

Emergency care provided in a Greek dental school and analysis of the patients' demographic characteristics: a prospective study

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Objectives: The aim of this study was to evaluate the incidence of pain of endodontic origin and its relationship with socio-economic and demographic factors among patients seeking unscheduled urgent dental care. **Methods:** Patients attending the Emergency Clinic of Athens Dental School, Greece, between November 2011 and June 2012, were evaluated to determine their socio-economic profile, dental problem and treatment required. The facility operated from Monday to Friday, from 8.30 am to 1.00 pm, excluding the 4 weeks encompassing the Christmas and Easter holidays. In total, 533 patients were assessed regarding gender, age, ethnicity, occupation, reason for visiting, diagnosis and treatment provided. The data obtained were recorded, reviewed, coded and analysed using Poisson regression models. **Results:** Mondays and Wednesdays were the busiest days of the week. The most common occupation among the patients was 'unemployed'. Pain of endodontic origin (reversible or irreversible pulpitis, or acute apical periodontitis) was the prevailing reason for the visit. The most frequent treatments administered were pulpectomy and drainage. Prescriptions for medications were rare. **Conclusion:** Services were requested primarily by individuals who were experiencing acute pain of endodontic origin, had low or no income and were available during morning hours, probably because of the service's low cost and operational hours. Prospective studies, such as the present investigation, can provide epidemiological evidence and indicate areas in the infrastructure of emergency services which may be improved. Additionally, such studies can provide rationale for public insurance programs and can generate profiles of the patients who utilise these low-cost public services.

Key words: Acute apical periodontitis, dental emergency treatment, health finances, pain, pulpitis, socio-economic factors

INTRODUCTION

An endodontic emergency is defined as pain and/or swelling caused by inflammation or infection of the pulpal and/or periapical tissues¹. Dental pain is generally caused by caries, deep or defective restorations, or trauma. Dental emergencies include reversible and irreversible pulpitis, interappointment endodontic emergencies, dental trauma, periapical and periodontal abscess, cellulitis, pericoronitis and cracked tooth syndrome¹. The dense nerve network of the head and neck region is primarily responsible for the severity and intensity of the pain, which causes stress for both the patient and the clinician and requires an immediate diagnosis and accurate treatment. In the vast majority of cases, the pain presented

in dental emergencies originates from pulpal pathology. Consequently, the appropriate treatment ranges from a simple restoration to more invasive approaches, such as root canal treatment, abscess drainage or even extraction of the tooth responsible for the pain².

A review of the current literature reveals limited knowledge regarding the distribution, diagnostic accuracy and treatment of dental emergencies and the socio-economic status of the patients. Most reports have focused on the military, in which soldiers receive a thorough clinical examinations to reduce the possibility of an urgent condition that could affect their operational potential^{3–15}. There are few well-conducted studies of dental school clinics and hospitals that do not address a limited

patient list but are instead open to the general public^{16–26}.

Prospective studies in health care may help to improve the management of public health services by ensuring adequate medical staff and technical support and by providing a rationale for public insurance. The results obtained from such surveys may provide epidemiological evidence, a clearer understanding of the personal and socio-economic profiles of the patients who use these services and a better estimation of the financial aspects involved in operating such services.

The aim of this study was to present the incidence of pain of endodontic origin and its relationship to socio-economic and demographic factors among patients seeking unscheduled urgent dental care at the Emergency Clinic of the Athens Dental School. The null hypothesis of this prospective study was that all members of the general public were the same in seeking care for acute pain, regardless of demographic factors and seasonal trends.

METHODS

The study project had a prospective design, was conducted in full accordance with the World Medical Association Declaration of Helsinki and obtained approval from the Ethical Committee of the Dental School, University of Athens, Greece (Ref. 165A/26.05.2011).

The Department of Endodontics of the Dental School of the University of Athens is primarily responsible for the operation of the Dental School's Emergency Clinic. This clinic receives and treats patients throughout the academic year; these patients are either self-referred (which is usually the case) or, in rare cases, are referred by general hospitals, local dental clinics in the public health system and even private dental offices.

The emergency clinic staff members consisted of five certified endodontists who were trained for a 2-week period for calibration purposes before the main part of the study began. This training provided a detailed overview, in the form of a standard service protocol, for conducting an overall assessment of the patients, including a complete dental and medical history, extra-oral and intra-oral examinations, tooth vitality tests and radiographic examination, when deemed necessary, for every patient who presented for treatment. In this way, each clinician used the same systematic and organised approach towards generating a differential diagnosis and determining the definitive diagnosis. Furthermore, the clinicians were thoroughly informed about and trained in the system for recording the findings in this study. In cases of pain of endodontic origin, the patient was treated to achieve

pain relief. In cases of non-endodontic pain, the patient was referred to the appropriate department of the Dental School (the Department of Maxillofacial Pain Treatment or the Department of Periodontology) or to a physician for further consultation.

During the training period (the first 2 weeks of the study), each visiting patient was examined by all of the clinic's staff members, and their findings and treatment recommendations were recorded. At the end of this period, inter-examiner agreement was calculated and found to be excellent (Cohen's kappa coefficient values of overall agreement for the evaluation and treatment recommendations were 0.97 and 0.95, respectively).

All patients were informed about the ongoing study via a written form and consented to participate by their signature. For patients under 18 years of age, the written form was offered to their guardians, who also gave their written assent to the minor's involvement in the survey. For non-Greek-speaking patients, the information was verbally provided in English, French or German; the patients gave their consent to participate by signing the original Greek form. All consent procedures were approved by the Ethics Committee. During the study period, the clinic was open weekly from Monday to Friday from 8.30 am to 1.00 pm, excluding 2 weeks in December and January for the Christmas holiday and another 2 weeks in April for the Easter holiday. All data were reviewed by one author (E.T.F.) and then numerically coded and statistically analysed.

To provide a more representative analysis within the aims of the study, the total patient population (Group A) was divided into subgroup A1, which comprised patients experiencing pain of dental origin, and subgroup A2, which comprised patients who required relief for pain with an endodontic etiology.

Statistical analysis

The data were summarised according to their absolute and relative frequencies. Time trends in the number of patients who visited the Emergency Clinic of Athens Dental School over the study period are presented graphically with scatterplots that include kernel-weighted local polynomial smoothed curves. Formal comparisons of the rates of visits based on various factors were assessed using Poisson regression models. When visit frequencies were compared according to these factors, incidence rate ratios (IRR) are reported, along with the relevant *P*-values derived from the fit of the corresponding Poisson models. The data were analysed using Stata v11 (StataCorp, College Station, TX, USA). *P* < 0.05 was considered statistically significant.

RESULTS

In total, 553 patients (Group A) sought dental care at the Emergency Clinic of Athens Dental School during a period of 117 days (from 7 November 2011 to 8 June 2012), excluding holidays and weekends. None of the patients who sought treatment at the clinic was excluded from the study. The patients' demographic and clinical characteristics are presented in *Table 1*.

According to the clinic's service protocol, every patient who complained of pain or discomfort in the

Table 1 Demographic and clinical characteristics of the study population

Characteristic	n (%)
Gender	
Male	257 (46.5)
Female	296 (53.5)
Age (years)	
0–18	18 (3.3)
19–30	109 (19.8)
31–50	214 (38.8)
51–65	131 (23.8)
65+	79 (14.3)
Nationality	
Greek	390 (70.5)
Immigrant	163 (29.5)
Occupation	
Private sector	82 (14.9)
Public sector	32 (5.8)
Self-employed	57 (10.3)
Unemployed	175 (31.8)
On pension	99 (18.0)
Housewife	66 (12.0)
Pupil	13 (2.4)
Student	27 (4.9)
Reason for visiting	
Pain	371 (67.1)
Other	182 (32.9)
Type of emergency	
No pain associated	191 (34.5)
Pain (endodontic + non-endodontic origin)	1 (0.2)
Pain (endodontic origin)	270 (48.8)
Pain (non-endodontic origin)	91 (16.5)
Referral to physicians	3 (0.5)
Treatment	
Pulp removal	79 (14.3)
Drainage	39 (7.1)
Anti-inflammatories	13 (2.4)
Antibiotics/Referral	10 (1.8)
Antibiotics	8 (1.4)
Anti-inflammatories/Antibiotics	4 (0.7)
Anti-inflammatories/Referral	4 (0.7)
Anti-inflammatories/Antibiotics/Referral	3 (0.5)
Referral	393 (71.1)
Payment	
No – financial restraints	52 (9.4)
No – lack of co-operation	48 (8.7)
No – referral	347 (62.7)
Yes	106 (19.2)
Day of the week	
Monday	144 (26.0)
Tuesday	90 (16.3)
Wednesday	168 (30.4)
Thursday	73 (13.2)
Friday	78 (14.1)
Total	553 (100.0)

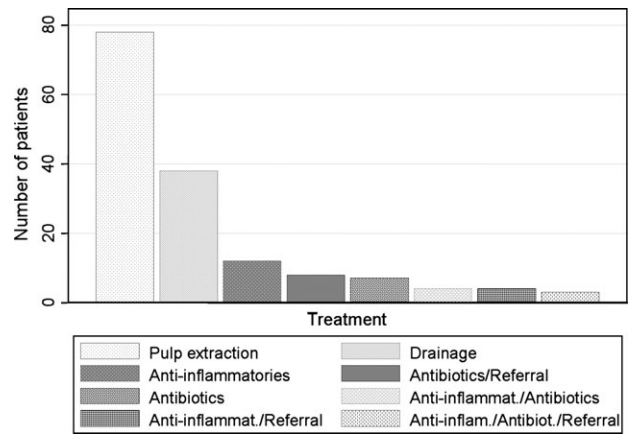
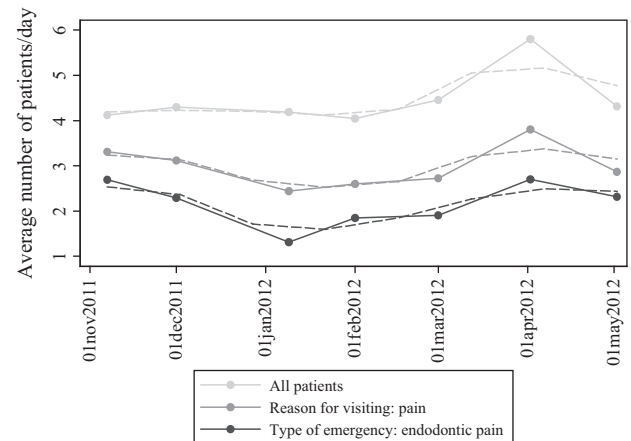
maxillofacial area underwent a complete dental and medical history and was thoroughly examined. The main reason that patients sought dental care was pain; 371 (67.1%) of 553 patients mentioned pain somewhere in the head and neck region (Other *vs.* Pain, IRR = 0.491; $P < 0.001$; *Table 2*). After a thorough clinical examination and radiographic examinations when necessary, the type of emergency was classified into one of the five categories shown in *Table 1*. Nine of the 371 patients who initially stated 'pain' as their main reason for visiting were found free of symptoms and pathologic signs and were assigned to the 'No associated pain' category. The statistical analysis revealed that the differences among the categories were highly significant, as pain of endodontic origin (reversible or irreversible pulpitis; acute apical periodontitis) prevailed ($P < 0.001$). Other diagnoses included periodontal abscess and pericoronitis.

Figure 1 presents the treatments provided to relieve acute symptoms in the subgroup of patients with pain of dental origin (subgroup A1: 371/553 patients). In the majority of cases (219 of 371 patients), the emergency patient was referred to another clinic of the dental school, such as the Department of Oral Surgery for treatment of pericoronitis of a wisdom tooth or the Department of Maxillofacial Pain Treatment for patients diagnosed with temporomandibular joint disorders. Patients were rarely referred to physicians for further consultation (three of 553). The most frequent treatment provided at the emergency clinic was pulpectomy (because it provided a solution for the painful condition) in 79 cases, followed by drainage in 39 cases. The other approaches ranged from use of anti-inflammatory drugs, antibiotics and drainage to a combination of these treatments. For the same subgroup (A1) of patients, it is noteworthy that the day of attendance, gender, nationality, age and occupation status were similar to those of the general population (Group A) (*Table 1*).

In contrast, the analysis of patients in subgroup A2 (270/553), who required relief of pain of endodontic origin, revealed notable differences in terms of the day of attendance; Wednesday was the day with the highest number of patients, followed by Friday (Global test $P = 0.018$). The patients in subgroup A2 were either treated to relieve acute symptoms or given a prescription and referred to the Department of Oral Surgery with a diagnosis of a non-restorable tooth (*Figure 1*). The treatment fee was only applied to patients in subgroup A2 who underwent pulpectomy, or drainage performed by the clinic's staff. The referred patients were not obliged to pay for treatment other than the fee for an X-ray when it was necessary to establish a diagnosis. All fees were only a small fraction of those charged in private practice.

Table 2 Results from univariable Poisson regression analysis for the differences in the number of patients by various demographic and clinical factors

Factor	IRR ¹	95% CI ²	P-value	Global test P-value
Day of the week				
Monday	0.857	(0.686–1.071)	0.175	<0.001
Tuesday	0.536	(0.415–0.692)	<0.001	
Wednesday*	1			
Thursday	0.435	(0.330–0.572)	<0.001	
Friday	0.464	(0.355–0.607)	<0.001	
Month of study³				
November 2011*	1			0.365
December 2011	1.041	(0.746–1.452)	0.813	
January 2012	1.015	(0.723–1.426)	0.931	
February 2012	0.982	(0.709–1.359)	0.912	
March 2012	1.080	(0.790–1.475)	0.629	
April 2012	1.406	(0.988–2.001)	0.058	
May 2012	1.047	(0.765–1.433)	0.775	
June 2012	0.727	(0.415–1.274)	0.266	
Gender				
Male*	1			0.098
Female	1.152	(0.975–1.361)	0.098	
Age (years)				
0–18	0.084	(0.052–0.136)	<0.001	<0.001
19–30	0.509	(0.404–0.641)	<0.001	
31–50*	1			
51–65	0.612	(0.493–0.761)	<0.001	
65+	0.369	(0.285–0.478)	<0.001	
Nationality				
Greek*	1			<0.001
Immigrant	0.418	(0.348–0.502)	<0.001	
Occupation				
Private sector*	1			<0.001
Public sector	0.390	(0.259–0.587)	<0.001	
Self-employed	0.695	(0.496–0.975)	0.035	
Unemployed	2.134	(1.642–2.774)	<0.001	
On pension	1.207	(0.901–1.618)	0.207	
Housewife	0.805	(0.582–1.113)	0.189	
Pupil	0.159	(0.088–0.285)	<0.001	
Student	0.329	(0.213–0.509)	<0.001	
Reason for visiting				
Pain*	1			<0.001
Other	0.491	(0.411–0.586)	<0.001	
Type of emergency				
No pain associated*	1			<0.001
Pain (endodontic + non-endodontic origin)	0.005	(0.001–0.037)	<0.001	
Pain (endodontic origin)	1.414	(1.174–1.701)	<0.001	
Pain (non-endodontic origin)	0.476	(0.371–0.612)	<0.001	
Payment				
No – financial restraints	0.150	(0.112–0.201)	<0.001	<0.001
No – lack of co-operation	0.138	(0.102–0.187)	<0.001	
No – referral*	1			
Yes	0.305	(0.246–0.380)	<0.001	
Treatment				
Anti-inflammatories	0.165	(0.092–0.296)	<0.001	<0.001
Anti-inflammatories/Antibiotics	0.051	(0.019–0.138)	<0.001	
Anti-inflammatories/Antibiotics/Referral	0.038	(0.012–0.120)	<0.001	
Anti-inflammatories/Referral	0.051	(0.019–0.138)	<0.001	
Antibiotics	0.101	(0.049–0.210)	<0.001	
Antibiotics/Referral	0.127	(0.066–0.244)	<0.001	
Drainage	0.494	(0.336–0.724)	<0.001	
Pulp extraction*	1			
Referral	4.975	(3.907–6.335)	<0.001	

¹Incidence rate ratio.²95% confidence interval.³Results adjusted for number of operating days in each month. Asterisk (*) defines reference category.**Figure 1.** Type of treatment (endodontic pain cases; referrals not shown).**Figure 2.** Average number of patients/day per month (continuous lines). Dashed lines represent kernel-weighted local polynomial smoothing of the observed trends.

The busiest contact days were Mondays and Wednesdays, on which 26% (144 patients) and 30.4% (168 patients) of the patient visits occurred, respectively. The results revealed that the number of emergency patients differed significantly according to weekday (Monday to Friday), with fewer patients seeking help on Tuesdays, Thursdays and Fridays (Global test $P < 0.001$). Moreover, a marginally significant increase in patient attendance was noted in April (IRR = 1.41, April *vs.* November; $P = 0.058$; Table 2). Temporal trends in the number of emergency patients per day are presented graphically in Figure 2.

Regarding gender, male and female subjects showed a similar pattern of clinic visits during the year [296 (53.5%) patients were female and 257 (46.5%) were male; IRR = 1.15, Female *vs.* Male; $P = 0.098$; Table 2].

With respect to age, the original total number of patients (ranging from 12 to 84 years of age) was

classified into five categories, as shown in *Table 1*. The 31–50 years age group had a significantly higher number compared with the other age groups (Global test $P < 0.001$; *Table 2*).

Regarding the nationality of the 533 patients seen in the clinic, 390 (70.5%) were Greek, and 163 (29.5%) were immigrants (*Table 1*). This difference was highly significant (IRR = 0.42, Immigrants *vs.* Greek; $P < 0.001$; *Table 2*).

The occupational status of the patients who attended the emergency clinic varied greatly. The patients were categorised into the eight main groups shown in *Table 1*. The differences in the patients' occupations were statistically significant (Global test $P < 0.001$; *Table 2*). Notably, the most prevalent occupation was 'unemployed' (IRR = 2.13, unemployed *vs.* private sector employees; $P < 0.001$), whereas patients working in the public sector and those who were self-employed represented significantly lower proportions compared with those working in the private sector (IRR = 0.39; $P < 0.001$ and IRR = 0.69; $P = 0.035$, respectively; *Table 2*). Finally, individuals receiving a pension were notably represented.

DISCUSSION

The definition of 'dental emergency' provided by the American Dental Association includes acute dental pain; in the vast majority of cases, the origin of the pain is endodontic¹. Several authors have studied the epidemiological aspect of dental emergencies, the socio-economic profiles of the patients involved and the treatment provided in each case^{2,23–26}. However, few well-organised, randomised surveys have been conducted in dental clinics or hospitals worldwide^{16–22}, and most of the data currently available have been obtained from military databases^{3–15}.

The clinic's strict operating hours within the working period of the university were the major limitations of this study. These limited hours prohibited the potential exploration of the differences in demographic and other contextual factors between individuals who accessed the clinic on weeknights and weekends *versus* during the week. In contrast, the clinic received referrals for a certain number of patients from general hospitals and local dental public offices that could not provide special endodontic care during the previous evening. This provided a certain balance in the grouping of the patients who visited the Emergency Clinic for criteria other than socio-economic profile. Furthermore, the percentage of patients who sought help for reasons other than pain relief (e.g. dental prosthetics-aesthetics) was similar to that of other studies which offered extended work hours

and service periods^{20,21}, a fact that probably strengthens this study's reliability.

The present survey revealed a significant peak in dental emergencies during April. Other studies conducted by Gibson *et al.* and Bae *et al.* reported an increase in urgent dental conditions during the summer, which is consistent with the epidemiological pattern of 'flare-up' endodontic conditions^{16,20}. A possible explanation for the abovementioned difference is the exclusion of summer months, during which the dental clinic remained closed to the public.

Regarding the busiest contact days, the present study revealed results similar to those stated by Gibson *et al.*²⁰, namely patients attended the dental emergency clinics mainly on Mondays and Wednesdays. In contrast, other studies reported Fridays and weekends as the busiest days, which is somewhat consistent with the results of the present study for patients who indicated endodontic pain as their reason for visiting the clinic^{16,22}. The aforementioned surveys were performed in hospitals, and it is likely that patients mainly sought treatment at these facilities when they could not visit university dental clinics or private dental practices.

Regarding gender, there was a predominance of female subjects among the dental emergency patients, although the difference between genders was not statistically significant. Other researchers also have reported that women more often seek dental treatment for their painful dental conditions, which may be related to their inherent tendency to care for their health and their lower pain tolerance compared with men^{17,21–23}. Only one survey reported that men were seen more often as emergency patients¹⁸. In addition, studies of patients visiting pediatric clinics demonstrated that boys were seen more often than girls for dental emergencies^{24,25}. Considering that the main reason for dental emergencies among children is trauma, this finding is not unexpected.

Other studies have reported results similar to the findings of the present study in terms of the age of patients who visit emergency dental clinics. A peak was observed among patients ranging in age from 31 to 50 years, and this finding was statistically significant. Gibson *et al.* reported similar results, whereas Maneliene *et al.* and Tiradentes *et al.* observed that between 20 and 39 years was the most common age of patients who visit emergency dental clinics^{20,21,26}. The authors of the present study propose that the increased incidence of dental caries, which is the main cause of pulp pathology, among these age groups was responsible for the observed peak. Only 18 (3.3%) of the patients were younger than 18 years of age. A potential explanation is that the Department of Pedodontics treated younger patients who sought help

and/or treatment for dental trauma during the same period.

The present study also analysed the ethnicity of the patients who sought emergency dental treatment. The vast majority of the patients, approximately 70%, were Greek, and the remaining patients were immigrants. The demographic characteristics of the patients who visited the clinic reflect the current Greek population profile: individuals 25–54 years of age represent 43.2% of the population, with a male:female ratio of almost 1:1 (http://www.indexmundi.com/greece/demographics_profile.html). A review of the literature revealed that only one survey which included these data reported findings consistent with the present results without ignoring different cities' and countries' demographic and ethnic differences. That survey was performed by Austin *et al.*¹⁹ at two hospitals in London, revealing that 53–75% of the patients were indigenous.

The present survey also revealed that regarding the occupational status of the patients, unemployed patients visited the emergency clinic most frequently, followed by those who received a pension. This observation can be attributed to the following two reasons: (i) the fee for treatment at the dental school was a fraction of the cost of a private dentist; and (ii) these individuals can easily utilise the services during the morning hours of the emergency clinic.

This study found that pain was the major reason for visiting the emergency clinic (accounting for 67.1% of the visits). This observation is consistent with the findings of Widström *et al.*, Pennycook *et al.* and Austin *et al.*, who reported acute pain in 50%, 72% and 60% of the patients included in their surveys, respectively^{18,19,22}. The remaining 32.9% of the patients presented for other reasons, including restorative and prosthodontic dental procedures such as the replacement of defective crown fillings, aesthetic concerns or even the placement of dentures. Such patients were referred to the Pre-Graduate Dental Clinic.

Regarding the underlying pathology of the patients in pain, the findings of the present study are similar to those of other surveys^{20,21}. Among the cases assessed in the present study, pulpal involvement was responsible for the pain in 48.8% of the total population. Pulp necrosis and/or periapical abscess with reversible and irreversible pulpitis were the causes of pain in 76% and 44% of the patients reported by Gibson *et al.* and Tiradentes *et al.*, respectively^{20,21}. In contrast, an analysis of the military database revealed that fewer than 20% of the cases of acute pain among soldiers could be attributed to pulp pathology^{5–7}. A possible explanation for this discrepancy might be the thorough clinical examination that soldiers undergo before joining the army to exclude men with severe caries. Regarding the surveys that were conducted in

pediatric clinics, caries was responsible for pain in the vast majority of cases, whereas dental trauma was the second most common reason that patients attended the clinics^{24–26}.

According to the clinic's protocol, as soon as the possibility of endodontic pain was eliminated, the patient was referred to the appropriate department of the Dental School (the Department of Maxillofacial Pain Treatment or the Department of Periodontology) or to a medical specialty, such as an otolaryngologist, based on the possible diagnosis established by the examiners. Urgent help was provided to patients who experienced irreversible pulpitis. The pulp of the tooth was extracted (14.3%), and the patients were given written information concerning the need to complete the endodontic treatment and the crown restoration as soon as possible. Anti-inflammatories were also prescribed as needed to provide relief for the symptoms of irreversible pulpitis²⁷.

Drainage was performed to help patients presented with acute abscess (7.1%), and antibiotics/anti-inflammatories were prescribed²⁸. The patients were encouraged via written information to contact a provider of their choice to complete the root canal and crown restoration. It is notable that patients experiencing either acute pulpitis or periapical abscess and whose responsible tooth was diagnosed as unrestorable were referred to the Department of Oral Surgery at the Dental School to receive proper care.

Our findings regarding the socio-economic status of the patients who sought dental care are in concordance with those of Cohen *et al.*²⁹. That study focused on patients who needed unscheduled dental care in Maryland, USA, over a 12-month period, and they concluded that lower-income populations are more likely to seek dental help from an emergency department, whereas higher-income populations are more likely to visit a private dentist. In our study, 31.8% of the patients were unemployed.

CONCLUSIONS

Despite the limitations of this prospective study, it could be concluded that the Emergency Clinic of the Dental School of the University of Athens was primarily visited by individuals who presented with acute pain of endodontic origin, had low or no income and were available during morning hours.

In an era of economic crisis, a change in the profile of patients who use public or university services is likely. Declining incomes may alter utilisation patterns, with more people shifting to public facilities. The services provided by the Emergency Clinic of the Dental School at the University of Athens were in high demand by people with low or no income. Further study will identify changing trends and mitigating

factors and could provide invaluable information for developing public dental services that are better organised to meet the needs of disadvantaged citizens.

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Competing interest

There are no competing interests involved in this study.

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