

Occurrence of dental emergency events in Primary Health Care services

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Abstract: The aim of this study was to describe the occurrence of dental emergency and its association with individual factors and primary health care services. A follow-up study was conducted with data extracted from an exploratory study about the classification of dental care needs over time according to a care framework. There were included 1831 patients of five services. The outcome was the occurrence of dental emergency analyzed according to sex, age, skin color, service and maximum waiting time for dental care. A multivariate analysis with Poisson regression was used to estimate weighted prevalence ratio (PR) with 95% Confidence Intervals (CI) and survival analysis was conducted. The prevalence of dental emergency was 12.6%, varying according to age (13–19: PRa = 1.79 (95%CI: 1.0–3.21); 20–65: PRa = 2.71 (95%CI: 1.73–4.26); Over 65: PRa = 2.51 (95%CI: 1.41–4.46)) and Primary Health Care service (FHS 2: PRa = 2.20 (95%CI: 1.37–3.53), FHS 3: PRa = 1.43 (95%CI: 0.90–2.27); FHS 4: PRa = 3.25 (95%CI: 2.15–4.92), FHS 5: PRa = 2.49 (95%CI: 1.56–3.97)) For 231 cases classified as emergency, the failure rate was 7.4%. For 214 cases of emergency, the non-continuity after appointment rate was 53.7%. The incidence of dental emergency was 8.3% and recurrence was 7.2%. Considering all 262 emergency cases attended, the resolution rate was 93.5% and most cases (n = 252, 96.1%) received care within one day. The results point to high effectiveness in emergency dental care within Primary Health Care services. There are indications of the need for improvements in retention and continuity of care.

Keywords: Emergencies; Primary Health Care; Oral Health; Health Services.

Introduction

Oral diseases are a global public health issue with social determination and impact on the quality of life. Oral diseases, a group of conditions that includes untreated dental caries of deciduous and permanent dentition, periodontal disease and edentulism, affected 3.5 billion people worldwide in 2019.^{1,2}

The inversion of the high prevalence of oral diseases depends on population and individual strategies, which require access to oral health care, particularly health promotion activities and patient-centered care.³ Untreated dental caries may present itself asymptotically, or with



episodes of pain.⁴ Pain is one of the main reasons for seeking dental emergency services. Barriers in access to primary health care (PHC) have been associated with increased use and spending on emergency services.^{5,6}

The Brazilian Unified Health System has been extending the access to PHC, primarily through the Family Health Strategy (FHS), and reorganizing actions and services through health care networks. Nevertheless, the oral health care network still presents several gaps at all levels, the coverage of oral health care is not homogeneous throughout the country and a discrepancy has been found in the amount and composition of the oral health teams (OHT).⁷ The OHT are responsible for providing oral health care, including care to dental emergencies according to the needs of its community within their technological abilities and during their opening hours. With the response time in relation to risk regarded as the key element in the emergency care, the recommendation is to base the admission of patients on risk classification.^{8,9} However, even though this network has been improving, patients dissatisfaction is still high (48.1%), mostly associated with the waiting time and the time required to address the demand¹⁰.

Taking into account that the evolution of untreated cases is reflected as emergency care needs, and that PHC is the main point responsible for the provision of dental emergency care, studies to monitor it are pivotal, albeit scarce and based on prevalence figures. Therefore, this study intended to describe the occurrence of dental emergencies and its association with individual factors and the primary health care services, while analyzing its prevalence, incidence, continuity of care and recurrence, as well as the time to provide emergency dental care.

Methodology

This was a follow-up study of the occurrence of dental emergencies over time based on data extracted from an exploratory study, which applied a framework for equity access to primary dental care. The exploratory study was conducted in five

different public primary health care services, all FHS, located in the city of Sapucaia do Sul, metropolitan area of Porto Alegre, Rio Grande do Sul, Brazil, from June 2014 to August 2015.¹¹ The health units were selected in 2013 and in that same year the framework was defined, the collection began in 2014. In 2013, this city PHC services was counting with six Basic Units of Health, sixteen FHS, seven of FHS with OHT. All dentists of FHS with OHT were invited to participate, five dentists accepted. According to the Family Health Program, 100% of residents in the catchment areas should be registered at the local clinics and they are all eligible for public health services. In 2014, the resident population estimated to Sapucaia do Sul was 137 750¹² and the target population encompassed nearly 17 500 people living in the catchment areas of five Family Health clinics, that represents nearly 12.8% of resident population estimated. All people registered in one of the five FHS services were eligible to the study. The invitation to take part was presented to patients who attended the services, then extended to their families. The invitation to minors was made through their parents or legal guardian.¹¹

The data collection on the oral health classification scale was conducted by five dentists trained in meetings, which took place between April 2013 and 2015. The stages of development of classification guidelines, training and inter and intra-examiner agreement were observed. The training and calibration of examiners followed the guidelines of the British Association for the Study of Community Dentistry (BASCD).¹³ The SB 2000 Examiner's Manual (MS) guided the logistics of the clinical examination (visual examination, natural light, examiner position, etc.). The intra-examiners and inter-examiners agreement levels the method used to analyze was Gwet AC1.¹¹ The chance agreement probabilities for Gwet's AC1 followed the Landis and Koch benchmarks with values between 0.0 and 0.20 representing poor or slight agreement; between 0.21 and 0.40 fair agreement; between 0.41 and 0.60, moderate agreement; between 0.61 and 0.80, substantial agreement and between 0.81 and 1.00 an almost perfect agreement. The inter-examiners agreement was in the range between

0.47 (2013) and 0.62 (2015). The intra-examiners agreement was in the range between 0.57 (2013) and 0.87 (2013).¹⁴ The exploratory study relies on a framework for equity access to primary dental care that associates a classification of oral health conditions, to a set of fractions of maximum waiting times for care provided by the required dental staff. This framework provides waiting time benchmarks for PHC services needed by people living within local clinics catchment areas. A time of 90 seconds was estimated for a dentist to perform the oral examination using the framework classification criteria, categorizing patients' quadrants according to five categories (1, 2, 3, 4, 5). Category 1 corresponds to the lower end of dental needs and longer waiting time for a dentist appointment, while 5 corresponds to the higher needs and shorter waiting time (up to 2 days), *i.e.*, need of emergency dental care. The model was devised, discussed and validated with primary care dentists in 2010¹⁵. The waiting times with a 90% stability guarantee for classes 1, 2, 3 and 4 were adjusted in 2016 being 365, 365, 180 and 76 days respectively.¹¹

In the exploratory study, the quadrants of the participants were classified in one of the five diagnostic categories during the first appointment with the dentist. With every new appointment, each quadrant was reclassified before and after the procedure by the worst dental condition found, which allowed the assessment of category variation. The scheduling routine of the PHC services was kept. The collection instrument was an electronic form in Tablets that used Android as the operating system and the data produced were uploaded in real-time to an Excel spreadsheet via web.¹¹

Based on these data, the need for dental emergency care, category 5 (E) was analyzed. The classification of the individual was defined by the first and worst condition of the quadrants. The diagnosis or a change to category E in the patient defined the outcome, and the other classes (1, 2, 3, 4) were grouped as non-emergency. The longitudinal study comprised people who were seen at least twice, with a follow-up time over more than 5 days. Recurrence was considered the second E event in the same quadrant as the first occurrence, with an interval

longer than 2 days. Improvement, worsening and stability were changes in categories or not. The resolution rate was established as the ratio between the total improvements and the total number of E cases that received clinical dental care.

The diagnosed and unattended cases were classified as "waiting in model time" or "failure". The time was got by the difference between the dates of diagnosis and the end of study, the last possible day of return to service. Patients classified as E that received dental care were analyzed regarding the model's waiting time. The cases attended under the model time were deemed an event and those that survived this time as censorship. The time was calculated as the difference between the dates of first care and the diagnosis or the first worsening.

The independent variables were sex, age group (0 to 12 years old-children, 13 to 19 years old-adolescents, 20 to 65 years old-adults and over 65 years old-older adults, skin color, categorized into white and non-white, and service, each of the five primary care services that took part in the study. The age group was regrouped in up to 19 years old (children and adolescents) and above 20 years old (adults and older adults).

Prevalence of E was calculated by the ratio between the number of individuals diagnosed as E and the total number of diagnoses (1, 2, 3, 4, 5). The extent of emergency refers to the number of quadrants affected. The failure rate was calculated as the ratio between the number of E cases diagnosed and missed under the model time and the total number of E cases diagnosed. The analysis between the classified groups (1, 2, 3, 4, 5) was performed according to the continuity or not of the attendance considering the times of the model for each class.

The cohort allowed the description of the cumulative incidence, expressed as the rate of new events in the follow-up period, and the incidence-density, expressed as the number of new events divided by the total number of person-days at risk. Incidence shows the number of individuals with all quadrants without an E diagnosis that, during clinical follow-up, registered worsening as part of class E in at least one quadrant, being considered only the first worsening.

In order to analyze the emergency recurrence, all E cases were followed up. Recurrence indicates the number of individuals who were admitted as E, received care and then worsened in the same quadrant (s), returning to class E. The inclusion criterion was to have admitted as E and to have returned to the service in a time interval greater than two days between the first and second visit.

Statistical analysis

Absolute and relative frequency analyses were conducted for the qualitative variables and mean, standard deviation, median and percentiles for quantitative variables. Pearson's chi-square test, Yates' correction and Fisher's test, with a 5% significance level, were all used to assess differences in the variables studied. The association among sex, age, skin color and PHC services and class E was obtained by Poisson Regression method with robust variance was applied for multivariate analysis and to get the adjusted prevalence ratios with their respective 95% confidence intervals. For the adjusted model, only the variables that remained associated with the outcome with a p-value < 0.20 were included. In the fully adjusted model, associations with p < 0.05 were considered significant. The goodness of fit of Poisson Regression was evaluated by the deviance and Log Likelihood. Kaplan-Meier was used to construct the model's time survival curve. The analyses were conducted in the software for statistical analysis IBM SPSS Statistics version 20.0 (SPSS Inc., Chicago, USA).

Ethical considerations

The primary study was approved by the Ethics Committee of Hospital Moinhos de Vento, in 2013, no. 337.813.¹¹ All individuals from the age of 18, who agreed to participate, were presented with the Informed Consent Form (ICF) to sign. Minors were invited to participate and, upon acceptance of the minor and his/her parent, the ICF was made available to both and signed by the parent.¹¹

Results

The participants of the study (n = 1,831) were mostly women (n = 1,090, 59.5%), white (n = 1,517,

91.6%), and adults (age 20–65, n = 1053, 57.5%) The initial diagnosis revealed a prevalence of dental emergency cases as 12.6% (n = 231). The participants initial diagnosis as emergency cases were mostly women (n = 144, 62.3%), white (189, 87.5%) and adults (age 20–65 n = 165, 71.4%). The others participants (diagnosis 1,2,3,4) were distributed as: 1 (n = 225, 12.3%), 2 (328, 17.9%), 3 (n = 444, 24.2%), and 4 (n = 603, 32.9%). Most people with dental emergency as initial diagnosis presented an extension limited to one quadrant (n = 205, 88.7%), and most of them occurred in a lower quadrant (n = 125, 54.1%). Bilateral dental emergency cases occurred in 18 patients (0.8%). Figure 1 presents the flowchart of the distribution of dental emergency cases by individual, according to the classification and times defined by the framework. In the crude and adjusted models of the prevalence ratios, it was possible to verify the association of dental emergency with age and service used (Table 1).

Among the participants, 732 (40%) individuals were diagnosed and had no scheduled appointment. Most of those diagnosed were waiting under the expected time recommended by the framework (511, 69.8%), including all those classified as 1 or 2 (72.8%). Of the 221 patients in a time failure situation, 17 (7.7%) were classified as dental emergencies of which most with extension limited to one quadrant (n = 13, 76.5%). The median time in failure of dental emergencies cases was 138 days (P25 = 70, P75 = 316). No associations were found with sex, skin color and age between emergency and non-E cases of the failing group. Emergency cases were clustered in two services (n = 15, 88.2%). As for the 231 E emergencies cases classified, the failure rate was 7.4%.

After diagnosis, 422 people were treated and had no continuity of care. Most as part of the non-emergency group (n = 307, 72.7%), which differed from the emergency group (n = 115, 27.3%) only in terms of age (p = 0.013). As for the 214 dental emergencies cases with appointments after classification, the no continuity of care rate was 53.7%.

The clinical follow-up cohort comprised 677 people, with a median follow-up time of 43 days (P25 = 17, P75 = 108.5) and 53,458 person-days of follow-up. The median follow-up time of the 99

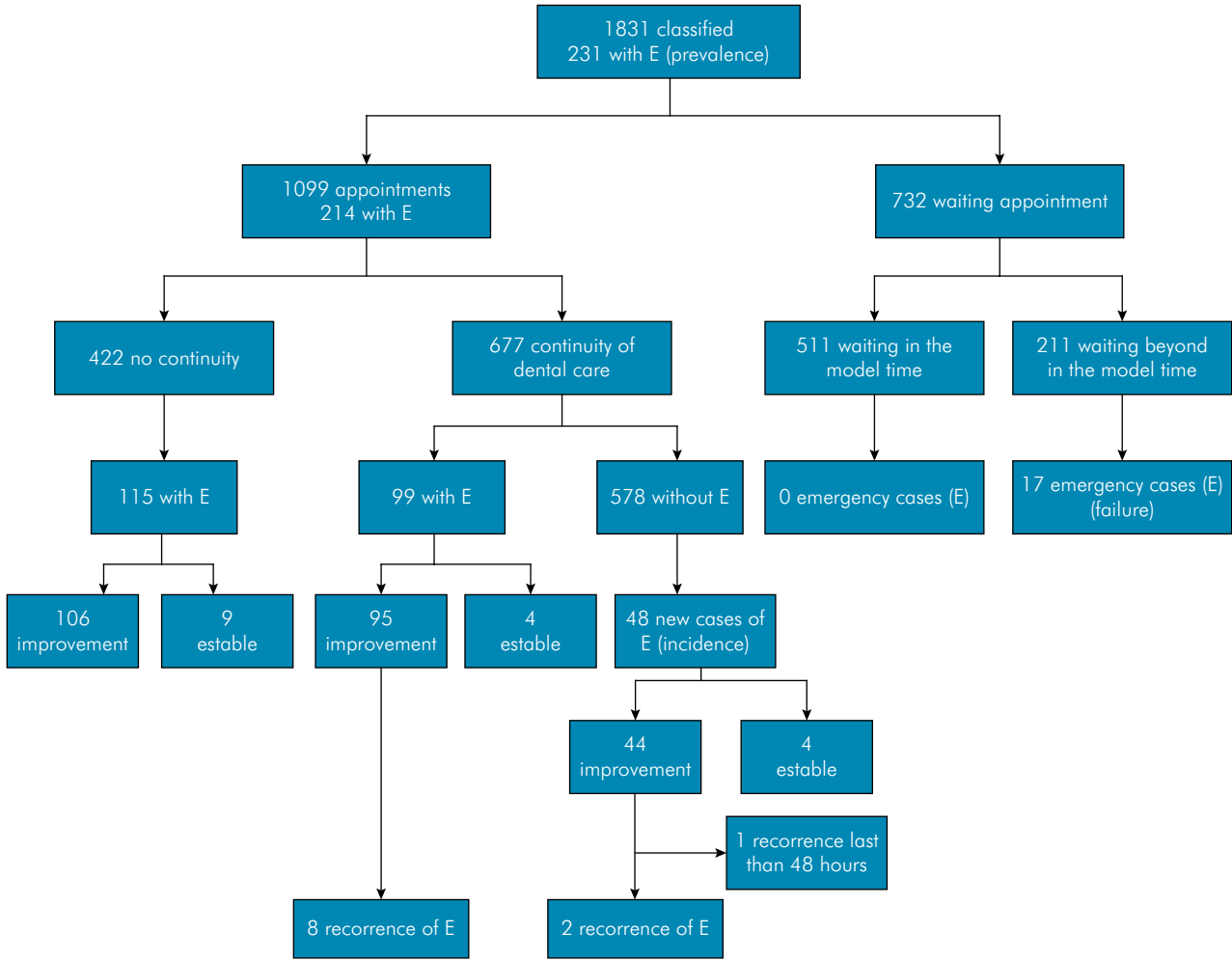


Figure 1. Flowchart of the distribution of E cases.

dental emergencies cases with continuity of care was 36 days (P25 = 14, P75 = 92).

The emergency incidence follow-up cohort comprised 578 patients without an emergency diagnosis in the first classification appointment, 85.4% of the original cohort. The median follow-up time was 43 days (P25 = 18, P75 = 113.25) with 46384 patients-day of follow-up. During this period, there were 48 patients who sought care because of worsening in their oral health status, a cumulative incidence of dental emergency needs of 8.3% and an incidence-density of 1/1000 patients/day. The median follow-up time for new dental emergencies cases was 110.5 days (P25 = 48.5, P75 = 207.75). The incidence distribution according to the classification prior to the occurrence was similar (1: 12 cases/25%, 2: 13 cases/27.1%,

3: 11 cases/22.9% and 4: 12 cases/25%). This cohort's general characteristics and the comparison between groups with and without emergency incidence are presented in Table 2. The mean survival rate at the emergency event was 311 days (95%CI: 290.5–331.6).

When considering all the 262 dental emergencies cases attended, 245 improved and 17 (6.5%) remained stable, the resolution rate was 93.5%. Most cases (n = 252, 96.1%) received care within one day. Figure 2 presents the high probability of admission under the time of the model, those attended out of time are clustered in a time less than 20 days. Table 3 presents the comparative analysis of improvement between the group of dental emergencies cases with and without continuity of care. No significant difference was found when considering sex, age

Table 1. Crude and adjusted prevalence ratios of variables associated with dental emergency cases (E), Sapucaia do Sul, RS, Brazil. 2014-2015.

Variable	Categories 1, 2, 3, 4 (n = 1600)	Category dental emergency (n = 231)	Crude PRc (95%CI)	Adjusted* PRa (95%CI)
Sex				
Male	654 (88.3%)	87 (11.7%)	1	-
Female	946 (86.8%)	144 (13.2%)	1.13 (0.88–1.44)	-
Age group				
0-12	406 (94.6%)	23 (5.4%)	1	1
13-19	194 (90.2%)	21 (9.8%)	1.82 (1.03–3.21)	1.79 (1.0– 3.21)
20-65	888 (84.3%)	165 (15.7%)	2.92 (1.92–4.46)	2.71 (1.73–4.26)
Over 65	112 (83.6%)	22 (16.4%)	3.06 (1.76–5.32)	2.51 (1.41–4.46)
Skin color				
White	1328 (87.5%)	189 (12.5%)	1	1
No-white	112 (80.6%)	27 (19.4%)	1.56 (1.08–2.24)	1.40 (0.97–2.01)
FHS				
1	445 (93.9%)	29 (6.1%)	1	1
2	224 (85.8%)	37 (14.2%)	2.31 (1.46–3.68)	2.20 (1.37–3.53)
3	435 (90.2%)	47 (9.8%)	1.59 (1.02–2.49)	1.43 (0.90–2.27)
4	302 (78.9%)	81 (21.1%)	3.46 (2.31–5.17)	3.25 (2.15–4.92)
5	194 (84%)	37 (16%)	2.62 (1.65–4.15)	2.49 (1.56–3.97)

*deviance goodness of fit for Poisson regression= 879.296, $p = 0.483$.

Table 2. Baseline characteristics of cohort members (n = 578), description an analysis of groups changed to dental emergence (n = 48) and didn't change to dental emergence class (n = 530), Sapucaia do Sul, 2014-2015.

Variable	Cohort n = 578	Changed to dental emergency n = 48	Didn't change to dental emergency n = 530	p-value
Sex				
Female	342 (59.2%)	26 (54.2%)	316 (59.2%)	0.56 ^a
Age group				
Up to 19	161 (27.9%)	9 (18.8%)	152 (28.7%)	0.19 ^a
Skin color				
White	495 (93.6%)	43 (97.7%)	452 (93.2%)	0.34 ^b
FHS				
1	180 (31.1%)	6 (12.5%)	174 (32.8%)	0.007 ^a
2	75 (13%)	10 (20.8%)	65 (12.3%)	
3	191 (33%)	15 (31.2%)	176 (33.2%)	
4	94 (16.3%)	10 (20.8%)	84 (15.8%)	
5	38 (6.6%)	7 (14.6%)	31 (5.8%)	
Diagnosis				
1	13 (2.2%)	2 (4.2%)	11 (2.1%)	0.47 ^b
2	68 (11.8%)	6 (12.5%)	62 (11.7%)	
3	178 (30.8%)	17 (35.4%)	161 (30.4%)	
4	319 (52.2%)	23 (47.9%)	296 (55.8%)	

^aPearson's chi-square test; ^bFisher test.

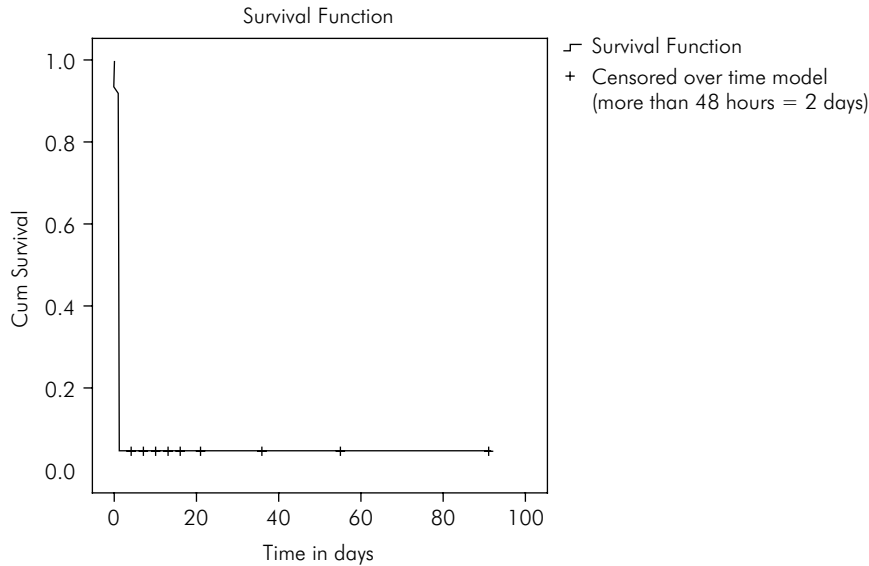


Figure 2. Survival curve of admission under the time of the model.

and skin color between stable cases with or without continuity of care, and they occurred in all services with a similar distribution.

For the analysis of recurrence, 138 emergencies cases were followed up, 43 from the emergency incidence cohort and 95 initially diagnosed as dental emergencies. There were 10 cases of emergency recurrence (7.2%), most from the group initially diagnosed as dental emergencies (n = 8, 80%).

Discussion

Among the guiding principles of oral health actions that are part of the Brazilian Oral Health Policy, there is the recommendation to prioritize cases of oral/dental pain, infection and suffering and also the sign that primary care should provide emergency care.¹⁶ The definition of criteria and time of up to 48 hours for care had the intent to ensure emergency care within an adequate time and coincides with the time presented in other studies.^{17,18} As for the criteria, a study points out some disagreement between professionals and the public, but that patients know that not all health issues need to be addressed immediately.¹⁷ The study suggests that clear definitions of criteria and time can improve the efficiency of the emergency and emergency care systems in oral health, in line with the purpose of applying the framework

Table 3. Distribution of improvement after emergency care with and without continuity of care.

Variable	No continuity n = 106	With continuity n = 139	p-value
Sex			
Female	61 (57.5%)	85 (61.2%)	0.66
Age			
Up to 19	28 (26.4%)	20 (14.4%)	0.29
Skin color			
White	84 (84.8%)	119 (58.6%)	0.12
FHS			
1	11 (10.4%)	14 (10.1%)	0.78
2	14 (13.2%)	19 (13.7%)	
3	18 (17%)	42 (30.2%)	
4	40 (37.7%)	48 (34.5%)	
5	23 (21.7%)	16 (11.5%)	
Class after appointment			
1	22 (20.8%)	15 (10.8%)	0.84
2	9 (8.5%)	9 (6.5%)	
3	21 (19.8%)	24 (17.3%)	
4	54 (50.9%)	91 (65.5%)	
Study output class			
1	21 (18.8%)	28 (20.1%)	0.06
2	9 (8.5%)	27 (19.4%)	
3	24 (22.6%)	43 (30.9%)	
4	52 (49.1%)	41 (29.5%)	

^aPearson's chi-square test.

which is to improve the quality of PHC.^{11,17} Based on the framework, which establishes a relationship between diagnosis criteria, maximum waiting time and allocation of human sources, it was possible to acknowledge the dynamics of care provided to dental emergencies in PHC and indicated improvements in dental emergency care.

Non-admission within the expected time of some cases (3, 4 and E) and the average time of absence of these E cases in PHC show some patients are not being provided with access in appropriate time. Previous studies pointed out that patients look for care in specific emergency services when the care cannot be provided by the PHC, either because of infrastructure issues or exaggerated waiting times, generating dissatisfaction with PHC.^{19,20}

Comparing the demographic variables in relation to the results of Sapucaia do Sul in the 2010 Census, differences in distribution were observed. The distribution of the diagnosis of E (62.3%) and other classes (59.1%) by sex is higher than expected for women (51.3%). These results are consistent with a review that demonstrated greater use of emergency dental services by women.⁸ Regarding skin color, the frequency of non-whites increases when we analyze exclusively the group with a diagnosis of urgency (12.3%), being closer to what was expected (13.4%). This suggests inequity in the use of the service by skin color group. As for age, the highest frequency of adults is above the expected frequency for the group diagnosed with E (71.4%) and below the group without E (55.0%). The results suggest barriers for adults to use the services in non-emergency cases, and the more frequent use of emergency dentistry by adults was supported by results from a scoping review.²¹ For the old-adults, frequency was higher than expected in both conditions of entry to the services. Age results should consider that dental caries has an important place in dental emergencies, therefore the chronic condition, accumulation and progressive worsening, were well represented in the high frequency of E cases in adults and the old-adults.

The prevalence of emergency among adolescents was lower than the result of “pain as the reason for the last appointment” (14.5%) reported in the 2010

epidemiological survey by SB Brasil. The use of other emergency services among adolescents may explain this difference. A study which compared the prevalence of dental emergencies between PHC and secondary emergency care (SEC) found that adolescents were more prevalent in SEC;²² in Sapucaia do Sul, this kind of service is only available in neighboring municipalities. Among adults, the prevalence of E coincides with the result of “pain as the reason for the last appointment”, found in the 2010 SB Brasil (15.8%) and may be explained difficulty of access, such as the incompatibility of the worker’s schedule with the service opening hours, considering that it is acknowledged that difficulties of access tend to force people to seek for care when the problem is aggravated.^{23,24} In the older adults, the figure was much higher than the survey measurement (8.4%), and this may be partially explained by the inclusion of the discomfort criteria and health impairments with medical reference in the emergency condition, however it strongly points to barriers to elective care for the older adults.²⁵

First contact and the continuity of care constitute essential attributes of the PHC pattern of utilization.²⁶ In this study, it was possible to observe the continuity of care for people who accessed PHC services and those who had new dental emergency events. Interestingly, no differences were found in terms of individual characteristics between new cases of dental emergencies and non-emergency cases, but there was a contextual difference by services. There was an 8.3% incidence of E cases. The value found and its uniformity are distinct from the emergency analysis by type of injury. In children, for instance, the incidence of dental trauma is between 1 and 3% and is more frequent in boys.²⁷ The low recurrence of emergency suggests PHC is effective when access and continuity of care are established.

Some cases of emergency demanded a waiting time until the improvement exceeded twenty days. This time may be explained by the occurrence of an emergency being registered by quadrant. In other words, if there is more than one emergency need in the quadrant, the time for improvement may be greater. A significant number of people did not have continuity of care after emergency care, and others

remained stable. Stable cases may reflect referral cases, which did not return, or abandoned the treatment before there was an improvement. These results point to weaknesses in the coordination and comprehensiveness of care, compatible with those revealed by a study of the PHC work processes in Brazil.²⁸

The limitations of this study are associated with the characteristics of the primary study, which was a service-based study for the evaluation of an allocation of care matrix. The impact generated by the number of new accesses having been lower than expected in one year (n = 1,831/15,000) is emphasized, and the loss in the follow-up of cases with diagnosis that underwent without assistance or with short follow-up time. Furthermore, the possible effect that the study

generated on the performance of dental surgeons, whose assistance was being registered by them, must also be considered.

Conclusions

Emergency dental care provided by PHC was highly effective and most dental emergency cases were attended in the adequate time. The prevalence of emergency in adolescents, adults and older adults show barriers in the expected access for these groups. The care expected for all emergency patients was not obtained, some of them did not get continuity of care and some remained in a stable situation, which indicates the need for improvements in the coordination and comprehensiveness of care.

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