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EVALUATION OF CARE INDICATORS OF THE CHEST PAIN PROTOCOL IN EMERGENCY CARE UNITS OF A MUNICIPALITY IN THE COAL-MINING REGION

EVALUACIÓN DE LOS INDICADORES ASISTENCIALES DEL PROTOCOLO DE DOLOR TORÁCICO EN UNIDADES DE ATENCIÓN DE URGENCIA DE UN MUNICIPIO DE LA REGIÓN CARBONÍFERA

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Abstract
The chest pain protocol is a structured tool for the rapid assessment of patients presenting with chest discomfort, initially conducted by nurses in Emergency Care Units (UPAs) through triage and risk classification. This study aimed to analyze care indicators related to the implementation of this protocol in two UPAs in a municipality in the coal-mining region of Santa Catarina, Brazil. This quantitative, descriptive, documentary, and retrospective study analyzed 526 medical records of visits conducted in 2024 and 2025. The results showed a predominance of male patients aged 56 to 65 years, with frequent hypertension, diabetes mellitus, and smoking. Door-to-triage and door-to-ECG times had medians below 10 minutes across the analyzed outcome groups. Differences were observed among outcomes for age, door-to-triage, door-to-biochemical-marker, door-to-chest-radiography, and door-to-symptom-resolution times. Door-to-ECG showed an overall difference between groups (H = 14.07; p = 0.007), but no pairwise comparison remained statistically significant after Bonferroni correction. Missing records were also identified in temporal variables, particularly for biochemical markers. The findings indicate favorable performance in initial care stages, while record quality and the availability of data for complementary examinations remain priorities for improving care processes.

Keywords: Clinical Protocols; Chest Pain; Health Indicators.

Resumen
El protocolo de dolor torácico constituye una herramienta estructurada para la evaluación rápida de pacientes con queja de dolor en el pecho, realizada inicialmente por el enfermero en las Unidades de Atención de Urgencia (UPAs) mediante acogida y clasificación de riesgo. Este estudio tuvo como objetivo analizar los indicadores asistenciales relacionados con la aplicación de dicho protocolo en dos UPAs de un municipio de la región carbonífera de Santa Catarina, Brasil. Se trata de un estudio cuantitativo, descriptivo, documental y retrospectivo, basado en el análisis de 526 historias clínicas de atenciones realizadas en 2024 y 2025. Los resultados evidenciaron predominio de pacientes del sexo masculino, con edades entre 56 y 65 años, y elevada frecuencia de hipertensión arterial, diabetes mellitus y tabaquismo. Los tiempos puerta-acogida y puerta-ECG presentaron medianas inferiores a 10 minutos en los grupos de desenlace analizados. Se observaron diferencias entre los desenlaces para edad, puerta-acogida, puerta-marcadores bioquímicos, puerta-radiografía de tórax y puerta-resolución de los síntomas. El tiempo puerta-ECG presentó diferencia global entre los grupos (H = 14,07; p = 0,007), pero ninguna comparación por pares permaneció significativa después de la corrección de Bonferroni. También se identificaron registros ausentes en variables temporales, especialmente para los marcadores bioquímicos. Los resultados indican un desempeño favorable en las etapas iniciales de atención, mientras que la calidad de los registros y la disponibilidad de datos para los exámenes complementarios constituyen prioridades para mejorar los procesos asistenciales.

Palabras clave: Protocolos clínicos; Dolor torácico; Indicadores de salud.

1. Introduction

Cardiovascular diseases remain the leading cause of morbidity and mortality in Brazil, representing a substantial portion of the demand in urgent and emergency care services. According to the Ministry of Health, acute coronary syndromes, particularly Acute Myocardial Infarction (AMI), are time-dependent events that require rapid recognition, risk stratification, and immediate initiation of clinical management

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(Brazil, 2024). In this context, the Emergency Care Network (RUE) organizes care flows that integrate Primary Care, Emergency Care Units (UPA), and hospital services, aiming to ensure timely and safe responses for patients presenting with chest pain.

Chest pain is one of the main reasons for seeking care in UPAs and represents a diagnostic challenge, as it may be associated with both cardiac and non-cardiac causes. Guidelines from the Brazilian Society of Cardiology (SBC), updated in 2021 and 2022, emphasize that an electrocardiogram (ECG) must be performed and interpreted within 10 minutes of patient arrival, constituting an essential quality indicator and a determinant of prognosis (Nicolau et al., 2021; Albuquerque Neto et al., 2023).

The use of standardized clinical protocols has become a fundamental strategy to improve care quality, reduce variability in clinical decision-making, and enhance patient safety. Chest pain protocols guide steps such as initial assessment, risk classification, ECG acquisition, monitoring, pharmacological management, and referral according to regulatory flow. Recent studies demonstrate that systematic adoption of these protocols reduces adverse events, improves diagnostic accuracy, and optimizes door-to-ECG time (Almeida et al., 2024).

Nurses play a central role in this process, particularly in risk classification, a step that requires clinical judgment, recognition of typical and atypical signs, and identification of cardiovascular risk factors. The literature indicates that continuous training, mastery of guidelines, and familiarity with protocols increase triage accuracy and contribute to early interventions, reducing complications and mortality (Segalla et al., 2023).

To monitor the effectiveness of these protocols, the Ministry of Health establishes care indicators that assess the quality of care provided to patients with chest pain, such as ECG completion time, adequacy of risk classification, initial monitoring, recording of vital signs, and adherence to regulatory flow (Brazil, 2021). Analysis of these indicators allows identification of weaknesses, guides improvements, and strengthens patient safety in urgent and emergency care units.

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Given the clinical and organizational relevance of chest pain and the need for continuous monitoring of care quality, the following research question was formulated: How do the care indicators related to the Chest Pain Protocol behave in Emergency Care Units in a municipality of the Carboniferous Region?

Based on this question, the objective of the study was defined as analyzing adherence to and performance of care indicators related to the Chest Pain Protocol in Emergency Care Units in a municipality of the Carboniferous Region, with emphasis on door-to-triage time, door-to-ECG time, door-to-medical-care time, door-to-biochemical-markers time, door-to-chest-X-ray time, door-to-other-tests time, and door-to-symptom-resolution time, as well as the clinical outcomes of the visits.

2. Methodology

This study is characterized as a quantitative, descriptive, retrospective, and documentary investigation based on medical records and conducted in the Emergency Care Units (UPAs) of a municipality in the Coal Region of Santa Catarina, Brazil. A total of 526 medical records of patients treated for chest pain with the Chest Pain Protocol activated in 2024 and 2025 were analyzed, including 287 cases in UPA A and 239 in UPA B. All medical records of patients treated in the UPAs with the protocol activated during the study period were included.

The selection of medical records followed a probabilistic sampling procedure, using the formula proposed by Barbetta (2022), considering sample size, confidence level, probability of event occurrence, complementary probability (q), and acceptable margin of error.

The variables analyzed comprised the care times established in the protocol: door-to-triage/classification, door-to-ECG, door-to-medical-care, door-to-biochemical-markers, door-to-chest-X-ray, door-to-other-tests, and door-to-symptom-resolution, in addition to the clinical outcomes of the visits. The specific biochemical marker, repetition strategy, and distinction between collection time and result availability were not sufficiently specified in the revised textual dataset and, therefore, were not inferred in this version. The door-to-chest-X-ray variable was

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maintained as a descriptive indicator, without interpretation as a universal or mandatory step for all patients with chest pain. The door-to-symptom-resolution variable was treated as a clinical temporal variable rather than an isolated indicator of operational efficiency.

Data collection was performed directly from physical and electronic medical records, following a previously structured protocol, and conducted by tenth-semester nursing students from UNESC under faculty supervision. No additional information was available regarding formal training, pilot testing, double-checking, or inter-collector agreement, and therefore such details were not added.

Data were organized in an electronic spreadsheet and subjected to descriptive statistical analysis, with absolute and relative frequencies for categorical variables and median and interquartile range (IQR) for quantitative variables. For comparison of categorical variables, Pearson's Chi-Square test and Fisher's Exact test were applied as appropriate. For comparison of quantitative variables across outcome groups, the Kruskal-Wallis test was used, followed by pairwise comparisons with Bonferroni correction. A significance level of 5% was adopted. The valid number of observations varied according to the availability of records in the medical charts; missing data were kept as missing and were not imputed. The statistical software used was not specified in the original manuscript.

The study was approved by the Research Ethics Committee of UNESC, in accordance with Resolution No. 466/2012, under opinion CAAE 96179426.7.0000.0119. The institution responsible for safeguarding the medical records ensured confidentiality and anonymity of participants through the signing of a Confidentiality Agreement by the researchers.

3. Results

A total of 526 medical records of patients treated for chest pain with an activated protocol were evaluated across two Emergency Care Units (UPA A and UPA B), with 287 visits in UPA A and 239 in UPA B.

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Table 1 presents the sociodemographic profile of the patients. A significant association was observed between age group and UPA (p = 0.017), with a higher proportion of visits among individuals aged 66–75 years in UPA A, while the predominant age group in both units was 56–65 years. Regarding biological sex, no significant association with UPA was found (p = 0.756), with males accounting for 55.1% of the visits.

Table 1. Sociodemographic profile of patients treated under the chest pain protocol (n = 526)

Variable	UPA A	UPA B	Total	p-value
Age group				0.017
16–25 years	16 (5.6%)	22 (9.2%)	38 (7.2%)	
26–35 years	27 (9.4%)	33 (13.8%)	60 (11.4%)	
36–45 years	60 (20.9%)	41 (17.2%)	101 (19.2%)	
46–55 years	48 (16.7%)	46 (19.2%)	94 (17.9%)	
56–65 years	67 (23.3%)	61 (25.5%)	128 (24.3%)	
66–75 years	52 (18.1%)	20 (8.4%)	72 (13.7%)	
76–92 years	17 (5.9%)	16 (6.7%)	33 (6.3%)	
Biological sex				0.756
Female	127 (44.3%)	109 (45.6%)	236 (44.9%)	
Male	160 (55.7%)	130 (54.4%)	290 (55.1%)	
Race/skin color				<0.001
White	151 (52.6%)	192 (80.3%)	343 (65.2%)	
Brown	78 (27.2%)	17 (7.1%)	95 (18.1%)	
Black	58 (20.2%)	30 (12.6%)	88 (16.7%)	

Source: Authors (2026)

Regarding race/color recorded in the medical charts, a significant association was observed between categories and UPA (p < 0.001). UPA B showed a higher proportion of records classified as White (80.3%), whereas UPA A had higher proportions of Brown (27.2%) and Black (20.2%) patients.

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Table 2. Comorbidities and risk factors of patients treated under the chest pain protocol (n = 526)

Variable	UPA A	UPA B	Total	p-value
Diabetes mellitus				0.143
No	218 (76.0%)	168 (70.3%)	386 (73.4%)	
Yes	69 (24.0%)	71 (29.7%)	140 (26.6%)	
Arterial hypertension				0.534
No	172 (59.9%)	136 (56.9%)	308 (58.6%)	
Yes	115 (40.1%)	103 (43.1%)	218 (41.4%)	
Smoking status				<0.001
No	207 (72.1%)	221 (92.5%)	428 (81.4%)	
Yes	80 (27.9%)	18 (7.5%)	98 (18.6%)	

Source: Authors (2026)

Table 2 summarizes the comorbidities evaluated. No significant association was found between diabetes and UPA (p = 0.143), nor between hypertension and UPA (p = 0.534). Smoking status showed a significant association (p < 0.001), with a higher proportion of smokers in UPA A (27.9%) compared to UPA B (7.5%).

Table 3. Clinical outcomes of patients treated under the chest pain protocol (n = 526)

Outcome/Effectiveness	UPA A	UPA B	Total	p-value
Outcome				<0.001
Discharge	243 (84.7%)	143 (59.8%)	386 (73.4%)	
Referred to Primary Care Unit (UBS)	1 (0.3%)	57 (23.8%)	58 (11.0%)	
Left without being seen	13 (4.5%)	4 (1.7%)	17 (3.2%)	
Death	8 (2.8%)	0 (0.0%)	8 (1.5%)	
Hospital transfer	21 (7.3%)	34 (14.2%)	55 (10.5%)	
Not reported	—	—	2 (0.4%)	—

Source: Authors (2026). *Note: The original table contained 524 classified records; two records lacked outcome information in the analyzed version and were maintained as "not reported," without UPA distribution due to unavailable data.*

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Table 3 presents the clinical outcomes. A significant association was found between outcome and UPA ($p < 0.001$). UPA A had a higher proportion of discharges (84.7%) and deaths (2.8%), whereas UPA B had higher proportions of referrals to Primary Care Units (23.8%) and hospital transfers (14.2%). The table accounts for 524 visits; two records lacked outcome classification in the original dataset and were maintained as "not reported," without UPA distribution due to unavailable information.

Table 4. Outcomes of patients in UPA A according to biological sex (n = 287)

Outcome	Female (n = 127)	Male (n = 160)	Total (n = 287)	p-value
Not recorded in medical chart	0 (0.0%)	1 (0.6%)	1 (0.3%)	0.824
Discharge	110 (86.6%)	133 (83.1%)	243 (84.7%)	
Referred to Primary Care Unit (UBS)	0 (0.0%)	1 (0.6%)	1 (0.3%)	
Left without being seen	6 (4.7%)	7 (4.4%)	13 (4.5%)	
Death	3 (2.4%)	5 (3.1%)	8 (2.8%)	
Hospital transfer	8 (6.3%)	13 (8.1%)	21 (7.3%)	

Source: Authors (2026)

Outcome analysis by biological sex was presented only for UPA A and showed no significant association ($p = 0.824$). As this analysis was not conducted uniformly across both units or for the full sample, findings by sex should be interpreted as an exploratory analysis specific to UPA A, without generalization to all visits.

Inferential analyses demonstrated significant differences between outcome groups for age ($p < 0.001$), door-to-triage time ($p < 0.001$), door-to-biochemical-markers time ($p < 0.001$), door-to-chest-X-ray time ($p = 0.007$), and door-to-symptom-resolution time ($p < 0.001$). For door-to-ECG time, a global difference was identified using the Kruskal-Wallis test ($H = 14.07$; $p = 0.007$), but no pairwise comparison remained significant after Bonferroni correction. Door-to-medical-care time showed no significant difference between groups ($H = 6.73$; $p = 0.151$).

The Kruskal-Wallis test indicated a significant difference in age ($H = 24.78$; $p < 0.001$), with patients transferred to hospital presenting a higher median age (63

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years; IQR = 53.0–71.5) compared to those discharged (51 years; IQR = 37.0–62.0), referred to Primary Care Units (52.5 years; IQR = 39.5–60.8), and those who left without being seen (53 years; IQR = 35.0–60.0).

A significant difference was also found in door-to-triage time ($H = 34.71$; $p < 0.001$). Patients discharged had a higher median time (2.5 min; IQR = 1.2–4.7) compared to those referred to Primary Care Units (1.5 min; IQR = 1.0–2.0) and those transferred to hospital (1.0 min; IQR = 0.9–2.1).

Door-to-biochemical-markers time showed a significant difference ($H = 24.60$; $p < 0.001$), although with a high proportion of missing data. Patients discharged had a lower median time (44 min; IQR = 27.2–124.4) compared to those referred to Primary Care Units (138.5 min; IQR = 104.5–166.8).

Door-to-chest-X-ray time also differed significantly between groups ($H = 14.20$; $p = 0.007$). Patients discharged had a lower median time (27.6 min; IQR = 19.1–52.2) compared to those referred to Primary Care Units (133 min; IQR = 35.7–177.0).

Door-to-symptom-resolution time showed a significant difference ($H = 22.45$; $p < 0.001$). Patients transferred to hospital had a higher median time (167 min; IQR = 86.4–273.5) compared to those discharged (83.5 min; IQR = 58.5–137.0) and those referred to Primary Care Units (115 min; IQR = 46.5–182.8).

Door-to-ECG time showed a global difference between groups ($H = 14.07$; $p = 0.007$). However, no pairwise comparison remained significant after Bonferroni correction. Therefore, this result should be described as a global difference between groups, without asserting statistical significance for any specific pair.

4. Discussion

Chest pain remains one of the main reasons for seeking care in emergency services and accounts for a substantial demand in Emergency Care Units (UPAs) and hospital services in Brazil (Oliveira et al., 2024). The literature emphasizes that among the differential diagnoses, acute coronary syndromes (ACS), including ST-segment elevation and non-ST-segment elevation Acute Myocardial Infarction

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(AMI), stand out as conditions with high morbidity and mortality that require rapid and structured management (Miranda & Rampellotti, 2019; Medeiros et al., 2018).

The findings of the present study broadly corroborate the epidemiological profile described in national research. The predominance of male patients (55.1%), aged 56–65 years, and mostly White (65.2%) is consistent with studies reporting higher prevalence of AMI among men over 60 years of age, often associated with cardiovascular risk factors (Oliveira et al., 2024; Nunes et al., 2024; Falcão et al., 2020). The higher proportion of White patients in UPA B and of Brown and Black patients in UPA A reflects local sociodemographic characteristics and population distribution patterns also observed in national surveys (Falcão et al., 2020).

Regarding comorbidities, hypertension, diabetes mellitus, and smoking were the most prevalent risk factors, aligning with what is widely described in the literature as major determinants of ACS risk (Miranda et al., 2025; Oliveira et al., 2024). The prevalence of hypertension (41.4%) and diabetes (26.6%) observed in this study is similar to that reported in national and international investigations, reinforcing the importance of controlling these conditions to prevent coronary events. Smoking, significantly more frequent in UPA A (27.9%), stands out as a major modifiable risk factor, as evidenced by recent epidemiological studies (Lodi et al., 2023).

Analysis of care times revealed differences between outcome groups for door-to-triage, door-to-biochemical-markers, door-to-chest-X-ray, and door-to-symptom-resolution. Patients who were discharged had shorter times for some examinations, whereas those referred to Primary Care Units or transferred to hospital had longer times. These findings should be interpreted with caution, as clinical severity and outcome may simultaneously influence the need for examinations, length of stay, and symptom resolution. Thus, the results demonstrate associations between temporal variables and outcomes but do not allow causal inference.

Door-to-ECG time showed a global difference according to the Kruskal-Wallis test, but no pairwise comparison remained significant after Bonferroni correction. This result is compatible with relative homogeneity among specific groups but does not, by itself, confirm compliance with the 10-minute target for all visits. Median and

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interquartile range values also do not replace the presentation of the percentage of visits meeting the target, a metric not fully available in the revised dataset.

Age differed between outcome groups, with higher median age among patients transferred to hospital (63 years; IQR = 53.0–71.5). This finding should be interpreted as an observed association within the sample, without attributing a causal or independent determinant role to age.

Door-to-symptom-resolution time was longer among transferred patients (median = 167 min) compared to discharged patients (median = 83.5 min) and those referred to Primary Care Units (median = 115 min). As this variable is influenced by clinical condition, etiology, treatment response, and need for transfer, it was interpreted as a clinical temporal variable rather than an operational efficiency indicator.

Findings related to outcomes by biological sex in UPA A showed no statistical association, although men had higher proportions of deaths and hospital transfers. This pattern is consistent with studies reporting greater severity and mortality from AMI among men, possibly due to higher prevalence of risk factors and biological differences in the pathophysiology of coronary disease (Falcão et al., 2020; Nunes et al., 2024).

The analysis does not support the assertion that UPA B experienced greater delays due to specific bottlenecks, as temporal results were not systematically presented by UPA for all indicators. Differences in outcome distribution between units may be related to unmeasured clinical or structural characteristics. Therefore, caution is recommended when directly comparing units or attributing causes to observed time differences.

Overall, the results demonstrate associations between age, care times, and outcomes but do not allow the conclusion that age, comorbidities, or prolonged times are independent determinants of outcomes, as no multivariable analysis was performed and there was no control for clinical severity, risk classification, or other potential confounding variables. Interpretation should remain restricted to the associations observed in the analyzed medical records.

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5. Study Limitations

The main limitations of this study relate to the quality and completeness of the clinical records. There were missing temporal data across different stages of care, particularly for biochemical markers, which made it impossible to calculate essential indicators such as the percentage of ECGs performed within 10 minutes and the compliance rates for other time-based measures. It was also not possible to operationalize a reproducible measure of effectiveness, which led to the removal of the previously reported value of 41.4% from the final interpretation.

The study did not include multivariable analyses or a detailed structural characterization of the two emergency units, limiting the understanding of organizational factors that may influence care times. The retrospective design based on medical records prevents inferences regarding causality, clinical safety, post-discharge adverse events, readmissions, or missed ischemic diagnoses. Additionally, sampling parameters were not fully described in the original manuscript, and the exploratory sex-based analysis was restricted to one of the units.

Future research should improve standardized recording of care times, digitize temporal fields, enhance the quality of medical record documentation, and explicitly report the number of valid and missing observations for each variable. Subsequent studies may evaluate adjusted associations based on risk classification and clinical severity when such data become available.

6. Conclusion

This study described the behavior of key care indicators related to the management of chest pain in two Emergency Care Units. Favorable performance was observed in the initial stages of care, particularly in triage times and in the overall behavior of door-to-ECG times across outcome groups. Differences were identified in door-to-triage, door-to-biochemical markers, door-to-chest X-ray, and door-to-symptom resolution times.

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Although the protocol demonstrates consistent organization in the early phases of care, the available data do not allow conclusions regarding clinical safety, the reliable exclusion of ischemic events, or efficiency based on discharge rates. The findings highlight the need to improve care processes, enhance record quality, and advance the evaluation of indicators capable of measuring effectiveness and safety in chest pain management.

7. Declaration of Use of Artificial Intelligence

The authors declare that they used generative artificial intelligence tools (such as ChatGPT and NotebookLM) exclusively to support structural organization and linguistic refinement of the manuscript. All scientific content, including data analysis, interpretation, and conclusions, was fully reviewed, validated, and approved by the authors, who assume full responsibility for the material presented.

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