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Original Article

Epidemiological profile of sepsis in a high-complexity hospital in northwest Paraná

Perfil epidemiológico de sepse em um hospital de alta complexidade do noroeste do Paraná
Perfil epidemiológico de la sepsise nun hospital de alta complejidad del noroeste de Paraná

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ABSTRACT

Background and Objectives: Sepsis constitutes a major cause of global morbidity and mortality with exorbitant costs. It is necessary to relate the patients' sociodemographic profile with sepsis diagnosis in order to understand the specific characteristics and outcomes and to provide information for the development of clinical protocols that positively impact prognoses. **Methods:** This cross-sectional, retrospective, and quantitative study with a documentary research collected data from January to December 2023. Data were analyzed on R (version R-4.3.0) with inferential statistics and association testing. The Fisher's exact test was used to assess variable relationships, with a 5% significance level. **Results:** Of the total 320 records, 76.6% (n=245) of patients died and 23.4% (n=75) were discharged. Patients aged over 60 years had a higher risk of infection and unfavorable outcomes. Regarding infection site, death was related to pulmonary (60.4%) and abdominal infections (13.1%). The analysis of the correlation between length of stay and mortality showed a higher incidence of unfavorable outcomes within the first seven days (40.0%). **Conclusion**: This study showed the relationship between sociodemographic profile and outcomes related to sepsis and septic shock in line with the Brazilian context and adding information that enables the development of a sepsis management protocol to reduce mortality.
Keywords: *Epidemiology. Hospitalization. Mortality. Sepsis.*

RESUMO

Justificativa e Objetivos: A sepse é uma grande causa de morbimortalidade global com custos extremamente elevados, para contribuir com informações para o desenvolvimento de protocolos clínicos se faz necessário relacionar o perfil sociodemográfico dos pacientes com diagnóstico de sepse e conhecer as especificidades e os desfechos apresentados. **Métodos:** Trata-se de uma pesquisa transversal, retrospectiva e documental de abordagem quantitativa, com universo amostral de pacientes adultos internados com diagnóstico de sepse de janeiro a dezembro de 2023. Os dados foram analisados no software R (versão R- 4.3.0) com estatística inferencial e teste de associação. Para relacionar as variáveis foi realizado o teste Exato de Fisher, com o nível de significância de 5%. **Resultados:** Do total de 320 prontuários, verificou-se que 76,6% (n = 245) dos pacientes evoluíram a óbito e 23,4% (n = 75) receberam alta. Pacientes com idade superior a 60 anos apresentaram maior risco de adquirir uma infecção e ter evolução desfavorável. Em relação ao foco da infecção, detectou-se que o desfecho de óbito está mais relacionado com a infecção pulmonar (60,4%) e abdominal (13,1%). A correlação entre o tempo de internamento e o óbito determinou que o desfecho desfavorável é maior no período de até 7 dias (40,0%). **Conclusão:** Este estudo mostrou a relação entre o perfil sociodemográfico com os desfechos relacionados com a sepse e o choque séptico, sendo condizente com o cenário brasileiro e contribuindo com informações que possibilitem o desenvolvimento de um protocolo de gerenciamento da sepse para a redução da mortalidade.
Descritores: *Epidemiologia. Hospitalização. Mortalidade. Sepse.*

RESUMEN

Justificación y Objetivos: La sepsis es una de las principales causas de morbimortalidad en el mundo, con costos extremadamente elevados, por lo cual con el fin de contribuir con información para el desarrollo de protocolos clínicos es necesario relacionar el perfil sociodemográfico de los pacientes con diagnóstico de sepsis y comprender las especificidades y los desenlaces presentados. **Métodos:** Se trata de una investigación transversal, retrospectiva y documental con enfoque cuantitativo, en la cual se contó con la participación de pacientes adultos, hospitalizados con diagnóstico de sepsis de enero a diciembre de 2023. Los datos se analizaron en el software R (versión R- 4.3.0) utilizando estadística inferencial y pruebas de asociación. Para relacionar las variables se realizó la prueba Exacta de Fisher, con un nivel de significancia del 5%. **Resultados:** Del total de 320 registros, se verificó que el 76,6% (n=245) de los pacientes fallecieron y que el 23,4% (n=75) fueron dados de alta. Los pacientes mayores de 60 años presentaron un mayor riesgo de adquirir una infección y tener un resultado desfavorable. En cuanto al foco de la infección, se detectó que el desenlace de fallecimiento estuvo relacionado con la infección pulmonar (60,4%) y abdominal (13,1%). El análisis de la correlación entre la duración de la estancia hospitalaria y la mortalidad reveló una mayor incidencia de resultados desfavorables en los primeros 7 días (40,0%). **Conclusión:** Este estudio mostró la relación entre el perfil sociodemográfico y los desenlaces relacionados con la sepsis y el choque séptico, por lo cual estuvo coherente con el contexto brasileño y aportó información para el desarrollo de un protocolo de manejo de la sepsis con el fin de reducir de la mortalidad por esta afección.
Palabras Clave: *Epidemiología. Hospitalización. Mortalidad. Sepsis.*

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INTRODUCTION

Sepsis constitutes a major cause of global morbidity and mortality. In 2017, 48.9 million cases and 11.0 million deaths were recorded, representing 19.7% of deaths worldwide.[1] It is also considered a main cause of hospital mortality, surpassing the death rates for myocardial infarction and cancer. The Covid-19 pandemic has further aggravated this problem in healthcare facilities.[2]

A multicenter study conducted by the Latin-American Sepsis Institute (ILAS) entitled *Sepsis PREvalence Assessment Database* (SPREADs) evaluated sepsis incidence and mortality in 227 randomized intensive care units in Brazil, finding an average of approximately 30% of ICU beds occupied by patients with sepsis or septic shock and a lethality rate around 55%.[3]

Sepsis can vary according to age group, sex, and region analyzed, as places with lower sociodemographic indices have higher incidence and mortality. [1] Thus, updates on the epidemiological profile are fundamental to direct fighting programs and prevent involvement. These measures must be implemented and monitored mainly in the hospital environment since this setting has a high development of this disease, with higher mortality rates than community-acquired sepsis.[4, 5]

Furthermore, sepsis-related costs are extremely high.[6] In Brazil, a case of sepsis can cost up to US$ 9,632.00 with a daily average of US$ 934.00, and the median daily cost for non-surviving patients is significantly higher than that of survivors.[7] From 2010 to 2019, the state of Paraná recorded 27,516 deaths, showing a coefficient of 24.8 per 100,000 inhabitants, data that represent patients treated by the Brazilian Unified Health System (SUS).[3]

Given the above, this study describes the sociodemographic profile of patients diagnosed with sepsis in order to understand the specificities and outcomes presented, and to contribute with information for developing clinical protocols that can reduce mortality.

METHODS

This is a quantitative cross-sectional, observational, retrospective and documentary study conducted in a high-complexity hospital in northwest Paraná. It was conducted at the Sarandi Metropolitan Health Care Network, a tertiary hospital in northwest Paraná that provides 204 beds, 42 of which are divided into three Adult Intensive Care Units and is a reference center for neurocritical and polytraumatized patients. ICD-10 code A41 was used for data search and collection on records from the Infection Control Service and the electronic medical records made available by the Medical and Statistical Archive Service (SAME) regarding the population admitted to the institution from January to December 2023. Sociodemographic profile data (sex, age group, race/ethnicity, origin, occupation, inflammatory site, and length of hospital stay) were collected using a specific form. These data were collected from patients over 15 years old with records of sepsis or septic shock diagnosis at this hospital.

Data were stored and organized in Microsoft Office Excel spreadsheets and analyzed using the R software (version R-4.3.0). For this purpose, an inferential statistic was considered with p-value calculation and association test. Tables were constructed to describe patient sociodemographic profile and show the diagnosis characterization. Relationship between personal and diagnostic variables were estimated by Fisher's exact test which analyzes the relationship between two qualitative variables. Significance level was set at 5%.

The research was authorized by the Research Ethics Committee (COPEP) of the State University of Maringá, as recommended by Resolution 466/12 by opinion No. 6,014,607. Protocol No. CAAE 66526722.5.0000.0104.

RESULTS

A total of 320 medical records related to ICD-10 code A41 were selected, 54.1% of which were male patients and 45.9% female. Table 1 shows that community-based infection and healthcare-related infection (HRI) have a higher occurrence in males. However, statistical analysis indicates that they are independent. Regarding age group, most patients were over 60 years old (67.2%). The remaining patients were divided into different age ranges. For infections, both community infections (found on admission) and HRI, the most affected age group was also those over 60, corresponding to 69.2% and 57.4%, respectively. This association was statistically significant with a p-value of 0.0041 (Table 1).

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Table 1. Sociodemographic profile regarding infection origin presented by patients treated at a tertiary and philanthropic hospital in northwest Paraná from January to December 2023.

Sociodemographic profile	Community (%)	HRIs (%)	Total (%)	P-value
Sex				
Female	125 (47.0)	22 (40.7)	147 (45.9)	0.4552
Male	141 (53.0)	32 (59.3)	173 (54.1)	
Age group				
15 to 30 years	12 (4.5)	7 (13.0)	19 (5.9)	
31 to 45 years	19 (7.1)	9 (16.7)	28 (8.8)	
46 to 60 years	51 (19.2)	7 (13.0)	58 (18.1)	0.0041*
61 to 75 years	83 (31.2)	20 (37.0)	103 (32.2)	
Over 75	101 (38.0)	11 (20.4)	112 (35.0)	
Ethnicity/Race				
White	168 (63.2)	37 (68.5)	205 (64.1)	
Mixed-race	83 (31.2)	16 (29.6)	99 (30.9)	0.8223
Black	10 (3.8)	1 (1.9)	11 (3.4)	
Asian	5 (1.9)	0 (0.0)	5 (1.6)	
Origin				
Maringá	50 (18.8)	13 (24.1)	63 (19.7)	
Sarandi	107 (40.2)	9 (16.7)	116 (36.3)	
Other municipalities of the 15th Regional	82 (30.8)	17 (31.5)	99 (30.9)	0.0004*
Other Regionals	27 (10.2)	15 (27.8)	42 (13.1)	

As for race/ethnicity, most patients were white (64.1%), followed by mixed-race (30.9%), black (3.4%) and Asian (1.6%) individuals. Statistical analysis using this variable and community and HRI sepsis showed that this association can be ruled out based on the p-value = 0.8223. Most patients came from the municipality of Sarandi (36.3%), followed by those from other 15th Regional Health Region municipalities (30.9%), Maringá (19.7%) and patients from municipalities of other health regions (13.1%). Association test of origin and infection resulted in a p-value of 0.0004, indicating a correlation between these variables (Table 1).

There were 245 deaths and 75 discharge processes, with no association between sex and outcome (discharge or death) (p-value = 0.3573). Among patients over 60, 52.0% were discharged and 71.9% of those who remained hospitalized died. Association test between age group and outcome resulted in a p-value of 0.0002, i.e., the age group is related to the patient's outcome, especially in case of death (Table 2).

Table 2. Sociodemographic profile regarding the outcome of patients treated at a tertiary and philanthropic hospital in northwest Paraná from January to December 2023.

Sociodemographic profile	Discharge (%)	Death (%)	Total (%)	P-value
Sex				
Female	38 (50.7)	109 (44.5)	147 (45.9)	0.3573
Male	37 (49.3)	136 (55.5)	173 (54.1)	
Age group				
15 to 30 years	10 (13.3)	9 (3.7)	19 (5.9)	
31 to 45 years	14 (18.7)	14 (5.7)	28 (8.8)	
46 to 60 years	12 (16.0)	46 (18.8)	58 (18.1)	0.0002*
61 to 75 years	20 (26.7)	83 (33.9)	103 (32.2)	
Over 75	19 (25.3)	93 (38.0)	112 (35.0)	
Origin				
Maringá	15 (20.0)	48 (19.6)	63 (19.7)	
Sarandi	33 (44.0)	83 (33.9)	116 (36.3)	
Other municipalities of the 15th Regional	18 (24.0)	81 (33.1)	99 (30.9)	0.3593
Other Regionals	9 (12.0)	33 (13.5)	42 (13.1)	
Occupation				
Non EAP	46 (61.3)	182 (74.3)	228 (71.3)	0.0406*
EAP	29 (38.7)	63 (25.7)	92 (28.8)	

Legend: EAP: Economically active person.

Note that 44.0% of the discharged patients and 33.9% of those who died were from the municipality of Sarandi. However, the association test between origin and outcome was not significant (p-value = 0.3593). As for occupation, discharge occurred in 38.7% of Economically Active (EA) patients and in 61.3% of non-EA individuals, i.e., homemakers, retirees/pensioners, students, among others. Death occurred in 74.3% of non-EA patients and 25.7% of EA. Association test between occupation and outcome was significant (p-value = 0.0406) (Table 2).

Among the discharged patients, 81.3% were diagnosed with community-acquired infection and 18.7% with HRIs. Of those who died, 83.7% were diagnosed with community-acquired infection and 16.3% with HRIs. Statistical analysis found no correlation between the type of infection and outcome (p-value = 0.6026). Table 3 summarizes the relationship between outcome, infection site, and length of hospital stay.

Table 3. Analysis of outcome in relationship to infection site and the length of hospital stay of patients treated at a tertiary and philanthropic hospital in northwest Paraná from January 2023 to December 2023.

Diagnosis	Discharge (%)	Death (%)	Total (%)	P-value
Type of infection				
Community	61 (81.3)	205 (83.7)	266 (83.1)	0.6026
HRIs	14 (18.7)	40 (16.3)	54 (16.9)	
Site				
Abdominal	6 (8.0)	32 (13.1)	38 (11.9)	
Cutaneous	3 (4.0)	19 (7.8)	22 (6.9)	
Soft parts	0 (0.0)	1 (0.4)	1 (0.3)	
Pulmonary	39 (52.0)	148 (60.4)	187 (58.4)	0.0241*
Urinary tract	23 (30.7)	31 (12.7)	54 (16.9)	
Two sites**	4 (5.3)	12 (4.9)	16 (5.0)	
Unspecified	0 (0.0)	2 (0.8)	2 (0.6)	
Length of hospital stay				
0 to 7 days	16 (21.3)	98 (40.0)	114 (35.6)	
8 to 15 days	19 (25.3)	64 (26.1)	83 (25.9)	
Up to 1 month	15 (20.0)	46 (18.8)	61 (19.1)	0.0014*
Up to 3 months	19 (25.3)	33 (13.5)	52 (16.3)	
More than 3 months	6 (8.0)	4 (1.6)	10 (3.1)	

As for the correlation between infection site and discharged patients, 52.0% had pulmonary site-related sepsis and 30.7%, urinary tract-related. Regarding the outcome death, pulmonary site was also observed in greater proportion (60.4%), followed by abdominal (13.1%) and urinary tract (12.7%). Association test between infection site and patient outcome showed a significant relationship with p-value = 0.0241. For discharged patients, the proportion was similar between the time ranges of 1 day to 3 months. Of the patients who died, 40% were hospitalized up to 7 days, 26.1% up to 15 days, 18.8% up to 1 month, 13.5% up to 3 months and 1.6% more than 3 months. Association between length of hospital stay and outcome was confirmed with p-value = 0.0014 (Table 3).

DISCUSSION

A study conducted in the Brazilian territory shows that sepsis incidence in the Southeast stands out due to the State of Minas Gerais, which had the highest coefficient of hospitalizations with 81.3 cases per 1000 patients/day (95% CI 80.0–82.5). As for mortality, the Northeast had a PCA of 17.8 (95%CI 14.5–21.2) from 2010 to 2016.[8]

Statistical analysis found that patients over 60 years are more likely to acquire an infection with evolution to sepsis, showing that the older the age (> 60 years), the greater the probability of death. This finding corroborates other studies which verified that this condition mainly affects older adults, a population more vulnerable to infectious agents and consequent development of inflammatory processes that may be related to physiological changes inherent to the ageing process which increases the risk of death.[9,10,11,12]

Regarding sex, a small difference was observed between the percentage values of sepsis occurrence and/or septic shock for male patients compared with female patients. Similar situation was described in two studies which obtained information from the Ministry of Health's SUS Department of Informatics (DATASUS). These studies highlight that male individuals pay less care and attention to their health compared with women and thus may present greater occurrence of sepsis.[13,14] However, research conducted from January 2017 to March 2018 in a university hospital in southern India showed a higher occurrence for women.[15]

Given this context, new studies should focus on the possible difference related to sepsis development, establishing a relationship between the biological differences between sexes to justify a sex-based prevalence in relation to hospitalizations due to sepsis.

As for the occupation of patients affected by sepsis, non-EA patients may be correlated with age, since 71.3% of patients are retired/pensioners, among others. Hence, they are close to or over 60 years old.

Hospitalized patients who self-declared their race/ethnicity were mostly white (64.1%) which concurs with the study by Belo et al., who analyzed the epidemiological aspects of sepsis and mortality in Brazil.[16] The 2022 IBGE Census also corroborates this study and highlights that Paraná has approximately 64% of if its population self-declared white.[17]

Correlation between outcome (discharge/death) and the infectious site was significant, and here patient death was related especially with pulmonary and abdominal site-relate infection. Some authors have reported the prevalence of pulmonary site-related sepsis,[13,18] whereas others reported the prevalence of abdominal site-related sepsis. A study conducted in Rio Branco from March 2016 to February 2018 found that patients with abdominal sepsis died, were over 60 years and presented septic shock.[19]

A global study covering 42 countries observed that ICU patients with intra-abdominal infection and age over 60 years had an association with the outcome death, and that patients over 80 years presented the worst prognosis associated with comorbidities and general disease severity.[20]

Moreover, the shorter the hospitalization time, the greater the probability of death. This association might be related to the patient's clinical condition at time of hospitalization, in which many patients already present alterations in vital organs and end up evolving to an unfavorable outcome, as described by Arvaniti et al.[20]

Still regarding the outcome (discharge/death), some authors have described that patients with septic shock are more likely to die compared with patients diagnosed with sepsis. Additionally, this outcome is also related to patient comorbidities and age, concurring with the present results and with those described by Arvatini et al. and Gorordo-Delsol et al.[20, 21]

In short, our findings showed the relationship between the sociodemographic profile and the outcomes related to sepsis and septic shock, corroborating the statistical accuracy presented by the Brazilian scenario. Importantly, as the search for care records used the ICD-10 code A41, some medical records may have been overlooked since they indicated infection with sepsis criteria but lacked the ICD code. To mitigate this fact, data collection should take place during patient hospitalization so that any absent information can be obtained from the care team.

This study investigated the relationships between the sociodemographic profile of patients with sepsis and septic shock with outcomes (discharge/death) who were treated at a tertiary and philanthropic hospital in northwest Paraná. Our results concur with the Brazilian scenario and contribute with useful information that enables developing a sepsis management protocol aimed at standardizing conducts and reducing mortality.

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AUTHORS' CONTRIBUTIONS

Patrícia Junglos contributed to the bibliographic research, writing of the abstract, introduction, methodology, discussion, interpretation, conclusions. **PhD Prof. Edilson Nobuyoshi Kaneshima** contributed to project management, bibliographic research, methodology, discussion and review.

All authors have approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.