ARQUIVOS DE ASMA, ALERGIA E IMUNOLOGIA

Original Article

Analysis of the clinical and epidemiological profile of hospitalizations due to asthma in the period 2020-2021 in a hospital in southern Santa Catarina, Brazil

Análise do perfil clínico e epidemiológico das internações por asma no período de 2020 a 2021 em um hospital do sul de Santa Catarina

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ABSTRACT

Introduction: Bronchial asthma is a chronic inflammatory disease with a high worldwide frequency, especially in Brazil, where more than 100,000 asthma-related hospitalizations occur annually according to DATASUS data. Identifying patients upon hospital admission who may require an ICU bed or mechanical ventilation due to an asthma attack is a challenge for healthcare professionals. It is important to analyze clinical variables that may predispose to deterioration and evaluate more vulnerable patients to ensure that effective interventions are instituted promptly. **Objective:** To analyze the clinical and epidemiological profile of patients admitted due to asthma in a hospital in southern Brazil and evaluate predictors of longer hospital stay. **Methods:** Observational epidemiological study with a cross-sectional design. The source of information were secondary data obtained from medical records of patients admitted to a hospital in southern Brazil. **Results:** Overall, 261 medical records were analyzed. Patients were predominantly under the age of 40, representing 57% of hospitalizations. In terms of gender and ethnicity, most patients were female (63%) and white (87%). Three patients (1.1%) required ICU admission, approximately 6.9% had prolonged hospitalizations (>3 days), and 2 (0.8%) died. Low oxygen saturation and elevated heart rate correlated significantly with prolonged hospitalization. **Conclusion:** Vital signs at the time of hospital admission and the epidemiological profile of patients should be analyzed, so that the most prevalent populations and predictors of severe outcomes can be monitored, and appropriate and effective measures can be taken.

Keywords: Asthma, hospitalization, vital signs, prognosis.

RESUMO

Introdução: A asma brônquica é uma doença crônica inflamatória de alta frequência mundialmente, e em especial no Brasil, onde ocorreram mais de 100.000 internações por ano, segundo dados do DATASUS. Identificar pacientes em admissão hospitalar que poderão necessitar de leito em UTI ou uso de ventilação mecânica por conta de crises asmáticas é um desafio ao profissional de saúde, portanto, faz-se importante analisar variáveis clínicas que possam predispor agravos e avaliar pacientes mais vulneráveis, para que as condutas realizadas sejam efetivas e rápidas. **Objetivo:** Analisar o perfil clínico e epidemiológico de pacientes internados em um hospital do sul do Brasil e avaliar os preditores relacionados ao maior tempo de internação. **Métodos:** Estudo epidemiológico observacional, do tipo transversal, que utilizou como fonte de informação dados secundários, os quais foram obtidos através de prontuários de pacientes internados em um hospital do sul do Brasil. **Resultados:** Foram analisados 261 prontuários. Verificou-se que a população menor de 40 anos de idade teve maior prevalência, representando 57% das internações. Além disso, em relação a gênero e etnia, mulheres e caucasianos foram as populações com maiores taxas de hospitalização, sendo 63% e 87% das admissões hospitalares, respectivamente. A necessidade de internação em UTI foi encontrada em 1,1% dos casos (3 pacientes), cerca de 6,9% tiveram internações prolongadas (maiores de 3 dias), e 0,8% vieram à óbito (2 pacientes). Identificou-se que a baixa saturação de oxigênio e a alta frequência cardíaca tiveram relação significativa com internação prolongada. **Conclusão:** É importante analisar sinais vitais no momento das admissões hospitalares e o perfil epidemiológico dos pacientes para que as populações mais prevalentes e os fatores preditivos de desfechos mais graves possam ser acompanhados e a conduta a ser tomada seja adequada e efetiva.

Descritores: Asma, hospital dia, sinais vitais, prognóstico.

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Introduction

Asthma is a condition that results from the interaction of various external factors, such as exposure to allergens, and intrinsic factors related to the individual genetics of each patient. Asthma is a chronic, inflammatory disease characterized by the presence of hyperreactivity of the upper airways. Clinically, asthma manifests as episodes of dyspnea, cough, wheezing, and recurrent chest tightness, which tend to worsen during the night and early morning. The need for hospitalization indicates decompensation of asthma or an absent or inadequate response to treatment, increasing the patient's susceptibility to associated complications.[1,2]

According to DATASUS, the database of the Brazilian Unified Health System, in 2011 there were more than 100,000 hospitalizations due to asthma in Brazil.[3] In southern Brazil, 20% of school-age children have asthma, and most of them severe, uncontrolled cases affecting their school performance and leading to hospitalizations.[4] Asthma is therefore a problem that negatively influences the daily lives of those affected, as it is a physically, emotionally and socially limiting condition. Some studies suggest that the severity of asthma can be considered inversely proportional to quality of life; in other words, the more severe the condition and the higher the disease activity, the greater the limitation and the poorer the patient's quality of life.[5]

According to the Brazilian Society of Pulmonology and Phthisiology (SBPT), asthma is a significant cause of hospitalization in the Brazilian Unified Health System (SUS), ranking among the third and fourth leading causes. Although asthma mortality has decreased in the last decade, asthma management in Brazil is still limited and a considerable proportion of the population remains untreated.[6] However, hospitalizations for exacerbation of asthma attacks are associated with a significant number of deaths.[6]

In Brazil, between 1996 and 2015, there were more than 5000 deaths due to asthma, the majority of which occurred in children under the age of 5. Most of these deaths occurred in the hospital setting (about 80% of cases).[7] Because of the recurrent nature of childhood asthma, it has a significant impact on quality of life.[8]

Health care workers are challenged to identify patients who will be admitted to the intensive care unit (ICU) or will require mechanical ventilation because of asthma attacks. Identifying the clinical profiles most likely to require these interventions is therefore important. By evaluating factors that predispose to the exacerbation of asthma, elevated heart and respiratory rates as well as low oxygen (O_2) saturation were found to be significantly associated with admission to the pediatric ICU (PICU) in asthmatic children.[9,10]

At-risk patients can be effectively and quickly identified by monitoring vital signs at the time of admission to an emergency department.[9,10] The Modified Pulmonary Index Score (MPIS) has been found to be useful for prognostic evaluation during patient triage and, when elevated, is associated with prolonged PICU stay.[9-11]

Therefore, the aim of the present study was to analyze the clinical and epidemiological profile of patients hospitalized in a hospital in southern Brazil and to evaluate the predictors associated with prolonged hospitalization.

Methods

This is an observational, epidemiological, cross-sectional, single-center study that used secondary data as a source of information. This study was conducted by reviewing electronic medical records (Philips Tasy® system) provided by Hospital Nossa Senhora da Conceição (HNSC), a hospital located in the southern state of Santa Catarina, Brazil. We analyzed male and female patients of all ages who were hospitalized between January 2020 and December 2021 for asthma classified under ICD J45 as the cause of admission. We included patients hospitalized at HNSC between January 2020 and December 2021 whose electronic medical records were available at HNSC, and whose cause of hospitalization was due to asthma exacerbation. Dyspnea was the admission criterion considered by the on-call hospital staff. Patients whose records were so incomplete that data registration was impossible, and patients who were hospitalized during the data collection period were excluded from the study.

The present study was conducted by means of a research form. The form was designed to include sociodemographic variables, variables related to hospitalization, and vital signs of the participating patients. Clinical data were collected at the time of patient admission to the hospital. The variables included age (described numerically and categorized as 0–9 years, 10–19 years, 20–39 years, 40–9 years, and ≥ 60 years), ethnicity, sex, associated respiratory

comorbidities, COVID-19 status, smoking status, need for ICU admission, need for mechanical ventilation (MV) or O_2 therapy during hospitalization, length of stay, mortality, and vital signs at patient admission (i.e., systolic blood pressure [SBP], diastolic blood pressure [DBP], peripheral O_2 saturation [SpO_2], heart rate [HR], and respiratory rate [RR]).

Data collection began only after approval by the research ethics committee of Universidade do Sul de Santa Catarina (UNISUL). This study was approved under opinion no. 5.542.011, signed on July 24, 2022. No informed consent was required for this study.

Data were organized by using Microsoft Excel and then exported to SPSS version 20.0 for analysis. Quantitative variables were described by using measures of central tendency and data dispersion, while qualitative variables were described by using absolute and percentage frequencies. Differences in proportions were tested by using the chi-square test. Bivariate and multivariate logistic regression were used for odds ratios (ORs). In multivariate analysis, variables with $P < 0.2$ were included by using the backward method. The level of significance was set at 5% ($P < 0.05$).

Results

In this study, a total of 261 patients hospitalized with asthma at HNSC from January 2020 to December 2021 were evaluated. Mean (SD) age was 39.9 (16.8) years. The age range of the patients was evaluated in 3 categories: <40 years, 40-60 years, and >60 years.

Table 1 shows the relationship between age group and the need for hospitalization, as more than half (57.1%) of the cases involved patients under 40 years of age. Table 1 also shows women were more affected than men, accounting for 62.8% of hospitalizations. In addition, Table 1 shows the white population was much more likely to be hospitalized than other populations, representing 87% of the cases of hospitalization due to worsening asthma attacks.

Preexisting respiratory comorbidities were found to be present in approximately 15% of cases, with chronic obstructive pulmonary disease (COPD) being the most common, affecting 4.6% of patients. Overlapping respiratory comorbidities were rare, with only 1.2% of hospitalized patients having more than one concurrent respiratory condition. In addition, although most records lacked information on whether the patient was a current or former smoker (74.7%), it was still possible to associate smoking with hospitalizations. Of the 66 patients whose records contained information on smoking, 5.8% of them reported being former or current smokers. This was the only variable with missing data and was therefore excluded from further statistical analyses.

Of the 261 patients evaluated, 6.2% of them required O_2 therapy, and the use of nasal cannula was the most common method. Regarding the clinical outcome of hospitalizations, most patients were discharged in stable condition. However, in this study, 1.1% of cases (3 patients) required ICU admission, approximately 6.9% had prolonged hospitalization (longer than 3 days), and 0.8% (2 patients aged ≥ 60 years) died.

Figure 1 shows the distribution of vital signs at the time of hospital admission. Figure 1 shows the average SBP was 132 mm Hg and the DBP was 80 mm Hg, thereby indicating a degree of hypertension at the time of admission. Regarding RR, approximately 97% of patients were within normal parameters (RR = 20 breaths per minute). In addition, Figure 1 shows O_2 saturation levels also tended to be within normal parameters, with 96% of patients having saturation levels between 98% and 100%. HR values were more variable, with some patients having normal HRs between 60 and 100 bpm, while others had HRs of 100 bpm or higher, thereby indicating tachycardia at the time of admission.

When comparing patients who were hospitalized for 3 or more days, 93.1% of the 261 patients were discharged in less than 3 days, while longer stays (3 days or more) accounted for 6.9%.

Analysis of Table 2 shows there was no statistically significant difference between sex and length of hospital stay, indicating men and women are equally likely to be hospitalized for longer periods.

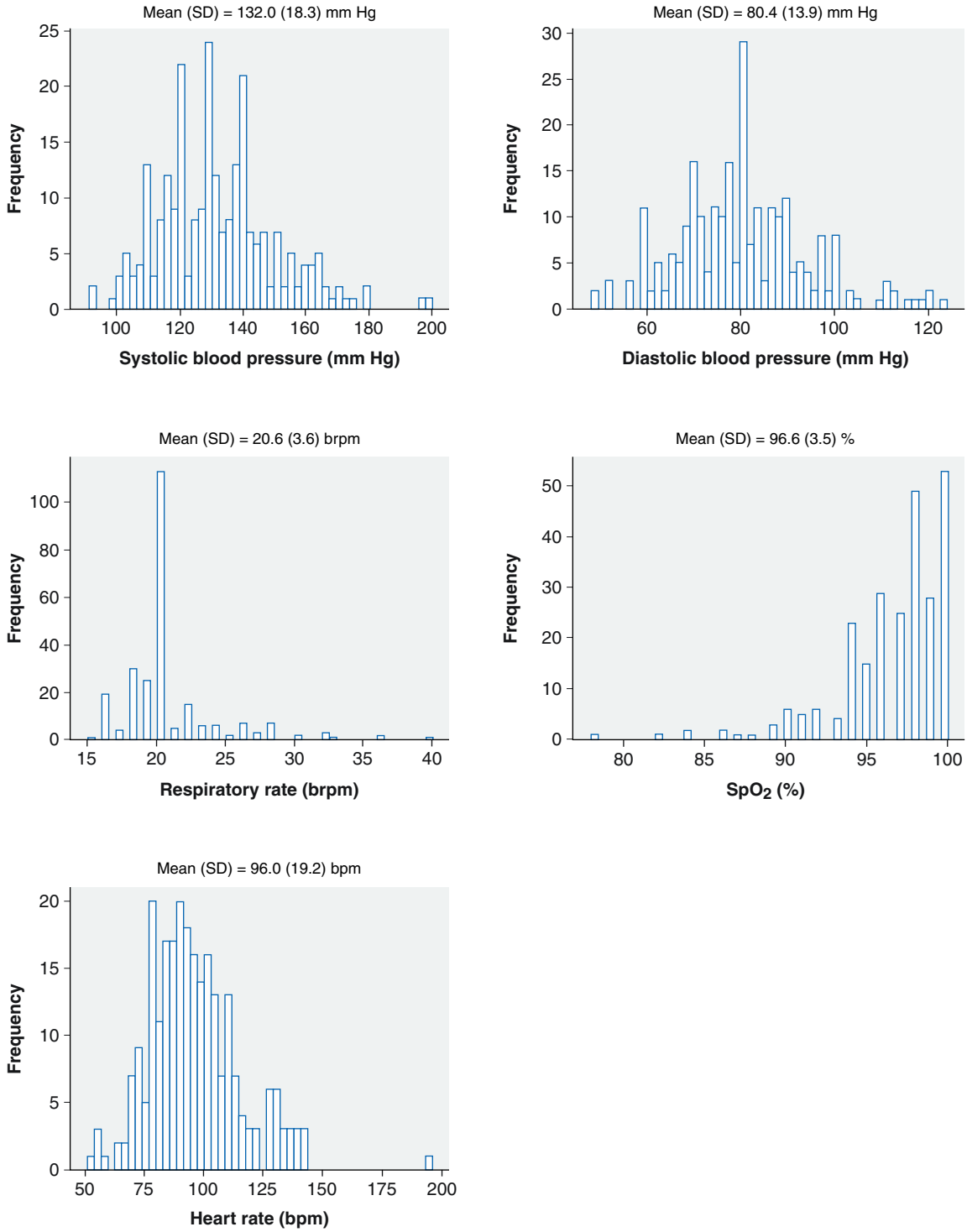
In addition, patients aged 10–19 years had a higher likelihood of prolonged hospitalization compared to patients aged 20–59 years. For comorbidities associated with asthma attacks, there was a trend toward statistical significance ($P = 0.086$), which implies individuals with respiratory disease were more likely to have longer hospital stays.

In the analysis of vital signs, SBP and HR were higher in patients hospitalized for more than 3 days. Conversely, SpO_2 was lower during longer hospital stays.

Table 1
Profile of patients hospitalized with asthma from January 2020 to December 2021 in a hospital in southern Santa Catarina

	n	%
Sex		
Male	97	37.2
Female	164	62.8
Age group		
0-9 years	1	0.4
10-19 years	6	2.3
20-39 years	142	54.4
40-59 years	73	28.0
≥ 60 years	39	14.9
Ethnic group		
White	227	87
Black	11	4.2
Mixed race	21	8.0
Other	2	0.8
Respiratory comorbidity	38	14.8
Lung decortication	1	0.4
COPD	19	7.6
Acute pulmonary edema	1	0.4
Pulmonary fibrosis	1	0.4
URTI	3	1.2
Pulmonary malformation	1	0.4
Pulmonary nodules	1	0.4
Pneumonia	4	1.6
Rhinosinusitis	4	1.6
OSAHS	2	0.4
Influenza	1	0.4
Smoker		
Yes	15	5.8
No	51	19.5
Not reported	195	74.7
Length of hospital stay ≥ 3 days	18	6.9
Need for O_2	16	6.2
Nasal cannula	15	5.8
Non-rebreather mask	1	0.4
Did not use O_2	245	93.8
Need for ICU	3	1.1
Need for MV	3	1.1
Death	2	0.8

COPD = chronic obstructive pulmonary disease, OSAHS = obstructive sleep apnea-hypopnea syndrome, URTI = upper respiratory tract infection.



SpO_2 = peripheral oxygen saturation.

Figure 1
Vital signs at admission of patients hospitalized for asthma from January 2020 to December 2021 in a hospital in southern Santa Catarina

In the multivariate regression analysis, the variables included in the model were SBP, HR, RR, SpO_2, age group, and presence of respiratory comorbidities. Only HR (OR = 1.030, 95% CI 1.005–1.057, P = 0.021) and SpO_2 (OR = 0.787, 95% CI 0.698–0.886, P < 0.001) were significant for the outcome of length of hospital stay ≥3 days.

Discussion

Asthma is a comorbidity characterized by chronic inflammation of the lower respiratory tract associated with a range of clinical conditions that may vary according to severity, risk factors, response to treatment, and genetics.[12] Between 2008 and 2013, asthma hospitalizations in Brazil totaled 1,054,184 patients, which underlines the significant prevalence of asthma among Brazilians as well as the need to evaluate predictive and associated factors to determine appropriate management strategies.[13]

Among the main findings of the present study, asthma hospitalizations were more common in women, particularly in the age group of 40 years, and in Caucasian patients. In addition, SpO_2 at the time of hospitalization was often above 90%, and patients often presented with mild tachypnea and tachycardia, although these variables were not predisposing factors for more severe hospitalizations. A target population requiring more attention during hospitalization was identified, characterized by low SpO_2 associated with tachycardia and its association with more severe hospitalizations.

The present study analyzed 261 medical records of patients hospitalized for severe asthma attacks and found a predominance of Caucasian patients. This finding differs from a study conducted in Northern California,[14] USA, which examined 242 patients hospitalized for asthma and found hospitalization rates were higher among other races. A study conducted in New York City, USA, also reported that the white population was less common, with 81.8% of hospitalized patients being black or Hispanic.[15] However, research in the United States assessing national asthma hospitalization costs was consistent with the findings of this study, showing a prevalence of Caucasian patients hospitalized for asthma.[16] This suggests the most affected population is not a fixed factor and is influenced by the region where patients are analyzed; the white are more prevalent in southern Brazil.

In terms of sex, females were found to have a higher prevalence of hospitalization than males (62.8%). This result differs from the findings of a study in the USA,[16] which showed a preponderance of hospital admissions among males up to 18 years of age. However, studies conducted in New York[17] and Pennsylvania,[18] found similar results to this study, with the female population requiring hospitalization more frequently.[17] Therefore, women often have higher hospitalization rates for asthma, although there are variations in certain regions and some age groups where the opposite is true.[19] This is due to the pathophysiology of asthma, which is an inflammatory disease characterized by an increase in CD4+ Th2 cells, mast cells, basophils, and innate immune cells.[19] Ovarian hormones such as progesterone and estrogen strengthen innate and adaptive immune responses, leading to airway inflammation in asthma. In contrast, androgens such as testosterone and 5-alpha-dihydrotestosterone suppress the immune response, thereby reducing the inflammatory state.[19]

Regarding sociodemographic data, the mean age in this study was 39.9 years, which is consistent with studies where the hospitalized population was predominantly in the age range of 36 to 64 years.[17,18] However, these data differ from the findings in Finland,[20] where studies have shown a higher hospitalization rate among patients over 70 years of age. This discrepancy can be explained by examining the age demographics of the 2 countries. According to the Brazilian Institute of Geography and Statistics, people over 60 years of age represent about 14% of the population of Brazil, while in Finland this age group represents about 24% of the population.[21,22] Thus, the higher rate of hospitalization among older people in Finland is consistent with the population data and the large proportion of people over 60, as Finland is a country with a significant focus on its growing older population. Therefore, the high rate of hospitalization among older individuals in Finland is proportional to the percentage of the population in this age group. This indicates the age profile of hospitalizations varies and, except for the most severe or mild cases, asthma hospitalization does not correlate with age.

Regarding outcomes followed during this study, most patients were discharged from the hospital. However, approximately 6.9% required prolonged hospitalization, 1.1% were admitted to ICU, and 0.8% died. In a New Zealand study of approximately

Table 2
Comparison of the length of hospital stay of patients admitted for asthma from January 2020 to December 2021 in a hospital in southern Santa Catarina

	Length of hospital stay < 3 days N (%) - 243	Length of hospital stay ≥ 3 days N (%) - 18	Odds ratio	p
Sex				
Female	153 (93.3)	11 (6.7)	1.00	0.875
Male	90 (92.8)	7 (7.2)	1.082 (0.405-2.890)	
Age group				0.035
0-9 years	1 (100.0)	0 (0.0)	–	
10-19 years	4 (66.7)	3 (33.3)	1.00	
20-39 years	136 (95.8)	6 (4.2)	0.088 (0.013-0.581)	
40-59 years	68 (93.2)	5 (6.8)	0.147 (0.021-1.008)	
≥ 60 years	34 (87.2)	5 (12.8)	0.294 (0.042-2.046)	
Respiratory comorbidity				0.086
No	211 (94.2)	13 (5.8)	1.00	
Yes	32 (86.5)	5 (6.9)	2.536 (0.847-7.591)	
Systolic blood pressure [a]	131.3 (±18.2)	141.2 (±17.1)	1.027 (1.003-1.052)	0.026
Diastolic blood pressure [a]	80.1 (±13.9)	83.7 (±13.5)	1.017 (0.984-1.052)	0.306
Respiratory rate [a]	20.5 (±3.5)	21.8 (±3.8)	1.080 (0.972-1.201)	0.147
SpO_2 [a]	96.9 (±2.9)	91.6 (±6)	0.750 (0.666-0.844)	< 0.001
Heart rate [a]	94.6 (±17.5)	114.6 (±29.3)	1.046 (1.021-1.071)	< 0.001

[a] mean (±SD), SpO_2 = peripheral oxygen saturation.

270 medical records, the number of patients who died was also considered small (17%). However, this study only looked at deaths in patients with severe asthma who had previously been hospitalized for asthma. Therefore, the 17% mortality rate should be analyzed carefully because it cannot be compared with patients whose condition is moderate or mild.[23] In California, although asthma mortality has decreased in recent years, it is still common and occurs mainly with increasing age, especially in patients over 60 years of age. This finding also supports the results of this study, as the 2 deaths observed in the medical records occurred in patients in this age group.[24] Regarding sex and its relationship to mortality, the present study was not able to test for an association. However, the study conducted in California, which analyzed all deaths from asthma exacerbations between 1960 and 1989, found no significant difference in mortality between the sexes.[24]

The need for ICU admission was also rare in this study. Despite the increase in asthma hospitalizations in several countries, the incidence of severe exacerbations has decreased. This has been attributed to improved access to health care and advances in management strategies and therapies. A study conducted in the United States found of 33,000 patients with asthma requiring hospital care, only 10% required an ICU bed and 2% required invasive mechanical ventilation.[25] These findings are consistent with the present study, as only 3 (1.1%) of the 261 patients evaluated required invasive MV. Regarding ICU admissions, our data were lower compared to the study conducted in the USA, in which only 1.1% of cases required ICU care. However, despite the decline in ICU admissions, there remains a significant association with mortality. For every 3 ICU admissions in this study, 2 resulted in death, meaning that 66.6% of patients admitted to the ICU died. Furthermore, the total number of patients who died in the present study represented 0.8% of the hospitalized cases; in both cases of death, there was a prolonged hospital stay and a prior ICU admission.

The patient's vital signs at the time of admission were critical in predicting the likelihood of prolonged hospitalization. We found in most cases, patients with O_2 saturation above 95% were more likely to be discharged within 3 days of admission. Conversely, patients with longer hospital stays had significantly lower O_2 saturations at the time of hospital arrival. A study conducted in Europe found comparable results, with hospitalized asthma patients having an average SpO_2 of 89.8%.[26] The mean values for HR (96 beats per minute) and RR (20.6 breaths per minute) are considered slightly elevated compared to clinical parameters. However, in the European study, patients were found to be tachypneic and tachycardic on admission.[26] Studies evaluating pediatric asthma hospitalizations are also consistent with the findings of this study and show evidence of decreased O_2 saturation at the time of hospital arrival.[9,27]

Analyzing patients' smoking profiles was challenging because this information was lacking from many medical records, making it difficult to determine a possible association between smoking and clinical outcomes after hospitalization for asthma. Similarly, the present study could not establish an association between more severe asthma attacks and past or current COVID-19 infection because this information was also lacking from the medical records. However, a systematic review found a 7.46% prevalence of bronchial asthma in patients who tested positive for COVID-19.[28] In addition, non-severe cases of asthma were found to be more common than severe cases among COVID-19-infected patients.[28] Among patients who were not infected, those with asthma were 14% less likely to become infected, indicating some resistance to the virus.[28]

Finally, vital signs are important predictors of clinical outcomes in patients and should be carefully evaluated to propose appropriate and individualized management for hospitalized patients.[9,10,27] The present study demonstrated the combination of low SpO_2, and tachycardia were factors associated with prolonged hospital stay. In addition, the profile of patients hospitalized for asthma in this study was of low severity, as evidenced by the good clinical outcomes in most cases.

This study has certain limitations regarding the medical records analyzed, as many patient health details were missing. For most hospitalizations, the patient's COVID-19 infection status was not documented, nor was the patient's smoking history, which was often not asked. In addition, incomplete records further limited this research, as variables analyzed at the time of hospital admission were sometimes not recorded in the hospital system. Moreover, as a single-center study, the profile of the hospital influences the selection of patients included in the sample. Therefore, the extrapolation

of the studied population as representative of other socioeconomic and geographic contexts should be done with caution. The state of Santa Catarina and the southern Brazil as a whole have a different demographic composition compared to the rest of Brazil.

Conclusion

An analysis of the medical records of patients hospitalized for severe asthma attacks in a hospital in southern Brazil found hospital admissions occurred predominantly in white patients, women, with a mean age of 40 years, mild tachycardia and tachypnea, and SpO_2 greater than 90% at the time of admission.

Tachycardia and low SpO_2 were found to be predisposing factors for prolonged hospitalization.

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