Analysis of the Application of the National Emergency Department Over-crowding Score (NEDOCS®) in a Brazilian Federal University Hospital

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Research Article

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Abstract

Overcrowding in urgency and emergency units is considered a global challenge that affects the quality of health services and patient safety. Among the main causes, we can mention the lack of adequate investments and the increase in demand.

Keywords: Total quality management, Emergency medical services, Health services administration

INTRODUCTION

The saturation of the operational capacity of hospital emergency care services reflects the quantitative lack of resources, especially with regard to the insufficient availability of effective hospitalization beds[1].

The emergency care hospital component is responsible for ensuring and coordinating the availability of back-up beds in sufficient numbers to meet the demand of patients from urgent and emergency hospital services, according to their degree of clinical complexity, whether in wards, intensive care units and/or long-term care beds[2-4].

The dynamics of emergency units, related to the high flow of patients, unexpected admissions and even overcrowding make it impossible to constantly revaluate seriously ill patients, sometimes masking clinical deterioration, which predisposes the need for unplanned transfers to therapy units. Intensive, contributing to the risk of adverse events occurring. It is imperative to highlight that the mortality rate among patients who are suddenly transferred from the UUE to the ICU in the first 24 hours after admission significantly exceeds that observed in those who are directly admitted to the ICU[5,6].

The use of performance indicators, such as NEDOCS®, supports more assertive decision-making and the search for adequate accommodation for patients who require urgent and emergency care.

With the aim of defining a numerical parameter that represented the overcrowding of emergency services, supporting decision making, Weiss SJ, et al.[7] carried out, in the United States of America, an assessment of overcrowding in 8 hospitals linked to medical schools, the project called National ED Overcrowding Study through the use of a form with 23 questions prepared with the collaboration of doctors who worked in emergency units[7].

This study then gave rise to the NEDOCS® scale, which uses the following variables: patients in the emergency department, places of care in the emergency department, number of patients in the emergency department awaiting hospitalization, operational inpatient beds in the emergency department, patients in the respirator, longer hospital stay (bedside) and last wait to get to the bed[7].

These data, when analyzed by a mathematical algorithm, standardized by researchers, result in a score. The interrelationship between the score obtained and the level of overcrowding, parameterized by the researchers, is as follows: 00 to 20 points – (No Busy) – empty; 20 to 60 points – (Busy) – Crowded; 100 to 140 points – (Over-Crowded) – Overcrowded; 140 to 180 points – (Severely Over-Crowded) – Severely Overcrowded; 180 to 200 points – (Dangerously Over-Crowded) – Dangerously Overcrowded[7].

Since 2004, NEDOCS® has been used internationally and has contributed to raising awareness among teams regarding the need to implement actions that can improve the quality of care services and guarantee the safety of patients and healthcare teams[7-9].

The objective of the present study was to use the NEDOCS® scale to assess overcrowding in a Brazilian hospital.

The hospital studied is part of the network of public federal university hospitals, accredited as a high complexity reference, in the Triângulo Mineiro region, state of Minas Gerais. In 2023, the institution had 306 active hospitalization beds. Access to the emergency service occurs through regulation by the municipality's bed center and through the mobile pre-hospital care network, in the case of acute conditions and urgent and emergency situations. The urgency and emergency unit is the institution's main entry point. According to internal data from the service, the unit carried out 10,975 consultations in the period from January to July 2023, an average of 1829 consultations/month[10].

METHODOLOGY

This is a descriptive and analytical study of time series, defined as the simultaneous observation of one or more variables, carried out in successive periods of time over an interval in an attempt to identify the trend of a given variable in a specific population.

The NEDOCS® scale was applied daily, at 10 am and 2 pm, for 24 months (July/2021 to July/2023), totaling 1494 collections.

RESULTS

In the present study, the researchers defined 27 "Places of care" in the urgent and emergency unit evaluated.

The variable Patients in the Emergency Department had an average of 28 patients in care, ranging between 10 and 40, median 31 and standard deviation 9 (**Figure 1**).
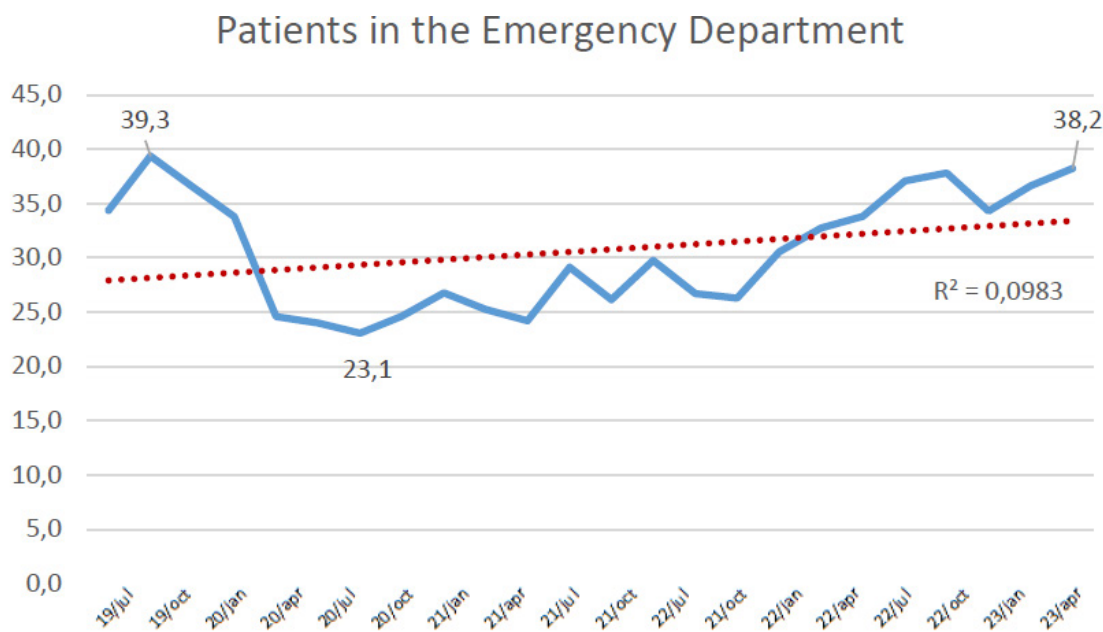

Figure 1. Average distribution of the number of patients receiving care at the urgency and emergency Unit/HC-UFTM from July/21 (month 1) to July/2023 (month 24). Brazil, 2023. Source: Urgency and emergency UNIT/HC-UFTM.

The variable Total Patients Awaiting Admission, corresponding to patients who have already been evaluated by the medical team and were waiting for an inpatient bed to be made available in the units, that is, the so-called "patients in boarding". In the period from July to December/2021 there was an average of 30 patients, ranging between 39.1 and 22.2 patients (**Figure 2**).
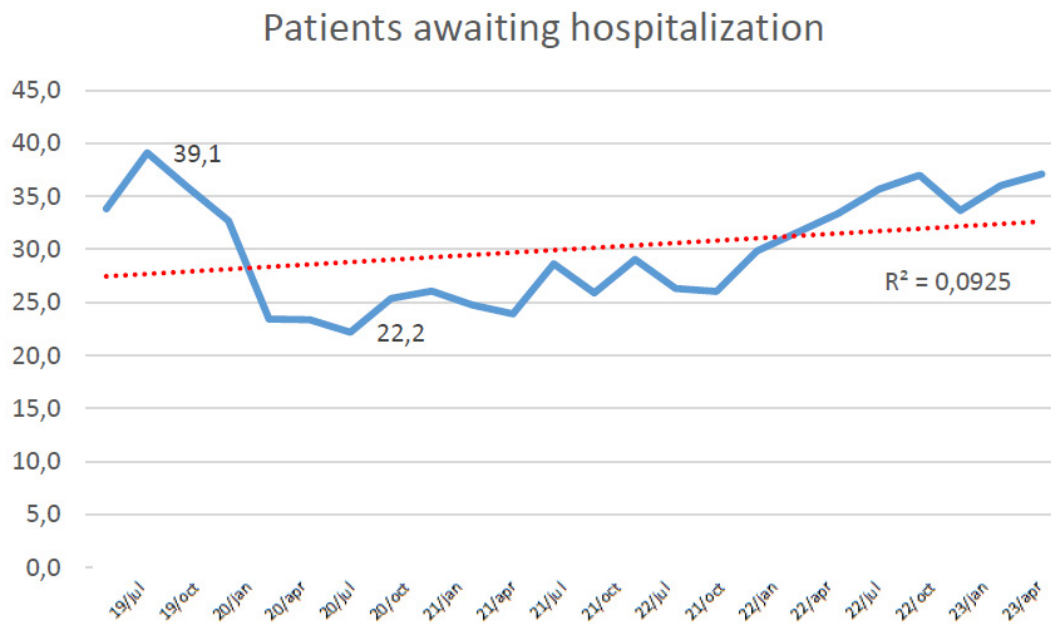
Patients awaiting hospitalization

Figure 2. Average distribution of the number of patients in the urgency and emergency unit awaiting hospitalization. Brazil, 2023. Source: Urgency and emergency UNIT/HC-UFTM.

The variable Operational Inpatient Beds in the Emergency Service also called back-up beds. This institution provides 104 back-up beds for the urgency and emergency unit. During the evaluated period, the average number of operational beds was 98.

The variable waiting time, or bedside time, which corresponds to the interval, in hours, between a patient leaving the bed and the next patient occupying it, involves all stages of cleaning and preparing the bed. In the present study, this time was on average 23.6 hours, ranging between 92.8 and 12.9 hours (**Figure 3**).
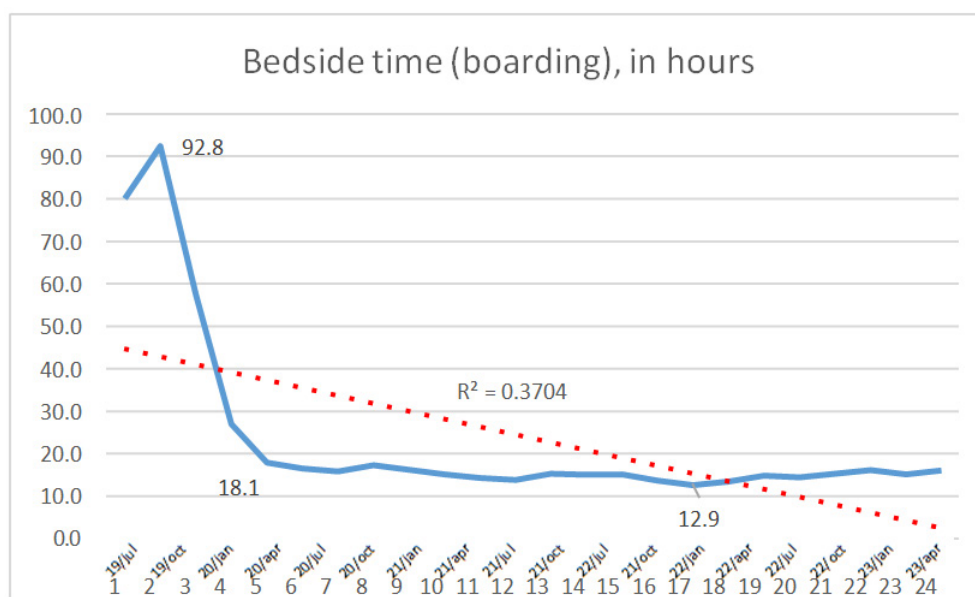
Bedside time (boarding), in hours

Figure 3. Average Bedside time (boarding) in the urgency and emergency unit. Brazil, 2023. Source: Urgency and emergency UNIT/HC-UFTM.

The variable Patients on Respirator highlights the presence of critically ill patients in the urgency and emergency unit. The results analyzed indicate an average of 3.9 patients, ranging between 1.1 and 7.9 patients on mechanical ventilation (**Figure 4**).
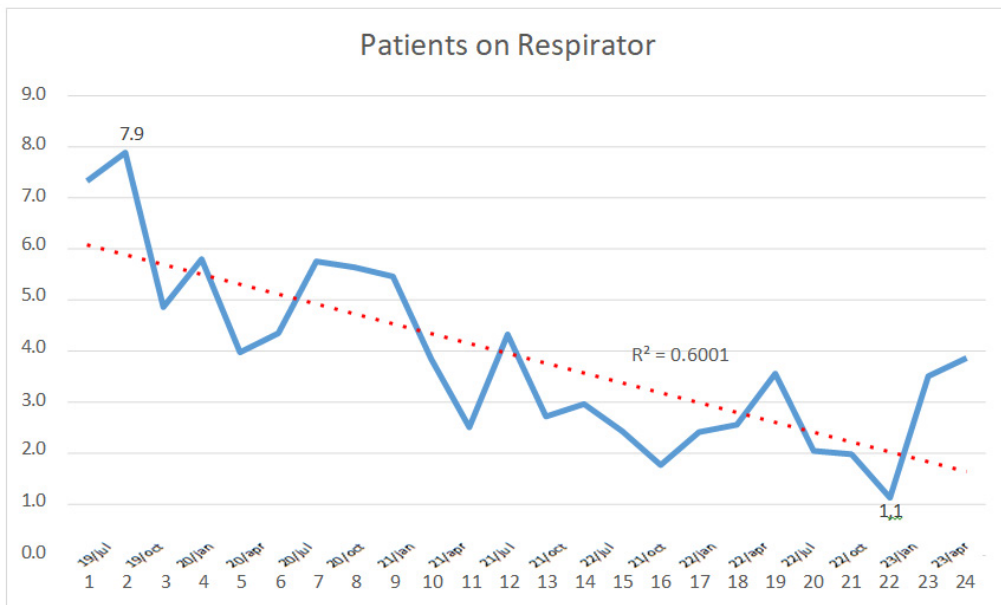
Figure 4. Average Patients on Respirator in the Urgency and Emergency Unit. Uberaba, MG, Brazil, 2023. Source: Urgency and emergency UNIT/HC-UFTM.

When analyzing the Waiting Time to arrive at the Bed, which corresponds to the period of time elapsed between the release of the bed by the internal regulation core and the transfer from the urgency and emergency unit to the hospitalization bed, a time was identified average of 3.3 hours, ranging between 2.2 and 4.7 hours (**Figure 5**).
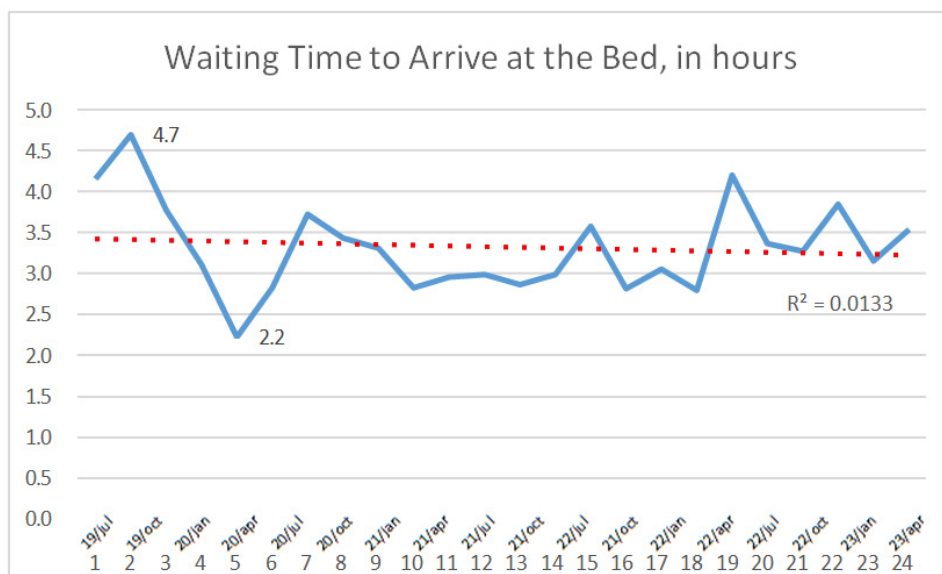

Figure 5. Average waiting time to arrive at the bed. Brazil, 2023. Source: Urgency and emergency UNIT/HC-UFTM.

In the present study, the average NEDOCS® score was 366 points, varying between 257 and 631 points (**Figure 6**).
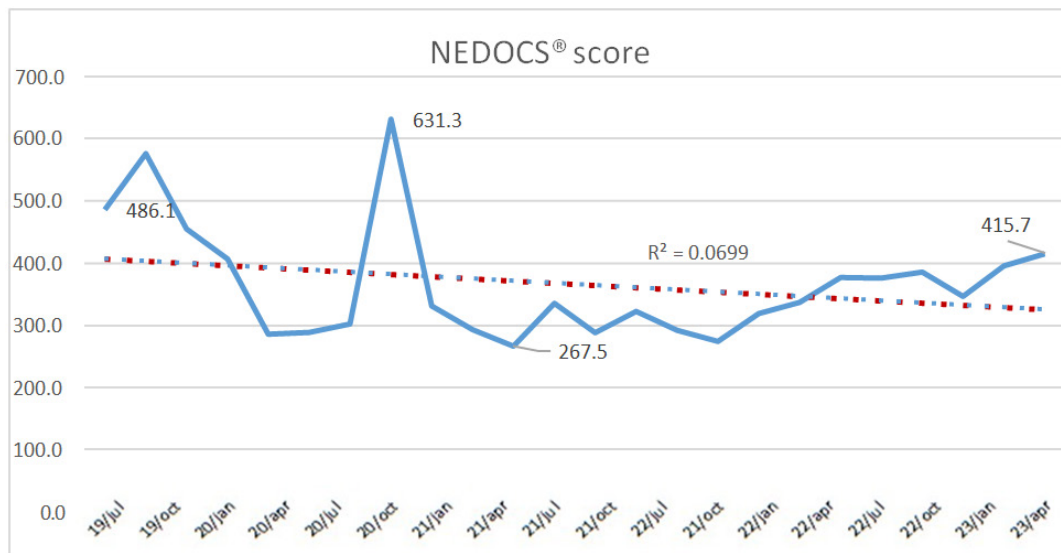
Figure 6. NEDOCS® score. Brazil, 2023. Source: Urgency and emergency UNIT/HC-UFTM.

Validation of the representativeness of NEDOCS® in the number of Patients in the Emergency Service as well as the impact of the overcrowding rate on service capacity was carried out by analyzing the correlation between the NEDOCS® score and the indicators Patients in the Emergency Service and Daily Average Admissions to the urgency and emergency unit.

When evaluating the correlation between the NEDOCS® score and the number of Patients in the Emergency Department, it was identified that there was a statistically significant association.

The association between NEDOCS® and Number of Patients in the Emergency Department (ρ = -0.534) was strong (**Table 1**) (**Figure 7**).

Table 1. Correlation between NEDOCS® and the number of patients in the emergency service at HC/UFTM, 2021 to 2023. Brazil, 2023.

	NEDOCS®	
Number of Patients in the Emergency Department	Spearman correlation coefficient	0.730
	Sig. (2 extremidades)	<0.001
	N	24

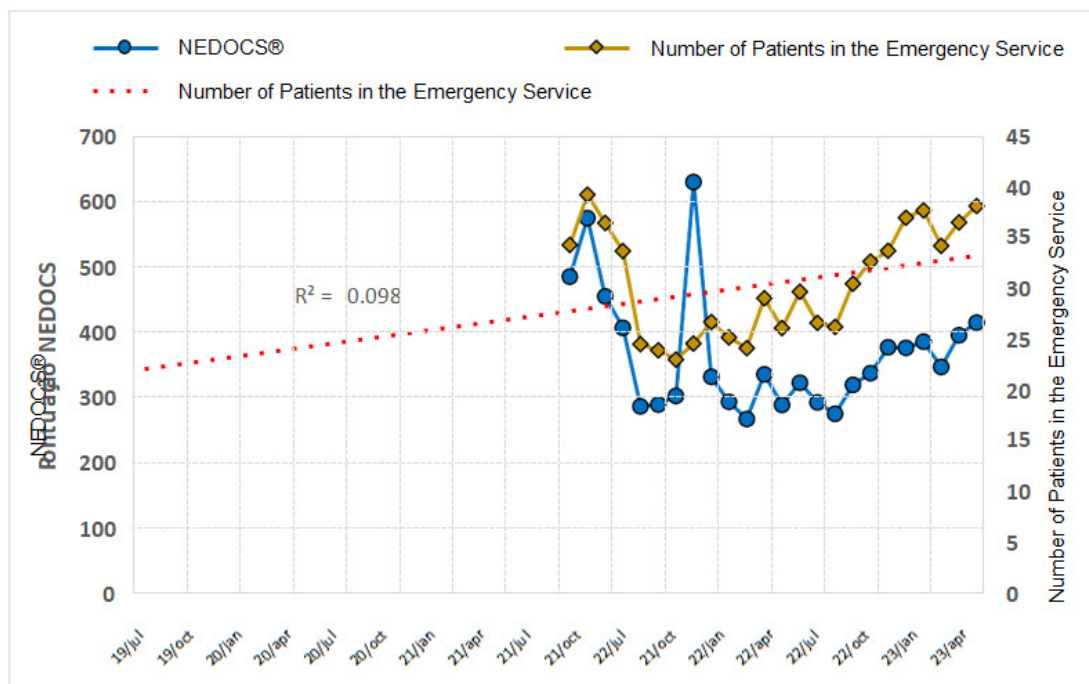**Source:** Prepared by the author, 2023.

Figure 7. Correlations between NEDOCS® and the number of patients in the HC/UFTM emergency service, 2021 to 2023. Uberaba, MG, Brazil, 2023 (Source: Urgency and emergency UNIT/HC-UFTM).

By analyzing the daily average of admissions to the urgency and emergency unit, it was possible to identify an inversely proportional correlation between the number of admissions to the urgency and emergency unit and the NEDOCS® score.

The association between NEDOCS® and Admissions (ρ = -0.128) was moderate and inversely proportional (**Table 2**) (**Figure 8**).

Table 2. Correlation between NEDOCS® and HC/UFTM Admissions, 2021 to 2023. Brazil, 2023.

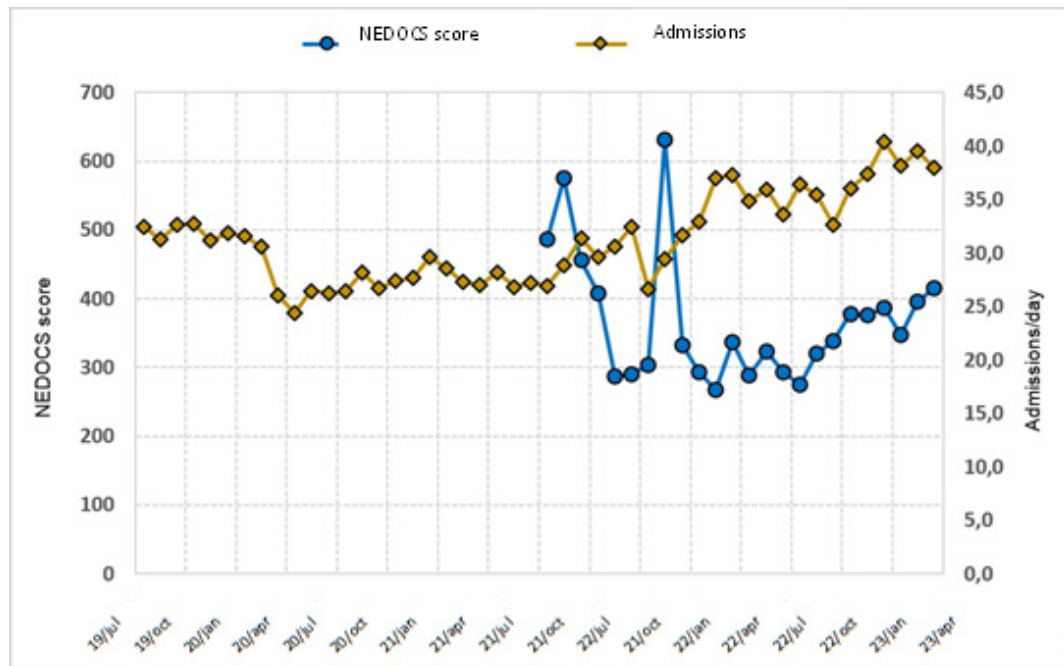|	NEDOCS®	
	Spearman correlation coefficient	-0.128
Admissions	Sig. (2 extremidades)	0.552
	N	24
Source: Prepared by the author, 2023.		

Figure 8. Correlations between NEDOCS® and HC/UFTM Admissions, 2021 to 2023. Brazil, 2023 (Source: Urgency and emergency UNIT/HC-UFTM).

DISCUSSION

The total variable of Patients in the Emergency Service showed a downward trend in the period from July/2018 to May/2022, however from May/2022 the data assume an upward trend, showing the increase in the number of patients on boarding.

The total variable of Patients Awaiting Admission, from July to December/2021, there was a decrease in the number of patients, the average fell from 39.3 to 23.1 patients. From January/2022 onwards, the trend line starts to turn slightly upward, reflecting an increase in the number of patients awaiting hospitalization, which reaches an average of 38.2 patients in July/2023.

The variable Operational Inpatient Beds in the Emergency Service, also called back-up beds, reflects stability in the number of beds. This institution provides 104 back-up beds for the urgency and emergency unit. During the period evaluated, the average number of operational beds was 98. This difference refers to the eventual blocking of beds due to morbidities for which it is recommended to accommodate patients in private rooms or the need for bed maintenance.

The variable waiting time (boarding) in the emergency unit for hospitalization, in July/2021 was on average 92.8 hours, corresponding to 4 days. Over the following five months (July to December/2021), there was a sharp drop in this indicator, and the average waiting time reduced to 18 hours (80%). In the period from January to July/2022 the average was 32.3 hours and in the period from July/2022 to July/2023, 15 hours, maintaining a downward trend, showing a reduction in the average boarding time, consequently fewer patients waiting in the urgency and emergency unit.

The results analyzed point to a gradual reduction in the annual averages of the Patients on Respirator variable, reaching the best value in the period from June/2022 to June/2023 (average of 2.06 patients on respirator), with a downward trend curve. In other words, throughout the period evaluated, the stay of intubated patients in the urgency and emergency unit decreased.

When analyzing the Waiting Time to Reach the Bed, we identified that in the period from July/2021 to December/2021, there was a 54% reduction in the average waiting time (4.7 hours to 2.2 hours). In the period from January/2022 to July/2023, the average stabilized at 3.3 hours. The significant reduction in average waiting time for transfer to inpatient beds highlights the effectiveness of this approach in optimizing processes.

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When evaluating the correlation between the NEDOCS® score and the number of Patients in the Emergency Department, it was identified that there was a statistically significant association. It should be noted that there was a 70% reduction in the total number of patients in the period from July/2021 to April/2022 (30 patients to 10 patients). However, from March/2022 the number rose again, the trend curve is on the rise in the month of February/2023 the values were equal to those of July/2021, that is, 30 patients. These data point to the need to resume the measures that contributed to the reduction in the occupancy rate.

In the present study, the average NEDOCS® score, which represents the sum of all variables that make up this indicator, was 366 points and reflects occupancy and operational efficiency. According to Weiss SJ, et al.[7] a unit with NEDOCS® greater than 200 points is classified as dangerously Over-crowded. However, Ilhan et al. highlight the importance of each emergency service defining its reference values for NEDOCS®. Considering the characteristics of the analyzed unit, mainly operational capacity, 330 points are considered plausible as the cutoff point for the evaluated unit.

CONCLUSION

Given the results presented, we concluded that the NEDOCS® scale was able to represent the overcrowding of the evaluated unit, acting as a simple and direct methodology capable of alerting the entire team about the need to adopt measures to reduce overcrowding.

ACKNOWLEDGMENT

None.

CONFLICT OF INTEREST

None.

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