental chair, he starts involuntary jerking his hands and legs. Your assistant observes this activity and immediately notifies you.

Diagnosis and Basic Plan of Intervention

Diagnosis-

Best Basic Intervention Step-

- a) Place a bite block in the patient's mouth, so they do not bite their tongue until involuntary movements subside. Call EMS if the episode does not resolve within 5 minutes.
- b) Protect patient by clearing items out of the way. Do not restrain patient. Have all staff line up on opposite sides of the chair to prevent the patient from falling. Call EMS if the episode does not resolve within 5 minutes.
- c) Protect patient by clearing items out of the way. Gently restrain the patient and have all staff line up on opposite sides of the chair to prevent the patient from falling. Call EMS if the episode does not resolve within 5 minutes.
- d) Protect patient by clearing items out of the way. Gently restrain the patient so that they do not know themselves. Call EMS if the episode does not resolve within 10 minutes