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Epidemiological profile of amputee patients in a Brazilian reference hospital, 2012-2019

Perfil epidemiológico de pacientes amputados num hospital de referência brasileiro, 2012-2019

Perfil epidemiológico de pacientes amputados en un hospital de referencia brasileño, 2012-2019

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Abstract
Responsible for high rates of morbidity and mortality, amputation has constituted a great public health problem, which burdens the social security costs and the health system. We aimed to describe the epidemiological profile of people who suffered amputation in a public hospital in the interior of Brazil, which is a reference for a macroregion.This was a retrospective and descriptive epidemiological study, carried out by analyzing the medical records of 214 patients who underwent amputations of various causes, between the years 2012 and 2019 at the Municipal Hospital Dr. Raimundo Gobira, located in Teófilo Otoni, Minas Gerais, Brazil. Statistical analysis of Pearson's correlation, mean and standard deviation was performed. A significance level of 5% was adopted. Of the 214 cases of amputations, the majority were men (91.12%), aged 19-30 years (21.96%), from the urban area (63.45%). Of these, 46.26% were associated with work. The *maquita* was the tool responsible for most injuries (17.35%). The fingers of the left hand were the main body segments affected (23.60%). Most of the subjects were residents of Teófilo Otoni (34.57%). Approximately 20.10% of amputations occurred in the year 2018. Statistical significance was not demonstrated when age and length of hospital stay were correlated, although the results point to a longer length of stay as age increases. The results made it possible to understand the epidemiological reality of the causes of amputations performed in the region and provide public managers with the opportunity to make decisions based on prevention.
Keywords: Amputation; Descriptive epidemiology; Health profile; Brazil.

Resumo
Responsável por elevados índices de morbimortalidade, a amputação tem se constituído em um grande problema de saúde pública, que onera os custos previdenciários e do sistema de saúde. Objetivamos descrever o perfil epidemiológico das pessoas amputadas em um hospital público do interior do Brasil, referência para uma macrorregião. Trata-se de um estudo epidemiológico retrospectivo e descritivo, realizado por meio da análise de prontuários de 214 pacientes que sofreu amputações de diversas causas, entre os anos de 2012 e 2019, no Hospital Municipal Dr. Raimundo Gobira, localizado em Teófilo Otoni, Minas Gerais, Brasil. Foi realizada análise estatística de correlação de Pearson, média e

desvio padrão. Foi adotado nível de significância de 5%. Dos 214 casos de amputações, a maioria era de homens (91,12%), com idade entre 19 a 30 anos (21,96%), procedentes da zona urbana (63,45%). Destes, 46,26% estavam associados ao trabalho. A maquita foi o instrumento responsável pela maioria das lesões (17,35%). Os dedos da mão esquerda foram os principais segmentos corporais afetados (23,60%). A maioria dos sujeitos era residente em Teófilo Otoni (34,57%). Aproximadamente 20,10% das amputações ocorreram no ano de 2018. Não foi demonstrada significância estatística quando a idade e o tempo de internação foram correlacionados, embora os resultados apontem para um maior tempo de internação com o aumento da idade. Os resultados possibilitaram conhecer a realidade epidemiológica das causas das amputações realizadas na região e oportunizar aos gestores públicos a tomada de decisões com base na prevenção.
Palavras-chave: Amputação; Epidemiologia descritiva; Perfil de saúde; Brasil.

Resumen
Responsable de las altas tasas de morbilidad y mortalidad, la amputación ha constituido un gran problema de salud pública, que grava los costos de la seguridad social y el sistema de salud. Nuestro objetivo fue describir el perfil epidemiológico de las personas que sufrieron amputación en un hospital público del interior de Brasil, el cual es un referente para una macrorregión. Se trata de un estudio epidemiológico retrospectivo y descriptivo, realizado a partir del análisis de las historias clínicas de 214 pacientes que sufrió amputaciones de diversas causas, entre los años 2012 y 2019 en el Hospital Municipal Dr. Raimundo Gobira, ubicado en Teófilo Otoni, Minas Gerais, Brasil. Se realizó un análisis estadístico de correlación, media y desviación estándar de Pearson. Se adoptó un nivel de significancia del 5%. De los 214 casos de amputaciones, la mayoría fueron hombres (91,12%), de 19 a 30 años (21,96%), del área urbana (63,45%). De estos, el 46,26% estaban asociados al trabajo. La maquita fue la herramienta responsable de más lesiones (17,35%). Los dedos de la mano izquierda fueron los principales segmentos corporales afectados (23,60%). La mayoría de los sujetos eran residentes de Teófilo Otoni (34,57%). Aproximadamente el 20,10% de las amputaciones ocurrieron en el año 2018. No se demostró significación estadística cuando se correlacionaron la edad y la duración de la estancia hospitalaria, aunque los resultados apuntan a una mayor duración de la estancia a medida que aumenta la edad. Los resultados permitieron comprender la realidad epidemiológica de las causas de las amputaciones realizadas en la región y brindar a los gestores públicos la oportunidad de tomar decisiones basadas en la prevención.
Palabras clave: Amputación; Epidemiología descriptiva; Perfil de salud; Brasil.

1. Introduction

Traumatic or surgical amputation consists of removing a body segment, being performed as a last resort or last surgical possibility, to improve limb function and avoid extreme consequences (Schoeller et al., 2013)**.**

Responsible for high rates of morbidity and mortality, it has become a major public health problem, with an important impact on the individual's independence and on the costs of the health and social security sector. Its etiologies are divided into vascular causes, such as diabetes mellitus, atherosclerosis and inflammation of blood vessels, as well as tissue necrosis; and non-vascular causes, such as trauma, neoplasms, congenital and infectious conditions (Padovani et al., 2015).

Data from the Hospital Information System of the public health system in Brazil in 2011, presented external causes such as violence, accidents at work, domestic and traffic (33.1%), as the main causes of amputations in Brazil. The other etiologies are related to infectious and parasitic diseases (17.9%), circulatory system (16.1%), diabetes (13.6%), gangrene (10.4%), diseases of the musculoskeletal system and connective tissue (6.0%), neoplasms (1.9%), diseases of the skin and subcutaneous tissue (0.5%), congenital malformations, deformities and chromosomal abnormalities with 0.4% (Brasil, 2014).

It is estimated that the worldwide incidence of limb amputation is approximately 1 million per year (Seidel et al., 2008; Senefone et al., 2012)**.** Among Latin American countries, Brazil is among the record holders in the number of amputations, with an approximate number of 40,000 per year, with diabetes, traffic accidents, and work accidents as the main causes (Caiafa e Canongia, 2003)**.**

Few studies on the causes of amputations have been carried out in Brazil. In the state of Minas Gerais, two studies carried out in a hospital institution in Itajubá (De Jesus-Silva et al., 2017) and Uberaba (Tavares et al., 2009) stand out, aiming to analyze the risk factors involved with lower limb amputations, and describe the clinical and sociodemographic characteristics of the amputations related to diabetes.

Most of the case review studies carried out to date have been carried out in locations in the central-southern region of the country such as Goiânia-Goiás (Seidel et al., 2008), Campo Grande-Mato Grosso do Sul (Dos Reis et al., 2012), Cascavel-Paraná (Senefonte et al., 2012), Maringá-Paraná (Carvalho et al., 2015) and Santa Maria-Rio Grande do Sul (Agne et al., 2004). In northeastern Brazil, studies are scarce. Those available were prevalence studies conducted in Recife (Carvalho et al., 2020)**,** and another in the state of Alagoas (De Souza et al., 2019). In the northern region of the country, there are no published studies on this subject, although it is known that there are amputation procedures in this population.

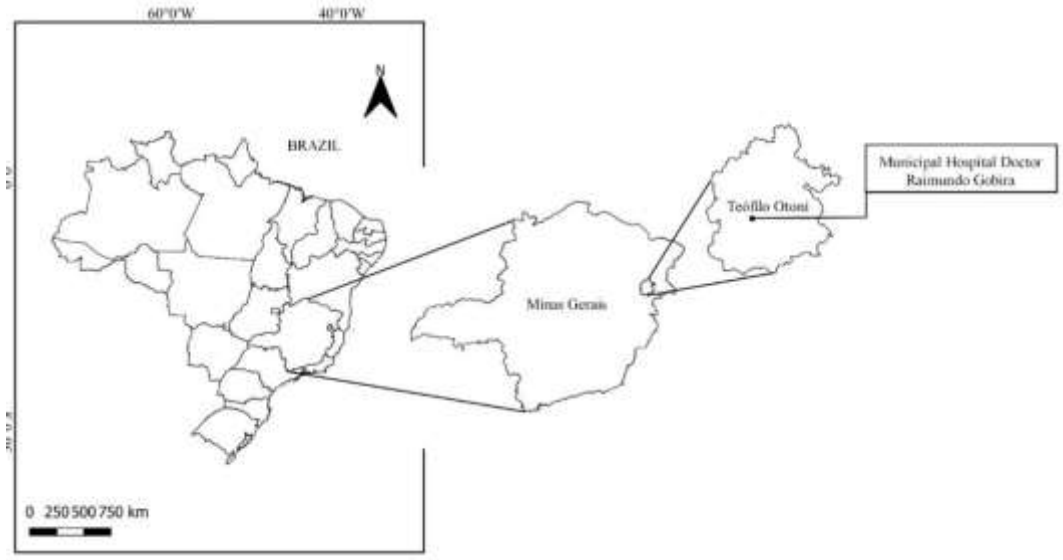
Thus, this study aimed to describe the epidemiological profile of people who suffered an amputation due to different causes, treated at a municipal public hospital, located in the city of Teófilo Otoni - Minas Gerais / Brazil.

2. Methodology

This is a retrospective and descriptive study (Werneck, 2009; Freire & Pattussi, 2018), conducted through the analysis of medical records of 214 patients who underwent major and minor amputations of upper and lower limbs from January 2012 to December 2019 in a vascular surgery and traumatology service at a hospital reference located in the municipality of Teófilo Otoni, State of Minas Gerais / Brazil.

The municipality of Teófilo Otoni is located in the region of southeastern Brazil, more precisely in the northeast of the state of Minas Gerais (Figure 1). It has approximately 140,937 inhabitants living in a territorial area of 3,242,270 km², with a demographic density of 43.46 inhabitants / km² according to the Brazilian Institute of Geography and Statistics (IBGE, 2016).

Figure 1. Map of the Brazilian territory identifying the state of Minas Gerais and the municipality of Teófilo Otoni that hosts the Municipal Hospital Doctor Raimundo Gobira.



Source: Authors.

The study was carried out at the Municipal Hospital Dr. Raimundo Gobira located in the central region of Teófilo Otoni, which is an area of coverage for approximately 900,000 users of the public health service of 63 municipalities in the Mucuri and Jequitinhonha Valleys macroregion. The study unit specializes in low and medium-complexity orthopedics, which results in around 260 surgeries/month. The nosocomial also has outpatient care in orthopedics, radiology, and physiotherapy, with approximately 9,500 monthly visits.

In this research, all types of dislocations and amputations of the upper and lower limbs at any level were considered, as they are understood as mutilating surgical interventions, which cause severe functional damage to the patient.

The study obtained prior authorization from the hospital management to access the data. All data were extracted from the analyzed medical records. The variables analyzed were: age, sex, municipality of residence, zone of residence, date of the procedure, number of days of hospitalization, cause of amputation, and amputated body limb. The medical records were obtained by manually accessing the hospital file since there was no electronic medical record implanted.

The data were entered (double entry) in an Excel office spreadsheet (2016 version) with inconsistency correction, obtaining absolute values and percentages of the information collected. The version of SPSS 13.0 (Chicago, IL, USA) was used to proceed with the statistical analysis of Pearson's correlation for two variables, obtaining the means and their standard deviation. Throughout the analysis, the level of statistical significance was set at 5% ($p < 0.05$).

All data were treated confidentially and the only way to identify the patient was through the number of the hospitalization record. The study was carried out following the recommendations of Resolution number 466/2012 of the National Health Council of Brazil, having been approved by the Research Ethics Committee of the Federal University of the Jequitinhonha and Mucuri Valleys, under the number 3.892.165 and CAAE under the number 27027619.9.0000.5108.

3. Results

Data from 214 patients aged 2 to 87 years who underwent amputation at the Municipal Hospital Dr. Raimundo Gobira, Teófilo Otoni, Minas Gerais / Brazil, were analyzed. A look at the results obtained points to work accidents as the main cause of amputation in the evaluated period (46.26%), followed by the other causes of traffic and domestic accidents. The causes related to the diseases were responsible for approximately 7.0% of the registered cases of amputation. As for the type of equipment that causes amputation in work-related activities, the *maquita* (electric saw for sawing marble, tiles, and concrete) appears in first place with 17.35%, and the electric saw for sawing wood with 10.20%. Regarding the amputated body limb, the fingers of the left hand were the most affected site with 23.60% (Table 1**).**

Table 1.

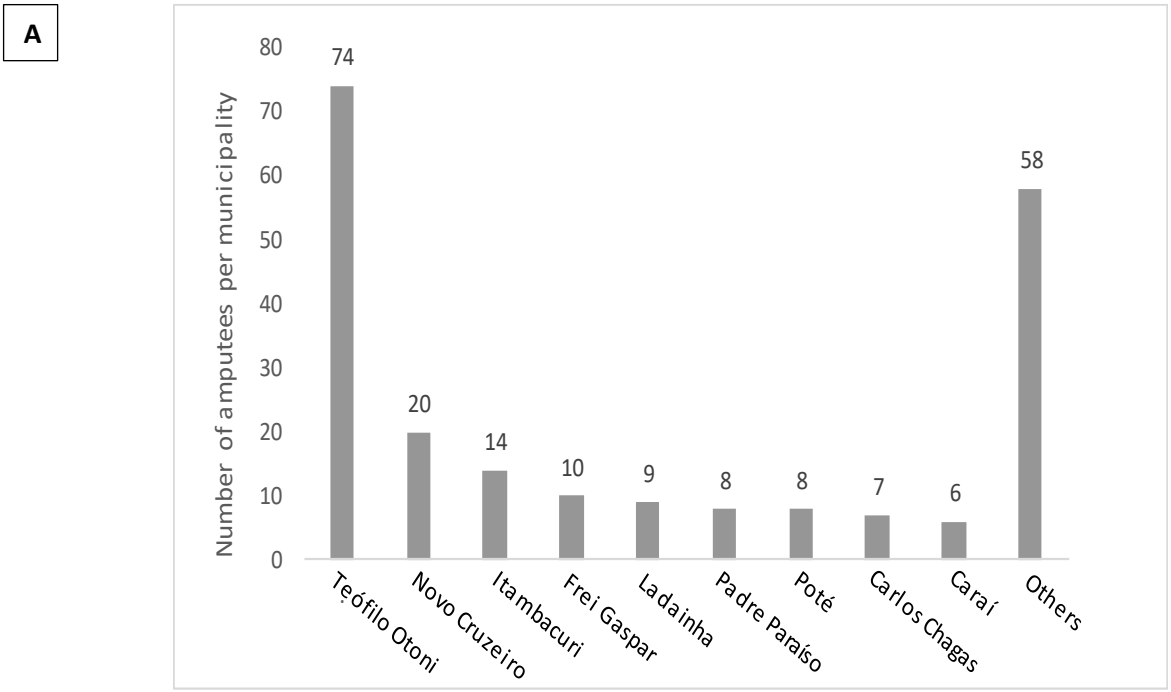
Variables	N (214)	%
Causes of Amputation		
Work	99	46.26
Traffic	43	20.09
Domestic	33	15.42
Disease	15	7.0
Others*	24	11.21
Type of equipment causing work-related amputation		
Maquita	17	17.35
Electric saw	10	10.20
Mill	6	5.10
Others**	10	10.20
Not informed***	56	57.15
Amputated body limb		
Left hand finger(s)	60	23.60
Right hand finger(s)	52	20.64
Left toe(s)	20	7.93
Right toe(s)	21	8.34
Second left hand phalanx	36	14.28
Second right hand phalanx	22	8.74
First left hand phalanx	29	11.51

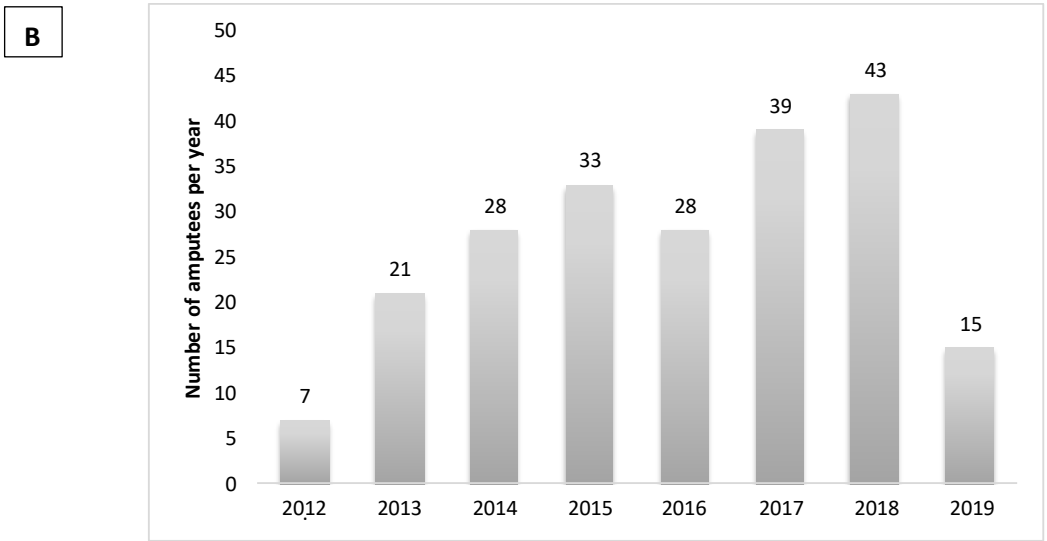
Second right hand phalanx	12	4.76

Note: *Referring to falls, accidents with animals, and violence; **Referring to other tools such as band saws, picks, axes, sickles, machetes, and accidents with animals; *** Referring to situations in which the causes of amputation are unknown due to the absence or poor quality of hospital records. Source: Authors.

Regarding the number of amputees per municipality of residence, the majority are residents in the municipality of Teófilo Otoni (34.57%), followed by Novo Cruzeiro (9.34%) and Itambacuri with 6.54% (Figure 2A). Concerning the year of occurrence of amputations, 2018 was the year with the highest prevalence of amputations, adding up to 43 occurrences (20.10%), shown in Figure 2B.

Figure 2. Distribution of the number of amputations through the spatial and temporal relationship. **(A)** Number of amputees per municipality of residence**, (B)** and number of amputations per year at Municipal Hospital Dr. Raimundo Gobira, Teófilo Otoni, Minas Gerais, Brazil, from 2012-2019.





Source: Authors.

As for the sociodemographic characteristics of the sample, shown in table 2, it is observed that the majority of amputations performed occurred in male people, corresponding to 91.12% of the total cases with the female sex. Amputations occurred in greater numbers in the 19-30 age group (21.96%), followed by the 31-40 age group. As for the origin, most of the amputees were from the urban area, with 63.45%.

Table 2. Sociodemographic characteristics of patients who suffered amputations at Municipal Hospital Dr. Raimundo Gobira, Teófilo Otoni, Minas Gerais, Brazil.

Variables	N (214)	%
Sex		
Male	195	91.12
Female	19	8.88
Age		
0 to 10 years old	15	7.00
11 to 18 years old	20	9.35
19 to 30 years old	47	21.96
31 to 40 years old	43	20.10
41 to 50 years old	30	14.01
51 to 60 yeas old	28	13.08
61 to 70 years old	20	9.35
71 and over	11	5.15
Zone of residence		
Urban area	138	64.48
Rural area	76	35.52

Source: Authors.

The general mean of age between females and males showed little difference (females 36.7 / ± 29.41 and males 38.1 / ± 18.68). The lowest mean age in domestic accidents was 25.9 years (± 23.90), followed by traffic accidents where the mean age of amputees was 31.7 years (± 12.31). The highest mean age was observed in the group of people affected by diseases (66.1 years / ± 13.49). When analyzing the correlation between age and length of hospital stay, there is no significant correlation between the variables analyzed (Table 3).

Table 3- Mean age, standard deviation (SD) and coefficient of variation (COV) and Pearson's correlation of patient age, in years and length of stay in days of people who suffered amputation at Municipal Hospital Dr. Raimundo Gobira, Teófilo Otoni, Minas Gerais, Brazil, between 2012 and 2019.

Amputations	Age / SD	COV	Hospitalization days/ SD	COV	Age (years) x Length of hospital stay (days)
General Female	36.7 ± 29.41	80.86%	3.84 / ± 3.40	88.54%	0.0815 n. s.
General Male	38.1 ± 18.68	49.03%	3.95 / ± 3.40	86.07%	0.0815 n. s.
Work Accident	41.7 ± 16.23	38.92%	3.70 / ± 3.70	2.84%	0.0565 n. s.
Traffic Accident	31.7 ± 18.31	38.83%	3.86 / ± 3.86	100.00%	-0.179 n. s.
Domestic Accident	25.09 ± 23.90	95.21%	4.20 / ± 4.10	97.62%	-0.001 n. s.
Disease	66.1 ± 13.49	20.41%	6.69 / ± 16.88	252.00%	045869 n. s.

Note: SD (Standard Deviation); COV (Coefficient of Variation); n. s. (no significancy).
Source: Authors.

4. Discussion

Our work showed a higher incidence of amputations resulting from an accident at work. The social and economic impacts for both the individual and the society that surrounds us are noteworthy since the majority of people who suffer trauma are young, functionally active individuals in the labor market. Souza et al corroborate our findings when he states that the highest concentration of hand trauma occurs in men up to 42 years old, which has serious psychological, social, and economic implications (Souza et al., 2008).

We considered in the research work accidents that resulted in amputations occasioned by equipment as (*maquita*, chainsaw, agricultural machine, of feed, of mill, sugar cane mill, pickaxe). As traffic-related amputations, motorcycles and cars were considered. As domestic accidents, explosives, washing machines, six-pack, firearm, stab, and machete were considered. As disease amputations, we consider malignant neoplasm, necrosis, osteonecrosis, chronic osteomyelitis, diabetic foot, diabetes mellitus, and vascular dysfunction, and as other causes, falls, accidents involving animals, and violence.

About amputations resulting from traffic accidents in the sample evaluated, many of them resulted from the combination of excessive speed, alcohol consumption, and aggressiveness in traffic, and are most often provided by accidents involving motorcycles when compared to other motor vehicles, confirming our findings with the study by Biffe et al., 2012.

Similar to the study by Xavier-Gomes et al., 2013, the present research pointed out that within the group of domestic accidents, children were the ones who suffered the most amputations. According to the referred study, the puerile group is the most vulnerable to disasters and accidents in the population stratum, because the younger and immature the child is, the lower his / her perception of risk and the greater his / her vulnerability and dependence on third parties in terms of safety against accidents and accidents disasters. Regarding the amputations resulting from the disease, practically all the outcomes were the result of complications related to diabetes, a condition recognized by Spichler et al as the main vascular cause related to amputation (Spichler et al., 2004).

Referring to the equipment that caused the amputation in the workplace accident, the *maquita* and the electric saw stood out, respectively, as the main causes of accidents involving workers. And in the category of other equipment that led to amputation in accidents at work, we can highlight band saws, picks, axes, sickles, and machetes as tools that cause accidents, in addition to the situations that involved accidents with animals related to rural work. As for the unreported causes, these referred to the lack of specification of the equipment or causal agent of the injuries in the hospital records, which is quite common in regions where there is no implementation of the computerization of medical records (Almeida Filho, 2002; Nakamura-Pereira et al., 2013). For Souza et al., 2019, a higher incidence of accidents on the non-dominant side could be related to the causative agent or to the way people manipulate instruments and machines, holding them with the dominant hand, making the non-dominant more susceptible to injuries since each activity has particular characteristics regarding the form of performance and the materials and equipment used (Souza et al., 2008).

The fingers of the left hand were the most affected spot among the body segments of the evaluated sample, considering that it is of great importance to know which hand was injured and the respective severity of the injury, mainly due to the relationship that can be established between dominance and the hand injured in the trauma and its consequences in terms of permanent functional sequelae, often leading the individual to have to alternate dominance or even become incapable for some bimanual activities at work (Fonseca et al., 2006). It is worth noting that in some cases there was more than one body segmentation amputated, which further aggravates the situation experienced and demonstrates a heavy burden of impacts and damage that this condition implies to the individual, society, social security, and the health system.

Most of the amputated subjects are residents of Teófilo Otoni, which was already expected by the fact that this municipality has the highest demographic density in the region and because it is the headquarters of the referred hospital that is a reference for the entire health macroregion of the Northeast of the state of Minas Gerais. These absolute numbers presented by the municipality of Teófilo Otoni produced a general prevalence of 52.50 amputations per 100,000 inhabitants, a prevalence proportionally higher than that of any of the 26 Brazilian states and the Federal District, according to the study by Peixoto et al., 2017. The aforementioned author extracted his data from the Hospital Information System in Brazil. About the year of occurrence, there is a certain growing trend over the years that is consistent with the increase of several factors such as a significant increase in the number of vehicles circulating throughout the region, mainly motorcycles and employed persons, or even acting in own businesses, a fact that occurred with the improvement in the economic development of Brazil in the analyzed period. The reduction in the number of cases observed in the year 2019 is related to the partial assessment of the year 2019, which is a limitation of our study.

Our findings are similar to other studies (Seidel et al., 2008; Sequeira & Martins, 1996) in demonstrating that the profile of amputees is predominantly male, possibly because they are more exposed to environments with greater risks in their daily activities and because they are an important portion of the country's working and productive age population, who mostly live in urban areas (Montiel et al., 2012). However, it is noted that the other age groups also had a very homogeneous distribution of occurrence. If we add the cases of the first two extracts, it can be seen that the group of children and young people represents the third most prevalent group, since these causes are predominantly domestic accidents.

It is worth emphasizing that other relevant sociodemographic information, such as education, occupation, color, and marital status were not recorded in the respective medical records, demonstrating the lack of standardization of hospital medical records and poor quality of hospital records that end up compromising the possibility of evaluating the relationship of these variables with the observed outcomes.

Regarding the days of hospitalization in the sample evaluated, our results confirmed what was expected, that is, the number of days of hospitalization is greater when compared to other causes. Age and low immunity are factors that can delay the organic response to injury and increase the risk of acquiring other pathologies, prolonging your hospital stay. In the other causes of hospitalization where the amputation procedure occurred, the average length of hospital stay ranged between 3.70 and 4.20 days. When analyzing the correlation between age and length of stay, we found that, although there were no significant correlations between the determinant causes of amputations, the mean days of stay were much higher (6.69 / ± 16.88), showing a relationship between a higher age of the patient, with a longer hospital stay. A retrospective study carried out in Turkey in 2004 analyzed the average duration in the number of days of hospitalization of patients with diabetic foot, demonstrated a greater number of days among the subjects who underwent amputation when compared with those who were not amputated (Karakoc et al., 2004).

We consider our findings relevant to public health, as they make it possible to know the regional reality regarding the epidemiological indexes of these conditions, as well as enabling us to understand the importance of health services in response

to this demand. It is also possible to infer in the regional policy of traffic safety and work for the entire region, making it possible to help public managers to allocate resources for the prevention of these conditions.

Furthermore, our study had limitations. Absence of sociodemographic variables in the medical records, difficulty in collecting data due to the absence of a computerized system, and for portraying only the users of the public health system.

5. Conclusion

The present study indicates that the majority of patients undergoing amputation were victims of occupational accidents, male, and aged between 19 and 30 years, suggesting that this problem imposes an important socioeconomic impact as it affects mainly young adult individuals, in the period most productive of their lives.

It is proposed that these results presented make it possible to facilitate the planning of actions that provide a higher level of prevention of different types of amputations, by an intersectoral policy, which sensitizes everyone about the risks of unsafe attitudes and behaviors and one of their most devastating consequences, amputation.

We hope that this research can stimulate future studies on the subject in question so that a sensitizing perspective is built to encourage safe attitudes and behaviors in the most different environments.

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