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Research article

Medical emergencies in dental practice: A nationwide web-based survey of Italian dentists

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ABSTRACT

Objective: Dentists must be prepared to manage medical emergencies, which are arisen during dental practice together with the increase of age population and medically compromised patients. This study aims at assessing the occurrence of medical emergencies in a cohort of Italian dentists, to ascertain their level of confidence in the management of these conditions, also based on their educational training and type of medical graduation, and, finally, to know their educational needs, in order to plan appropriate institutional interventions for specific training.

Methods: A national-based cross-sectional study was carried out by means of an online survey sent to all dentists working in Italy.

Results: The survey included 6818 questionnaires. Most of the respondents (n = 4443; 65.2%) reported the occurrence of at least one medical emergency during their professional life. The events rarely resulted in death as declared by only 62 (0.9%) of respondents. The commonest medical emergency was the vasovagal syndrome. Most medical emergencies occurred during the dental procedure (n = 4883; 71.6%). An average degree of satisfaction about the ability to diagnose and manage medical emergencies was reported by most of respondents, with high level of confidence in treating vasovagal syndrome, while a lack in preparedness about the management of myocardial infarction or transient ischemic attack (TIA) and stroke. Medical doctors were more confident in managing the emergencies than dentistry graduates ($p < .01$). Considering the educational needs, almost all of participants (n = 6721; 98.6%) declared the need to improve their training and expressed their interest in theoretical-practical institutional courses as well as in the establishment of an official national register for medical emergencies occurred in dental practice.

Conclusions: Medical emergencies are not negligible and the dentist should receive adequate training and continuing education to be updated and ready for their correct management.

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Clinical significance: The dentist should be ready to deal with medical emergencies and provide first aid to the patient. The dentist is not always prepared to manage the most complex emergencies; therefore, there is the need to organize post-graduate courses and to set up an emergency register.

1. Introduction

Despite patient's safety is the main objective of dental practice, dental procedures are not exempted by risks or complications, which may be also life-threatening. The aging population and the ongoing improvements in medical therapies mean that patients in dental settings show progressively complex clinical histories [1–5]. Dental patient could experience fear and anxiety [6–8], facilitating the onset of a medical emergency that can occur at the dental chair during the execution of the planned therapies, in the waiting rooms or even at home, when the patient is discharged.

Medical emergencies, during routine dental practice, are fortunately rare, but, according to a recent systematic review, the frequency of presentation of these events is increasing and a dentist could be faced with a medical emergency every 3.6–5 years of professional activity [4]. In Europe, among the 40% and 70% of dentists reported the occurrence of at least one emergency during their professional life [9–11]. Vasovagal syncope remains the most common event, followed by allergic reactions, seizures, foreign body inhalation and asthmatic and hypertensive crises [9–11].

Dental practitioners are expected to be adept in their initial management, avoiding any delay in the response time for critical care, which can impact on morbidity or mortality for the patient. In spite of this, dentists' training to face these emergencies during the dental degree course is not always adequate and several Authors claimed the need to implement pre-graduate and postgraduate courses on this specific topic [9,11,12].

The knowledge about the frequency and the type of a medical emergency is pivotal to implement the training and practice of all the dental staff, for an early diagnosis and management. Studies on the prevalence and the type of medical emergencies in the dental setting have been conducted in Canada, Brazil, Europe, Great Britain, United States, Iran and Saudi Arabia [9,10,12–21]. However, data often concern small population cohorts and, so far, no epidemiological figures are still available about medical emergencies in the Italian dental setting.

The hypothesis is that dentists are called upon to deal, albeit rarely, with medical emergencies during the practice, but not always have the suitable training to manage them adequately. The primary aim of this work was to obtain data about the occurrence of medical emergencies as experienced by a cohort of Italian dentists. Secondary aims were to ascertain their level of confidence in the management of aforementioned emergencies, also based on their educational training and type of medical graduation, and, finally, to know their educational needs, in order to plan appropriate institutional interventions for specific training.

2. Materials and methods

2.1. Study design and participants

A cross-sectional study was carried out by means of an online survey sent to all dentists (n = 62,441) working in Italy, via Continuing Medical Education (CME)-related online course. The survey associated to the CME course was, then, promoted by the national commission dentists' board (Commissione Albo Odontoiatri, CAO, Nazionale), guaranteeing the possibility of reaching all Italian dentists. The dentists had to complete the survey before attending the CME, as prerequisite to access to the latter. The completion of the survey before the CME course on medical emergencies should avoid source of bias in the answers. For obtaining maximum compliance from respondents, the survey was conducted in Italian, since not all Italian dentists are familiar with the English language and/or have experiences in international contexts, preferring to update via national congresses or course in mother-language.

Sample size calculation was performed with an online tool (http://www.raosoft.com/samplesize.html) setting the following parameters: margin of error = 5%, confidence interval (CI) = 95% and response distribution = 50%. This calculation was based on the total population under investigation (i.e., Italian dentists, n = 62,441), and the minimum number of required respondents for the survey was 382.

The survey was conducted from April 2020 up to October 2021.

2.1.1. Inclusion criteria

Questionnaires completed in full by dentists registered at the dental doctor Italian board. According to the Italian legislative decrees, the following categories can be enrolled in the register of dental doctors: graduates in Medicine and Surgery with specialty in Dentistry, enrolled at the University before 1980; graduates in Medicine and Surgery enrolled at the University in the period between 1980 and 1985, who have taken an aptitude test (law decree 386 October 13, 1998); graduates in Dentistry and Dental Prosthetics (from 1985 up to now). The latter could have a further additional dental specialty (oral surgery, orthodontics or pedodontics).

2.1.2. Exclusion criteria

We excluded questionnaires in case the respondent was not a dentist, or in case the respondent did not work in Italy.

Table 1
Study questionnaire administered to dental hygienists (translated from Italian).

Demographic data
Age (years):
Gender:
Italian region where you work:
• Abruzzo
• Basilicata
• Calabria
• Campania
• Emilia- Romagna
• Friuli-Venezia Giulia
• Lazio
• Liguria
• Lombardia
• Marche
• Molise
• Piemonte
• Puglia
• Sardegna
• Sicilia
• Toscana
• Trentino-Alto Adige
• Umbria
• Valle d'Aosta
• Veneto
How long have you been a dentist?
What university education did you have?
• Degree in Dentistry
• Degree in Medicine with specialty in Dentistry (before 1985)
• Degree in Dentistry with further dental specialty (oral surgery, orthodontics, pedodontics)
In which of the following dental facility do you work? More than one answer can be provided
• Private practice
• Public practice
• Other (please specify)
Which one or which of these anesthetic procedures do you use in your clinical practice? More than one answer can be provided
• Local anesthesia
• General anesthesia
• Deep sedationOther (please specify)
Knowledge and training on the diagnosis and management of medical emergencies
In relation to the diagnosis and clinical management of medical emergencies, indicate your degree of satisfaction on a scale from 1 (absolutely dissatisfied) to 10 (perfectly satisfied) about the university training received
Did you carry out practical cardio-pulmonary resuscitation exercises during your university training? Yes/No
Have you ever taken postgraduate updating courses on medical emergency management in the dental practice? Yes/No
Prevalence and management of medical emergencies in their dental practice
How many medical emergencies have you encountered in your professional practice?
Have you had any medical emergencies in your professional practice during the past two years? Yes/No
The emergencies you encountered occurred: (more than one answer can be provided)
• In the waiting room before the procedure
• During the procedure
• At the end of the procedure
• I haven't encountered any emergencies so far
Have you ever had to call 112 (Italian emergency phone number) seeking for emergency medical support? Yes/No
If so, how many times?
Have any deaths ever occurred in the dental setting in which you work? Yes/No
If so, how many times?
Have any of the following medical emergencies ever occurred in the dental setting in which you work? (please indicate the number of events)
• Vasovagal syndrome
• Allergic drug reaction
• Hypertensive crisis
• Asthmatic crisis
• Seizure
• Hypoglycemic crisis
• Hyperglycemic crisis
• Anaphylaxis
• Angina pectoris

(*continued on next page*)

Table 1 (*continued*)

Demographic data
• Myocardial infarction • TIA or stroke • Severe bleeding • Foreign body ingestion • Foreign body inhalation
Dentists' clinical preparedness for critical care
Please, indicate, on a scale from 1 (severe management difficulty) to 10 (full confidence), how much you feel able to manage the following types of medical emergencies in the professional environment in which you operate
• Vasovagal syndrome • Allergic drug reaction • Hypertensive crisis • Asthmatic crisis • Seizure • Hypoglycemic crisis • Hyperglycemic crisis • Anaphylaxis • Angina pectoris • Myocardial infarction • TIA or stroke • Severe bleeding • Foreign body ingestion • Foreign body inhalation
Would you consider it useful for an institutional register of medical emergencies occurred in the dental setting to be made available and continuously updated on the website of the commission for dentists' board, collecting the reports of medical emergencies in an anonymous and voluntary form? Give your rating on a scale from 1 (not at all useful) to 10 (extremely useful)
Would you consider it appropriate to improve your professional preparation in the field of prevention, diagnosis and management of medical emergencies? Yes/No
Would you consider it useful that the commission for dentists' board should promote theoretical-practical national courses for the management of medical emergencies in dental setting? Yes/No/I do not know
Would you consider it useful that the commission for dentists' board should prepare a poster for diagnosis and the management of medical emergencies in dental setting, to be displayed in the facility where you work? Yes/No/I do not know

2.2. Questionnaire and outcomes

The online platform for CME was used to conduct the survey (https://www.fadinmed.it/). The questionnaire was associated with a CME course on this topic, accessible only to dentists. Each respondent could not automatically answer the questionnaire more than once. The system prevented questions from being skipped.

The questionnaire was validated through a number of steps to ensure its feasibility. All the questions of the survey have been revised and implemented in consecutive steps by different researchers with different competencies (clinicians, methodologists, researchers) up to the final agreed version to be administered to the target population. A team of four dentists, two working in private and two working in public dental clinics, prepared the questionnaire. All the items and questions on relevant issues were based on previous literature and discussed by the authors [9–11]. As a second step, two methodologists reviewed the questionnaire's draft. Eventually, all the six contributors made the final consensus on the final version. Before proceeding with the nationwide dissemination, a small group of three dentists screened the questionnaire applications for a conclusive check. The results of this preliminary process were not included in the main study.

Besides demographic data, the questionnaire (Table 1) showed three main domains, which included the study outcomes, i.e., reporting the prevalence and the management of medical emergencies in their dental practice (primary outcomes); the level of knowledge and training on the diagnosis and management of medical emergencies, and the perceived need of a better clinical preparedness for critical care (secondary outcomes). Concerning the prevalence of medical emergencies occurred, each respondent was asked to detail how many medical emergencies encountered in the professional practice, where/when they occurred (waiting room before the procedure, during the procedure, at the end of the procedure), whether it was necessary to call the emergency phone number, and how many times the emergency resulted in deaths. About the level of knowledge, training and perceived clinical preparedness on the diagnosis and management of medical emergencies, the questions mainly focused on the training received at university to ascertain the level of preparedness and satisfaction of each respondent. It was also asked about the attendance to postgraduate courses to keep updated, the need of an institutional register to collect reports about these events, and, eventually, the utility of organizing institutional theoretical-practical national courses on this topic.

2.3. Statistical analysis

Continuous variables were described as mean ± standard deviation (SD) or median, and first and third quartile (q1-q3), according to distribution's normality. Dichotomous variables, including numbers of replies to the questionnaire, were expressed as numbers and percentages. In order to analyse whether university education influenced the responses, we carried out some sub-analyses. In relation

to their education, the respondents were divided into two categories: Medicine degree (with and without specialty or aptitude test), and Dentistry degree (with and without further dental specialty). Moreover, the variables expressed on a scale from 1 to 10 have been categorized into 3 categories, with this subdivision: from 1 to 4 low score, from 5 to 7 medium score, and for numbers greater or equal than 8 high score. Therefore, to compare whether professionals belonging to the two categories gave significantly different answers, we performed contingency tables and compared answers using Pearson's χ^2 or Fisher's exact test, as appropriate. Statistical analysis was performed using Stata software, StataCorp, 4905 Lakeway Drive, College Station, Texas 77845 USA. Statistical significance was set at $p \leq .05$.

The study was conformed to S1 Checklist (STROBE Supplementary Information).

2.4. Ethics approval

The work has been carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. No personally identifiable data were collected, and responses were anonymous from the point of entry. The approval of the research ethics committee was obtained from the Institutional Review Board (Dental and Medical Board of Milan; July 16, 2022). In order to complete the survey, dentists consented to the data collected from the survey being used for research purposes; informed consent was obtained.

3. Results

This survey included 6818 questionnaires, completely filled by the respondents contacted online and that fully met the inclusion criteria (4444 males, 2374 females; median age 50, first and third quartiles 38–59 years). Table 2 summarizes the demographic data of study participants, indicating a broad range of specialists with an average work experience. Most of the respondents worked in a private facility, with just the 11.6% (n = 789) of them working in the public healthcare. Moreover, most of respondents worked in Lombardy and Lazio (Fig. 1).

3.1. Knowledge and training on the diagnosis and management of medical emergencies

Most of respondents reported an average degree of satisfaction on the ability to diagnose and manage medical emergencies, with scores from five to eight in 64.6% (n = 4400) of cases.

The cohort was, then, divided in about half about having already taken a basic life support (BLS) course or not during the university training: 3010 (44.1%) participants reported positively, while 3808 (55.9%) did not receive any academic training. To overcome this gap, postgraduate updating courses were followed by the 72.9% (n = 4972) of them. As described in Table 3, the individuals having the degree in Medicine (with and without specialty or aptitude test) were on average more satisfied about the university training, although performed less practical BLS academic courses, than the ones having the degree in Dentistry (with and without further dental specialty) ($p < .01$). Accordingly, the former followed more training courses during the post-graduation period than the latter ($p < .01$) (Table 3). Comparing answers according to the responders' clinical experience, dentists with less than 10 years of experience carried out more practical cardio-pulmonary resuscitation exercises during their university training and reported less post-graduate course attendance

Table 2
Socio-demographic data of study participants.

Socio-demographic variables	Number of respondents
Total, n	6818
Male, n (%)	4444 (65.2)
Female, n (%)	2374 (34.8)
Age, median (1st quartile - 3rd quartile), years	50 (38–59)
How long have you been a dentist?	
For less than 5 years, n (%)	841 (12.3)
From 5 to 10 years, n (%)	793 (11.6)
For more than 10 years, n (%)	5184 (76.1)
Academic degree	
Degree in Medicine and Surgery, n (%)	1097 (16.1)
Degree in Medicine and Surgery and specialization in Odontostomatology, n (%)	743 (10.9)
Degree in Dentistry and Dental Prosthetics, n (%)	4162 (61.0)
Degree in Dentistry and Dental Prosthetics and a further dental specialization, n (%)	816 (12.0)
Type of dental practice	
Private, n (%)	6029 (88.4)
Public, n (%)	789 (11.6)
Anesthetic techniques used during practice (more than answer possible*)	
Local anesthesia, n (%)	6790 (99.6)
Pharmacologically induced deep sedation, with anesthesiological aid	525 (7.7)
Inhaled sedation-nitrous oxide	948 (13.9)
General anesthesia, n (%)	117 (1.7)

Legend: n = number; * 22.9% of respondents gave more than one reply.

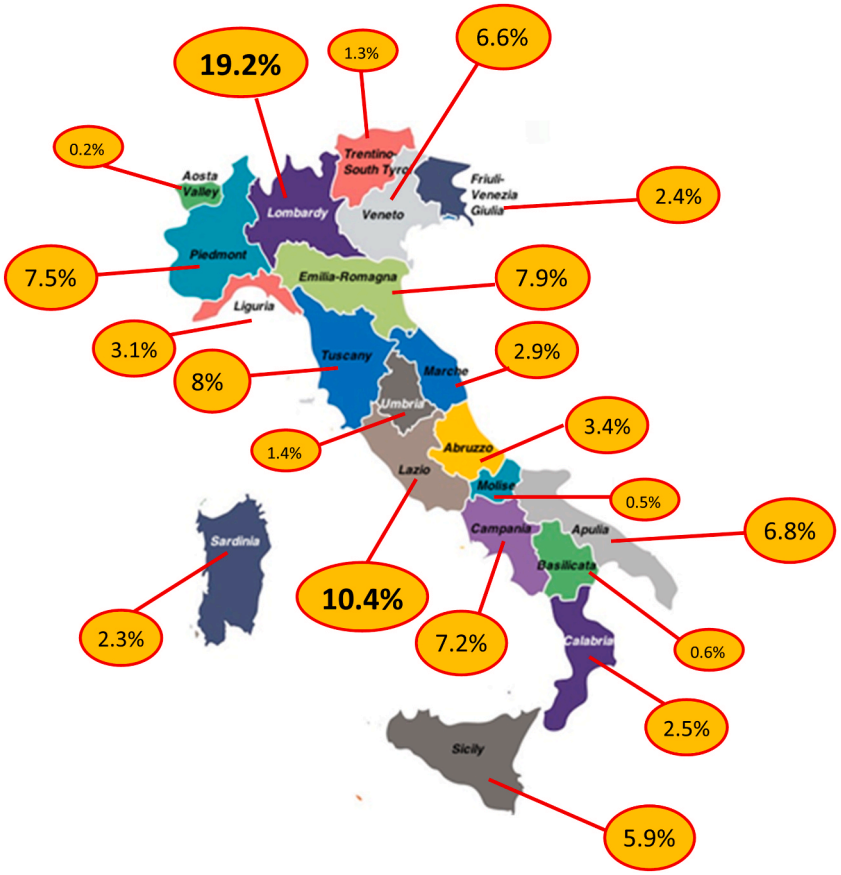

Fig. 1. Map describing the working place of study participants (% of respondents).

Table 3
Subgroup analysis based on education of responders regarding knowledge and training on the diagnosis and management of medical emergencies.

Questions	Answers (grouped according to respondent degree)		p-value*
	Medicine (with and without specialty or aptitude test)	Dentistry (with and without further dental specialty)	
In relation to the diagnosis and clinical management of medical emergencies, indicate your degree of satisfaction on a scale from 1 (absolutely dissatisfied) to 10 (perfectly satisfied) about the university training received			
Total, n	1840	4978	
Low level of satisfaction (1,2,3,4), n (%)	459 (24.9)	1361 (27.3)	
Medium level (5,6,7), n (%)	859 (46.7)	2567 (51.6)	*<0.01*
High level (8,9,10), n (%)	522 (28.4)	1050 (21.1)	
Did you carry out practical cardio-pulmonary resuscitation exercises during your university training?			
Total, n	1840	4978	
Yes, n (%)	662 (36.0)	2348 (47.2)	*<0.01*
No, n (%)	1178 (64.0)	2630 (52.8)	
Have you ever taken postgraduate updating courses on medical emergency management in the dental practice?			
Total, n	1840	4978	
Yes, n (%)	1495 (81.3)	3477 (69.9)	*<0.01*
No, n (%)	345 (18.7)	1501 (30.1)	

Legend: * Fisher's exact test.

than more experienced dentists ($p < .01$) (Table S1).

About the anesthetic procedures during the practice, local anesthesia was the mostly performed (n = 6790; 99.6%) followed by sedation by inhalation-nitrous oxide (n = 948; 13.9%). Pharmacologically induced deep sedation and general anesthesia, with the support of an anaesthetist, were rarely used (n = 525; 7.7% and n = 117; 1.7%, respectively).

3.2. Prevalence and management of medical emergencies in their dental practice

Most of respondents (n = 4443; 65.2%) encountered at least one emergency event during their professional life, and one fifth of them (n = 1453; 21.3%) reported the occurrence in the past two years (Fig. 2 A and B). The medical doctors with specialty/aptitude test encountered a higher number of emergencies during their career than the dental graduates, although, in the last two years, the latter reported more events ($p < .01$) (Table 4). Dentists with more than 10 years of experience reported lower rate of emergencies than less experienced dentists ($p < .01$) (Table S2). The event more often did not require the call of emergency number (Fig. 2 C), and those who answered affirmatively declared they had called only on one occasion (n = 1088; 80.1%). The emergency rarely resulted in death, as stated by only 62 (0.9%) of respondents (Fig. 2 D); only in seven cases, the respondent declared to of having witnessed more than one death.

The commonest medical emergency was the vasovagal syndrome, followed by hypoglycaemic crisis, seizure, hypertensive crisis, allergic drug reaction, severe bleeding and foreign body ingestion (Fig. 2E). Most of medical emergencies occurred during the procedure (n = 4883; 71.6%) and/or at the end of the procedure (n = 2203; 32.3%).

Fig. 2. Answers of study participants to the questions: A) how many medical emergencies have you encountered in your professional practice?; B) have you had any medical emergencies in your professional practice during the past two years?; C) have you ever had to call 112 (emergency phone number) seeking for emergency medical support?; D) have any deaths ever occurred in the dental setting in which you work?; E) have any of the following medical emergencies ever occurred in the dental setting in which you work? (please indicate the number of events).

Table 4
Subgroup analysis based on academic degrees of responders regarding prevalence and management of medical emergencies during their dental practice.

Questions	Answers (grouped according to respondent degree)		p-value*
	Medicine (with and without specialty or aptitude test)	Dentistry (with and without further dental specialty)	
How many medical emergencies have you encountered in your professional practice?			
Total, n	1840	4978	
None, n (%)	451 (24.5)	1924 (38.6)	*<0.01*
<5, n (%)	1008 (54.8)	2578 (51.8)	
≥5, n (%)	381 (20.7)	476 (9.6)	
Did you have any medical emergency in the past 2 years?			
Total, n	1840	4978	
Yes, n (%)	318 (17.3)	1135 (22.8)	*<0.01*
No, n (%)	1522 (82.7)	3843 (77.2)	

Legend: * Fisher's exact test.

3.3. Dentists' clinical preparedness for critical care

Fig. 3 A described the level of confidence of the respondents in managing the different medical emergencies that could occur in dental setting: there was high level of confidence in treating vasovagal syndrome perceived by most of the participants, while a lack in preparedness in the management of myocardial infarction or transient ischemic attack (TIA) and stroke. Overall, medical doctors were more confident in managing the emergencies than dentistry graduates ($p < .01$) (Table 5). Similarly, the more experienced dentists were on average more confident in their emergency management skills than the less experienced ones ($p < .01$) (Table S3).

Almost all of them ($n = 6721$; 98.6%) declared the need to improve their training and expressed their interest in theoretical-practical institutional courses (Fig. 3 B and C). Medical doctors were less interested in receiving postgraduate institutional theoretical-practical courses than dentistry graduates ($p < .01$) (Table 5).

A further need was ascribed to the lack of a national emergency register, and 81.4% ($n = 5553$) of participants perceived as highly useful to set up one.

4. Discussion

Dental patients can be of various ages and medical emergencies can take place at any age, although the likelihood of medical emergencies is greater with elderly patients, frequently affected by one or more chronic diseases and regularly taking multi-drug therapies. The primary aim of this work was to obtain data about the occurrence of medical emergencies as experienced by a cohort of Italian dentists. Most of respondents ($n = 4443$; 65.2%) encountered at least one emergency during their professional life, although ambulance was rarely required for the patient. The emergency infrequently resulted in death (reported by the 0.9% of respondents). The commonest medical emergency was the vasovagal syndrome and most of medical emergencies occurred during the procedure. Interestingly, dentists with more than 10 years of experience reported lower rate of emergencies than less experienced dentists and this might be related to higher skills in implementing preventive procedure.

These findings are consistent with the most of the previous literature, supporting the high rate of medical emergency in the dental practice, seldomly resulting in death, with the main event represented by the vasovagal syndrome [9,15,20,21]. To the best of our knowledge, similar comparing data on the Italian population are lacking. A recent study aimed at retrieving the number of deaths in Italy, secondary to medical emergencies occurring in dental facilities, by consulting scientific medical databases and the national press: the Authors could not derive data from scientific publications, but only identified reports through the analysis of the national press, which described 29 fatal emergencies occurred within the dental clinics from 1990 to 2019 [22].

Further aims were to ascertain the level of confidence in the emergency management, also based on the university training received, and the educational needs of respondents. The survey showed an average degree of satisfaction about the ability to diagnose and manage medical emergencies, with high level of confidence in managing vasovagal syndrome, while a lack in competences about the management of myocardial infarction or TIA and stroke, in line with what reported in other countries [10,12,16,23]. Dentists with less than 10 years of experience carried out more practical cardio-pulmonary resuscitation exercises during the university training ($p < .01$), suggesting a greater focus on BLSD academic course than in the past.

Accordingly, almost all of dentists declared the need to improve their training and expressed their interest in theoretical-practical institutional courses as well the need of a national register of medical emergencies, nowadays lacking in Italy. This is consistent with previous studies on medical emergencies in the dental setting, which report a recurrent call for improved medical education on this topic, starting from the dentistry curriculum and continuing during professional carrier [1,2,4,14,16,20,24–27].

From a methodological point of view, this national survey obtained a high response rate, and the study participants had adequate regional distribution, which was proportional to the number of dentists working in each region. The sample size can be considered representative of the entire population (i.e. Italian dentists). This study, in particular, embodies the first one conducted in this country, which enrolled the largest number of respondents, so far, available in literature.

The main limitations of the survey include the self-reporting and its cross-sectional design, which impedes to evaluate in depth the factors accounting for differences among participants and it also is prone to selection bias, since we used an online survey and not all

Table 5
Subgroup analysis based on academic degrees of responders regarding their confidence on management of medical emergencies during their dental practice.

Questions	Answers (grouped according to respondent degree)		p-value*
	Medicine (with and without specialty or aptitude test)	Dentistry (with and without further dental specialty)	
Please, indicate, on a scale from 1 (severe management difficulty) to 10 (full confidence), how much you feel able to manage the following types of medical emergencies in the professional environment in which you operate			
Total, n	1840	4978	
Vasovagal syndrome			
Poor confidence (1,2,3,4), n (%)	189 (10.3)	671 (13.5)	
Medium confidence (5,6,7), n (%)	518 (28.1)	1799 (36.1)	*<0.01*
High confidence (8,9,10), n (%)	1133 (61.6)	2508 (50.4)	
Allergic drug reaction			
Poor confidence (1,2,3,4), n (%)	412 (22.4)	1753 (35.2)	
Medium confidence (5,6,7), n (%)	884 (48.0)	2461 (49.4)	*<0.01*
High confidence (8,9,10), n (%)	544 (29.6)	764 (15.4)	
Hypertensive crisis			
Poor confidence (1,2,3,4), n (%)	419 (22.8)	1898 (38.1)	
Medium confidence (5,6,7), n (%)	862 (46.8)	2405 (48.3)	*<0.01*
High confidence (8,9,10), n (%)	559 (30.4)	675 (13.6)	
Asthmatic crisis			
Poor confidence (1,2,3,4), n (%)	440 (23.9)	1766 (35.5)	
Medium confidence (5,6,7), n (%)	896 (48.7)	2443 (49.1)	*<0.01*
High confidence (8,9,10), n (%)	504 (27.4)	769 (15.4)	
Seizure			
Poor confidence (1,2,3,4), n (%)	575 (31.2)	1962 (39.4)	
Medium confidence (5,6,7), n (%)	853 (46.4)	2214 (44.5)	*<0.01*
High confidence (8,9,10), n (%)	412 (22.4)	802 (16.1)	
Hypoglycemic crisis			
Poor confidence (1,2,3,4), n (%)	323 (17.5)	1180 (23.7)	
Medium confidence (5,6,7), n (%)	794 (43.2)	2352 (47.3)	*<0.01*
High confidence (8,9,10), n (%)	723 (39.3)	1446 (29.0)	
Hyperglycemic crisis			
Poor confidence (1,2,3,4), n (%)	606 (32.9)	2162 (43.4)	
Medium confidence (5,6,7), n (%)	857 (46.6)	2261 (45.4)	*<0.01*
High confidence (8,9,10), n (%)	377 (20.5)	555 (11.2)	
Anaphylaxis			
Poor confidence (1,2,3,4), n (%)	738 (40.1)	2422 (48.6)	
Medium confidence (5,6,7), n (%)	783 (42.6)	2079 (41.8)	*<0.01*
High confidence (8,9,10), n (%)	319 (17.3)	477 (9.6)	
Angina pectoris:			
Poor confidence (1,2,3,4), n (%)	674 (36.6)	2499 (50.2)	
Medium confidence (5,6,7), n (%)	832 (45.2)	2067 (41.5)	*<0.01*
High confidence (8,9,10), n (%)	334 (18.2)	412 (8.3)	
Myocardial infarction			
Poor confidence (1,2,3,4), n (%)	936 (50.9)	2830 (56.8)	
Medium confidence (5,6,7), n (%)	699 (38.0)	1802 (36.2)	*<0.01*
High confidence (8,9,10), n (%)	205 (11.1)	346 (7.0)	
Transient ischemic attack (TIA) or stroke			
Poor confidence (1,2,3,4), n (%)	1041 (56.6)	3154 (63.4)	
Medium confidence (5,6,7), n (%)	643 (34.9)	1575 (31.6)	*<0.01*
High confidence (8,9,10), n (%)	156 (8.5)	249 (5.0)	
Severe bleeding			
Poor confidence (1,2,3,4), n (%)	632 (34.3)	1907 (38.3)	
Medium confidence (5,6,7), n (%)	828 (45.0)	2237 (45.0)	*<0.01*
High confidence (8,9,10), n (%)	380 (20.7)	834 (16.7)	
Foreign body ingestion			
Poor confidence (1,2,3,4), n (%)	707 (38.4)	1792 (36.0)	
Medium confidence (5,6,7), n (%)	848 (46.1)	2447 (49.2)	0.08
High confidence (8,9,10), n (%)	285 (15.5)	739 (14.8)	
Foreign body inhalation			
Poor confidence (1,2,3,4), n (%)	932 (50.7)	2413 (48.5)	0.06
Medium confidence (5,6,7), n (%)	725 (39.4)	2114 (42.5)	
High confidence (8,9,10), n (%)	183 (9.9)	451 (9.0)	
Would you consider it useful for an institutional register of medical emergencies occurred in the dental setting to be made available and continuously updated on the website of the commission for dentists' board, collecting the reports of medical emergencies in an anonymous and voluntary form? Give your rating on a scale from 1 (not at all useful) to 10 (extremely useful)			
Total, n	1840	4978	
Not very useful (1,2,3,4), n (%)	84 (4.6)	247 (5.0)	
Moderately useful (5,6,7), n (%)	442 (24.0)	1200 (24.1)	0.79
Very helpful (8,9,10), n (%)	1314 (71.4)	3531 (70.9)	

(*continued on next page*)

Table 5 (*continued*)

Questions	Answers (grouped according to respondent degree)		p-value*
	Medicine (with and without specialty or aptitude test)	Dentistry (with and without further dental specialty)	
Would you consider it appropriate to improve your professional preparation in the field of prevention, diagnosis and management of medical emergencies?			
Tot, n	1840	4978	
Yes, n (%)	1790 (97.3)	4931 (99.1)	*<0.01*
No, n (%)	50 (2.7)	47 (0.9)	
Would you consider it useful that the commission for dentists' board should promote theoretical-practical national courses for the management of medical emergencies in dental setting?			
Tot, n	1840	4978	
Yes, n (%)	1736 (94.3)	4810 (96.6)	
No, n (%)	20 (1.1)	26 (0.5)	*<0.01*
I don' know, n (%)	84 (4.6)	142 (2.9)	
Would you consider it useful that the commission for dentists' board should prepare a poster for diagnosis and the management of medical emergencies in dental setting, to be displayed in the facility where you work?			
Tot, n	1840	4978	
Yes, n (%)	1620 (88.0)	4413 (88.6)	
No, n (%)	77 (4.2)	188 (3.8)	0.69
I don' know, n (%)	143 (7.8)	377 (7.6)	

Legend: * Fisher's exact test.

dentists may have had access to it. Moreover, findings derived from subgroup analyses must be considered cautiously, being very preliminary, based on a sample population, which shows certain imbalances in numbers between groups, and on simple statistical methods (i.e. conduction of survey, contingency tables, and Fisher exact test). It can be noted that the participating dentists came from the various geographical regions of Italy, with different clinical experience, working in the private and public sectors, and holding various types of academic qualifications. With these characteristics of the study population, the findings of this survey can be generalized to a great extent, to reflect the current position of Italian dentists regarding the management of medical emergencies in the dental practice.

Future research should focus on perform qualitative and quantitative studies on medical emergencies in dental setting. Indeed, a qualitative study could help to obtain more in-depth knowledge regarding the variables evaluated in this questionnaire-based cross-sectional study. More robust results could come from further quantitative studies collected by national registries (where available) or based on structured sources of data, thus not based on self-reported surveys, which show high risk of bias risk.

5. Conclusion

This cross-sectional survey, which includes one of the most significant sample sizes available in literature, showed, as primary outcome, the frequency of medical emergencies during dental practice as self-reported by a cohort of Italian dentists. Emergencies resulted common events during dentist professional life, but rarely resulting in hospitalization or death. The commonest medical emergency was the vasovagal syndrome and most of medical emergencies occurred during the dental procedure.

The level of confidence in the management of aforementioned emergencies, also based on their educational training and type of medical graduation, changed according the type of medical event, being high with vasovagal syndrome, whilst was low for myocardial infarction or TIA and stroke. Overall, medical doctors were more confident in managing emergencies than dental graduates. Finally, considering the educational needs, in order to plan appropriate institutional interventions for specific training, our findings showed the need and the interest, as reported by most of respondents, about the organization of periodical training and theoretical-practical institutional courses, as well as about the establishment of an official national register for medical emergencies occurred in dental practice.

Author contribution statement

Elena M. Varoni, Antonio Carrassi, Marta Rigoni, Giovanni Lodi, Andrea Sardella, Paola Muti: conceived and designed the experiments, analyzed and interpreted the data, wrote the paper.

Antonio Vitello, Lucio Montebugnoli, Antonella Polimeni, Stella Tommasino, Marcello Iriti, Andrea Senna, Raffaele Iandolo, Alessandro Nisio: analyzed and interpreted the data, wrote the paper.

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Data availability statement

Data will be made available on request.

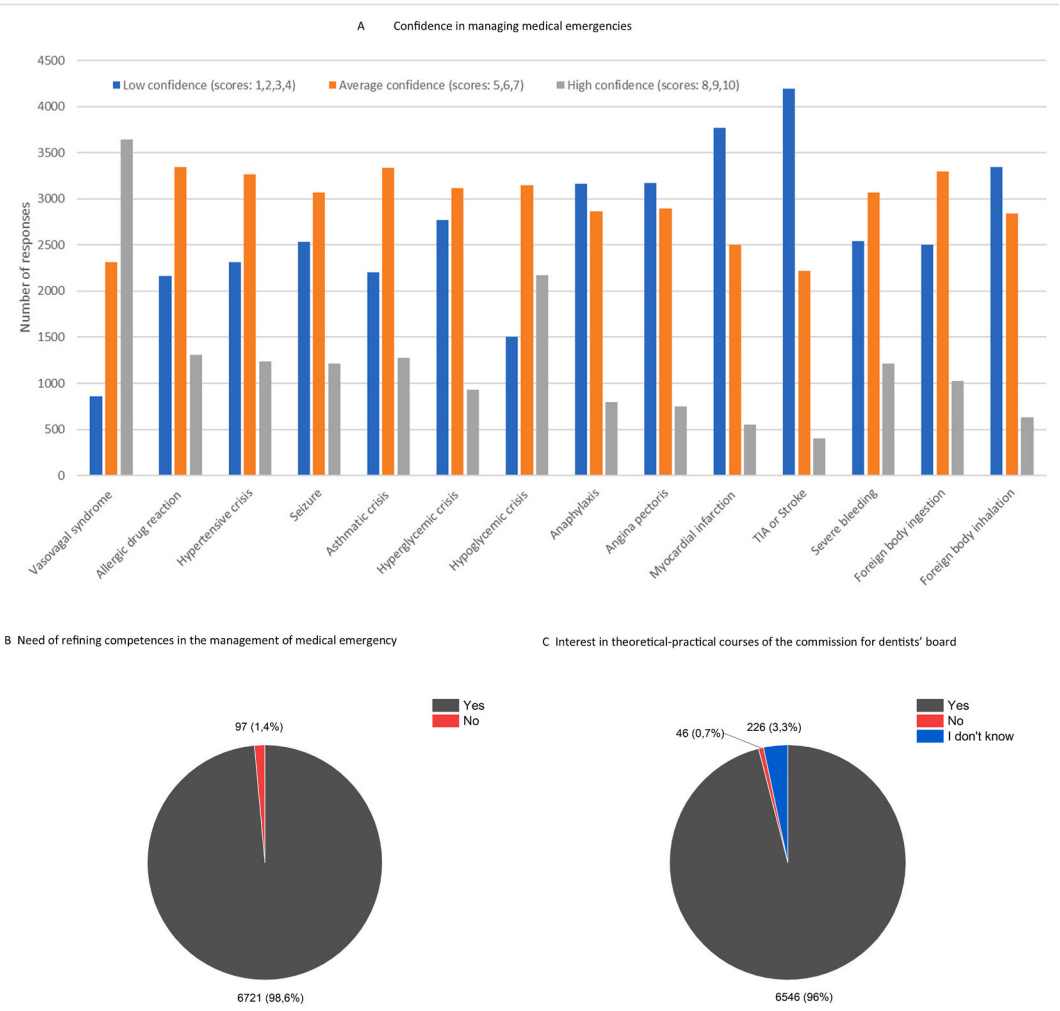

Fig. 3. Answers of study participants to the questions: A) please, indicate, on a scale from 1 (severe management difficulty) to 10 (full confidence), how much you feel able to manage the following types of medical emergencies in the professional environment in which you operate; B) would you consider it appropriate to improve your professional preparation in the field of prevention, diagnosis and management of medical emergencies?; C) would you consider it useful that the commission for dentists' board should promote theoretical-practical national courses for the management of medical emergencies in dental setting?.

Declaration of interest's statement

The authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e13910.

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