# Spatial distribution of patients with pressure injuries treated at a teaching hospital

https://doi.org/10.56238/levv15n38-034

**Juliana de Oliveira Musse**[1]
**Cristina Braga**[2]
**Marcelo Marreira**[3]
**Maria José dos Reis**[4]
**Christian Douradinho**[5]
**Cristina Nunes Capeloa**[6]
**João Carlos de Andrade Menezes**[7]
**Carlos Alberto Ocon**[8]
**Adriana Paula Jordão Isabella**[9]
**Fernanda Sebastian Mendes Pitanga**[10]

[1] Doctor in Health and Environment
Institution: Tiradentes University
Avenida Murilo Dantas, 300, Farolandia, Aracaju, Brazil. Tiradentes University
EBSERH
Email: julimusse@hotmail.com
[2] Doctor in Health Sciences from the Institute of Medical Assistance to the State Public Servant of S. Paulo (IAMSPE)
Universidade Nove de Julho, Institute of Medical Assistance to the State Public Servant of S. Paulo
99434-5148
E-mail: cris.br@terra.com.br
[3] Doctor in Biophotonics Applied to Health Sciences
Universidade Nove de Julho (UNINOVE)
Email: marcelo.marreira@uni9.pro.br
[4] Doctor in Women's Health from the Faculty of Medical Sciences of the State University of Campinas (UNICAMP)
State University of Campinas (UNICAMP)
Cidade Universitária Zeferino Vaz, Barão Geraldo, Campinas - SP
Email: mjreis03@hotmail.com
[5] Master in Medical Sciences Focus on Gerontology from the Faculty of Medicine of the University of São Paulo (FMUSP)
Universidade Nove de Julho
Email: c.douradinho@uni9.pro.br
[6] Doctor in Biophotonics Applied to Health Sciences
Universidade Nove de Julho (UNINOVE)
E-mail: cristina.capeloa@uni9.pro.br
[7] Specialist in Urgency and Emergency - FANESE.
EBSERH
Email: carlosmzs@yahoo.com.br
[8] Doctor of Health Sciences in Medicine
Institution: Universidade Nove de Julho (UNINOVE)
E-mail: cocion@uni9.pro.br
[9] Doctor in Biophotonics
Universidade Nove de Julho (UNINOVE)
Email: apji@uninove.br
[10] Master in Psychiatry and Mental Health
Institution: Universidade Nove de Julho (UNINOVE)
E-mail: fernandasmp@uninove.br

**Claudia Cristina Soares Muñiz**[11]
**Alfredo Ribeiro Filho**[12]
**Lidiane Souza Lima**[13]
**Gleyce Kelly de Brito Brasileiro Santos**[14]
**Neylor Rodrigo Oliveira Aragão**[15]
**João Pedro Santos Torres**[16]
**Aloísio Olímpio**[17]

## ABSTRACT

Introduction: Pressure injury (PI) is characterized by pressure exerted mainly on bony prominences, or even related to the use of medical devices. As epidemiological aspects are still scarce in the country, it is appropriate to produce studies that delimit the information for a better characterization of this public health problem, with extraterritorial dimensions. Geoprocessing is a revolutionary technology that encompasses the most diverse disciplines, data, equipment, analysis and interpretations from certain locations and geographic data, thus obtaining maps and/or spreadsheets with information relevant to that particular region that, when used in the health area, allows the identification and mapping of risks and injuries that affect the population. Objective: To demonstrate the technical experience of spatial demarcation and geoprocessing of patients with pressure injuries treated at a teaching hospital in the state of Sergipe. Method: A descriptive epidemiological study was carried out from a data sheet of patients with pressure injuries treated by the Skin Care Service team of a teaching hospital in Sergipe, between 2018 and 2022. Georeferencing and geoprocessing were developed in conjunction with Google Maps and Google Earth software. Results: The study sample consisted of 215 patients with pressure injuries (PI) in which the age group that stood out was the elderly (54.8%), followed by adults (40.0%). It is noted, in the spatial representation, that most of the patients with PL were residents of Greater Aracaju (n=130), followed by the East of Sergipe (n=23) and Central Agreste (n=18). Most of the LPs were acquired prior to admission to the institution studied (55.8%), while the others (44.2%) appeared during the hospital stay. Conclusion: In view of the analysis presented, it was possible to verify that most patients affected by PLs are men and elderly, and that the Greater Aracaju regional was the one that stood out the most because it concentrated most of the patients with PL, whether pre-existing or acquired at hospitalization.

[11] Doctor in Health Sciences Heart Institute INCOR FMUSP
Universidade Nove de Julho
Email: claudiafcr@gmail.com
ORCID: 0000-002-2472-8182
[12] Master in Pharmacy Uniban
Universidade Nove de Julho.
Email: arfmm@uol.com.br
[13] Specialist in Stomatherapy at Escola Bahiana de Medicina e Saúde Pública
Brazilian Company of Hospital Services (EBSERH).
Email: lidi_lima88@hotmail.com
[14] Master's Degree in Nursing from the Federal University of Sergipe
MBA from Unifesp in Hospital Management and Specialist in Infection Control in Adult and Elderly Health from the Federal University of Sergipe
Postgraduate student in stomatherapy at Faculdade Venda Nova do Imigrante - FAVENI
Federal University of Sergipe and Brazilian Company of Hospital Services – EBSERH
[15] Specialist in Stomatherapy at Escola Bahiana de Medicina e Saúde Pública
Brazilian Company of Hospital Services (EBSERH).
Email: wilde_br@yahoo.com.br
[16] Specialist in Adult and Elderly Health from the Federal University of Sergipe.
Brazilian Company of Hospital Services (EBSERH).
E-mail: enf.joaotorres@gmail.com
[17] Specialist in Collective Health from the Faculty of Medical Sciences of the State University of Campinas (UNICAMP)
State University of Campinas (UNICAMP)
Email: aloisio6@unicamp.br

**Keywords:** Pressure Injury, Spatial Distribution of the Population, Primary Health Care, Public Health Policies.

## INTRODUCTION

One of the ways to better understand the distribution of events in epidemiology and which has become a reference point for analyzing the problems found in public health is the use of space. The territory in which individuals live, coexist and socialize is the locus where the social determinants of health directly interfere in the dynamics of the health-disease process (Lima; Brook; Santos, 2022).

Spatial analysis itself has been used for many years in the context of geoenvironmental features, soil contamination and mineral dispersion. However, currently, this analysis has gained notoriety in the health area as a result of the emergence of epidemics of various infectious diseases distributed in the regions of the country (Santos, 2018).

Geoprocessing is a revolutionary technology that encompasses the most diverse disciplines, data, equipment, analysis and interpretations from certain locations and geographic data, thus obtaining maps and/or spreadsheets with information relevant to that particular region that, when used in the health area, allows the identification and mapping of the risks and injuries that affect the population (Santos, 2018).

Thus, the use of geoprocessing in health is considered a powerful analysis tool, as it allows guiding the understanding of public health issues, with a view to controlling diseases, through the identification of priorities and the implementation of agile and problem-solving policies (Ribeiro et al., 2021).

In this scenario, spatial analysis and mapping has become a great ally of public management, as it provides a broad and detailed interpretation of the information collected, which facilitates the early diagnosis of the problems contained in the analyzed territory. This makes it possible to provide rapid responses that positively impact the management of the health service and that ensure the development of actions for the equal distribution of processes and resources (Pereira; Moschini; Uehara, 2021).

The problems identified are several in the territorial context of the municipalities. However, one that stands out and is configured as a global public health problem is pressure injury (LP) that brings individuals several losses such as discomfort, pain, emotional suffering, social distancing, in addition to increasing the risk of more serious complications interfering with morbidity and mortality (Farias; Queiroz, 2022).

Pressure injury is characterized by pressure exerted, mainly, on bony prominences, or even related to the use of medical devices. Thus, the compressed blood capillaries are ruptured, preventing

the body region from being oxygenated and nourished, thus causing cell death, ischemia and the appearance of the lesion itself (Araújo; Soares, 2022).

Several factors contribute to the development of PL and, in a didactic way, are classified as intrinsic and extrinsic: the first are focused on the patient's problems, such as immobility, skin changes, incontinence, age, nutrition, associated pathologies, vasopressor medications, and altered sensory perception; extrinsic problems refer to problems external to the patient, such as pressure, friction, shear, poor hygiene, humidity, inadequate seats and mattresses (Carvalho; Cigre2022).

A study published in the United States of America on the prevalence of PL, with a sample of 104,266 patients, elucidated a rate of 19.9% of medical device-related pressure injury (LPRDM), while 14.3% were PI in the sacral region, 10.2% in the calcaneus, and 8.8% in the buttocks (Cavalcanti, 2019).

In Brazil, in 2017, 13,834 cases of PI and 5 deaths were reported by health institutions due to this problem, corresponding to 18.37% of the notifications of adverse events and 1.14% of the deaths resulting from this type of event. However, the National Health Surveillance Agency (ANVISA) recognizes the possibility of underreporting, so the true magnitude of this problem still remains uncertain (Lima et al., 2020).

In general, this technology will provide a better evaluation of public policies, directing them to the most vulnerable groups, as well as areas of greater risk, aiming to meet the needs of those who need it most at that given moment (Santos, 2018). Thus, the present study aims to describe the spatial distribution of patients with pressure injuries treated by the Skin Care Service of the University Hospital of the Aracaju Campus, in the state of Sergipe, showing the regions with the highest number of affected users.

From this perspective, it will be possible to analyze which health regions are home to the largest number of people affected by pressure ulcers, in order to improve care in addition to providing the structuring of a specific care network for patients affected by this disease.

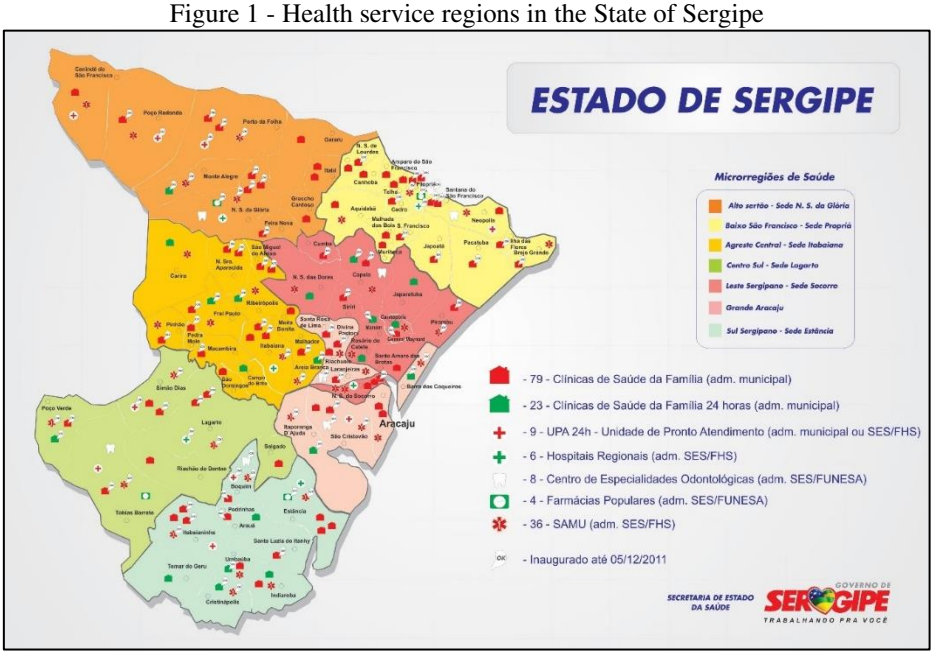
Thus, this study aims to demonstrate the technical experience of spatial demarcation and geoprocessing of patients with pressure injuries treated at a teaching hospital in the State of Sergipe.

## METHOD

This is a descriptive epidemiological study, carried out at the University Hospital of Sergipe, a public institution linked to the Federal University of Sergipe and managed by the Brazilian Company of Hospital Services (EBSERH), which has an installed physical capacity of 111 beds for hospitalization, distributed as follows: 36 beds for the Surgical Clinic, 36 for the Medical Clinic, 18 for Oncology, 11 for Pediatrics and 10 for the Intensive Care Unit.

The hospital is located in the state of Sergipe, the smallest unit of the Brazilian federation, with 75 municipalities and 2,210,004 inhabitants. Its territorial area is estimated at 21,938 km² and its demographic density is 100.74 inhabitants/km², according to IBGE data (SERGIPE, 2022). According to the Multi-Year Health Pact Plan, the State is subdivided into 7 health regions, as described in figure 1.

Figure 1 - Health service regions in the State of Sergipe




Source: https://saude.se.gov.br/120/ accessed in January 2024.

Sociodemographic and health data were collected from a spreadsheet of data from the Skin Care Care Service (SACP) of the researched institution, which includes all patients assisted by the service. Only patients with pressure injuries treated between August 2019 and September 2022 were extracted from this spreadsheet. The research population consisted of 221 patients. However, after the analysis, it was found that six of them had incomplete data. Thus, the final sample of the study consisted of 215 patients with pressure ulcers.

The statistical approach was developed based on the descriptive analysis of the data, performed in the Statistical Package for Social Sciences (SPSS, v. 20, Chicago, IL) software. The analysis was also synthesized with the help of the Google Maps program, in which the spatial distribution was verified, at the individual and/or collective level, with data aggregated by health regions, making it possible to use the ArcView program (ESRI, Redlands, CA) for the preparation of digital geographic maps.

The inclusion criteria were designed to ensure a homogeneous and representative sample, covering the following points: patients with pressure injuries acquired prior to or during hospitalization at the institution studied, located in any area of the body, regardless of age group and gender.

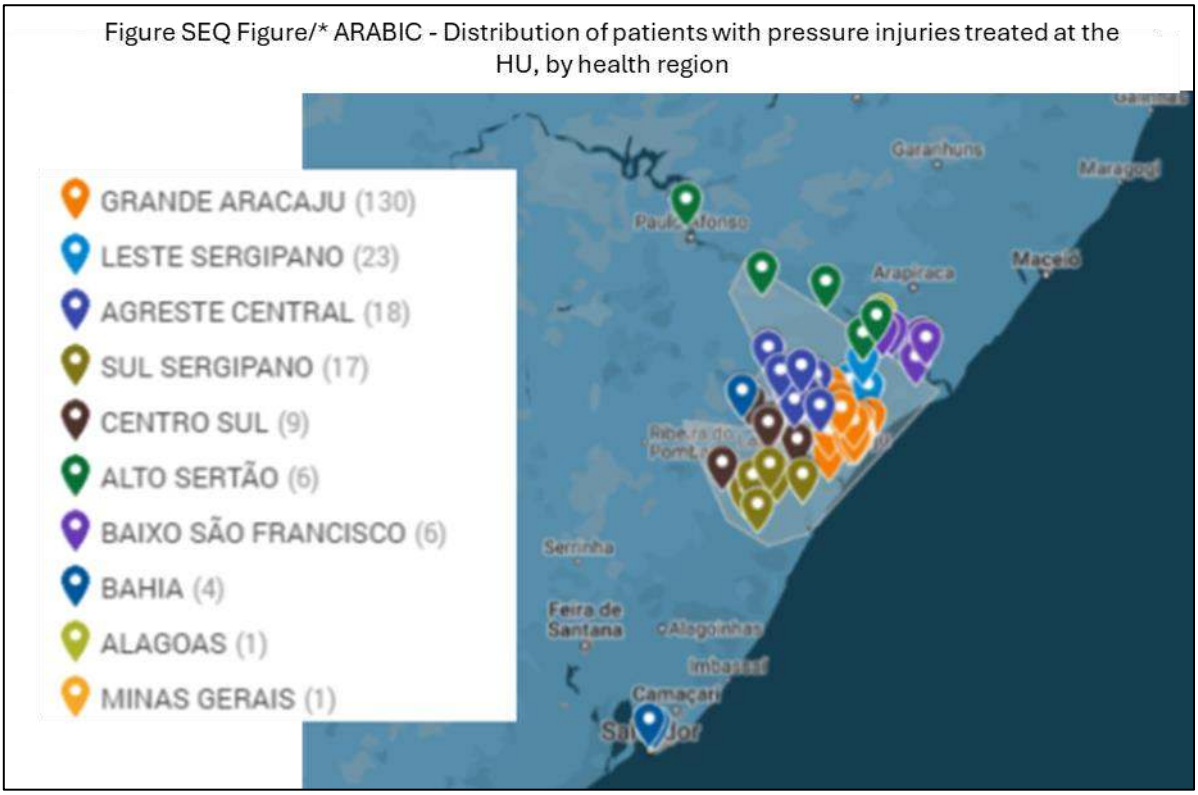
Patients for whom the diagnosis of pressure injury was not clearly defined were excluded from the sample; and those whose medical records had incomplete or missing data.

The study was submitted to the evaluation of the Research Ethics Committee (CEP) via Plataforma Brasil, in compliance with resolution number 466/12, of the National Health Council of the Ministry of Health, with CAAE code 68846923.1.0000.5546.

## RESULTS

The study showed that most patients with pressure ulcers (PL) are residents of greater Aracaju (n=130), followed by eastern Sergipe (n=23) and central agreste (n=18). The participation of patients from other states such as Alagoas (n=1), Bahia (n=4) and Minas Gerais (n=1) is also noteworthy.

Figure SEQ Figure/* ARABIC - Distribution of patients with pressure injuries treated at the HU, by health region




Source: Authors, 2024.

Regarding the origin of the pressure ulcer, it was observed that the majority (55.8%) was acquired prior to admission to the researched institution, while the remainder (44.2%) developed during the hospital stay.

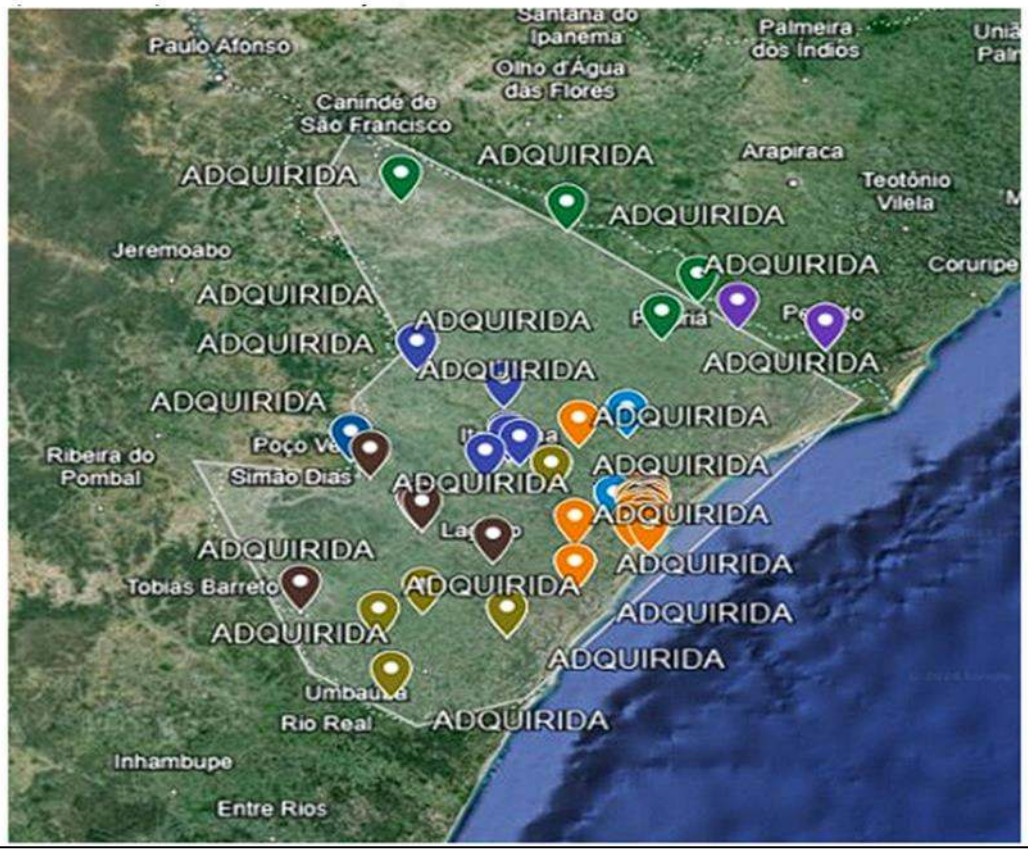
Figure SEQ Figure * ARABIC 3 - Spatial distribution of patients with pressure injuries pre-existing at admission, treated at the HU




Source: Authors, 2024.

Of the patients with pre-existing PLs at admission, those from Greater Aracaju (n=83) stood out, followed by those from the East Sergipe (n=13), Agreste Central Sergipano (n=08), South Sergipe (N=07), South Central Sergipe (n=03), Baixo São Francisco (n=03), Alto Sertão Sergipano (n=01), Alagoas (n=01) and Bahia (n=01), making a total of 120 users with pre-existing PLs (Figure 3).

Figure SEQ Figure/* ARABIC - Distribution of patients with pressure injuries acquired during hospitalization, treated at the HU




Source: Authors, 2024.

With regard to LPs acquired at the institution, the regional region that stood out was Greater Aracaju (n=47), followed by Agreste Central Sergipano (n=10), East Sergipe (n=10), South Sergipe (n=10), South Center Sergipe (n=06), Alto Sertão Sergipano (n=05), Lower São Francisco (n=03), Bahia (n=03) and Minas Gerais (n=01), totaling 95 clients with LPs acquired during hospitalization (Figure 4).

The age group that stood out the most was the elderly (54.8%), followed by adults (40.0%). In relation to gender, men prevail (58.6%) while women follow behind (41.4%). Among the clinical disorders during admission, respiratory (19.5%), infectious (13.9%) and neoplasms (11.6%) stood out (Table 1).

The "high risk" classification, according to the Braden scale, was seen in most cases (86%), and the most affected region of the body is the sacral (72.1%) and the calcaneus (7.4%). Regarding staging, most of them were classified as stage 2 (33.4%), followed by non-classifiable (25.5%) (Table 1).

Table 1. Sociodemographic and clinical aspects and characterization of Pressure Injuries in patients treated by the Skin Care Service of the University Hospital, Aracaju Campus (SE), Brazil, (n=215) - 2023.

| **Age group** | **n° (%)** |
|---|---|
| Elderly (60 years or older) | 118 (54,8) |
| Adult (20 - 59 years) | 86 (40,0) |
| Preschool (2 – 4 years) | 5 (2,3) |
| Teenager (11 - 19 years old) | 2 (0,9) |
| School (5 – 10 years old) | 2 (0,9) |
| Infant (0 - 1 year) | 2 (0,9) |
| **Gender** | **n° (%)** |
| Male | 126 (58,6) |
| Female | 89 (41,4) |
| **Clinical disorders in the admission** | **n° (%)** |
| Respiratory | 42 (19,5) |
| Infectious | 30 (13,9) |
| Neoplasia | 25 (11,6) |
| Not Specified | 20 (9,3) |
| Digestive | 18 (8,3) |
| Neurological | 16 (7,4) |
| Cardiovascular | 13 (6,0) |
| Renal | 12 (5,5) |
| Hematologic | 11 (5,1) |
| Hepatic | 10 (4,6) |
| Endocrine | 7 (3,2) |
| Player | 4 (1,8) |
| Dermatological | 3 (1,4) |
| Muscular | 2 (0,9) |
| Feed | 1 (0,4) |
| **Origin of the LP (n=215)** | **n° (%)** |
| Prior to hospitalization | 120 (55,8) |
| Acquired at the institution | 95 (44,2) |
| **Risk of LP** | **n (%)** |
| High risk | 185 (86,0) |
| Medium risk | 20 (9,3) |
| No risk | 5 (2,3) |
| Low risk | 5 (2,3) |
| **Anatomical location** | **n (%)** |
| Sacral | 155 (72,1) |
| Calcaneus | 16 (7,4) |
| Trochanter | 8 (3,6) |
| Occipital | 6 (2,8) |
| Narina | 4 (1,8) |
| Comissura labial | 4 (1,8) |
| Malleolus | 4 (1,8) |
| Thorax | 3 (1,4) |
| Coccyx | 3 (1,4) |
| Ischium | 3 (1,4) |
| Ear | 2 (0,9) |
| Gluteus | 2 (0,9) |
| Cheek | 1 (0,4) |
| Scapula | 1 (0,4) |
| Vertebral processes | 1 (0,4) |
| Urethra | 1 (0,4) |
| Tibia | 1 (0,4) |
| **LP Standings** | **n (%)** |
| Stage 2 | 72 (33,4) |
| Unsortable | 55 (25,5) |
| Deep tissue | 27 (12,5) |
| Stage 4 | 23 (10,7) |
| Stage 1 | 14 (6,5) |

| | |
|---|---|
| Stage 3 | 14 (6,5) |
| Device-related doctor | 7 (3,02) |
| Pressure Injury in mucous membrane | 3 (1,4) |

Source: Authors, 2024.

## DISCUSSION

The present study obtained and analyzed a total of 215 medical records in which the patients had a pressure ulcer as a prerequisite. The regional in which the most cases prevailed was Greater Aracaju, which is composed of 9 municipalities (Aracaju, Barra dos Coqueiros, Itaporanga d'Ajuda, Laranjeiras, Maruim, Nossa Senhora do Socorro, Riachuelo, São Cristóvão and Santo Amaro das Brotas); the same happens for cases of pre-existing LPs at hospitalization and for those acquired during hospitalization. It is possible to infer that this fact happens because most of the inhabitants live in these places, especially when the regional includes a capital.

Based on the observation of the georeferencing of the regions in question and considering the problem of pressure injuries, it is possible to infer that the health networks are well established in terms of structuring and organizing the levels of primary, secondary and tertiary care. With this perspective, patients who seek care in tertiary services in their respective regions, such as those in the Agreste Central Sergipe, East Sergipe and South Sergipe, often end up prolonging their hospitalization due to the lack of resolution of the primary problem, which can result in complications, including the development of pressure injuries. This often leads them to seek treatment in the capital in search of better clinical outcomes, leaving open the possibility of underreporting of PL cases upon entering the hospital. This finding highlights the importance of a detailed analysis of local health structures, in order to ensure that patients receive appropriate and timely treatment, thus avoiding the emergence of this disease.

During the study period, it was observed that most of the LPs were prior to hospitalization (55.8%), thus totaling an incidence rate of 44.2%. According to Silva et al. (2019), in their longitudinal study carried out in a hospital in Vitória da Conquista (BA), an incidence of PI of 47% was found; Ferreira et al. (2018), in their cross-sectional epidemiological research in southern Brazil, showed an incidence of 39.4%; the study by Prado et al. (2021) in two public hospitals in Rio de Janeiro, remains statistically similar, even higher, listing an incidence of 65.3%. All of them corroborate the data of the present research.

However, some studies, such as those by Mejía et al. (2015), Rocha et al. (2020), and Santos et al. (2020), contradict these results, presenting, respectively, an incidence of 11.5%, 13.3%, and 5.6%. This suggests the absence of a consistent pattern in the incidence of pressure injuries in the studies analyzed. Despite the disparity in results, both incidents in hospital services and in LPs have high numbers, as recorded in the Patient Safety Bulletin. While hospital incidents occupy the initial

position in terms of notifications, pressure injuries rank second among the types of incidents reported (Jesus et al., 2020).

With regard to pre-existing LPs, which covers most of the study, it is important to highlight the role that Primary Health Care establishes, since the vast majority of injuries are prior to hospitalization; And, even if they are acquired in a hospital environment, it is important to emphasize the care, guidance, and follow-up that these patients will need to have continuously when they are at home.

During the transition from the hospital environment to the home, after medical discharge, it is crucial to maintain continuity of care and ensure effective communication between health teams. However, this integration often doesn't go as expected. Studies conducted in Ribeirão Preto/SP highlight the urgency of better coordination among health services, especially when the patient is at risk or has already developed pressure injuries and needs home care after hospital discharge (Moro; Caliri, 2016).

In this sense, it is important to emphasize that factors such as the type of housing, quality of sanitation, socio-environmental environment, socioeconomic level, education, and prevalence of diseases have a direct impact on the health of both individuals and the community in general. These elements influence the health and disease process and, with adequate prior knowledge, it is possible to intervene to reduce or eliminate the risks and damage caused by the environment, thus reducing the risk of a pressure injury arising (Paudarco et al., 2021).

The emergence of LPs entails a significant financial burden for health institutions, in addition to being recognized as a socioeconomic and educational challenge. Therefore, it is essential to direct resources to prevention, since the costs involved in this step are lower than those necessary for subsequent treatment (Guerra et al., 2021). From a study carried out in a palliative care unit in Minas Gerais, it was possible to identify the annual cost for the treatment of LP, which resulted in R$445,664.38, thus concluding the association of the inappropriate use of materials proportionally direct with the cost of care (Lima et al., 2020).

In a certain study, a high number of records of elderly people were observed in the health units, but few medical records contained relevant information about the existence of skin lesions. In view of the lack of details in the records of health professionals who did not identify these lesions, during the home visit it was possible to verify the presence of wounds. This evidenced the lack of information on the health status of the users on the part of the team that provided care to them (Freitas; Alberti, 2013). As a result, there is a great possibility that many cases of pressure injuries at home are still not being reported. However, more research is needed to actually show that this problem is recurrent.

It is important to emphasize that the occurrence of the development of these lesions in the home environment indicates the need for a different approach and, above all, suggests that changes are necessary in the scope of practices within the context of Primary Care (Soares et al., 2015).

From this perspective, it is of great relevance that the multidisciplinary team constantly seeks to update its knowledge to provide high-quality care to the patient, focusing on promoting the care and treatment of injuries both at the systemic and local levels (Freitas; Alberti, 2013).

## CONCLUSION

In summary, the in-depth analysis of pressure injuries (PL) clearly reveals their magnitude as a public health problem that demands more careful attention. This study highlighted the relevance of directing efforts to understand and mitigate PL, emphasizing that the population most impacted by this disease is predominantly composed of men and elderly people with respiratory and infectious diseases. The majority of PIs were located in the sacral region and calcaneus with stage 2 and high risk on the Braden scale.

In addition, it is evident that the capitals emerge as areas particularly susceptible to this health problem due to the high number of populations, such as Aracaju/SE, covering the Greater Aracaju region, which concentrates most of the patients with PL, whether pre-existing or acquired at hospitalization, emphasizing the need for preventive and specific strategies, as well as targeted interventions to effectively address this public health issue.

In addition, the indispensability of effective public policies to address this problem is emphasized, since the performance of Primary Care, with its emphasis on territorialization and preventive care, plays a crucial role in this scenario, playing a proactive role in reducing the incidence and impact of PL, contributing to a more comprehensive and effective approach to the care of this vulnerable group.

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