

Final Year Dental Students' Perception of Knowledge, Training and Competence in Medical Emergency Management

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Abstract

Objective: The potential for a medical emergency to occur during dental treatment must be met by dental practitioners who are competent to manage such situations. However the literature shows that not all dentists have received training in this area, and of those who have, many are deficient in knowledge, skills and confidence. The objective of this study was to examine the perceptions of final year Jordanian dental students regarding their education and preparedness to manage medical emergencies.

Methods: This study was a cross-sectional, descriptive study which gathered questionnaire data from an undergraduate student cohort at two Jordanian universities. Descriptive analysis of the data was undertaken, and a Chi-squared test was used to explore the relationships between participants' responses and the variables of gender and previous attendance at any ME workshop. Statistical significance was deemed at $p < .05$.

Results: Three hundred and seventy dental students responded to the questionnaire with response rates of 76.2% and 81.8% from the two sites. The results indicate that not all of the students had received training in medical emergency management, and their self-reported proficiency and experience was sub-optimal. However, participating in a workshop on managing medical emergencies was associated with changes in some skills and experiences.

Conclusion: The low levels of medical emergency management knowledge and skills in the final year dental students reflects the situation reported in existing literature. This study indicates the importance of effective medical emergency management training within the dental undergraduate program, and may be used to inform future curricula planning.

Keywords: cardiopulmonary resuscitation, dental education, emergency treatment, curriculum

1. Introduction

As the global population continues to age, both the proportion and absolute number of older people are increasing (World Health Organization, 2015). To illustrate this, it has been estimated that the population over 65 years of age in the United States of America (US) will more than double in the years between 2005 and 2050 (Passel & Cohn, 2008). Likewise, the population of all countries of the Middle East is projected to increase dramatically over future decades, including Jordan which has a projected increase of 70% between 2007 and 2050 (Roudi-Fahimi & Kent, 2007). With increasing age, there is an increasing incidence of chronic diseases such as cardiovascular, respiratory, musculoskeletal, mental and neurological disorders, as well as cancer, diabetes, and dementia (Prince et al., 2015). It has been estimated that 80% of elderly people have one chronic disease and 50% have two or more (National

Centre for Chronic Disease Prevention and Health Promotion, 2011).

This worldwide change in demographic profile of the population increases the likelihood that dental patients will present with more complex medical histories, thereby increasing the potential for medical problems to occur during dental care (Little, Miller, & Rhodus, 2018). A study from the US reported that patients in their dental clinic had an average age of 52 years, and over half were taking medication or had at least one systemic illness (Radfar & Suresh, 2007). The combination of an aging patient profile, multi-morbidity and medications taken results in an increasingly medically complex patient cohort, thereby necessitating that dentists are prepared to identify and manage medical emergencies (MEs). Furthermore, dental procedures such as anaesthesia or surgery may increase the possibility of a ME occurring in predisposed patients (Laurent et al., 2009).

MEs may occur at any time, in any environment, including within a dental practice, and have been reported to be over 5 times more likely to occur in a dental office than a medical office (Feck, 2012). The incidence of MEs has been reported at 164 events per million dental visits (Anders, Comeau, Hatton, & Neiders, 2010). An earlier report concluded that a dentist who practices for 40 years will be exposed to between nine and eleven emergency events throughout their career (Atherton et al., 1999), and studies from various countries have reported that 32 to 69% of dentists have encountered a ME in their practice (Čuković - Bagić et al., 2017; Müller, Hänsel, Stehr, Weber, & Koch, 2008; Mwita, Machibya, & Nyerembe, 2017). Although it is difficult to compare frequency levels due to various timeframes being used for data collection, this does indicate that MEs do occur and are an important consideration in dental practice.

Vasovagal syncope is often cited as the most commonly occurring ME in dental practice (Alhamad et al., 2015; Müller et al., 2008). However other MEs that may occur include: cardiac arrest, anaphylaxis, airway obstruction, stroke, as well as hypoglycaemic, asthmatic, and epileptic episodes (Leelavathi, Reddy, Elizabeth, & Priyadarshni, 2016; Müller et al., 2008). While the occurrence of a ME is relatively infrequent in dental practice, all dentists have a duty of care to provide effective and safe care to their patients (Jevon, 2012). This imperative includes the ability to identify and manage a ME should one arise. A slow or non-existent response to a ME such as a cardiac arrest may worsen a patient's prognosis considerably (Resuscitation Council (UK), 2015).

However, previous research indicates that dentists may lack the knowledge, confidence and preparedness to be able to manage MEs that may occur within their practice (Alhamad et al., 2015; Arsati et al., 2010; Broadbent & Thomson, 2001). The literature suggests that not all dentists are exposed to training about MEs, or basic life support (BLS) including cardiopulmonary resuscitation (CPR) (Leelavathi et al., 2016; Müller et al., 2008; Stafuzza, Carrara, Oliveira, Santos, & Oliveira, 2014). For example, a study carried out in New Zealand reported that 18% of dentists had no undergraduate ME training (Broadbent & Thomson, 2001), and approximately 25% of two different cohorts in India reported no ME training (Abraham & Afradh, 2016; Varma, Pratap, Padma, Kalyan, & Vineela, 2015). However even for those dental practitioners who have received training about MEs or BLS, many do not feel confident or competent to deliver these skills effectively (Stafuzza et al., 2014; Varma et al., 2015). Moreover, basic and advanced life support skills have been shown to deteriorate after only 6 months post skill acquisition (Cooper, Johnston, & Priscott, 2007; Yang et al., 2012), highlighting the importance of ongoing, recurrent training or refresher courses, both at undergraduate and postgraduate levels.

The dental program at the Jordan University of Science and Technology (JUST) is a five year undergraduate program, where second year students have a one-hour theoretical session covering basic emergency care taught by an emergency physician. This is a newly introduced course started two years ago, at the commencement of this study. The dental program at the University of Jordan (JU) is also a five year program which includes a three hour theoretical session covering the principles of first-aid, and also taught to second year students. The aim of the study was to examine perceptions of final year dental students at JUST and JU regarding their education and preparedness to manage MEs within a dental office.

2. Methods

This study was approved by the JUST Institutional Research Board (IRB protocol number 182/ 2015). Student responses were examined using a cross-sectional, descriptive methodology. A paper-based questionnaire developed by the authors at JUST was used to gather demographic information as well as information regarding participants' self-perceived skills and competencies of managing MEs, the types of MEs and emergency procedures they had encountered, and whether they had attended any ME training.

The questionnaire had not been previously utilised, and as such the reliability and validity was yet to be determined. In this study, it was used in an exploratory capacity to gather data on a topic in a previously unexamined cohort. Further studies will be required to determine the aforementioned questionnaire characteristics. The questions were

selected via author consultation and consensus. Initially, the questionnaire was distributed to a group of ten JUST dental students as a pilot study to evaluate their understanding of the questions. After student feedback, amendments were made to the questionnaire. The ten students who participated in the pilot study were excluded from the subsequent study group. The finalised survey was distributed to students from both participating universities by research assistants and the principle investigator at the conclusion of lectures and was collected after survey completion. Participation was voluntary, and consent was implied by return of a completed survey.

Data analysis was completed with the Statistics Package for the Social Sciences (IBM SPSS v17). Descriptive analysis of the data was undertaken, and a Chi-squared test for independence (with Yates Continuity Correction) was used to explore the relationships between participants' responses and the variables of gender and previous attendance at any ME workshop. Statistical significance was deemed at $p < .05$.

3. Results

A total of 370 dental students responded to the questionnaire with a response rate from JUST of 76.2% (253/332) and 81.8% (117/143) from JU. The majority (66.2%) were female and the mean age was 22.9 (SD 1.3) years. Most (68.4%) were enrolled at the Jordan University of Science and Technology (JUST) and 31.6% at the University of Jordan (JU).

Approximately half of the respondents (51.6%) reported receiving CPR training, and 42.7% had attended a workshop on managing MEs. Although 91.9% of respondents reported that they had knowledge about CPR, only 51.4% reported that they could perform CPR. Self-perceived competency with regards to emergency treatment and drugs revealed that 75.7% had knowledge about oxygen and its route of administration, and 69.5% reported the same knowledge of adrenaline. Almost eight in ten students (79.5%) were aware of common drugs used in dentistry that may precipitate an allergic reaction.

The self-reported proficiency in various ME management skills was generally low. For example, less than 50% of respondents felt they possessed skills in administering artificial respiration or the Heimlich manoeuvre. Proficiency in giving injections by various routes was also low (23.2% - 45.8%), however more than eight in ten individuals felt they were able to check the carotid pulse (Table 1).

Table 1. Self-perceived possession of ME management skills

Do you have the following skills?	Yes n (%)
Artificial respiration (n=370)	160 (43.2)
Give an IM injection (n=369)	169 (45.8)
Give a S/C injection (n=370)	120 (32.4)
Give an IV injection (n=370)	86 (23.2)
Check the carotid pulse (n=370)	306 (82.7)
Perform Heimlich manoeuvre (n=370)	178 (48.1)

The proportion of the students who had previously encountered various MEs ranged from 24.9% - 37.3% and the proportion that had encountered the specified ME procedures ranged from 10% - 15.7% (Table 2). Approximately four in ten students (42.7%) had attended a workshop on managing MEs, however overall 83.5% said that they were willing to attend any ME training in the future. For those that had not attended a ME workshop, their reasons for non-attendance were as follows: lack of time 24.3%, not interested 26.5%, didn't know where to go 36.2%, and felt it was unnecessary for a dentist 12.7%. For those that had attended ME training, all four included training modalities; simulation, seminars, videotapes, and slides / PowerPoint, were reported to have been used (Table 2).

Table 2. Medical Emergency training and experiences

Variable		Yes n (%)
Have you encountered any of the following medical emergencies?	Fainting attack (n=370)	95 (25.7)
	Foreign body inhalation (n=370)	138 (37.3)
	Epileptic attack (n=370)	96 (26.0)
	Uncontrolled bleeding (n=370)	92 (24.9)
	Chest pain (n=370)	99 (26.8)
	Shortness of breath (n=370)	130 (35.1)
Type of training received (by those who have received training)	Simulation (n=370)	130 (35.1)
	Seminars (n=369)	177 (48.0)
	Videotapes (n=370)	150 (40.5)
	Slides and PowerPoint (n=369)	167 (45.3)
Medical emergency procedure encountered during your practice	Venepuncture (n=369)	47 (12.7)
	Endotracheal intubation (n=370)	40 (10.8)
	Pulse oximetry (n=370)	58 (15.7)
	Automated external defibrillation (n=370)	37 (10.0)
	Cardiopulmonary resuscitation (n=370)	45 (12.2)

Table 3 shows the Chi-squared associations between having attended a ME workshop and various ME skills and knowledge, as well as experience of MEs and their management. Attending a ME workshop had a statistically significant association with the self-reported ability to provide artificial respiration, CPR, and intramuscular, subcutaneous and intravenous injections, having received CPR training, as well as encountering MEs (foreign body inhalation, chest pain, shortness of breath), and procedures (CPR, automated external defibrillation, venepuncture, intubation, pulse oximetry) while in practice.

Table 3. Associations of attending a ME workshop

Variable	Participants that had attended a ME workshop		Total (n)	χ^2	p		
	No (n)	Yes (n)					
Do you have the following skills?	Artificial respiration	No	133	77	210	6.67	.01*
		Yes	79	81	160		
	Give an intramuscular injection	No	144	56	200	37.85	≤.001*
		Yes	67	102	169		
	Give a subcutaneous injection	No	161	89	250	15.01	≤.001*
		Yes	51	69	120		
	Give an intravenous injection	No	178	106	284	13.52	≤.001*
		Yes	34	52	86		
	Check the carotid pulse	No	40	24	64	.62	.43
		Yes	172	134	306		
	Perform Heimlich manoeuvre	No	114	78	192	.54	.46
		Yes	98	80	178		

Cardiopulmonary resuscitation	Do you have any knowledge about CPR?	No	22	8	30	2.76	.10	
		Yes	190	150	340			
	Do you receive any type of CPR training?	No	132	47	179	37.04	≤.001*	
		Yes	80	111	191			
	Can you perform CPR?	No	126	54	180	22.12	≤.001*	
		Yes	86	104	190			
Medical emergency training	Are you willing to undergo any training on handling medical emergencies in future?	No	41	20	61	2.47	.12	
		Yes	171	138	309			
Do you have the knowledge about emergency drugs and their routes of administration?	Oxygen	No	55	35	90	.52	.47	
		Yes	157	123	280			
	Adrenaline	No	60	53	113	.94	.33	
		Yes	152	105	257			
	Are you aware of the common drugs used in dentistry that can precipitate an allergic reaction?	No	50	26	76	2.40	.12	
		Yes	162	132	294			
Have you encountered any of the following medical emergencies?	Fainting attack	No	160	115	275	.22	.64	
		Yes	52	43	95			
	Foreign body inhalation	No	151	81	232	14.58	≤.001*	
		Yes	61	77	138			
	Epileptic attack	No	162	112	274	1.17	.28	
		Yes	50	46	96			
	Uncontrolled bleeding	No	169	109	278	5.02	.03*	
		Yes	43	49	92			
	Chest pain	No	174	97	271	18.72	≤.001*	
		Yes	38	61	99			
	Shortness of breath	No	156	84	240	15.68	≤.001*	
		Yes	56	74	130			
	Have you encountered any of the following medical emergency procedures during your practice?	Venepuncture	No	195	127	322	9.01	.003*
			Yes	17	30	47		
Intubation		No	200	129	329	13.83	≤.001*	
		Yes	12	28	40			
Pulse oximetry		No	192	120	312	13.55	≤.001*	
		Yes	20	38	58			
Automated external defibrillation		No	204	129	333	19.80	≤.001*	
		Yes	8	29	37			
Cardiopulmonary resuscitation		No	203	122	325	27.42	≤.001*	
		Yes	9	36	45			

Note. χ^2 = Chi squared, *= statistically significant.

The associations of gender with ME skills, knowledge and experiences were then examined. Gender was significantly associated with encountering venepuncture χ^2 (1, n=369) = 8.01, p=.005, intubation χ^2 (1, n=369) = 5.21 p=.02, automated external defibrillation χ^2 (1, n=370) = 4.83, p=.03, and cardiopulmonary resuscitation χ^2 (1, n=370) = 6.02, p=.01, in practice. Gender was also associated with the ability to give a subcutaneous injection χ^2 (1,

$n=370$) = 4.43, $p=.04$, to perform the Heimlich manoeuvre χ^2 (1, $n=370$) = 6.25, $p=.01$, to have knowledge about CPR χ^2 (1, $n=370$) = 4.67, $p=.03$, and attending a workshop on handling MEs χ^2 (1, $n=370$) = 3.9, $p=.05$. There was no significant association of gender and the self-perceived ability to: deliver artificial respiration, IM and IV injections, checking the carotid pulse, performance of CPR, attendance at previous CPR training, willingness to participate in future ME training, knowledge of oxygen, adrenaline and drugs which may precipitate an allergic reaction, encountering any of the specified MEs, or encountering pulse oximetry during practice.

4. Discussion

This study explored the perceptions of final year dental students at JUST and JU regarding their education and preparedness to manage MEs within a dental office. Overall the student cohort reported sub-optimal levels of ME knowledge and skill. Less than half of the respondents reported possessing emergency medical skills such as providing artificial respiration, administering injections by various routes, and performing the Heimlich manoeuvre. In comparison, over 80% reported knowing how to check the carotid pulse. Moreover, only 51.4% reported that they could perform CPR. This is comparable to a previous project conducted in Saudi Arabia, which reported only 45% of dentists felt competent to perform CPR (Alhamad et al., 2015). Other studies have likewise reported the majority of dentists felt they are unable or unprepared to provide CPR, BLS or first aid in an emergency (Arsati et al., 2010; Stafuzza et al., 2014; Varma et al., 2015).

Approximately half of the present cohort reported that they had done some CPR training. This compares to figures reported in other studies; 56% of dental interns in Southern India had BLS training (Elanchezhiyan et al., 2013), a report from Nigeria documented that 58% final year students had received medical emergency training (Ehigiator, Ehizele, & Ugboadaga, 2014), an Indian study reported that three quarters of dental interns had received some ME training (Abraham & Afradh, 2016), and approximately six in 10 dentists in a Brazilian study had undergone CPR training (Arsati et al., 2010). It is noteworthy that the majority of dentists and dental students feel that they require more training in BLS and MEs and have a positive attitude to learning these skills (Abraham & Afradh, 2016; Mwita et al., 2017; Somaraj et al., 2017). This is reflected in the present cohort where 83.5% of participants were willing to do further ME training.

At least a quarter of the cohort had been exposed to one of the MEs included in the questionnaire. The literature reports varying amounts of exposure to MEs by students and dentists. It has been reported that one to two thirds of dental interns have encountered a ME (Elanchezhiyan et al., 2013; Leelavathi et al., 2016), with other reports stating that over a third of dental practitioners have encountered at least 1 ME over the previous few years (Joshi & Acharya, 2016; Mwita et al., 2017). Additional studies have reported higher incidence levels (Broadbent & Thomson, 2001; Müller et al., 2008); however, it is difficult to compare studies as various reporting timeframes have been used.

The present study has demonstrated a statistically significant association between previous attendance at a ME workshop and the self-perceived ability to perform artificial respiration and CPR as well as the various skills, such as giving IM injections, that may be required in an emergency medical situation. Previous studies have likewise shown that BLS training increases levels of BLS confidence, skills and knowledge (Ibnerasa & de Garve, 2016; Sharma & Attar, 2012).

However, self-perceived confidence in a skill and being able to perform the skill effectively may be two disparate entities, as demonstrated in a study of French dental students where more students felt competent to perform CPR than were able to when examined practically (Laurent et al., 2009). The over-estimation of CPR competencies has also been reported for other healthcare students (Grzeskowiak, 2006), and may be influenced by social desirability (Van de Mortel, 2008). Thus, for future studies, it may be important to include practical examination of skills to allow a better understanding of the interaction of educational interventions on skill acquisition.

Although structured BLS and ME training should be an integral component of dental undergraduate curricula (Sharma & Attar, 2012), it is also important to consider the value of repeated BLS / ME training throughout undergraduate and postgraduate periods. Resuscitation skills have been shown to decline from six weeks post training, with the greatest decreases occurring between six and twelve months (Yang et al., 2012). A survey of general dentists and final year students demonstrated that students had a higher level of knowledge of the management of medically unwell patients than practitioners (Ghapanchi, Shahidi, Kamali, & Zamani, 2016), and Akbari et al (2015) reported that more professional dental experience was associated with lower ME management awareness (Akbari, Raeesi, Ebrahimipour, & Ramezanzadeh, 2015). These studies suggest that it is not enough to have a single exposure to ME management education and training, but rather the importance of ongoing, repeated theory and practical sessions throughout the life of a dental student and practitioner.

A limitation of this study is the self-report nature of the questionnaire due to the possibility of a social desirability response bias. That is, participants responding in a way that is perceived to be appropriate within their social and/or professional environment. One may propose that this could be particularly true of health professionals when answering items which reveal their knowledge or competencies. A further limitation may be a non-response bias, where those who didn't respond to the questionnaire may have answered items differently than those who did respond. Furthermore, the use of a novel, non-validated survey limits generalisability. To advance understanding in this area, it would be beneficial for the questionnaire used in this study to undergo examination for validity and reliability. It is also recommended that further studies in this area examine the effects of educational interventions upon questionnaire findings and skill acquisition.

5. Conclusion

Although the occurrence of MEs within dental practice is relatively infrequent, it is vital for dental practitioners to have the knowledge, confidence, and competence to be able to identify and manage a ME in practice. This study demonstrates that the participating final year dental students have less than optimal levels of self-perceived knowledge and competency with regards to the management of medical emergencies. However the majority are willing to attend future training in this area. This indicates that the student cohort view training in medical emergency management as an important inclusion in dental education. Along with the importance of competence in this area, it is proposed that medical emergency management should be a mandatory component when planning dental undergraduate curricula.

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Competing Interests Statement

The authors declare that they have no competing interests regarding the publication of the paper.

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