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Profile of cases due to burn attended in emergency care units in Brazilian capitals in 2017

Perfil dos casos de queimadura atendidos em serviços hospitalares de urgência e emergência nas capitais brasileiras em 2017

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ABSTRACT: ***Objectives:*** To describe the profile of burn victims attended in emergency services and to identify associations between the variables investigated. ***Methods:*** Cross-sectional study based on data from the 2017 survey "Surveillance of violence and accidents in emergency units". We used descriptive analysis, according to demographic characteristics and aspects related to the burn injury, as well as the correspondence analysis technique, which allowed to verify possible associations between the variables investigated. ***Results:*** Burns were more frequent: in adults aged between 20 and 39 years (40.7%); in men (57.0%); in the household (67.7%); due to hot substances (52.0%). Household accidents were more frequent in the age group 0-15 years (92.0%) and elderly (84.4%), and in women (81.6%). Accidents in commerce, services and industry affected individuals aged 16 to 59 years (73.6%). Referral to other hospitals was associated with cases in the elderly and hospitalization with the cases in individuals aged between 0 and 15 years old. Events in the working age population were associated with alcohol use and the workplace. Among women, it is suggested to associate burn accidents with household and hot substances. ***Conclusions:*** The results point to the need for oriented actions in the field of health education, as well as labor regulation and supervision.

Keywords: Burns. Hospital Emergency Service. Unified Health System. Epidemiological Monitoring. Health Surveys.

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RESUMO: ***Objetivos:*** Definir o perfil das vítimas de queimadura atendidas nos serviços de emergência e identificar possíveis associações entre as variáveis investigadas. ***Métodos:*** Estudo transversal com base nos dados do inquérito "Vigilância de Violências e Acidentes em Unidades Sentinelas de Urgência e Emergência", de 2017. Procedeu-se à análise descritiva segundo características demográficas e aspectos relativos ao acidente por queimadura, bem como à técnica de análise de correspondência, que permitiu verificar possíveis associações entre as variáveis investigadas. ***Resultados:*** Os casos de queimadura foram mais frequentes: em adultos com idade entre 20 e 39 anos (40,7%); em homens (57%); no domicílio (67,7%); em decorrência do manuseio de substâncias quentes (52%). Acidentes no domicílio foram mais frequentes nas faixas etárias de 0 a 15 anos (92%) e idosos (84,4%) e em mulheres (81,6%). Acidentes no comércio, serviços e indústria acometeram indivíduos com idades entre 16 e 59 anos (73,6%). O encaminhamento para outros hospitais esteve associado aos casos ocorridos em idosos e a internação aos eventos que acometeram indivíduos na faixa de 0 a 15 anos de idade. Eventos na população em idade produtiva apresentaram associação com o uso de álcool e o local de trabalho. Entre as mulheres, sugere-se associação dos acidentes com o domicílio e substâncias quentes. ***Conclusão:*** Os resultados apontam para a necessidade de ações orientadas no campo da educação em saúde, bem como da regulamentação e da fiscalização trabalhistas.

Palavras-chave: Queimaduras. Serviço Hospitalar de Emergência. Sistema Único de Saúde. Vigilância Epidemiológica. Inquéritos Epidemiológicos.

INTRODUCTION

Burn injuries are quite common in the world and are associated with high morbidity and mortality[1], in addition to being causes of absence from work, sequelae, functional and aesthetic limitations, impaired emotional well-being and loss of quality of life[2,3]. In addition to immediate care, burns usually require long-term treatment, numerous outpatient consultations for dressing changes, multiple reconstructive surgical procedures, long term hospitalization, high socioeconomic cost for victims and the health system[1,4].

The World Health Organization (WHO) estimates that 130,000 people die from fire burns annually[4]. Burns are among the main causes of disability-adjusted life years lost (DALY) in low and middle income countries[1,4]. In 2004, almost 11 million people worldwide suffered burns to the point of needing medical assistance[5]. The Center for Disease Control and Prevention, in the United States of America, reported that about 486 thousand patients received emergency medical treatment due to burns in 2011[6].

Estimates by the Ministry of Health of Brazil point out that about one million new cases of burn victims per year, with 100 thousand hospital visits and, 2,500 deaths due to injuries[7]. All age groups are affected in different settings, although studies indicate significant domestic occurrences in childhood[1,2,8] and occupational occurrences in males[3].

Burns result in damage to organic tissues by thermal, electrical, chemical or radioactive trauma[3,9]. However, they correspond to potentially severe traumas, not only due to physical impairments and high mortality, but also due to the sequelae and disability resulting from the injuries and the emotional impact. For this reason, researches such as the Surveillance of Violence and Accidents Survey in Sentinel Services of Urgency and Emergency (VIVA Survey)[10] are fundamental for characterizing the population affected by burns and the factors associated with this event, allowing strategies that promote health and prevent such events.

This study aims to define the profile of burn victims attended in Brazilian emergency care services and to identify associations between burn cases and the variables investigated.

METHODS

DATA SOURCE, POPULATION AND STUDY LOCATION

Data from the VIVA Survey were collected from 90 emergency care services within the Unified Health System (SUS) in 2017[10]. In that survey, information was collected from victims of external causes (accidents and violence) who sought assistance in these services, with a total of 48,532 interviews conducted in 23 capitals and the Federal District, from September to December 2017. Among the capitals, Macapá, Florianópolis and Porto Alegre did not participate in the survey for local operational reasons.

The current study analyzes data from victims of burn injuries (n = 789). Following the 10th revision of the International Classification of Diseases (ICD-10), cases resulting from burns due to exposure to electric current, radiation and temperature were included; exposure to smoke, fire and flames; and contact with heat source and hot substances[11], related to codes W85 to W99, and X00 to X1910.

VIVA SURVEY DATA SAMPLING, COLLECTION PROCESS AND ETHICAL ASPECTS

Cluster sampling was carried out in a single stage of selection stratified by health services (HS), with the Primary Sampling Unit (PSA) being the variable that defines the structure of the sampling plan, consisting of 12-hour shifts. With regard to the drawing of shifts, the collection period of 30 days was considered divided into two shifts (daytime and night), totaling 60 shifts — 30 daytime and 30 nighttime[10].

For data collection, a standardized form[10] was used, which had already been used in previous VIVA surveys and updated for the 2017 edition. All the victims of accidents and violence treated in the selected emergency services were interviewed by previously trained researchers. When the victims admitted to the services were minors or unable to respond, their companion were queried and data from medical records were used[10].

The project for the Surveillance of Violence and Accidents Survey in Sentinel Urgency and Emergency Services (VIVA Survey) was approved by the National Commission for Ethics in Research (Conep) of the Ministry of Health, under Opinion no. 2,234,509.23/8/2017 – CAAE: 67709417.0.0000.0008 on August 23, 2017. Verbal consent was requested from the patient, or from a relative or guardian, when the patient was under 12 years of age or found it impossible to answer. Ethical principles were followed, as recommended by Resolution no. 466, of December 12, 2012, of the National Health Council/MS.

STUDY DESIGN AND DATA ANALYSIS

This is a cross-sectional study. Initially, a descriptive analysis was carried out according to demographic (sex, age) and behavioral (alcohol consumption) characteristics, to the accident's location, the affected body region, the agent causing the injury or type of burn and the severity of the injury or evolution of the case.

To test possible associations between the variables investigated, the correspondence analysis (CA) technique was used, since it allows working with a large number of qualitative variables, consisting of a large number of categories[12,13]. The CA is an exploratory phase of the data and uses contingency tables, also called cross tables, to check the dependence between their rows and columns. CA summarized the structure of data variability in terms of dimensions, with this number being less than that of variables[13]. CA is the equivalant of factor analysis, but the results are presented graphically, in which the shortest distances between the row and column categories represent the strongest associations, while the longest distances represent dissociations[12,13].

The simple correspondence analysis technique (SCA) was used to describe the profile of burn victims from the VIVA Survey. Since these are data from complex sampling plans (CSP), the expanded contingency tables (total attendances) were obtained considering the sample weights in the calculation of the proportions of each cell in the table, and based on them, the correspondence graph.

The estimator of the total attendance for accidents and violence in sentinel emergency services in the period of 30 days is given by the Equation 1:

$$\hat{Y} = \sum_{h=1}^{L} \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij}\, y_{hij} \qquad (1)$$

Whereby:
w_{hij} = the weight of the sample in the h-th stratum (ES), i-th UPA (shift) and j-th number of elements in the h-th stratum of the i-th UPA;
y_{hij} = the observed value of the variable (1 if it has and 0 otherwise) in the h-th stratum, i-th UPA and j-th number of elements in the h-th stratum of the i-th UPA.

Variables of interest were selected in CA. The line variables, which correspond to the cases, comprise the sociodemographic variables gender (male and female) and age group

(0 to 15, 16 to 19, 20 to 39, 40 to 59, 60 years and over). The column variables, or variables of interest, correspond to:

- characteristics of the event, such as the type of substance or object causing the burn (chemical substance, hot substance, hot object, fire or flame, electric shock);
- alcohol consumption (yes or no);
- severity of the injury (referral to another service, hospitalization, discharge);
- affected body part (head, chest or back, hip or abdomen, upper limbs, lower limbs, multiple organs or regions);
- place of occurrence (public space, residence, commerce or service or industry);
- occurrence during work or commuting to work.

The data were analyzed using the Stata 14 software.

RESULTS

Table 1 describes the distribution of burn cases (n = 789), according to some variables. There was a predominance of men (450 cases; 57.0% of the total) compared to women (339 cases; 43.0% of the total). The most affected age group was adults aged 20 to 39 years (40.7%), followed by those aged 40 to 59 years (24.5%) and 0 to 15 years (23.6%). The age distribution was similar between men and women. The use of alcoholic beverages was identified in 8.5% of male victims, while the percentage verified for women was 2.5% (Table 1).

The upper limbs were the most affected area (30.5%), followed by the lower limbs (21.1%), the face (20.7%) and multiple organs (13.3%). Most cases evolved to hospital discharge in 72.0% of cases, and hospitalization took second place, although with a large percentage difference, corresponding to 16.3% of cases (Table 1).

Regarding the location of the occurrence, 67.7% of the burns occurred at home, affecting women (81.6%) more than men (57.7%) (Table 1). Figures 1A and 1B illustrate the distribution of cases by age group, according to the variable's location of occurrence and causative agent variables. In households, occurrences in the 0-15 age group (92.0%) and elderly (84.4%) predominated (Figure 1A).

Places of commerce, services and industries accounted for 17.9% of the cases, occupying the second position. Men were more affected by burns in commerce, services and industries (23.4%) than women (10.2%) (Table 1). These places had a higher incidence of burns among the working age population, in the following order by age group: from 20 to 39 years old (28.7%), from 16 to 19 years old (27.0%) and between 40 and 59 years old (17.9%). Among adolescents aged 16 to 19 years, bar and similar places accounted for 12.7% of the notifications regarding place of occurrence, being higher than in other age groups (Figure 1A). Concerning work-related occurrences, 30.3% happened on the way to the service among men and 14.7% among women (Table 1).

With regard to the causative agent, data shown in Table 1 in the supplementary material indicate that hot substances (water and others) were the main causative agents of burns (52%), in a higher number among women (65.1%) than among men (42.6%), followed by fire or flame (16.3%), which, in turn, were the highest causative agents among men (21.5%), compared to women (9.2%). Hot substances were responsible for the highest proportion of burns in all age groups, with a higher number in individuals aged 0 to 15 years (56.7%) and lower in those aged 16 to 19 years (38.5%) (Table 1 of supplementary material). Burns from fire or flames ranked second in all age groups, with a higher proportion in the

Table 1. Distribution of burn cases according to age, place of occurrence, use of alcoholic beverage and evolution of the case, stratified by gender. VIVA, 2017.

Variables		Male (n = 450)			Female (n = 339)			Total (n = 789)		
		%	SE	VC	%	SE	VC	%	SE	VC
Age(years)	0 - 15	25.2	2.6	10.2	21.5	2.4	11.0	23.6	1.9	8.0
	16 - 19	5.5	1.3	23.8	4.3	1.2	26.5	5.0	0.9	17.0
	20 - 39	40.3	2.4	6.0	41.4	2.7	6.4	40.7	1.8	4.3
	40 - 59	24.0	2.6	10.8	25.3	2.6	10.1	24.5	1.8	7.4
	≥ 60	5.0	1.2	22.8	7.5	1.7	23.1	6.1	1.0	16.6
Place of occurrence	Residence	57.7	3.3	5.7	81.6	2.8	3.4	67.7	2.4	3.6
	Bar/Similar	2.8	1.0	35.7	0.4	0.3	70.5	1.8	0.6	33.3
	Public space	10.1	1.6	15.5	2.2	0.8	37.5	6.8	1.0	14.3
	Commerce, service, industries	23.5	2.8	12.0	10.2	2.0	19.3	17.9	2.1	11.4
	Other	5.9	1.4	23.9	5.5	1.6	28.4	5.8	1.1	18.8
Use of alcohol*	Yes	8.5	1.8	21.5	2.5	1.0	40.1	6.0	1.2	19.7
	No	79.3	2.4	3.0	84.2	2.2	2.6	81.4	1.7	2.1
Work route*	Yes	30.3	3.17	10.4	14.7	1.97	13.4	23.8	1.97	8.3
	No	59.3	2.8	4.7	74.7	2.4	3.2	55.8	1.8	2.8
Evolution*	Discharge	69.1	2.6	3.8	75.4	2.6	3.5	71.8	2.1	2.9
	Hospitalization	19.0	1.9	9.7	12.7	1.9	14.9	16.3	1.4	8.6
	Other hospital**	8.4	1.7	20.7	10.1	1.8	17.5	9.1	1.3	14.5
	Evasion	1.1	0.6	54.1	-	-	-	0.7	0.4	53.8

*The ignored category has been deleted. Thus, the totals do not add up to 100%; **sent to another hospital;
SE: standard error; VC: variation coefficient.

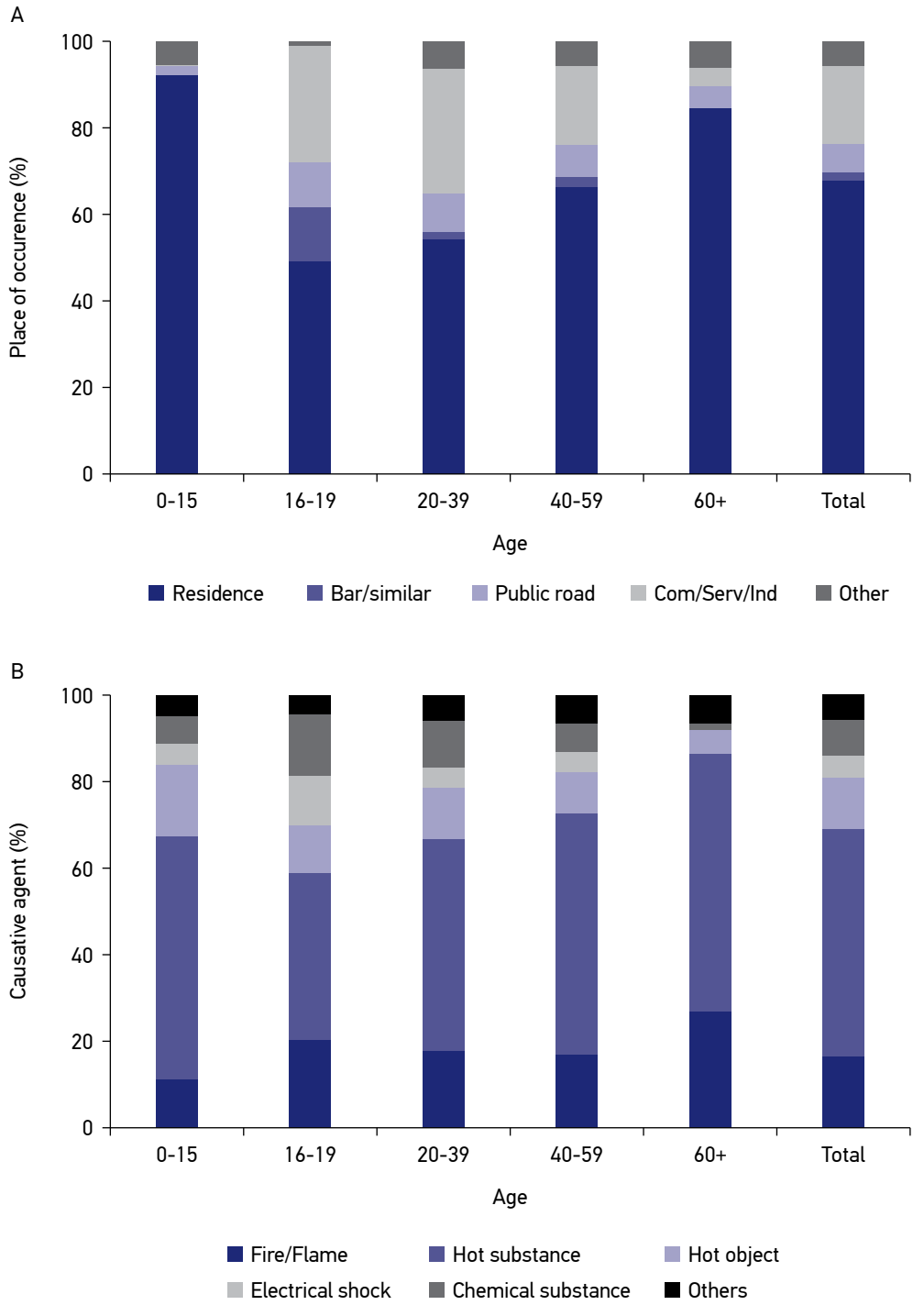


Figure 1. Proportion of burn cases according to place of occurrence and causative agent, stratified by age group. VIVA, 2017.

elderly (26.8%) (Table 1 of supplementary material). The highest percentages of burns by chemical substances were found in the age groups that correspond to working age, from 16 to 59 years (Figure 1B).

Regarding the AC analysis, the contributions and respective coordinates of demographic characteristics (gender and age) and those related to burns in each dimension can be seen in Table 2 of the supplementary material. The "dimension" should be understood as a set of categories of variables that have shown to be associated with each other and the "contribution" measures the importance of the category to explain the association in the composition of the dimension, so that the greater its contribution, the greater its importance. In dimension 1, age (0–15 years) is the variable that contributed most to the explanation (46.0% overall), followed by commuting to work (21.0% overall), and place of occurrence (18.0% in business and 16% in places of residence). In dimension 2, the variable male sex contributed 38.0%, female sex 26.0%, the evolution to hospitalization contributed 25%, followed by the types of burn with 33%, among them the hot substance, with 10% (Table 2 of the supplementary material).

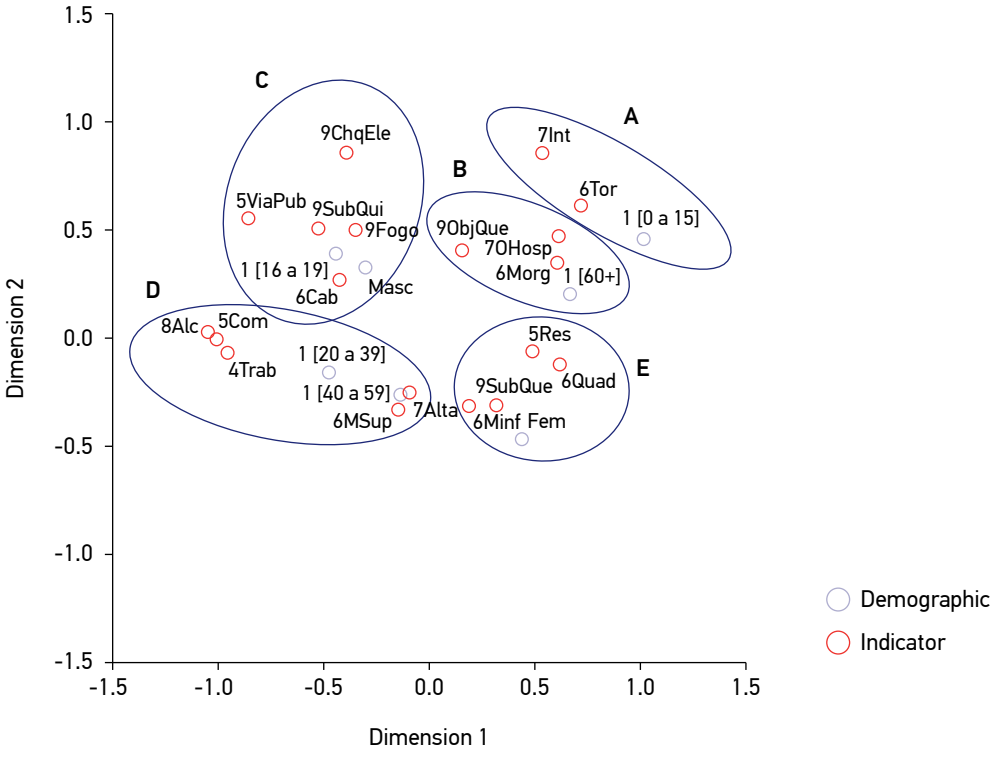
Table 2 shows the statistical measures resulting from CA ($\chi 2 = 1547.6$; $p < 0.001$), which indicate that the hypothesis H_0, of independence between demographic characteristics (lines) and characteristics of the burn event (columns), is rejected. It is concluded that there is an association between burns and the variables investigated. Two dimensions explain more than 90.0% of the structure of the data variability (Table 2).

The CA shown in Figure 2 represents, by means of circles, five sets of categories of variables that were associated. Set A, on the right, suggests that care for patients aged 0 to 15 years is associated with hospitalization and chest injuries. Set B suggests that elderly people aged 60 and over were associated with cases that were referred to other hospitals

Table 2. Dimensions of correspondence analysis according to singular value, inertia and percentage of variance. VIVA, 2017.

Dimension	Unique value	Inertia	χ^2	Significance *	Explained variance	
					% absolute	% accumualted**
1	0.248	0.061			74.60	74.60
2	0.119	0.014			17.16	91.76
3	0.061	0.004			4.55	96.31
4	0.043	0.002			2.28	98.59
5	0.034	0.001			1.41	100.00
6	0.001	0.000			0.00	100.00
Total		0.082	1547.609	.000	100.00	100.00

*P value of the χ^2 test; **accumulated variance.



Legend:

Occurence during journey
- 4Trab= Work

Place of occurence
- 5Res= Residence
- 5ViaPub= Public space
- 5Com= Commerce/Services/Industries

Body part affected
- 6Cab= Head or other region of head
- 6Tor= Thorax/Back
- 6Quad= Hip/Abdomen
- 6Minf= Lower limb
- 6Msup= Upper limb
- 6Morg= Multiple organs/regions

Evolution
- 7Alta= Discharge
- 7Int= Hospitalization
- 70Hosp= Reffered to other service

Consumed alcoholic beverage
- 8Alc= Alcohol

Type of Burn
- 9Fogo= Fire/Flame
- 9ObjQue= Hot object
- 9SubQue= Hot substance
- 9SubQui = Chemical substance
- 9ChqEle= Electric shock

Age (years)
- 1 (0-15)
- 1 (16-19)
- 1 (20-39)
- 1 (40-59)
- 1 (60+)

Sex
- Masc= Male
- Fem= Female

Set of categories

A
B
C
D
E

Figure 2. Bi-plot graph of demographic characteristics and related to the occurrences of burn victims. VIVA, 2017.

and services, burns from hot objects and multiple organs injuries. In group C, male adolescents aged 16 to 19 years old had occurrences on public spaces, due to chemical substances, affecting the head region. In set D, the events of the working age population (20 to 39 years and 40 to 59 years) were associated with alcohol use, occurrence in the workplace (commerce, service, industry) and involvement of upper limbs. Set E suggests that women had burns within the household due to hot substance, resulting in injuries to the hips and lower limbs.

DISCUSSION

The study's findings highlight that burns were more frequent among men in adulthood (20 to 59 years old), followed by those from 0 to 15 years old, and that the residence was the most frequent place of occurrences, followed by commerce, services and industry. A quarter of the occurrences occurred on the commuting to the workplace. The causative agents of the burns were hot substances (water, oil, others) in more than half of the occurrences, fire and flames contributed to a seventh of the events and the hot objects responded to a tenth of the events. Among the affected body parts, the upper limbs predominate. About a quarter of the burns resulted in hospitalization and referral to other health services, indicating severe injuries, which were more common among the extremes of age (0 to 15 years old and the elderly). Chest injuries were associated with the population aged 0 to 15 years. In patients aged 16 to 19 years, the variables associated were male, occurrences on public spaces, predominantly in the head and caused by chemicals and shocks. In the working age population (20 to 59 years old), burns occurred at the workplace (commerce, services and industry) and commuting to work, in addition to being associated with the use of alcohol. In the elderly, burns affected multiple organs and were caused by hot objects. Burns among women, on the other hand, occurred at home, due to hot substances, primarily affecting the lower limbs and hips.

CA is very useful when there are a large number of categories, which makes its visualization important in identifying points of "attraction" or "repulsion" between the categories of variables[13]. VIVA is an important national data source, which captures occurrences of external causes treated in emergency services, covering a set of events that occur in everyday life, including accidents due to burns. This allows establishing relationships and understanding the causes, the explanation and the relationship between the outcomes and the multiple variables more broadly.

Regarding the severity of burn injuries, in this study patients were hospitalized in about 20.0% of cases. In VIVA Survey 2017, 9.7% of all accident cases evolved to hospitalization, which highlights the greater severity of the burn cases studied here[10]. However, other studies in the literature point to even more serious cases, as they come from the analysis of hospitalization units or from the mortality database[3,5,14]. VIVA portrays occurrences at the entrance to emergency units and, therefore, is able to measure mild, moderate and severe cases[10].

Hospitalizations or referrals were more significant among vulnerable populations (<15 years and the elderly), which may indirectly indicate the severity of burns in these age groups[15]. Although VIVA does not allow the assessment of injury severity, the literature describes that the severity and prognosis of a burn are defined according to the causal agent, depth, extent of the burned body surface, location, age, pre-existing diseases and associated injuries[3,9].

The vast majority of occurrences in the present study took place in a residential environment, affecting children, women and the elderly. This data is important to support prevention policies aimed at families[16]. The finding of more than half of the burns occurred at the victims' homes is consistent with national[17,18] and international[19-22] literature. The residence is a place of high exposure to risks, with burns by liquids (cooking food, boiling water), hot objects (stove, pots, barbecues), household equipment (irons, heaters, flammable agents such as alcohol, kerosene, domestic gas, matches, candles), in addition to exposure to electric current (sockets, electrical installations)[17,22] the most likely occurrences in this context. Precarious and small houses with a high number of residents, low socioeconomic status, low education, poor kitchen equipment and child neglect by parents as well as the elderly facilitate the occurrence of accidents due to burns at home. [18,21]

The kitchen is the environment with the highest risk. Children's curiosity, games and lack of space can lead to spilling hot pots containing water and food[21,23]. Women become vulnerable due to the high frequency of activities related to food preparation at home[11]. Likewise, the elderly, who spend long periods at home, are also very vulnerable to burns in this place[11].

Burns in the working age population (20 to 59 years old) were more frequent in workplaces, such as commerce, services, industry and construction, and commuting to work. Although burns due to hot substances has also a high frequency in this age group, other agents such as fire and flames, chemical substances, shocks and hot objects were also observed, which was consistent with findings from another edition of VIVA[10]. Such agents are related to occupational activities and the risks at work[24]. Studies on burns at the workplace are scarce in the national literature, which shows that this is also a knowledge gap. In this context, VIVA helps to bring new evidence and point out the risks of these environments, highlighting the need to advance in protection, regulation and public inspection policies[10].

On the same subject, it should be noted that burns caused by electric shock were more frequent in males, adults and young people and associated with spaces outside the home (public places). Similar results have been described in other studies in burn health care units, suggesting a relationship with the risks at work and certain occupations[3,24,25]. VIVA not only highlights the workplace, but also the commute to the workplace as a factor associated with burns, which is in line with the results of the National Health Survey (PNS) 2013, which revealed that 30.0% of work accidents happened on this journey[24].

Another issue with a few studies is the association between burns, alcohol consumption and male sex, which this study highlights. The consumption of alcoholic beverages makes people vulnerable and more exposed to risks, accidents and violence[26]. This association reinforces the importance of surveys such as VIVA and the inclusion of the variable alcohol consumption in questionnaires.

The body parts most affected were the upper limbs, lower limbs, followed by the face, which was also found in other studies[2], although some studies have shown that the head is the most affected site[14,25].

Prevention is considered to be the most effective strategy for harm controlling. With regard to children and the elderly, educational measures with the parents and guardians should shed light on the need for direct supervision, implementation of safety measures at home, especially in the kitchen, and the adoption of simple daily practices that guarantee less exposure to burn injuries. The engagement of the local community in the dissemination of educational and preventive practices can strengthen the movement, with positive impacts in reducing the occurrence of such events. It is also relevant to promote advances in labor legislation — at least to ensure that there are no setbacks —, in the inspection of work environments and in the awareness of professionals with regard to adherence to personal protective equipment and the adoption of other safety measures at work.

As a limitation of the study, questions related to the methodological aspects of the VIVA Survey, the data source used here, are identified. Firstly, due to the fact that the sample population refers to individuals cared for in health services selected intentionally within the scope of the capitals (not all participated), the Federal District and some municipalities, it is not possible to generalize the results found here for Brazil. Neither can population-based measures of occurrence be calculated. Secondly, it is necessary to consider the potential information bias inherent in the form of data collection, which was based on information provided by patients or their companions.

Based on the analyzed data, the present study identified that cases due to burn present differences related to the sex and the age range of the affected individuals. At one extreme, the importance of occupational burns is evident, referring to the exposure of men of working age in places of commerce, services and industry and on the way to work. In the other, the occurrences within the house affected children, women and the elderly more, and in these cases, hot substances were mostly found to be causative agents. Based on the findings of this study, it is recommended to advance in studies on this theme, especially with regard to burns related to occupational activity and alcohol consumption. There is also a need to implement targeted actions in the health education field, as well as labor regulation and inspection.

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