









Prospective Study of Burn Admissions in Rio Grande do Norte, Brazil: Incidence, Complications, and Patient Profile

Estudo prospectivo das internações por queimaduras no Rio Grande do Norte: incidência, complicações e perfil dos pacientes

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Abstract

Introduction Burns are highly prevalent injuries in Brazil. These injuries may have severe complications, making their treatment complex. Sequelae are mostly permanent and result in physical, psychological, and economic losses. Despite the relevance of epidemiological data for improving care and guiding preventive actions, burns are not a notifiable disease, and there are no previous studies on hospitalizations at the Burn Treatment Center of Hospital Monsenhor Walfredo Gurgel (Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel, CTQ-HMWG, in Portuguese), the only referral service in Rio Grande do Norte, Brazil.

Objective To describe the epidemiological profile and main complications of patients admitted to CTQ-HMWG between November 2023 and November 2024.

Materials and Methods The present prospective and analytical study collected epidemiological and clinical data from patients admitted to CTQ-HMWG between November 2023 and November 2024. These data included interviews with patients or their legal guardians, as well as information from medical records.

Results Eighty patients were analyzed, predominantly mixed-race men with no formal education and of working age. Burns occurred mainly in domestic settings, with scalds being the most frequent cause, followed by flammable fluids and electrical accidents. The most prevalent complications were wound infection and sepsis.

Keywords

- ▶ Brazil
- ▶ burn unit
- ▶ burns
- ▶ health profile
- ▶ statistics on sequelae and disability

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Resumo

Palavras-chave

- ▶ Brasil
- ▶ unidade de queimados
- ▶ queimaduras
- ▶ perfil de saúde
- ▶ estatísticas de sequelas e incapacidade

Conclusion The study highlights the social and economic impact of burns in the state, reinforcing the need for public policies focused on prevention, home and workplace safety, as well as the expansion of ongoing educational strategies, to reduce morbidity and mortality and improve the quality of life of victims.

Introdução As queimaduras são lesões de alta incidência no Brasil, com elevado potencial de complicações graves, o que torna seu tratamento complexo. As sequelas, em grande parte permanentes, geram prejuízos físicos, psicológicos e econômicos. Apesar da relevância dos dados epidemiológicos para aprimorar a assistência e orientar ações preventivas, as queimaduras não constituem agravo de notificação compulsória, e não há estudos prévios sobre internações no Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel (CTQ-HMWG), único serviço de referência no Rio Grande do Norte.

Objetivo Descrever o perfil epidemiológico e as principais complicações dos pacientes internados no CTQ-HMWG entre novembro de 2023 a novembro de 2024.

Materiais e Métodos Estudo prospectivo e analítico, com coleta de dados epidemiológicos e clínicos de pacientes internados no CTQ-HMWG entre novembro de 2023 e novembro de 2024, obtidos por meio de entrevistas com os próprios pacientes ou responsáveis legais, complementados por informações de prontuário.

Resultados Foram analisados 80 pacientes, predominando homens pardos, sem escolaridade formal, em idade economicamente ativa. As queimaduras ocorreram principalmente em ambiente doméstico, sendo as escaldaduras o agente mais frequente, seguidas por líquidos inflamáveis e acidentes elétricos. As complicações mais prevalentes foram infecção da ferida e sepse.

Conclusão O estudo evidencia o impacto social e econômico das queimaduras no estado, reforçando a necessidade de políticas públicas voltadas à prevenção, segurança doméstica e laboral, além da ampliação de estratégias educativas permanentes, a fim de reduzir a morbimortalidade e melhorar a qualidade de vida das vítimas.

Introduction

The World Health Organization (WHO) estimates that approximately 11 million subjects sustain burn injuries each year, resulting in around 180,000 deaths worldwide. Regardless of etiology, burns are complex injuries that are difficult to treat and are associated with high morbidity and mortality rates. Recovery is not achieved solely through wound healing, as burn injuries lead to profound and long-term physical, psychological, and social consequences requiring addressing to optimize patients' quality of life.^{1,2}

Burns mostly occur at home due to lapses in attention to household hazards.³ In Brazil, approximately 1 million people suffer burns annually, but only about 100 thousand of them seek medical assistance. These injuries result in approximately 2,500 deaths per year, both from direct and indirect burn consequences.⁴ Furthermore, according to information from the Brazilian Unified Health System (Sistema Único de Saúde, SUS, in Portuguese), approximately 30,000 people are hospitalized annually due to this type of injury.⁵

Therefore, prevention is a priority, as burns are severe yet potentially preventable injuries. As such, it is possible to

mitigate them with epidemiological principles, awareness campaigns, and effective educational programs.^{6–8} Epidemiology is fundamental to formulate public health policies, as it provides essential data for the evaluation and development of treatment strategies and prevention initiatives, while also contributing to the identification and understanding of underlying causal factors. However, epidemiological studies addressing burn injuries remain scarce in Brazil.

Epidemiological data from Brazilian burn units allow healthcare institutions to determine the demand for beds by geographic region, as well as outcome parameters, length of stay, bed occupancy, mortality and infection rates, and use of materials, including antibiotics, blood products, and temporary skin substitutes—essential information for improving administrative planning, treatment, and rehabilitation of burn patients.⁹

According to the Brazilian Burn Society (Sociedade Brasileira de Queimaduras, SBQ), Brazil has 83 registered Burn Treatment Units (BTUs).¹⁰ These units are specialized centers for treating patients with complex second- and third-degree burns, often associated with significant comorbidities. They are multidisciplinary treatment centers, where dozens of professionals provide specialized care to patients.¹¹

The state of Rio Grande do Norte (RN), in Northeastern Brazil, has a single specialized burn treatment center—the Burn Treatment Center of Hospital Monsenhor Walfredo Gurgel (Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel, CTQ-HMWG, in Portuguese)—to provide care for approximately 3 million inhabitants of the state.¹² Although epidemiological data are essential for prevention strategies, improvements in care processes, and the formulation of public policies, hospitalization data in Brazil are primarily derived from the SUS Hospital Information System (Sistema de Informações Hospitalares, SIH/SUS, in Portuguese), which is structured for institutional reimbursement purposes. Consequently, SIH/SUS lacks detailed information on individual patients, burn circumstances, and trauma severity. Since data are aggregated rather than patient-specific, prognostic analyses and more in-depth clinical and epidemiological characterization of patients treated at this center are not feasible.^{5,12}

Objectives

The overall objective of the present study was to analyze the clinical and epidemiological profile of patients admitted to CTQ-HMWG from November 2023 to November 2024, considering sociodemographic aspects such as sex, age, race, schooling level, professional occupation, and origin, as well as the etiology, extent, and severity of injuries, including burned body surface area, affected locations, and smoke inhalation. In addition, the study aimed to identify burn circumstances, differentiating between accidental situations, violence, or attempted suicide, as well as analyzing the occurrence of associated traumas, clinical complications during hospitalization, length of stay in the ward and intensive care unit (ICU), and clinical outcomes.

Methods

The present analytical, prospective, and qualitative-quantitative study included severely burned patients admitted to CTQ-HMWG in the state of Rio Grande do Norte, Brazil, between November 2023 and November 2024. These patients presented with one of the following characteristics: 2nd-degree burns affecting 20% or more of the body surface area, 3rd-degree burns involving 10% or more of the body surface area, perineal burns, smoke inhalation injury, poly-trauma, head trauma, electrical trauma, shock, renal failure, heart failure, liver failure, hemostasis disorders, pulmonary embolism, acute myocardial infarction, severe infectious conditions resulting from the burn or unrelated it, compartment syndrome, and wasting diseases. The Research Ethics Committee of the Onofre Lopes University Hospital approved this study under opinion number 6.466.340.

Only patients or caregivers who refused to sign the informed consent form (ICF) and/or informed assent form (IAF) were excluded. For patients unable to respond to the survey, such as those under orotracheal intubation or with a decreased level of consciousness, their caregivers signed the ICF and provided information for the study. When the patient

was able to respond to the questionnaire again, they were approached to sign the ICF and confirm information. Patients without caregivers throughout the hospitalization period and/or lacking autonomous capacity were excluded from the study.

All patients admitted to CTQ-HMWG were invited to participate in the study. Patients received a detailed explanation of the study methodology in clear and appropriate language, including potential benefits and possible risks. It was emphasized that participation in the study was voluntary and that refusal to participate would not compromise access to the best available care.

The sample was selected by convenience, including all patients who agreed to participate after the procedures mentioned in the preceding paragraph, thereby maximizing the number of potential participants.

Data was collected through interviews with research participants and/or the guardians of minors who had signed the informed consent forms. When necessary, interview data were supplemented by information provided by health professionals working at CTQ-HMWG and by medical record review to obtain clinical variables (e.g., packed cell volume [PCV] and hemoglobin levels) or information that patients were unable to report. Moreover, medical records were essential for the exploratory analysis of injury circumstances and complications, as they enabled longitudinal monitoring of patient outcomes within the service.

Collected data (variables) included sex, date of birth, race, schooling level, professional occupation, and city of origin, to identify the sociodemographic characteristics of patients most affected by burns and thus generate hypotheses about their main causal and regional factors. Etiology, burned body surface area, affected anatomical sites, and special burn-related factors—such as smoke inhalation—are key variables for assessing injury cause, extent, and severity, which are critical for predicting patient morbidity and mortality. Data on burn location, context, and concomitant traumas are essential to formulate hypotheses about trauma circumstances and causal effects to develop preventive measures for the general population. Length of hospital stay, complications, and outcomes provide an overview of complications, mostly wound infection, sepsis, septic shock, pneumonia, endotracheal intubation, tracheostomy, urinary tract infection, amputation, deep vein thrombosis (DVT), and pressure ulcers. These data were correlated with burn circumstances, patient clinical progression, and admission period. Packed-cell volume and hemoglobin levels at admission were considered key indicators for evaluating patients' biochemical status in relation to these characteristics.

Accordingly, burn etiology, severity, and context were analyzed, along with length of hospital stay and the occurrence of sepsis, amputation, intubation, and other complications. Clinical and complementary data were entered into a Microsoft Excel for Windows (Microsoft Corp.) database, from which the required analyses were performed.

The quantitative variables age, hemoglobin levels, and PCV at admission were assessed for normality using the Shapiro-Wilk test. Among these variables, only age did not

Table 1 Patient characteristics regarding sex, origin, and age range.

Characteristic	n	%
Sex		
Male	45	56
Female	35	44
Age group		
0–12 years	27	34
13–17 years	4	5
18–60 years	36	45
> 60 years	13	16

Note: Distribution of patients by sex and age group from November 2023 to August 2024. **Source:** Burn Treatment Center of Hospital Monsenhor Walfredo Gurgel (Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel, CTQ-HMWG, in Portuguese).

present a normal distribution. Results were described using absolute and relative frequencies, means, and medians, and were presented in tables and graphs to facilitate visualization of data distribution.

Results

Data from 80 patients were collected between November 2023 and August 2024, as described in ►**Table 1**. The most predominant age range was from 18 to 60 years old, followed by those under 18 years old. The average age was 26.5 years.

Regarding race, 45 patients (56%) were classified as brown, 18 (23%) as White, 16 (20%) as Black, and 1 (1%) as Asian. With respect to schooling level, most patients had no formal education (n = 50; 63%), followed by those who had completed primary education (n = 19; 24%), secondary education (n = 9; 11%), and higher education (n = 2; 3%).

The predominant causes of burns were scalds, followed by flammable fluids and electricity (►**Table 2**). Injuries from flames and chemical agents were less common. Burns caused by contact with heated surfaces had a mean burned body surface area of 16.86%.

The distribution of burn-affected anatomical sites was broad, with the highest incidence in the upper limbs (43 cases; 53.75%), followed by the trunk (40 cases; 50%) and the hands (39 cases; 48.75%). Facial burns were observed in approximately one-third of cases (37.5%), while the lower limbs and feet were involved in 45% and 25% of patients, respectively. In addition, areas such as the perineum, folds, and circular burns were affected to a lesser extent, with 12 (15%), 12 (15%), and 5 cases (6%), respectively. Smoke inhalation was a complication observed in 5% of patients (►**Fig. 1**).

The household environment was the primary setting in which burn injuries occurred, accounting for most cases, as detailed in ►**Table 3**. In workplaces and other environments, proportions were smaller. Most incidents were accidental,

Table 2 Patient characteristics regarding burn etiology

Etiology	n	%
Scalding	22	28
Flammable fluids	20	25
Electricity	17	21
Flames	12	15
Hot surfaces	8	10
Chemical agents	1	1.25

Note: Distribution of burn causes among patients treated at the Burn Treatment Center of Hospital Monsenhor Walfredo Gurgel (Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel, CTQ-HMWG, in Portuguese) from November 2023 to August 2024.

Source: CTQ-HMWG.

Table 3 Burn site and nature

Characteristic	n	%
Occurrence site		
Household	58	72.5
Workplace	13	16.25
Other environments	9	11.25
Burn nature		
Accident	77	96
Attempted suicide	2	3
Violence	1	1

Source: Burn Treatment Center of Hospital Monsenhor Walfredo Gurgel (Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel, CTQ-HMWG, in Portuguese).

with a small number related to suicide attempts and one episode involving violence.

Furthermore, patients reported associated injuries occurring at the time of the burn, including episodes of fainting, traumatic brain injury (TBI), chest trauma, dizziness, and seizures, as detailed in ►**Fig. 2**. A subset of patients required admission to the ICU, with a mean ICU stay of 2.5 days. The overall mean length of hospital stay was 21.4 days.

The most prevalent complications during hospitalization were wound infection and sepsis, affecting 24 (30%) and 4 (5%) of the patients, respectively. Other complications, including urinary tract infection, escharotomy, anemia, amputation, colostomy, pleural effusion, phlebitis, and diarrhea, occurred in 3 or fewer patients.

Regarding admission laboratory data, the mean PCV was 36.6%, with a median of 35%. For hemoglobin levels, the mean value was 13.32 g/dL, with a median of 11.8 g/dL.

Taken together, these findings indicate that burn injuries represent a significant cause of external injury in Brazil, frequently resulting in profound and often irreversible physical, psychological, and social consequences. Beyond the physical sequelae associated with scarring, burns adversely affect multiple dimensions of life, including work, leisure, interpersonal relationships, religious participation,

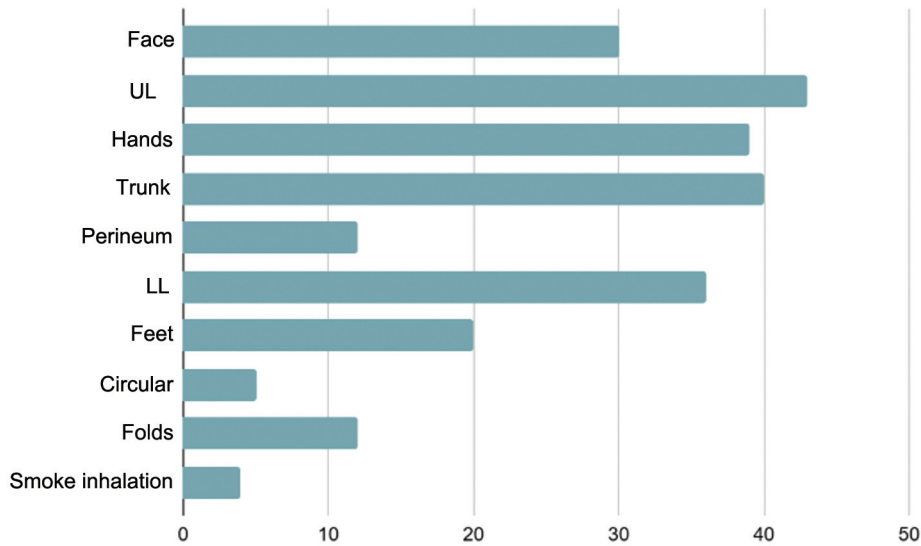


Fig. 1 Distribution of burn areas. **Abbreviations:** UL, Upper limbs; LL, lower limbs. **Source:** Burn Treatment Center of Hospital Monsenhor Walfredo Gurgel (Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel, CTQ-HMWG, in Portuguese).

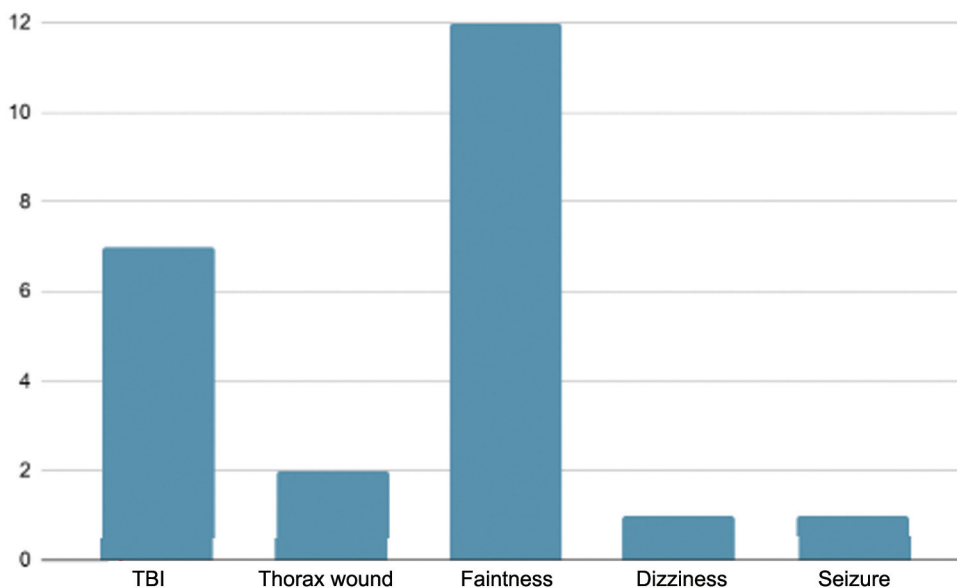


Fig. 2 Distribution of traumas concomitant with burns. **Abbreviation:** TBI, traumatic brain injury. **Source:** Burn Treatment Center of Hospital Monsenhor Walfredo Gurgel (Centro de Tratamento de Queimados do Hospital Monsenhor Walfredo Gurgel, CTQ-HMWG, in Portuguese).

educational activities, and daily routines.¹³ In this context, investigating and understanding the epidemiology of burn injuries is essential as a fundamental tool for prevention and for reducing this substantial burden of morbidity, particularly given that epidemiological patterns vary according to geographic, temporal, cultural, social, and individual factors.¹⁴

In this study, the highest incidence of burns occurred in males, a fact that aligns with data from both Brazilian¹⁵ and international studies.¹⁶ This finding has multifactorial justifications, possibly related to cultural and occupational fac-

tors. Culturally, men have historically shown a greater tendency to take risky actions compared to women, who, in turn, demonstrate greater caution. Behavioral studies can corroborate this fact by indicating that, in domains such as health/safety, for instance, attitudes towards the coronavirus disease 2019 (COVID-19) pandemic, ethical issues, finances, and recreational activities, women report a lower probability of engaging in dangerous behaviors.⁸ In many occupational sectors, men are predominantly employed in professions involving greater physical risk, such as construction, mining,

and heavy manufacturing. These occupations are associated with an increased risk of workplace accidents, including burn injuries.¹⁷

The most affected age group is between 18 and 60 years old (45%), representing a large part of the Brazilian economically active population. This data reinforces the importance of investing in policies aimed at workplace safety and highlights the economic impact of burns, since the most affected group corresponds to the country's main productive force. Next, the pediatric population, from 0 to 12 years old (34%), stands out. Children's natural curiosity and exploratory behavior increase their vulnerability to burn injuries.¹⁸ This occurs because children's intellectual and cognitive development does not keep pace with their motor development progress. Thus, the greater motor autonomy of children, combined with the difficulty in understanding cause and effect, can increase their vulnerability to burns.¹⁹ The lack of vigilance on the part of caregivers, who frequently need to divide their attention between parental care and other domestic or work activities, also contributes to children's exposure to risks. The elderly population (over 60 years old) accounts for 16% of those affected. This group deserves special attention because it presents greater hemodynamic instability, making burns potentially more severe, with a higher risk of complications and death.

Regarding racial epidemiology, there was a higher percentage of people who self-identified as brown (56%). Although racial self-identification is a personal choice, it is influenced deeply by the complex social dynamics of the country. It is worth noting that many people do not have a precise understanding of racial categories, and subjects who might identify as Black often prefer to declare themselves brown due to greater social acceptance and, in some cases, an attempt to avoid the stigma associated with Blackness.²⁰ Historical factors, such as the whitening policies from the late nineteenth and early twentieth centuries, influenced the perception and valuation of racial identity, creating a tendency to prefer racially lighter identities, such as the "mixed-race" classification.

As for educational level, 63% of participants had no formal education, 23% had completed primary education, 11% had completed secondary education, and only 3% had completed higher education. Therefore, an inverse association was observed between educational level and burn incidence. Individuals with lower educational levels may have reduced access to information on domestic accident prevention and safety measures, as well as greater difficulty in recognizing and understanding risks associated with certain situations, such as improper use of household appliances or inadequate supervision of children in hazardous environments.²¹ These subjects are more frequently employed in occupations with higher burn risk—such as industrial kitchens, construction, factory work, or chemical handling—often without adequate access to personal protective equipment (PPE) or in settings where safety standards are insufficient. In addition, they are more likely to live in precarious housing conditions, with increased exposure to low-quality gas stoves, wood-burning stoves, or inadequate electrical systems.

The most common cause of burns was scalding (28%), consistent with other Brazilian studies.²² A potential explanation for this finding is the daily use of hot fluids in the home environment, such as boiling water, coffee, tea, soups, and cooking oils, which increases the risk of accidents. Furthermore, especially in less developed regions, many households do not adopt proper safety measures, such as stove protectors or positioning pots with the handles turned inwards. This factor is particularly relevant at the extremes of age. Children, due to their natural curiosity and increasing mobility, are more likely to come into contact with hot fluids, particularly given their height, which places them closer to surfaces such as tables and countertops where these substances can be easily accessed and spilled. Older adults, in turn, may experience reduced sensitivity and slower reflexes associated with aging, which can delay the perception of imminent danger and increase the risk of burn injuries.

Flammable fluids (25%) were the second leading cause of burns. Substances such as gasoline, alcohol, kerosene, and acetone have relatively low flash points, meaning they can easily ignite upon contact with a heat source, spark, or flame. These fluids release flammable vapors that can spread in the air and accumulate in enclosed areas, increasing the risk of ignition. In addition, these substances are commonly used in households for cleaning, fire ignition, and as fuel, often involving improper handling or unsafe storage practices.

Electricity (21%) ranks third as a cause of burns; in these cases, electric current can result in internal burns to tissues and organs, even when the skin appears relatively intact externally. Social and occupational factors are strongly associated with these burn injuries, as inadequate or defective electrical installations increase risk. Exposed wiring, overloaded circuits, poorly maintained electrical equipment, and the absence of regular maintenance of electrical systems all contribute to a higher likelihood of burns. The employment context should also be considered; workers may be exposed to electrical hazards due to the nature of their work, including handling large amounts of electrical energy without proper precautions, and failure to use PPE, such as insulating gloves and appropriate tools, can result in direct contact with electric currents. Most victims of electrical burns are young men, consistent with the observation that men experience more burns due to occupational exposure in high-risk sectors.²³

As for distribution, most burns involved the upper limbs (43%), which is consistent with Brazilian studies.²⁴ These data may be related to the person's position relative to the flame source. The hands (39%) are the part of the body most used to manipulate objects and perform daily tasks; as a result, they are often the first to come into contact with heat sources, hot fluids, and other burn causes.

The household (72.5%) and work (16.25%) environments were the main locations for burn occurrence. In the household, the constant proximity to heat sources, such as stoves and heaters, and the frequency of activities involving heat (such as cooking) increase the risk of burns. This fact, combined with the lack of habit of using heat-resistant gloves or long sleeves during hazardous activities, can further

elevate this risk. In industrial environments, workers are frequently exposed to burn hazards and may not consistently wear appropriate personal protective equipment for their activities.

The most frequently burn-associated trauma was fainting, with 12 cases, since the pain resulting from a burn can overstimulate the vagal system. The autonomic nervous system's response leads to decreased blood pressure and reduced blood flow to the brain, causing fainting.²⁵ TBIs were also frequent, with seven cases, potentially resulting from accident-induced panic, causing disorientation and/or loss of balance. In industrial or household environments, explosions involving flammable fluids, gases, or chemicals can cause both burns and TBI.

Packed-cell volume and hemoglobin levels are expected to increase in extensive burns due to the strong tissue necrosis, vigorous fluid loss, and vasodilation, leading to initial hemoconcentration. The main complications in burn patients were wound infection and sepsis. These factors occur because burns significantly disrupt the skin barrier, that is, the first line of defense against pathogens.²⁶ Furthermore, extensive burns induce immunosuppression, increasing susceptibility to infections. Another factor is that burn patients also face a high risk of infections due to the presence of multidrug-resistant organisms in burn units.^{27–30} Therefore, effective infection management in burn patients requires a multidisciplinary approach and the use of rigorous infection control measures.

Most burns were accidental (96%). Although burns are complex traumas requiring multidisciplinary and highly complex treatment, fortunately, it is possible to prevent them through awareness campaigns and greater dissemination of information to the population.

Conclusion

Burns constitute a significant public health problem, affecting different age groups and presenting both physical, psychological, and social implications. Understanding the epidemiological profile of this injury in Rio Grande do Norte allows not only the identification of the most vulnerable groups but also supports the formulation of effective preventive strategies.

The incidence of burns was higher in men of working age, followed by children and the elderly, confirming the vulnerability of extreme age groups. Low educational attainment, adverse working conditions, and cultural factors emerged as key determinants of vulnerability to burn injuries.

Regarding etiology, the main causes identified were scalds, flammable fluids, and electricity, with a predominance of accidents in the household environment. However, work-related cases, suicide attempts, and episodes of violence also occurred. Most injuries affected the upper limbs, hands, trunk, and face, and about 5% of patients presented with smoke inhalation, highlighting the severity of the occurrences.

Associated traumas included fainting, head and chest trauma, seizures, and dizziness. The most prevalent clinical complications were wound infection and sepsis, followed by

urinary tract infection, anemia, and amputation, reflecting the complexity of clinical management. The overall average length of stay was 21.4 days, with some patients requiring ICU admission for an average stay of 2.5 days.

Clinical outcomes included hospital discharges, sequelae, and death, reinforcing the impact of burns on morbidity and mortality. Despite advances in clinical management and multidisciplinary care, prevention remains the primary strategy for reducing the incidence of burn injuries and minimizing their physical, psychological, and economic impacts.

Accordingly, this study reinforces the need for sustained educational campaigns, household and workplace safety programs, and the development of permanent public policies that expand access to information, protective resources, and rehabilitation services. Such measures are essential for reducing burn-related morbidity, mortality, and long-term sequelae, thereby improving the quality of life of affected patients and their families.

Data Availability

Data will be available upon request to the corresponding author.

Authors' Contributions

BXGS: conception, data collection, data analysis, and manuscript writing; JBLV, SML, STSF, and PRCD: data collection, data analysis, and manuscript writing; MAMRA and EPM: conception and final manuscript approval; HPB: conception, data analysis, and final manuscript approval.

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Conflict of Interests

The authors have no conflict of interests to declare.

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