

# Euroscore In The Cardiology ICU: A Pilot Study Of Risk Stratification In Cardiac Surgery, Implications For Care, And Correlation With Saps, Apache, And Nas

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## Abstract:

**Background:** Cardiac surgeries are complex procedures, often performed in patients with risk factors prior to the procedure, which can result in fatal outcomes; routinely admitted to the Cardiology Intensive Care Unit (CICU). The use of prognostic scores, such as EuroSCORE and SAPS, has been key to predicting mortality and optimizing CICU care.

**Objective:** To evaluate the applicability of EuroSCORE II in the CICU of a tertiary care hospital, providing a detailed analysis of its use in this context, and its correlation with APACHE II, SAPS III and NAS.

**Materials and Methods:** This is a retrospective, documentary, quantitative study of patients who underwent cardiac surgeries and were admitted to the CICU in a high-complexity hospital.

**Results:** Patients are predominantly male, with a mean age of over 60 years. Age was correlated with mortality risk and the EuroSCORE was correlated with the SAPS. Patients who died had, on average, greater clinical severity, according to APACHE. The EuroSCORE relationship with NAS indicates that patients at high risk of death are not always those who require a high nursing workload.

**Conclusion:** The findings demonstrate that the EuroSCORE was effective in predicting mortality, while the SAPS revealed a good discriminatory power and the NAS proved to be a reliable tool to measure the nursing workload in this group. The results obtained reinforce the need to validate these scores in different populations and clinical contexts.

**Key Word:** Workload, Nursing, Predictors of mortality, Cardiac surgery.

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## I. Introduction

Cardiac surgeries are complex procedures, often performed in patients with significant risk factors prior to the procedure, which can result in fatal outcomes. However, when indicated, they are mostly essential; these interventions contribute to increasing life expectancy and improving general health status (MENEZES *et al.*, 2020). Cardiac surgeries include valve replacement, interventions in arteries and repair of congenital alterations and treatment of aneurysms.

These patient's previous risk factors impact the postoperative period, resulting in a longer stay in Intensive Care Units (ICUs) and an increased risk of death. Consequently, admission to the ICU specialized in cardiology is routinely used to reduce the risks of postoperative complications and death among patients undergoing cardiac surgery. Continuous monitoring, complication management, and specialized support significantly increase the chances of successful recovery and reduce the risks of serious complications, especially when compared to general and other specialty intensive care units (PIRES *et al.*, 2018).

Some indicators are monitored in ICUs, such as: quantification of the severity of certain diseases, prediction for the main clinical outcomes (such as discharge and death), length of stay, bed turnover rate, professional's workload, among others (DE LIMA *et al.*, 2021). For many years, the evaluation of mortality prediction was carried out subjectively, according to subjective medical evaluation, with the objective of transforming it into a numerical scale and comparing performance between units (DE LIMA *et al.*, 2021). With the advancement of modern medicine, new statistical techniques, and the increase in markers and predictive

variables, several prognostic scores have been developed to assist in the evaluation of the prediction of events, as death, in various pathological clinical conditions.

The scores are constructed with data collection, validated in determined populations with their own socioeconomic, cultural, and epidemiological profiles, thus requiring analysis and validation before their use in other populations, better determining the calibration for the population and, therefore, promoting a better interpretation of the results (TANIGUCHI and SIQUEIRA, 2020). However, these validation processes are often not carried out due to methodological difficulty and lack of professionals in the institutions for this purpose, and start to be used in the routine without evaluation of their effectiveness or efficiency.

The first predictor of hospital mortality widely recognized in the medical field was the APACHE (Acute Physiology and Chronic Health Evaluation), developed in the 1980s (KNAUSS, *et al.*, 1981). APACHE I and its subsequent versions, such as APACHE II, were created to assess the severity of patients in Intensive Care Units (ICUs) and predict mortality based on physiological parameters and clinical characteristics (KNAUS *et al.*, 1985). Currently in its third version, the SAPS (Simplified Acute Physiology Score) was introduced in 2005 and evaluates data collected at admission and pre-admission, and is considered the best prognostic index since 2009, by the Brazilian Association of Intensive Care Medicine (DE LIMA *et al.*, 2021). Therefore, in the context of cardiac surgeries, the European System for Cardiac Operative Risk Evaluation - EuroSCORE, developed in 128 centers in European countries, is intended to predict 30-day mortality in patients undergoing cardiac surgery (NASHEF *et al.*, 1999). In an attempt to update the first EuroSCORE, EuroSCORE II was published in 2012, evaluating 22,381 patients from 43 countries around the world, including locations outside Europe as South America, to create a more reliable score, incorporating new variables and adjusting for new populations (NASHEF *et al.*, 2012).

Soares and Salluh (2006) validated SAPS III in a Brazilian cohort of cancer patients and obtained excellent results, as well as showing good discriminatory power (ability to distinguish between survivors and non-survivors) in observed patients, SAPS III became the disease severity score used in the vast majority of Brazilian ICUs (LEÃO *et al.*, 2018). However, the SAPS III does not predict the length of stay in ICUs (LEÃO *et al.*, 2018), while with regard to risk assessment in cardiac surgeries, the EuroSCORE II is the most used predictor (PIVATTO JÚNIOR *et al.*, 2020). Prognostic mortality scores are useful tools in assessing the efficacy of treatments, mortality risk, and quality of services, allowing comparison between different ICUs, in addition to the implementation of improvements in treatment protocols and public health policies (LEÃO *et al.*, 2018).

Another indicator commonly evaluated in ICUs is the nursing workload as already described for cardiology units (ALMEIDA JÚNIOR, *et al.*, 2021). Developed in 2003, the Nursing Activities Score (NAS) tool was created to measure the nursing workload of intensive care nursing, known as a reliable and valid indicator, and adapted to the Portuguese language (MIRANDA DR *et al.*, 2003; QUEIJO AF and PADILHA KG, 2012). The measurement of nursing workload allows patients to be classified according to the care needed (NOVARETTI MCZ *et al.*, 2014), allowing better allocation of personnel and reducing the risks of adverse events in patients. Despite this, if adequate workloads are not offered in these units, the outcomes tend to be negative (e.g. GOMES *et al.*, 2019).

The Cardiology Intensive Care Unit (CICU) (synonymous with Coronary Unit) of the *Hospital de Clínicas de Uberlândia* (HC-UFU) has historically used predictive scores of mortality risk, such as APACHE II and SAPS III, in addition to the Nursing Activities Score (NAS) (e.g. ALMEIDA JÚNIOR, *et al.*, 2021). As a large, high-complexity, tertiary care hospital, HC-UFU serves a wide diversity of patients, many with chronic diseases and serious conditions, being a reference for those with cardiac comorbidities who need surgical intervention within the Brazilian Public Health System (“Sistema Único de Saúde” in Portuguese).

The use of a tool such as EuroSCORE, combined with the assessment of patient workload and other predictors of mortality, can provide a more accurate quantitative analysis of risk, improving patient safety, the management of perioperative and postoperative care, and aiding in clinical decision-making. This, in turn, can contribute to better clinical outcomes and higher quality of care. Analyzing these scores makes it possible to identify the profile of a population, and to reflect the local reality. There is a lack of studies that evaluate the EuroSCORE for the southeastern region and in local populations, and even with studies that validated the EuroSCORE in Brazil, it is still necessary to expand mainly because the profile of the populations studied in each health institution is diverse.

Thus, the present study aims to evaluate the applicability of the EuroSCORE II in the Cardiology ICU, providing a detailed analysis of its use in this context. The study will allow the identification of risk stratification in patients undergoing cardiac surgery, in addition to correlating the predictive capacity of EuroSCORE II with other scores used in intensive care units, such as APACHE II, SAPS III and NAS. These findings may contribute to the expansion of studies on risk prediction instruments, improving clinical decision-making and the quality of care.

## II. Material And Methods

### Study location and study type

This is a retrospective, documentary, quantitative study carried out at the *Hospital de Clínicas de Uberlândia* of the Federal University of Uberlândia (“*Universidade Federal de Uberlândia - HCU-UFU*” in Portuguese) linked to the Brazilian Company of Hospital Services (“*Empresa Brasileira de Serviços Hospitalares – EBSEH*” in Portuguese), in the Cardiology Intensive Care Unit (Cardiology ICU). The hospital is a teaching and highly complexity hospital located in the city of Uberlândia, Minas Gerais, Brazil, a reference in tertiary level care for the 27 municipalities of the Extended Health Region of the Northern Triangle from Minas Gerais Brazilian state, and has specialties in cardiac and cardiovascular surgeries. The Cardiology ICU was inaugurated in November 2014, currently has 10 beds and is a sector specialized in the monitoring and treatment of patients with severe heart disease, among other critical conditions and surgical procedures related to the cardiovascular system.

The population of this study is composed of patients admitted to the ICU, included patients over 18 years of age, men and women undergoing cardiac surgeries, who were admitted to the ICU and who were evaluated by EuroSCORE.

The data generated by the APACHE II and SAPS III systems were collected from secondary documents and hospital control records, covering the period from January 2018 to December 2022. These records included information such as date of birth, hospital discharge, occurrence of death, as well as the percentages calculated by the APACHE II and SAPS III systems, generated by the medical CICU team. A total of 176 EuroSCORE II evaluations were identified, of which five (5) were excluded due to lack of patient identification, being considered potential duplicates. Thus, 171 patients were included whose data contained all the information necessary for the analysis of the operative mortality risk criteria, which according to the 17 (independent variables) established and adjusted by EuroSCORE II. When no death record was found and discharge from the unit, it was considered high, since all deaths are recorded in the unit (three cases without death record).

### Collected variables

The prognostic indices of SAPS III and APACHE II are usually calculated on the second day of hospitalization based on the patient's admission data to the ICU, and these use pre-hospitalization information and test results performed in the first 24 hours. The APACHE II scores were converted into the probability of death, and for the SAPS III we also calculated the probability of mortality based on the prediction models without geographic delimitation of the patient's origin and on the prediction model for patients from South and Central America (MORENO *et al.*, 2005). This data is stored on the unit in spreadsheets.

The Nursing Activities Score (first NAS in the unit) was also collected. As the data does not allow a clear tracking of the day of admission to the unit in all cases, we adopted as NAS always the first record of the NAS in the unit. This criterion would work similarly to the NAS of admission to the unit.

The collected data were tabulated in the Microsoft® Windows Excel spreadsheet, so that they included the risk variables included in the EuroSCORE II, and SAPS III. Based on the low sample of non-survivors (12 subjects), a descriptive presentation of the data was chosen. The data were presented as mean and 95% confidence interval, both for the mean and for the relative frequency of the data; regardless of the distribution of each variable. The low sample could bias the use of the median, for example. The indicators were correlated with each other, using Spearman's correlation. The significance of the correlation coefficient estimate was tested with Student's *t*-test for correlation. For all analyses, the significance of 0.05 was maintained. The analyses were performed using SPSS 20.0.

The privacy and confidentiality of the data obtained through the secondary files were ensured, and they were used exclusively for the present research. This project was submitted to the Human Research Ethics Committee (“*Comitê de Ética em Pesquisas em Seres Humanos – CEP*” in Portuguese), based on resolutions No. 466 of December 12<sup>th</sup>, 2012, and No. 510 of April 7<sup>th</sup>, 2016, of the National Health Council (“*Conselho Nacional de Saúde*” in Portuguese), and approved by protocol CAAE 38877220.4.0000.5152, with exemption from the Informed Consent Form.

## III. Result

A total of 171 EuroSCORE II evaluations were maintained in the analyses. Among these, 92.98% of the patients survived (95%CI: 89.15 - 96.81; *n* = 159) and 7.02% died (95%CI: 3.19 - 10.85; *n* = 12). Of the survivors, 65.41% were men (95%CI: 58.02 - 72.8; *n* = 104), and 91.67% of those who did not survive were men (95%CI: 76.03 - 107.3; *n* = 11). The mean age of the survivors was 61.38 years (95%CI: 59.72; 63.04; *n* = 159), and the mean age of the non-survivors was 61.17 years (95%CI: 52.49; 69.84; *n* = 12). The EuroSCORE II score showed a mean of 2.58 points (95%CI: 1.93; 3.23; *n* = 159) and a mean of 5.16 points (1.39; 8.93; *n* = 12) for survivors. The SAPS III analysis indicated a score with a mean of 36.95 points (35.16; 38.75; *n* = 151) and a mean of 43.49 points (95%CI: 34.62; 52.36; *n* = 12), in turn the mean probability of SAPS survivors was 7.58% (95%CI: 5.99; 9.17; *n* = 151) and non-survivors of 13.95% (1.01; 26.88; *n* = 12). In this context, the mean

probability of the SAPS for South America was 10.64% (95%CI: 8.6; 12.68; n = 151) and deaths of 17.73% (95%CI: 3.38; 32.08; n = 12). The APACHE II score showed a mean of 10.18 points (95%CI: 9.24; 11.12; n = 147), deaths of 11.67 points (95%CI: 7.22; 16.12; n = 12) and their probability of survival of 9.16% (95%CI: 7.5; 10.82; n = 143) and deaths of 12.56 points (95%CI: 0.75; 24.37; n = 9). The score assessed by the NAS (first record in the unit) represents a mean of 48.58 (95%CI: 46.79; 50.38; n = 147) of the survivors and 51.18 (95%CI: 45.11; 57.26; n = 12) of the observed deaths, as shown in Table 1.

**Table 1.** Predictors of mortality and age of surgical patients evaluated by EuroSCORE II in a Brazilian cardiac intensive care unit.

Predictor (unit)	Average (95% of confidence interval) [n]	
	Survivor (evaluated at discharge from the unit)	
	Yes	No
Age (in years)	61.38 (59.72; 63.04) [159]	61.17 (52.49; 69.84) [12]
EuroSCORE II (Escore)	2.58 (1.93; 3.23) [159]	5.16 (1.39; 8.93) [12]
SAPS III (Escore)	36.95 (35.16; 38.75) [151]	43.49 (34.62; 52.36) [12]
SAPS III (Probability)	7.58 (5.99; 9.17) [151]	13.95 (1.01; 26.88) [12]
SAPS III (Probability for South America)	10.64 (8.6; 12.68) [151]	17.73 (3.38; 32.08) [12]
APACHE II (Escore)	10.18 (9.24; 11.12) [147]	11.67 (7.22; 16.12) [12]
APACHE II (Probability)	9.16 (7.5; 10.82) [143]	12.56 (0.75; 24.37) [9]
NAS (first registration in the unit)	48.58 (46.79; 50.38) [147]	51.18 (45.11; 57.26) [12]

Legend: APACHE: Acute Physiology and Chronic Health Evaluation; EuroSCORE: European System for Cardiac Operative Risk Evaluation; SAPS: Simplified Acute Physiology Score; NAS: Nursing Activities Score.

The results indicate that there is a positive correlation between age and EuroSCORE II (0.280;  $p < 0.01$ ), SAPS III (0.328;  $p < 0.01$ ), pSAPS III (0.328;  $p < 0.01$ ), and the probability of SAPS SA (0.328;  $p < 0.01$ ). In addition, there is a positive correlation between age and APACHE II (0.234;  $p < 0.01$ ), while the correlation between age and NAS (-0.023;  $p > 0.05$ ) presents a negative correlation, which is practically nonexistent. Thus, age presents a greater positive correlation with the SAPS and its variants, concluding that age may be more associated with these indicators in relation to other variables. The EuroSCORE II variable showed a positive correlation with the SAPS (0.174;  $p < 0.01$ ), the probability of the SAPS (0.174;  $p < 0.01$ ) and the SAPS SA (0.174;  $p < 0.01$ ), presenting the same level of significance for the three variables. However, the correlation of the EuroSCORE II to the APACHE (0.139;  $p > 0.05$ ) is considerably weak, presenting insignificance in this combination, as well as the correlation of the EuroSCORE II to the NAS is non-existent (-0.023;  $p > 0.05$ ). The SAPS presents a highly significant correlation with pSAPS (1.00;  $p < 0.01$ ), and with SAPS SA (1.000;  $p < 0.01$ ), the correlation with APACHE is positive (0.351;  $p < 0.01$ ), and with NAS (0.271;  $p < 0.01$ ), representing that the greater the severity associated with SAPS, the workload of the nursing team increases. The correlation of the probability of SAPS to SAPS SA is positive (1.000;  $p < 0.01$ ), likewise, the correlation of pSAPS to APACHE (0.351;  $p < 0.01$ ) is significant. As pSAPS increases, so does NAS (0.271;  $p < 0.01$ ), showing a significant correlation. The pSAPS AS shows a positive correlation with the APACHE (0.351;  $p < 0.01$ ), and a significant correlation with the NAS (0.271;  $p < 0.01$ ). APACHE II exerts a positive correlation with NAS (0.187;  $p < 0.01$ ), data observed in Table 2.

**Table 2.** Spearman's correlation coefficient between predictors of mortality and age of surgical patients evaluated by EuroSCORE II in a Brazilian cardiac intensive care unit.

Variable	Variable					
	EuroSCORE	SAPS	pSAPS	pSAPS AS	APACHE	NAS
Age	0.280**	0.328**	0.328**	0.328**	0.234**	-0.023ns
EuroSCORE		0.174*	0.174*	0.174*	0.139ns	-0.023ns
SAPS			1.000**	1.000**	0.351**	0.271**
pSAPS				1.000**	0.351**	0.271**
pSAPS AS					0.351**	0.271**
APACHE						0.187*

Legend:  $p$ : probability; \*:  $p < 0,05$ ; \*\*:  $p < 0,01$ ; \*: ns  $> 0,05$ ; Age: Age in years; APACHE: Acute Physiology and Chronic Health Evaluation; EuroSCORE: European System for Cardiac Operative Risk Evaluation; SAPS: Simplified Acute Physiology Score; EuroSCORE: Escore of EuroSCORE II; SAPS: Escore of SAPS III; pSAPS: Probability SAPS III; pSAPS AS: Probability SAPS III for South America; APACHE: Escore of APACHE II; pAPACHE: Probability do APACHE II, NAS (first registered NAS in unit).

Data collection in the administrative sector responsible for the unit's medical-hospital archives presented important difficulties for this research. Access to secondary documents was one of the main challenges. Despite the availability, there is a great lack of data structuring and routine collection; Apparently, some of the indicators were collected only in some specific periods and it is not possible to recover the reason for this absence. The

number of records does not reflect the number of surgeries performed in the unit. In addition, a high prevalence of patients with incomplete information was observed, which limits the generalization of the analyses, in addition to impacting the sample size. Duplicate, confusing and inconcise data from the documented files were found in a significant proportion, which affects the research, reducing the sample and impacting on less statistical power, consequently preventing validation for the population studied, since the representativeness of deaths as in the research is low. The lack of standardization in the records also contributes to the inconsistency of the data and, consequently, to the imprecision of the research results. These factors make the development of concrete and robust studies based on secondary data more challenging, undermining the quality and reliability of the conclusions. It is important to highlight that there are no specific investigations that validate the application of EuroSCORE II to the sample of this study, considering the demographic and clinical particularities of this population. This methodological gap represents a significant obstacle to obtaining more consistent and reliable results. Furthermore, correlating the EuroSCORE II variables for this research with other indicators, what is observed is an even smaller number of samples, which limits the formation of representative pairs, which further compromises the external validity and accuracy of the conclusions obtained in the study. Another factor is that the retroactive application of the scores can be complex given the need to access all patient records, although in some situations the data necessary for the application of the scores are not recorded in the patient's medical or health records.

#### IV. Discussion

Age over 60 years showed a significant correlation with all predictors of mortality, as evidenced in other studies (NASHEF *et al.*, 1999, 2012; FREITAS *et al.*, 2010; ASSIS, 2019), demonstrating that advanced age is an independent and significant risk factor for mortality in patients undergoing cardiac surgery and who are hospitalized in intensive care units. In turn, the age of the patients did not present a statistically significant correlation with the nursing workload (here evaluated by NAS), a result similar to that of another study that evaluated the NAS in the cardiology ICU (COELHO *et al.*, 2011). In this sense, it is concluded that age may not be one of the most determinant isolated factors in the nursing workload, and therefore, in addition to age, the severity of the patient's clinical condition is one of the most important factors in the definition of the nursing workload, as evidenced by the significant correlation between APACHE II and NAS.

Another epidemiological finding is the prevalence of males. Studies that studied the NAS and EuroSCORE II in Brazil pointed to a higher prevalence of males, (COELHO *et al.*, 2011; PELICOLI *et al.*, 2019) this high proportion of male patients in cardiology ICUs is consistent with the incidence of cardiovascular diseases in the male population (MAURICIO *et al.*, 2022). The prevalence of males reflects important epidemiological evidence and highlights the need for careful evaluation in clinical management when undergoing cardiac surgery. One of the justifications is the absence of health care in this population that leads to higher morbidity and mortality.

EuroSCORE II seems to have underestimated the risk of death (mean 3.87 *versus* 7.02 mortality) for this population, since its score was considerably moderate in predicting mortality. In Brazil, other studies have identified this trend of underestimation, with examples of similar findings in the works of authors such as Pivatto Júnior *et al.* (2020) and Silva *et al.* (2015). However, following the line that the higher the score, the higher the risk of death, indicates that EuroSCORE II was effective in predicting mortality after cardiac surgery.

The non-existent correlation between EuroSCORE II and NAS suggests that EuroSCORE II may not adequately capture patient severity in terms of assessing nursing workload in intensive care units (ICU). The mean NAS score was 48.58 for the survivors, indicating an average demand for nursing care and interventions, showing that these patients may be in a slightly more stable clinical condition given their admission to the unit, an event consistent with the results found. The greatest complexity of these patients occurs after the surgical procedure. However, the NAS shows in this study that those patients who died demand a greater workload from the nursing team. An elevated NAS can be associated with several factors, including the high volume of therapeutic procedures, the severity of the clinical condition, and the instability of hospitalized patients.

Patients in critical conditions often require intensive monitoring, hemodynamic support, mechanical ventilation, and other invasive treatments, which significantly increases the workload of the nursing team (PADILHA *et al.*, 2018). In addition, the presence of comorbidities, postoperative complications, and the need for long-term care may contribute to the elevation of the NAS, reflecting the complexity of care involved in the intensive care unit. Regarding EuroSCORE II, patients at high risk of death are not always those who require a high level of nursing activity and the patient's life expectancy may be closely related to the amount of nursing activity (NASSIF *et al.*, 2018). The literature does not present solid evidence that more severe patients require a greater workload, but it is observed that, in patients who had higher NAS, the mortality rate was also higher, demonstrating these rates (NASSIF *et al.*, 2018). Despite this, the unit has low NAS compared to other units (ALMEIDA JÚNIOR *et al.*, 2021).

Although APACHE II and EuroSCORE II are important scores in intensive care and surgical settings, respectively, the lack of a positive correlation can be explained by the difference in focus and approach to each, as well as the distinct nature of the variables that each score considers, APACHE II is focused on acute and critical conditions, while the EuroSCORE II is designed to assess the risk of mortality in patients undergoing cardiac surgery, this tangent may explain the non-existent correlation between them. Thus, it is concluded that, although the high score for APACHE II does not necessarily mean that the patient necessarily has a high surgical risk according to EuroSCORE II. The mean APACHE score for patients who died is slightly higher than that of survivors, which suggests that, on average, patients who died had greater clinical severity according to APACHE, which, as a predictor of hospital mortality, could capture a difference in severity between survivors and non-survivors, showing that a higher score value is associated with an increased risk of mortality.

The analysis of the data shows that the SAPS for South America overestimated the probability of death in patients who survived, corroborating the results of previous studies (NETO *et al.*, 2015; SOARES *et al.*, 2006). The correlation between the NAS and the SAPS mortality predictor and its variations was significant, showing that as the SAPS score increases, so does the NAS score, this result is compatible with the findings of a Brazilian study (DE OLIVEIRA *et al.*, 2019), which also found a significant relationship between the two variables. Possible explanations for this correlation include the fact that patients with higher SAPS scores generally require intensive support, including continuous monitoring, mechanical ventilation, complex drug therapy, and invasive procedures, factors that increase the nursing team's care burden. In addition, the need for long-term care and the increased risk of complications may intensify the demand for interventions, directly impacting the NAS. These findings reinforce the importance of integrating predictive mortality scores and workload indicators to optimize resource allocation and improve the quality of care in intensive care units.

The three versions of SAPS (SAPS, *p*SAPS, and *p*SAPS SA) demonstrate strong correlations with each other, indicating that they are evaluating essentially the same severity parameter, albeit with different adjustments and adaptations. The similar scores observed between the versions of the SAPS are due to its predictive capacity for mortality, and the SAPS AS, in particular, stands out for more accurately estimating the mortality of patients in South America, corroborating the finding of Silva Júnior *et al.* (2010). In general, the high SAPS scores for patients who died reflect the conformity of the predictions with the actual results, evidencing a good discriminatory power, especially with regard to the calibration of the SAPS AS, considering the context of South America. On the other hand, the wider confidence interval for deaths indicates uncertainty, which can be attributed to the small size of the group of deaths, as pointed out by Silva Júnior *et al.* (2010), which results in the limitation and reliability of the estimate. These findings reinforce the need for validation of scores for specific populations.

The absence of validation in other similar contexts limits the scope of the results to other intensive care units, which indicates the need for further research and validation in different populations. This also highlights the importance of considering the demographic and clinical specificities of each region when applying these scores, which is crucial to ensure more accurate and efficient risk prediction. However, when trying to adjust scoring tools, care must be taken not to increase the number of variables all the time, since models with only a few variables are quite stable and, if robust, can achieve good calibration (LISBOA *et al.*, 2014).

Studying mortality predictors such as EuroSCORE can be a complex task, mainly due to the scarcity of data. The lack of standardization in the records contributes to the imprecision of the results, and the difficulties in accessing this information significantly limited the scope and robustness of the results of this study. The lack of an efficient infrastructure for the management and organization of data, as well as the impossibility of quick and efficient access to this information, restricted the sample and the ability to obtain more detailed and generalizable conclusions, compromising the potential of the study. The small number of samples may prevent the formation of representative pairs. These obstacles impact the validity and accuracy of a study's conclusions. The correct recording of patient profile data and the scores produced are of paramount importance for studies with a significant sample size, including the use of them for the development of other mortality predictors adjusted for Brazil. We reinforce that the use of administrative data, as in our case, has clear limitations, as in the case of sample size, but reflects its use in the practice of institutions; reinforcing the need for greater standardization, archiving control, and clear and well-defined routines for the use of any healthcare indicators.

The decision to use any scores can have administrative connotations and involve decisions that are difficult to evaluate. The use of one instrument or another may be associated with ease of use, previous experiences or even arbitrary management decisions. In this sense, reliable patient records and retrospective analyses can be an alternative to test the efficiency of various instruments, since administrative data may contain biases that are difficult to characterize.

## V. Conclusion

Although the study has some limitations, it is concluded that the EuroSCORE was effective in predicting mortality, the SAPS 3 system demonstrated good discriminatory power and, in general, the NAS proved to be efficient in assessing the nursing workload. However, it is essential to emphasize the continued importance of

studying predictors of mortality and nursing workload, as these tools play a crucial role in nursing management, improving the quality of care, the sustainability of health services, and clinical decision-making. Constant monitoring of these predictors is essential to adjust predictive models, ensuring greater accuracy and applicability in different contexts and populations. This makes it possible to customize the tools, improving the accuracy in predicting mortality and nursing workload in intensive care units. In addition, it is imperative to validate these models in broader contexts, as limitations in data management and storage have restricted the ability to generalize the results. Thus, the need for improvements in the data storage infrastructure is highlighted, in order to ensure a more accurate and efficient prediction.

The present study analyzed the applicability of the EuroSCORE in the Cardiology ICU, correlating it with the SAPS, APACHE and NAS scores, with the objective of evaluating risk stratification and the workload of the nursing team. The findings demonstrate that the EuroSCORE was effective in predicting mortality, while the SAPS III revealed a good discriminatory power and the NAS proved to be a reliable tool to measure the nursing care burden.

The significant correlation between SAPS and NAS reinforces the relationship between the severity of the patients clinical condition and the demand for intensive care, evidencing the importance of integrating predictive scores in hospital management. However, the absence of an expressive correlation between the EuroSCORE and the NAS indicates that the surgical risk may not directly reflect on the nursing workload, suggesting that additional factors influence this relationship.

Despite the limitations encountered, such as difficulties in standardization and access to some hospital data, the results obtained reinforce the need to validate these scores in different populations and clinical contexts. In addition, they highlight the importance of a more efficient structure for recording and storing information, ensuring greater reliability in the application of predictive models.

Therefore, the study contributes to the expansion of knowledge about prognostic scores in the Cardiology ICU, pointing to the need for new research to evaluate their applicability in different realities, in order to improve risk stratification, optimize care resources and promote better clinical outcomes for patients undergoing cardiac surgeries.

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