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# HOSPITALIZATIONS AND OUTCOMES IN THE INTENSIVE CARE UNIT OF A UNIVERSITY HOSPITAL: A CLINICAL AND EPIDEMIOLOGICAL ANALYSIS

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## ABSTRACT

Objective: To analyze the hospitalization profile and outcomes of an adult intensive care unit of a university hospital in the north of Minas Gerais and its clinical interventions.

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Methodology: A cross-sectional and retrospective study was carried out in an adult ICU of a university hospital in the north of Minas Gerais, with a census sample of 66 people hospitalized between 2022 and 2023. The collected data were analyzed using descriptive and inferential statistics (chi-square, Spearman's test, Mann-Whitney test). Results: Most people (57.6%) require mechanical ventilation, and 24.2% hemodialysis. The use of mechanical ventilation was significantly associated with higher mortality (OR: 16.0; 95% CI, 3.78-25.138; p<0.001). People with nosocomial infections and decubitus ulcers had longer hospital stays and high death rates. Conclusion: The study revealed that most people admitted to the ICU were adults, mainly men, with a stay of more than seven days and a frequent need for intensive interventions, such as mechanical ventilation and hemodialysis. These interventions significantly increased the risk of death. The findings highlight the importance of close monitoring of clinical conditions and the implementation of preventive strategies to improve outcomes in critically ill inpatients.

**Keywords:** Intensive Care Unit. Hospitalization. Nursing. Health Profile.

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## INTRODUCTION

The care differentiation, based on the clinical profile of people, refers to the organization of processes in the modern hospital. To understand its origins, reference is made to Nurse Florence Nightingale when, in the Crimean War (mid-1850s), she directed formal care with more complex and specialized care interventions, according to the degree of care dependence, where critical people were located closer to the nursing care structures to offer continuous monitoring and care (Kerlin, 2021). This innovative organization initiates a care model that culminates in the emergence of the first Intensive Care Units (ICU) (Castro *et al.,* 2021).

ICUs add fundamental importance to hospital inpatient services. These offer people specialized care for critical, semi-critical situations or situations with imminent risk of death, whether caused by clinical or surgical conditions. All this care depends on an interdisciplinary performance of nursing, medical and other health professionals, in a continuous and uninterrupted way (Brasil, 2017).

The clinical context of ICU patients is marked by the severity of health conditions, which often require interventions and continuous monitoring. These patients present with critical conditions that may include multiple organ failure, need for ventilatory support, use of vasoactive medications, and high vulnerability to hospital infections (Varallo; Pereira, 2020).

In the ICU, medical interventions must be carried out in accordance with the principles of humanization in health. This perspective emphasizes the relevance of the emotional, social, and human dimensions in the process of treatment and recovery of patients, recognizing that comprehensive care is essential for the promotion of favorable clinical outcomes (Nascimento; File; Passos, 2023).

When talking about specialized care for hospitalized people with critical situations, it is worth remembering surveys such as the one by the Brazilian Association of Intensive Care Medicine (AMIB), which highlights the care structure in Brazil. In 2022, it discloses the availability of 45,848 adult intensive care beds in the Brazilian territory, of which 22,844 (49.8%) are within the Unified Health System (SUS) network (AMIB, 2022).

When it comes to care availability, the recommendations of the World Health Organization (WHO), followed by the Ministry of Health (MS), also stand out. For these, the ideal ratio of ICU beds is 1 to 3 beds for every 10 thousand inhabitants, in Brazil this proportion is 2.2 beds, which can be considered a situation within the recommended

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standards. However, when the data are analyzed in detail and numbers are segmented between the public and private systems, it is observed that the average number of beds available by the SUS is 1.4 for every 10 thousand inhabitants, while the private network has an average of 4.9 beds per inhabitant. This discrepancy highlights the inequality in the distribution of health care structure between the public and private sectors in the country. In this sense, understanding and analyzing the profile of hospitalizations in SUS ICUs is a study of great importance in the context of public health (AMIB, 2022).

Despite the importance of ICUs in modern medicine and the need to know the therapeutic profile of these units, there are still challenges to be faced. One of the main problems is the lack of financial and human resources to ensure adequate care for critical patients. This problem can be evidenced by Leite (2005), where he addresses the difficulties faced by professionals who work in intensive care, especially in relation to the lack of material resources and teamwork. The professionals interviewed affirm that it is necessary to improvise many times, which is not always beneficial for the patient. The scarcity of material resources is considered a major problem, affecting the quality of care offered. The reports highlight the lack of basic materials, delaying and hindering the care provided.

In addition, it is important to emphasize that the profile of ICU admissions may vary according to the epidemiological and socioeconomic context of each region. In this sense, the identification of the profile of people hospitalized in ICUs is crucial to improve the care provided and prevent complications, since people's sociodemographic and epidemiological information allow for more effective strategies. Knowledge about the most common types of conditions, mortality rate, length of hospital stay, and other specific characteristics allows the team to be prepared to serve each patient in a personalized way (Castro *et al.,* 2021; Mequi *et al.,* 2024). The characterization of the profile of ICUs is essential for the proper functioning and quality care in these units (Aguiar *et al.*, 2021).

Based on these exposures, this study aims to analyze the hospitalization profile and outcomes of an adult intensive care unit of a university hospital in the north of Minas Gerais and its clinical interventions.

## METHODOLOGY

This is a cross-sectional, quantitative and retrospective study. It was carried out in a university hospital in the north of Minas Gerais that has an ICU for adults with a capacity

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for 10 beds, all of which are intended for care by the SUS. This hospital unit is characterized as a general unit, a reference for orthopedic surgical interventions, clinical situations of infectious diseases and leishmaniasis, mental health, and maternal and child care at all levels of complexity, including pediatric and neonatal intensive care (Unimontes, 2024).

The study sample consisted of 66 people admitted to the adult ICU of this university hospital during the period from January 2022 to December 2023. This sample was random, defined with a reliability of 95% of the total population. People who remained in the unit for less than twenty-four hours and those whose records were incomplete for research were excluded.

The following data were recorded for data collection: gender, age, unit of origin, length of hospital stay, ICD, morbidities acquired during hospitalization, use of mechanical ventilation, use of sedation, use of neuromuscular blockers, use of vasopressors, use of total parenteral nutrition, hemodialysis, development of infections, and development of decubitus ulcers.

The data were collected through records in their electronic medical records, which took place in the first half of 2024, at pre-scheduled times, respecting the availability of computers with access to the medical record system, available in the hospital library for research.

The data were recorded in an electronic database using Microsoft *Excel 2024 software.* Subsequently, the data were processed using the statistical program *Jamovi* (Mac IOS 2020 version).

The descriptive statistical analysis was conducted through the distribution of frequencies and simple percentages. For inferential statistical analysis, the *chi-square test*, Spearman's test, and the *Mann-Whitnney test were used* for non-parametric correlations between ordinal variables, and ordinal logistic regression for nominal variables, considering significant associations with a p-value lower than 0.05. The research project was approved by the Research Ethics Committee of the State University of Montes Claros under opinion 6.15.944.

## RESULTS

Table 1 presents the detailed distribution of people according to sociodemographic data and length of hospitalization. These data are important to characterize the

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demographic profile of the public served and to offer a basis for analyzing clinical interventions in different groups.

A sample of 66 people hospitalized in the adult ICU was used, highlighting variables such as gender, length of stay, use of mechanical ventilation, and clinical evolution. Most are male, with hospitalization for more than seven days, and more than half used mechanical ventilation and sedatives. In total, 65.2% survived and 34.8% died, offering an overview of the profile and prognosis of these people admitted to the ICU.

In addition, the table also describes the average length of hospital stay, the percentage of use of mechanical ventilation, the use of sedation, the need for hemodialysis, the development of infections, and the clinical evolution of people.

Table 1. Characterization of hospitalization, clinical interventions, and the outcome of people admitted to the adult ICU of a university hospital in Minas Gerais, Brazil, 2024 (n= 66).

| Variables | n | % |
|---|---|---|
| Sex | | |
| Female | 28 | 42,4% |
| Male | 38 | 57,6% |
| Length of hospital stay | | |
| < 7 days | 29 | 43,9% |
| > 7 days | 36 | 54.5 % |
| Not filled | 1 | 1.5 % |
| Use of Mechanical Ventilation (MV) | | |
| No VM | 28 | 42.4 % |
| With VM | 38 | 57.6 % |
| Use of Sedation | | |
| No sedatives | 26 | 39.4 % |
| With sedatives | 40 | 60,6% |
| Hemodialysis | | |
| Sem hemodiálise | 50 | 75.8 % |
| On hemodialysis | 16 | 24.2 |
| Clinical infection | | |
| No infection | 53 | 80.3 % |
| Develop. Infection | 13 | 19.7 % |
| Patient outcome | | |
| Death | 23 | 34.8 % |
| Non-death | 43 | 65.2 % |
| Total | 66 | 100 % |

Source: Author's data research (2024).

Table 2 presents the types of clinical interventions offered to people. These data are crucial to understand the complexity of care prepared in the ICU.

The chi-square *statistical test* is widely used to analyze the association between categorical variables. The *chi-square test* assesses whether the frequencies observed in a contingency table differ significantly from the expected frequencies, helping to determine independence between variables (Howell, 2010). On the other hand, the *odds-ratio*

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quantifies the strength of the association, expressing the ratio of the odds of an event occurring in one group compared to another. Both tests are fundamental in statistical research to infer relationships between categories (Rumel, 1986).

Table 2. Association between clinical variables and probability of death in people admitted to the adult ICU of a university hospital, Minas Gerais, Brazil, 2024 (n= 66).

| Variable | Category | Death (%) | Survivor (%) | Valu e $\chi^2$ | p-value | Odds-Ratio (OR) | 95% Confidence Interval (CI) |
|---|---|---|---|---|---|---|---|
| Develop. Infections | Yes | 9 (39,1%) | 4 (9,3%) | 8,43 | 0,004 | 6,27 | 1,664–23,473 |
| | No | 14 (60,9%) | 39 (90,7%) | | | | |
| Hemodialysis | Yes | 11 (47,8%) | 5 (11,6%) | 10,69 | 0,001 | 6,42 | 1,994–23,75 |
| | No | 12 (52,2%) | 38 (88,4%) | | | | |
| Using NPT | Yes | 5 (21,7%) | 2 (4,7%) | 4,61 | 0,032 | 5,69 | 1,84–17,62 |
| | No | 18 (78,3%) | 41 (95,3%) | | | | |
| Use of Vasopressors | Yes | 16 (69,6%) | 13 (30,2%) | 9,41 | 0,002 | 5,27 | 1,87–14,85 |
| | No | 7 (30,4%) | 30 (69,8%) | | | | |
| Use of Sedatives | Yes | 22 (95,7%) | 18 (41,9%) | 18,20 | <0,00 1 | 30,56 | 3,79–251,38 |
| | No | 1 (4,3%) | 25 (58,1) | | | | |
| VM usage | Yes | 21 (91,3%) | 17 (39,5%) | 16,44 | <0,00 1 | 16,06 | 3,33–77,50 |
| | No | 2 (8,7%) | 26 (60,5%) | | | | |

* For the analysis of these data, *a chi-square* with *an Odds-Ratio was used*
Source: Author's data research (2024).

For the analysis of nominal variables, non-parametric tests were used, including the *chi-square* test (Table 2) and the *Mann-Whitney* U test (Table 3), with a statistical significance level of $p<0.05$.

Table 3 shows the variables with the length of hospitalization of the hospitalized people. To this end, the Mann-Whitney U test was used, which is a non-parametric test that compares two independent samples, being useful when the data do not follow a normal distribution. It evaluates whether the distributions of the samples are different, using the classification of the data instead of their absolute values. The result is a U statistic, which indicates the significance of the differences observed between the groups (Siegel; Castellan, 2006).

Table 3. Association of the outcome death with the clinical variables of people admitted to the adult ICU of a university hospital in Minas Gerais, Brazil, 2024, (n= 66).

| Variable | Group | n | | Statistics | p |
|---|---|---|---|---|---|
| Age | Death | 23 | U de *Mann-Whitney* | 328 | 0,010 |
| | Non-death | 43 | Note. $H_a$ μ DEATH > μ NON-DEATH | | |
| VM Days | Death | 23 | U de *Mann-Whitney* | 270 | <0,001 |
| | Non-death | 43 | Note. $H_a$ μ DEATH < μ NON-DEATH | | |
| Length of Stay | Vasopressors use | 37 | U de *Mann-Whitney* | 391 | 0,015 |
| | Not used | 29 | Nota. $H_a$ μ USO VASOP < μ SEM USO | | |

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| | | | | | |
|---|---|---|---|---|---|
| Length of Stay | No sedatives | 26 | U de *Mann-Whitney* | 285 | <0,001 |
| | With sedatives | 40 | Note. $H_a$ μ SEM_SEDATIVOS < μ COM_SEDATIVOS | | |
| Length of Stay | No hemodialysis | 50 | U de *Mann-Whitney* | 241 | 0.003 |
| | On hemodialysis | 16 | Note. $H_a$ μ SEM HEMOD < μ EM HEMOD | | |
| Length of Stay | No infection | 53 | U de *Mann-Whitney* | 195 | 0.003 |
| | Develop. infection | 13 | Note. $H_a$ μ SEM INFEC < μ DESEN INFEC | | |
| Length of Stay | With decubitus ulcer | 14 | U de *Mann-Whitney* | 168 | <0.001 |
| | No decubitus ulcer | 52 | Note. Ha μ WITH ULC DEC > μ WITHOUT ULCER DEC | | |

* For the analysis of these data, the Mann-Whitney U was used .
Source: Author's data research (2024).

## DISCUSSION

The previous tables highlight how clinical variables influence the outcome of people in the ICU. Table 1 presents data such as the use of mechanical ventilation, sedation, hemodialysis, and infections, with a high prevalence in severe cases. The second table relates these variables to the risk of death, highlighting that infections (OR=6.27) and hemodialysis (OR=6.69) significantly increase this chance. The third table confirms these associations, indicating that interventions such as vasopressor use and hemodialysis are linked to longer hospital stays and greater severity. In this sense, it is evident that the tables complement each other by demonstrating how clinical variables and interventions influence ICU outcomes, highlighting important risk factors for the management and prognosis of hospitalized people.

Therefore, data on the use of mechanical ventilation (MV) show that 57.6% of the people (n=38) need this support during hospitalization, while 42.4% (n=28) did not use MV. These numbers indicate that mechanical ventilation was an important intervention in the management of hospitalized people, reflecting the need for respiratory support in a significant proportion of the cases studied.

The high percentage of people requiring mechanical ventilation suggests a considerable severity of the clinical conditions presented, as assisted ventilation is generally recommended in situations of acute respiratory failure or severe systemic failure (Patel, 2024). The use of ventilation in more than half of the cases can directly influence clinical outcomes, prolonging the length of hospital stay and increasing mortality.

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This finding is in line with previous studies, which indicate that mechanical ventilation is often required in intensive care units (ICU) for life support and is associated with higher complication rates and greater complexity in treatment (Durães *et al.*, 2023). These aspects require further investigation to optimize the care and management protocols for these hospitalized people.

Descriptive data on the need for hemodialysis reveal that 24.2% (n=16) of the hospitalized people were on hemodialysis, while the majority, 75.8% (n=50), did not need this treatment. These results indicate that hemodialysis was a less common intervention among the people in the study, suggesting that, in most cases, kidney functions were preserved or that clinical conditions did not require renal support.

The lower proportion of people on hemodialysis may reflect the nature of the pathologies presented and the severity of the conditions that led to admission to the intensive care unit (ICU). The need for hemodialysis indicates a significant complication, which can impact the prognosis and clinical evolution of the hospitalized person. The need for hemodialysis is often associated with significant complications, such as acute renal failure, which can worsen the patient's prognosis and clinical outcome (Bezerra, 2023).

People undergoing hemodialysis in the ICU had a significantly higher mortality compared to those who do not need this support, highlighting the relevance of renal function as a critical indicator of the severity of the clinical condition (Lima *et al.*, 2021). The studies by Grünewaldt *et al.*, (2023) reinforce this finding, showing that, among 246 patients undergoing hemodialysis, 182 (74.0%) died.

Regarding the analysis of nominal (categorical) variables, it was revealed that 39.1% of the hospitalized people who developed infections died, resulting in a value of 8.43 ($\chi^2$), with a p-value of 0.004 and an *odds-ratio* (OR) of 6.27. This indicates that people hospitalized with infections are 6.27 times more likely to die compared to those without infections.

This association is corroborated by studies that demonstrate that severe infections, especially in sepsis contexts, drastically increase the risk of mortality. According to the literature, sepsis is a systemic inflammatory response to infections that can lead to organ dysfunction and death, and is responsible for a high lethality rate in intensive care units (ICUs) (Batista *et al.*, 2011). Early identification and intensive management are crucial to improve clinical outcomes, highlighting the need for effective therapeutic strategies for critically ill people (Carvalho; Trotta, 2003).

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This data also highlights the severity of infections in people hospitalized in critical conditions, showing that these conditions not only compromise the effectiveness of treatment, but are also closely associated with adverse clinical outcomes (Rodrigues *et al.,* 2024). The evidence that infections significantly increase the risk of mortality justifies the need to implement more intensive and early management strategies in vulnerable populations.

The results of this research are in line with previous investigations that highlight the relationship between infections and increased mortality in intensive care units. The presence of bacterial infections in people admitted to the ICU is associated with significantly high mortality rates, reinforcing the urgency of prevention and control measures (Nassar *et al.*, 2022; Paixão *et al.,* 2024).

Data analysis reveals that 47.8% of hospitalized people who are on hemodialysis died, resulting in a $\chi^2$ value of 10.69 and a p-value of 0.001. The *odds ratio* (OR) calculated was 6.42, with a 95% confidence interval (CI) ranging from 1.994 to 23.75. These results indicate that people who require hemodialysis are 6.42 times more likely to die compared to those who are not on hemodialysis, highlighting the severity of the clinical conditions that often require this treatment.

The data highlights the complexity of kidney diseases in critically ill people, suggesting that the need for hemodialysis is associated with an unfavorable prognosis. People on hemodialysis may have multiple comorbidities and a general deterioration in health, which may explain this high mortality rate (Oliveira *et al*., 2022).

The results obtained are consistent with the existing literature, which discusses the correlation between the need for hemodialysis and high mortality among critically ill people. Kidney failure, treated through hemodialysis, is closely related to significantly high mortality rates in intensive care units (Oliveira *et al*., 2022).

The analysis shows that 95.7% of the people who received sedatives died, with a $\chi^2$ of 18.20 and a p-value of less than 0.001. The *odds-ratio* (OR) was 30.56, with a 95% confidence interval (CI) of 3.79 to 251.38. These data indicate that people under sedation are 30.56 times more likely to die compared to those who did not receive sedatives.

The results obtained in this study corroborate the literature, which shows that the use of sedation in intensive care units was identified as a significant factor in the mortality of these hospitalized people (Teixeira, 2023).

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Data analysis reveals that 91.3% of people who used mechanical ventilation (MV) died, with a $\chi^2$ of 16.44 and a p-value of less than 0.001. The odds *ratio* (OR) calculated was 16.06, with a 95% confidence interval (CI) ranging from 3.33 to 77.50. These results indicate that people who require mechanical ventilation have a 16.06 times greater chance of dying compared to those who did not use this respiratory support.

This result highlights the severity of the clinical conditions that lead to the need for mechanical ventilation, often associated with acute respiratory failure or other severe complications. The use of mechanical ventilation is therefore an indicator of a patient's critical condition (Patel, 2024).

Similarly, the results regarding mechanical ventilation are in line with previous studies that indicate a significant association between the use of this respiratory support and increased mortality. Research has shown that the need for mechanical ventilation is directly related to a substantial increase in mortality in intensive care units (Castilho, 2023).

Regarding the *Mann-Whitney* U test, the data obtained indicate a significant difference in the number of days of mechanical ventilation between the death and non-death groups, with people who died using ventilation for a longer time (*Mann-Whitney* U = 270, $p < 0.001$). This suggests that the need for mechanical ventilation for prolonged periods may be associated with a worse prognosis, possibly reflecting the severity of the clinical conditions that led to the need for this ventilatory support.

A previous study corroborates this observation, revealing that the duration of mechanical ventilation is often related to ICU mortality. This study showed that hospitalized people who require mechanical ventilation for more days have significantly higher mortality rates (Silva, 2022).

The results show a significant difference in the length of hospital stay between people who did not undergo hemodialysis and those who underwent this procedure (*Mann-Whitney* U = 241, $p = 0.003$). Hospitalized people on hemodialysis therapy have a longer hospital stay, indicating that this intervention is often indicative of conditions that require intensive monitoring and treatment. In this sense, it is observed that hemodialysis is associated with higher rates of mortality and complications (Parente *et al.*, 2022).

The data demonstrate a statistically significant difference in the length of hospital stay between the groups without infection and those with the development of infections (*Mann-Whitney* U = 195, $p = 0.003$). These results are consistent with the literature, which reveals that people with ICU-acquired infections have a longer stay and a higher mortality

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rate, which may reflect an additional complexity in their clinical management (Pinheiro *et al.*, 2021).

Finally, the results show a significant difference in the length of hospital stay between people with decubitus ulcers and those without these lesions (*Mann-Whitney U* = 168, $p < 0.001$). These data are in agreement with the existing literature, which often associates the development of decubitus ulcers with an increase in the average length of hospital stay compared to people hospitalized without these lesions (Teixeira *et al.*, 2022).

An important limitation of this study is the small number of beds in the ICU analyzed, which has 10 beds. In addition, the study was conducted in only one ICU, which limits the generalizability of the results, since conditions and practices may vary between different intensive care units. These restrictions may influence the interpretation of the data and reduce the applicability of the findings to other hospital settings.

## CONCLUSION

The results showed that most of the people hospitalized were male, remained hospitalized for more than seven days and interventions such as mechanical ventilation and hemodialysis were often necessary.

Therefore, it showed that hospitalized people who need intensive interventions, such as mechanical ventilation, sedation, hemodialysis and parenteral nutrition, had an increased probability of death. These findings demonstrate how the severity of clinical conditions is associated with the use of these interventions and with the mortality of people admitted to the ICU.

Among the most relevant variables, the use of mechanical ventilation, which increased the probability of death by 16.06 times, and the use of sedatives, which presented a 30.56 times higher probability of mortality, stand out. Thus, the analysis of the results allows us to conclude that carefully monitoring variables such as the need for mechanical ventilation and the development of infections is essential to improve the clinical outcomes of critically ill people. The contribution of this study to the health area consists in reinforcing the relevance of infection prevention strategies and careful monitoring of visits and hygiene routines in intensive care units.

It is recommended that future studies expand the scope of the investigation, including a larger number of ICUs and an analysis of care practices in different hospital contexts. In addition, future studies can investigate preventive approaches to infections and

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evaluate the effectiveness of interdisciplinary teams in the care of people hospitalized in critical conditions.

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