

# Medical emergencies in dental hygienists' practice

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## Abstract

Dental hygienists in Poland work in various settings, including public health care institutions, private dental practices, dental clinics, kindergartens, and schools. They can often face medical emergencies, whose rate is increasing owing to comorbidities and aging of dental patients' populations. The aim of the study was to assess the prevalence of medical emergencies in dental hygienists' practice in Poland and the hygienists' preparedness and attitudes toward emergencies.

A 10-question authors' own questionnaire was filled in by 613 dental hygienist. It referred to their cardiopulmonary resuscitation training, availability of emergency medical equipment in the workplace, the prevalence of medical emergencies including the need for an emergency medical service (EMS) call, and the management of cardiac arrest.

Overall, 613 dental hygienists working in Poland participated in the study; 38.99% had taken part in basic life support (BLS) training within the previous 12 months and 35.89% within 2 to 5 years; 15.17% had experienced at least 1 emergency situation requiring an EMS call within the previous 12 months. Vasovagal syncope was the most common medical emergency (15.97%), followed by moderate anaphylactic reaction (13.87%), seizures (8.81%), hyperventilation crisis (7.50%), and hypoglycemia (7.34%).

The most common medical emergency in dental hygienists' practice in Poland is syncope followed by mild anaphylactic reaction. Most of the dental hygienist had participated in a BLS course within the previous 5 years; however, 20% of them have never participated since graduation. Dental hygienists should participate in BLS courses every 2 years to keep the cardiopulmonary resuscitation skills and stay up-to-date with current guidelines. An important part of the study participants declare the lack of availability in their workplaces of life-saving equipment, including self-expanding bag resuscitator, oropharyngeal, and supraglottic airway device and oxygen source. Medical emergency equipment as recommended in the international guidelines should be available in every practice.

**Abbreviations:** AED = automated external defibrillator, BLS = basic life support, CPR = cardiopulmonary resuscitation, EMS = emergency medical service, ERC = European Resuscitation Council.

**Keywords:** cardiopulmonary resuscitation, dental hygienist, education, medical emergency

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*Scientific rationale for study.* The dental hygienists in Poland play an important role in dental care. The prevalence of medical emergencies in dental hygienists' practice and their attitudes toward medical emergencies were not analyzed before.

*Principal findings:* Vasovagal syncope, anaphylactic reaction, seizures, hyperventilation crisis, and hypoglycemia are the most common medical emergency; 15.17% of dental hygienists faced during last 12 months a medical emergency requiring an EMS call to their workplace. Significant part of study participant has lack of knowledge of current CPR guidelines.

*Practical implications.* More focused attention should be paid to postgraduate dental hygienists training in medical emergencies.

The authors have no conflicts of interest to disclose.

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## 1. Introduction

In Poland, dental hygienists usually work with dentists; however, there is a trend for developing independent dental hygienists' practices in various types of medical facilities. Dental hygienists can work in various settings, including public health care institutions, private dental practices, dental clinics, health prevention, and premedical assistance offices in kindergartens and schools.<sup>[1]</sup> The structure of dental care in Poland has a specific organization.<sup>[2]</sup> Most facilities are small or even 1-person dental offices. The dental office staff usually includes a dental assistant or hygienist; only in larger dental offices there is a medical secretary. Under the dentist's supervision, the dental hygienist performs preventive and technical procedures, selects the appropriate means to maintain oral hygiene, conducts preliminary diagnostic tests, provides several producers of oral and dental hygiene and prevention, instructs patients on how to properly implement oral hygiene.

The scope of duties and education of dental hygienists in Poland is wider compared with dental assistants. A dental hygienist can also play a role of a dental assistant, and currently also perform certain treatment procedures. In the context of this study, it is, however, important to what extent the scope of pregraduate and postgraduate education ensures proper hygienists' preparation for providing assistance in medical emergencies. As mentioned above, treatment can be performed by a dental hygienist, but the scope of these activities is strictly defined and

they are usually performed in a dentist's office and in a dentist's presence. Therefore, when considering medical emergencies, it will not be necessary for hygienists to take action on their own: they will be a member of a team. During the 2-year study, the dental hygiene students in Poland undergo theoretical and practical training on medical emergencies including cardiopulmonary resuscitation (CPR) and international guidelines for resuscitation, especially in a dental office. As a result of the significant predominance of women in the group of practicing dentists, assistants, and hygienists, it is worth noting that the majority of the medical personnel at a dental office are women. The time needed by an emergency medical service (EMS) team to reach the site in a city and a small town differs, which means that the dental office staff has to ensure the proper quality and continuity of CPR until the EMS takes over the duties.<sup>[3]</sup>

There have been many studies emphasizing the importance of medical emergency management during dental treatment. Most of the papers referred to the dentists' attitudes and knowledge concerning medical emergencies and their self-assessed preparedness to cope with typical emergency situations. Dental hygienists can often face medical emergencies because of increasing patients' comorbidities, aging of the dental patients' populations, and possible drug interactions, including those with chemical substances used in dental practice.<sup>[4]</sup> Many studies have suggested that among typical medical emergencies there are syncope and presyncope, orthostatic hypotension, hypoglycemia, seizures, and moderate and severe anaphylaxis.<sup>[5–8]</sup> Sudden cardiac arrest is rare in a dental office but all medical personnel has to be prepared to apply basic life support (BLS), including the usage of an automated external defibrillator (AED).<sup>[9,10]</sup>

Dental hygienists are involved not only in medical emergency situations; in several countries, they take an important part in disaster planning and management. It has been emphasized that dental hygienists can significantly support mass accident and disaster management, including forensic odontology.<sup>[11]</sup> Some studies suggest that nowadays the education of dental hygienists should include disaster preparedness and response.<sup>[12]</sup> The role of dental hygienists in mass accidents has been described especially in the United States.<sup>[11,13–15]</sup>

The aim of the survey was to assess the prevalence of medical emergencies in dental hygienists' practice in Poland and to determine the hygienists' attitudes toward medical emergencies in dental offices.

## 2. Methods

### 2.1. Participants and study design

The study was approved by the institutional review board of the Polish Society of Disaster Medicine (approval No. 07.06.2016. IRB) and conducted in full accordance with the applicable ethical principles, including the World Medical Association Declaration of Helsinki (the 2008 version). The participants were informed about the study objectives and voluntarily took part in the survey on providing a verbal consent, approved by the review board. The research was conducted between July 2016 and May 2017 in Poland during 20 scientific meetings for dental hygienists. The study is a continuation of surveys on medical emergency preparedness in Polish dentists' and dental hygienists' offices.<sup>[16]</sup>

The final version of the questionnaire was developed by the authors: experienced anesthesiologists, cardiologists, dentists, and paramedics. The questionnaire consisted of 10 questions. Questions 1 to 4 considered age, sex, work experience, and type

**Table 1**

**The dental hygienists' participation in cardiopulmonary resuscitation training before the study.**

Period	N (%)
Within the last 12 mo	239 (38.99%)
Within the last 2–5 y	220 (35.89%)
Within the last 6–10 y	28 (4.57%)
10 or more years ago	13 (2.12%)
Never since graduation	113 (18.43%)

of workplace. Question 5 was related to the latest training in CPR. Question 6 referred to the availability of emergency medical equipment in dental hygienists' work place, 7—to the prevalence of medical emergencies in a dental hygienist's practice during the previous 12 months, 8—to the number of medical emergencies in the previous 12 months that required an EMS call for assistance. Question 9 and 10 dealt with the patient's position during CPR in a dental office, signs of cardiac arrest, and the proper assessment of vital signs and agonal breathing.

### 2.2. Statistical analysis

Data were analyzed with the statistical package Statistica 13.3 (TIBCO Software Inc, Tulsa, OK). Descriptive statistics were used to analyze the demographic and other variables.

## 3. Results

A total of 800 active dental hygienists working in Poland were asked to participate in the study. Of those, 613 agreed, which resulted in the participation rate of 76.63%. In the final group of 613 participants, 611 (99.67%) were women. The median age of the respondents was 32 years (mean, 33.63 ± 11.20). The mean work experience equaled 6.53 ± 8.32 years.

Most of the participants 368 (60.03%) worked in a private dental office, 235 (38.34%) in dental clinics with at least 2 dentists employed, 17 (2.77%) in hospitals, and 60 (9.79%) in other facilities.

Data concerning the dental hygienists' participation in CPR training are collected in Table 1. The emergency equipment available in dental hygienists' practice in Poland is summarized in Table 2. Table 3 presents the prevalence of medical emergencies in dental hygienists' practice in the previous 12 months.

**Table 2**

**Emergency equipment available in dental hygienists' practice in Poland.**

Equipment	In no workplace	In part of workplaces	In all workplaces
Automated external defibrillator or manual defibrillator	346 (56.44%)	139 (22.68%)	128 (20.88%)
Oxygen source	200 (32.63%)	139 (33.67%)	274 (44.70%)
Supraglottic device (laryngeal mask airway, laryngeal tube, l-gel, etc.)	166 (27.07%)	203 (33.12%)	244 (39.80%)
Pocket mask	187 (30.51%)	216 (35.23%)	210 (34.26%)
Self-expanding bag resuscitator	183 (29.85%)	133 (21.70%)	297 (48.45%)
Portable suction device	155 (25.28%)	185 (30.18%)	273 (44.54%)
Oropharyngeal airway	214 (34.91%)	185 (30.18%)	214 (34.91%)

**Table 3****Prevalence of medical emergencies dental hygienists' practice in Poland in the previous 12 months.**

Emergency	0	1–3 times	4–9 times	≥10 times
Sudden cardiac arrest	605 (98.69%)	8 (1.31%)	0 (0%)	0 (0%)
Vasovagal syncope	504 (82.23%)	98 (15.97%)	9 (1.47%)	2 (0.33%)
Orthostatic hypotension	602 (98.21%)	9 (1.47%)	2 (0.32%)	0 (0%)
Hyperventilation crisis	561 (91.52%)	46 (7.50%)	5 (0.82%)	1 (0.16%)
Moderate anaphylactic reaction	526 (85.81%)	85 (13.87%)	1 (0.16%)	1 (0.16%)
Anaphylactic shock	591 (96.41%)	22 (3.59%)	0 (0%)	0 (0%)
Seizures	558 (91.03%)	54 (8.81%)	1 (0.16%)	0 (0%)
Hypoglycemia	567 (92.50%)	45 (7.34%)	1 (0.16%)	0 (0%)
Angina	583 (95.11%)	29 (4.73%)	1 (0.16%)	0 (0%)
Hypertension crisis	574 (93.64%)	33 (5.38%)	3 (0.49%)	3 (0.49%)
Asthma	591 (96.41%)	20 (3.26%)	2 (0.33%)	0 (0%)

The prevalence of medical emergency situations in dental hygienists' workplaces requiring an EMS call within the previous 12 months equaled 0 for 520 (84.83%) dental hygienists, 1 for 65 (10.60%), 2 for 17 (2.77%), 3 for 5 (0.82%), 4 for 2 (0.33%), 5 to 10 for 3 (0.49%), and >10 for 1 (0.16%) participant.

The total of 373 (60.84%) dental hygienists would take a patient with a cardiac arrest down from the dental chair and lay them on the floor, whereas 276 (45.02%) declared putting the dental chair horizontally or using a stool to stabilize the head of the dental chair to perform chest compressions.

When pointing out the signs of cardiac arrest, 523 (85.32%) of the dental hygienist participants specified lack of normal breathing, 120 (19.58%) slow and abnormal breathing, 38 (6.20%) gentle and 12 (1.96) loud snoring, 137 (22.35%) gasping, and 21 (3.43%) none of these.

#### 4. Discussion

Most of the study participants (99.67%) were women, which reflect the nation-wide tendency for this medical job in Poland. The mean work experience equaled 6.53 years; it has to be taken into account that a dental hygienist is a new job in Poland, still developing and gaining new tasks and duties, and more and more frequently working independently from dentists. Most respondents worked in dental offices and dental clinics with at least 2 dentist employed; approximately 10% worked in other facilities. This is due to the situation of dental hygienists in Poland and their role in the dental care system. It is believed that the number of dental hygienists working independently from dentists will increase.

Continuous education is important for all medical professionals, including dental hygienists. Medical emergencies are not restricted to cardiac arrest cases; they involve several situations associated specifically with dental patients. Varho et al<sup>[17]</sup> described cases of inhalation or ingestion of orthodontic appliances in Finland; 6.9% of dental hygienists reported facing ingestion or inhalation of orthodontic objects but none of the cases was finally life threatening. It was emphasized in several articles that the frequency and quality of medical emergency, BLS, and Advanced Life Support/Advanced Cardiovascular Life Support courses, with a special attention to dental patients' problems, play an important role in emergency care quality.<sup>[18]</sup> Specific problems include the local anesthetics and complications related to their usage, anaphylactic reaction, and shock being examples of them. Boynes et al investigated the educational

experience and the application of local anesthesia by dental hygiene providers in the United States. Most of the respondents received training in the administration of local anesthetics, its complications, and medical emergency management.<sup>[19]</sup> Many publications and guidelines suggest that dental personnel should participate in such a training every 1 to 2 years. Among dentists in various countries around the world, the self-assessed competence to manage medical emergencies is low.<sup>[7,20–22]</sup> Therefore, postgraduate training in medical emergencies, especially in CPR, is of crucial importance for dental professionals.<sup>[23]</sup>

We aimed to check the dental hygienists' knowledge concerning the 2015 European Resuscitation Council (ERC) Guidelines and the possibility to perform CPR when leaving the patient on a horizontally positioned dental chair.<sup>[24]</sup> Most of the dental hygienists (60.84%) would take a patient with a cardiac arrest down from the dental chair and lay them on the floor, whereas only 45.02% would set the dental chair horizontally and use a stool to stabilize the head of the chair to perform chest compressions. The concept of resuscitation on a dental chair is quite new and the dental professionals should be aware of the possibility, especially in patients with obesity and in limited space.

The participation of dental professionals in CPR courses varies depending on the country. In our study, 38.99% of dental hygienists had taken part in BLS training within the previous 12 months and 35.89% within the previous 2 to 5 years. This result is quite remarkable if one takes into account, for example, a study performed in Belgium in which it was reported that half of the dental professionals had never participated in an adult BLS course.<sup>[21]</sup> In contrary, in Slovenia, 87.4% of dentist declared that they had participated in a BLS course within the previous 5 years.<sup>[22]</sup> It should be noticed that Nogami et al<sup>[10]</sup> suggest a rapid deterioration of BLS skills among dentists.

The correct assessment of abnormal breathing is an important element in BLS procedures. The analysis of knowledge concerning signs of abnormal breathing, including lack of normal breathing, slow and abnormal breathing, gentle and loud snoring, and gasping, suggests that many dental hygienists are not familiar with the current resuscitation guidelines on the correct assessment of abnormal breathing in cardiac arrest patients. In many studies, dentists turned out to have problems with the correct assessment of medical emergency patients. As many as 68.7% of Brazilian dentists negatively assessed their competence to provide initial treatment, although only 5.6% of them negatively perceived their preparedness to assess breath-

ing.<sup>[20]</sup> A study among Belgian dentists revealed that heart attack and cardiac arrest were most difficult to diagnose for them.<sup>[21]</sup> The same study pointed out that dentists after a BLS training had a better level of self-assessed competence to diagnose emergency situations.<sup>[21]</sup>

In the present study among dental hygienists, vasovagal syncope was the most common medical emergency (15.97%), followed by moderate anaphylactic reaction (13.87%), seizures (8.81%), hyperventilation crisis (7.50%), and hypoglycemia (7.34%) (reported as at least 1 case within the previous 12 months). Generally, the prevalence of medical emergencies in dental offices in other countries is similar and vasovagal syncope or presyncope turns out the most common emergency.<sup>[7]</sup> Hypertension, orthostatic hypotension, seizures, moderate allergic reaction, and hypoglycemia are also among the leading causes of medical emergencies.<sup>[4,5,21,22]</sup>

In our study, the prevalence of medical emergencies in dental hygienists' workplaces that required an EMS call within the previous 12 months was low: 84.83% of dental hygienists had not participated in a situation necessitating an EMS call to a patient in their workplace. However, 10.60% of the dental hygienists had faced 1 such a situation in the previous 12 months. A study on Brazilian dentists reported that 10.5% of 374 respondents had experienced any type of medical emergency involving an ambulance call. In Saudi Arabia, 67% of dentists reported medical emergencies in their clinics; most of the participants (62.7%) had handled the emergency cases themselves, and 7.6% had called an ambulance.<sup>[23]</sup>

In the presented study, 20.88% of dental hygienists declared that there was an AED or a manual defibrillator in all their workplaces. The availability of other emergency medical equipment in the dental hygienists' workplaces turns out very high; this refers to oxygen sources, supraglottic airway devices and oropharyngeal airways, and self-expanding bags. In several countries in Europe, the availability of AED is approximately 5% and only in the United States it reaches >10%.<sup>[10]</sup> ERC recommends that all dental practices delivering clinical care should have immediate access to AED.<sup>[24]</sup> In a study by Kandray et al,<sup>[26]</sup> it was reported that 11% of dental offices in Ohio, USA were equipped with AED and 5% of the respondents (41% of the subjects were dentists, and 59% were dental hygienists) had performed CPR in a patient in the dental office. In our study, the cardiac arrest rate in dental hygienists' practice within the 12 months before the study was 1.31%. We revealed that 44.70% of dental hygienists had access to an oxygen source, 39.80% to supraglottic airway devices, and 44.54% to portable suction devices in all their workplaces. Only 25.28% were not provided with a self-expanding bag, and 34.91% with oropharyngeal airway. The data are quite impressive, suggesting that the situation in Poland has improved over years.<sup>[16,27]</sup> The obligatory emergency equipment for dental practices depends on the country. ERC recommends that basic emergency equipment should be immediately available in all primary care dental offices (including oxygen, suction, self-inflating bag with face masks, and emergency medications).<sup>[28]</sup> In several countries, for example, the United Kingdom, there are strictly defined equipment lists for dental practitioners, taking into account the type of dental practice and type of treatment provided, including sedation performed.<sup>[28]</sup>

This is the first study among Polish dental hygienists to analyze the prevalence of medical emergencies in their workplaces, including emergencies requiring an EMS call, the available

medical emergency equipment, BLS training, and knowledge on the current resuscitation guidelines.

## 5. Limitations

The limitations result from the type of the questionnaire survey. Several potential sources of bias should be considered, including the awareness of the available medical equipment and the diagnosis of the type of medical emergencies. However, the strength of the study is the number of participants and the analysis of the knowledge on the new international resuscitation guidelines.

## 6. Conclusions

The most common medical emergency in dental hygienists' practice in Poland is syncope followed by mild anaphylactic reaction. Most of the dental hygienist had participated in a BLS course within the previous 5 years; however, 20% of them have never participated since graduation. Dental hygienists should participate in BLS courses every 2 years to keep the CPR skills and stay up-to-date with current guidelines. An important part of the study participants declare the lack of availability in their workplaces of life-saving equipment, including self-expanding bag resuscitator, oropharyngeal and supraglottic airway device, and oxygen source. Medical emergency equipment as recommended in the international guidelines should be available in every practice.

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