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Original article

Clinical characteristics and care times in a chest pain unit of the emergency department of an Argentine center

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The authors declare no conflict of interest.

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ABSTRACT

Objective. To report the frequency of chest pain, describe clinical characteristics, and care times. **Materials and methods.** Retrospective descriptive study that included consultations in the Chest Pain Unit in 2021 in the emergency department of a private hospital in Argentina. **Results.** There were 1469 admissions for chest pain, yielding a frequency of 1.09% (95% confidence interval[CI]: 1.04-1.15). They were 52% men, mean age 62 years (standard deviation [SD] ± 15); 48% had hypertension and 32% dyslipidemia. The median time to initial ECG was 4.3 min (interquartile range [IQR]: 2.5-7.5); and 26 min (IQR: 14-46) to medical evaluation. A total of 206 (14%) were hospitalized with a median of 3 days, 76% were admitted to a closed unit, 9% required non-invasive ventilation/mechanical ventilation and in-hospital mortality was 2.9%. Those hospitalized presented shorter delay time to medical attention (p<0.01), and greater performance of complementary studies (p<0.01), with no differences in time to ECG (p=0.22). **Conclusions.** Care times were within the stipulated standards, being an important indicator of quality. Nursing was crucial, taking care of the correct triage, ECG on admission, and guaranteeing care until medical evaluation.

Keywords: Emergencies, Hospital; Nursing Care; Patient Care Management; Chest Pain; Cardiology (source: MeSH-NLM).

Introduction

Cardiovascular mortality continues to be the most common cause of loss of lives worldwide, where acute coronary syndrome (ACS) is one of the underlying causes, encompassing unstable angina and/or ACS with or without ST segment elevation [(1)]. All these conditions, whose most common clinical presentation is chest pain, still constitute a frequent reason for consultation in emergency settings [(2)]. ACS is associated with high mortality without appropriate treatment [(3)]; therefore, correct diagnosis depends on adequate evaluation upon admission.

Due to the increasing volume of unscheduled consultations and the limited capacity of the healthcare system to respond [(4)], operational strategies and care protocols based on triage systems have been implemented. Among them, allowing trained nursing staff to initiate the patient categorization process seems to be a promising strategy [(5)]. In this context, the Chest Pain Unit (CPU) was created in 2014, which is a structured circuit for the care of this subgroup of patients. This led to streamlining the flow, ensuring timely attention, and facilitating consultation (and/or early evaluation with cardiology specialists), based on the potential severity of this condition. Nursing staff plays a crucial role in this care process, since they identify critical conditions in a timely manner and prioritize their care over those that can wait, in order to provide necessary care in the right place, at the right time, and with appropriate resources, in an efficient manner [6]. To assume this role, they receive continuous educational training in triage and must recertify every 2 years as a professional requirement.

Once the patient is assigned to the CPU, an analog-digital electrocardiogram (ECG) is immediately performed [7]. The ECG results are then stored in the electronic medical record (EHR), allowing remote care by a cardiology specialist (who may physically be in the coronary care unit but can still provide reading and interpretation) [8]. Subsequently, the diagnostic process continues through the clinical judgment of the treating physicians (usually generalists or clinicians), who rely on basic tools (such as medical history and physical examination), which are crucial in facing this diagnostic challenge [9].

There are two crucial times for the CPU: the time to perform the first ECG and the time of delay in medical attention [10]. Therefore, the main objective of this study was to report the frequency of chest pain in an emergency service, describe the clinical characteristics of these patients, and report the time of care, as a proxy for the quality and safety of healthcare. As a secondary objective, we explored the factors associated with hospitalization.

Materials and Methods

Design and study population

Retrospective descriptive study that included all unscheduled consultations that occurred during the year 2021 at the Adult Emergency Center of the Italian Hospital of Buenos Aires, a high-complexity center located in the Autonomous City of Buenos Aires (Argentina). This center operates 24 hours a day, 365 days a year, and typically attends to an average of 350 daily consultations. It is divided into four areas for patient care, categorized based on the complexity of the patient, which is defined by their condition upon admission: Critical Care (Area A), Intermediate Care (Area B), Consultations of moderate complexity (Area C), and Spontaneous Demand Consultations or low-complexity consultations (Area D). Areas C and D correspond to patients with lower complexity, often presenting with common primary care issues, and represent the highest patient flow. On the contrary, Areas A and B have lower patient volume but involve more critical conditions.

Variables

The variables of interest were provided using high-quality secondary sources from EHR. Data collection was retrospective, identifying patients who were assigned to the UDT as their initial area of admission, as previously mentioned. This assignment was determined by the triage personnel, who were trained nurses. The collected administrative variables included: arrival date and time at the emergency service, date and time of medical attention - which allowed for the calculation of delay/waiting time -; date and time of episode closure - which enabled the calculation of the patient's overall emergency department stay time - and discharge condition (discharged to home, deceased, or hospitalized). Patient-related variables of interest encompassed: age, gender, cardiovascular history and comorbidities, ECG with date and time - used to calculate the time to completion-, as well as other complementary studies requested and/or treatments initiated in the emergency department.

In the subgroup of patients who were hospitalized, additional clinical outcome variables were recorded, such as the first area of admission (closed unit yes/no), transfer to a closed unit at any point, need for non-invasive ventilation (NIV) or mechanical ventilatory support (MV), length of stay, and in-hospital mortality.

Statistical analysis

Descriptive analysis was used, numerical variables was expressed as mean and standard deviation or median and interquartile range (IQR), while categorical variables were expressed as relative numbers and percentages, along with their respective 95% confidence intervals (95% CI). Comparative analysis was conducted to explore factors associated with hospitalization. For dichotomous variables, the chi-square or Fisher's exact test was used, and for numerical variables (following an assessment of normality), the T-test or Wilcoxon rank-sum test was used. Statistical significance was considered at $p<0.05$. The STATA software version 18 was used.

Ethical aspects

This project was developed in compliance with ethical principles aligned with national and international regulations for research involving human health. The protocol was approved by the institutional Ethics Committee (CEPI#6412). Since this was an observational and retrospective study, informed consent from participants was not required.

Results

During the study period, a total of 133,607 consultations occurred, of which only 1,469 were attributed to admissions in the UDT, yielding a global prevalence of 1.09% (95% CI: 1.04-1.15). **Figure 1** shows the stability of chest pain cases when stratified by month, with an average of 122 per month, with the lowest value in December (0.78%; 95% CI: 0.64-0.93) and the highest value in November (1.52%; 95% CI: 1.31-1.74).

As shown in **Table 1,** the UDT patients had a mean age of 62 years, and 52% were male. The most common preexisting cardiovascular comorbidities were hypertension (48%) and dyslipidemia (32%).

The median time to perform the ECG was 4.33 minutes (IQR: 2.48-7.5), while the median delay time in medical attention was 25.98 minutes (IQR: 13.7-45.6). Only 206 individuals concluded this unscheduled consultation with hospitalization (14%), and there was only one case of in-urgent-death (who passed away without being hospitalized). The patient was a 41-year-old man who was admitted for chest pain and was found to have ST-segment elevation in the high lateral wall (D1 and aVL) and reciprocal changes in the inferior leads (D2, D3, aVF). He experienced worsening chest pain, ventricular fibrillation, and cardiac arrest.

As shown in **Figure 2**, when stratifying patients based on their discharge condition in the medical records, according to hospitalization, there were no significant differences in the time to first ECG (median 3.8 vs. 4.4 min, respectively; p=0.216), but differences were observed in the delay in medical attention (median 18 vs. 27 minutes; p=0.001).

Regarding the performance of complementary tests, differences were noted in the frequency of use of laboratory tests, chest x-ray, and echocardiograms. However, the frequency of recording the initial ECG was similar. As for laboratory results, hospitalized patients exhibited higher levels of troponin, creatinine, and B-type natriuretic peptide (BNP), as shown in **Table 2.**

Out of the 206 hospitalized patients, the majority (76.70%) were admitted to a closed unit as their initial admission area (defined as coronary care unit, intermediate care unit, and/or intensive care unit) and remained for a median of 3 days (IQR: 2-5). However, among the remaining 48 patients who were initially admitted to a general ward, 62.5% experienced an occurrence that required transfer to a closed unit. When it comes to clinical outcomes, 19 patients (9.22%) required non-invasive ventilation and/or mechanical ventilatory support, and the in-hospital mortality rate was 2.91%.

Discussion

Chest pain accounted for 1% of all unscheduled consultations throughout the year 2021, and key time intervals within the care process were within the standards established by clinical practice guidelines. Our findings (median of 4 minutes for the first ECG and a delay of 26 minutes for medical evaluation) are consistent with previous studies that indicate assistance time for ACS ranges between 20-30 minutes [11], with the first ECG typically taking around 20-25 minutes [12,13], although these two studies reported means.

All our findings underscore that the presence of a triage system and differential nursing care ensures early attention and should be regarded as a relevant quality indicator for risk-efficiency relationship, which aligns well with the existing literature [14,15]. These professionals have demonstrated a crucial role in critical patient care in the emergency setting, particularly in the UDT, not only because of their high capacity to perform the correct triage (categorization that facilitates providing the necessary care, in the right place, at the right time, with appropriate resources, and in an efficient manner), but also due to their role in conducting and assessing the early admission ECG and ensuring initial care until medical evaluation occurs.

The delay time to medical attention was shorter in hospitalized patients compared to non-hospitalized patients, which likely suggests that patients with a higher probability of coronary disease are attended to more rapidly, especially when initial ECG results are normal and there is the possibility of reviewing reliable cardiovascular risk data pre-test through the EHR. As a result, there is likely a sub-stratification of priority levels for care following the ECG. Consistently, the presence of comorbidities was associated with a higher likelihood of hospitalization, possibly due to more severe cases. ACS is recognized as a time-dependent condition; therefore, a suspected case should be evaluated and treated promptly. These findings suggest a very early risk reevaluation conducted by cardiology specialists, possibly accompanied by cardiac enzyme testing, which was carried out in nearly a quarter of the subjects (22% had multiple troponin measurements).

It is worth mentioning that, more than in any other area of the hospital, the concepts of workflow and maintaining efficiency are crucial for the success of practicing medicine in the emergency setting; there is a certain discrepancy between the medical action and its documentation in the EHR [16]. Consequently, it continues to happen that patients are initially attended to, and then documentation is completed belatedly. A similar situation might occur with cardiology follow-up (only recorded in 25% of cases), with a median time of 2 hours from patient admission.

The frequency of 1% for chest pain consultations was low compared to other epidemiological studies that use a similar triage system, such as in the United States (5%) [17] or Norway (11%) [18]. This might be attributed to the study's time frame, which could still be influenced by the COVID-19 pandemic, coinciding with the second wave (June 2021) and third wave (December 2021), leading to a prevalence of other related reasons for consultation such as fever (5.1%), odynophagia (4.7%), and abdominal pain (2.6%) [19].

Despite the existence of diagnostic protocols to stratify the risk of these patients, (even validated) which have become central components of current practice guidelines [20], the fear of overlooking ACS remains a strong motivator for physicians to conduct additional diagnostic tests on their patients in

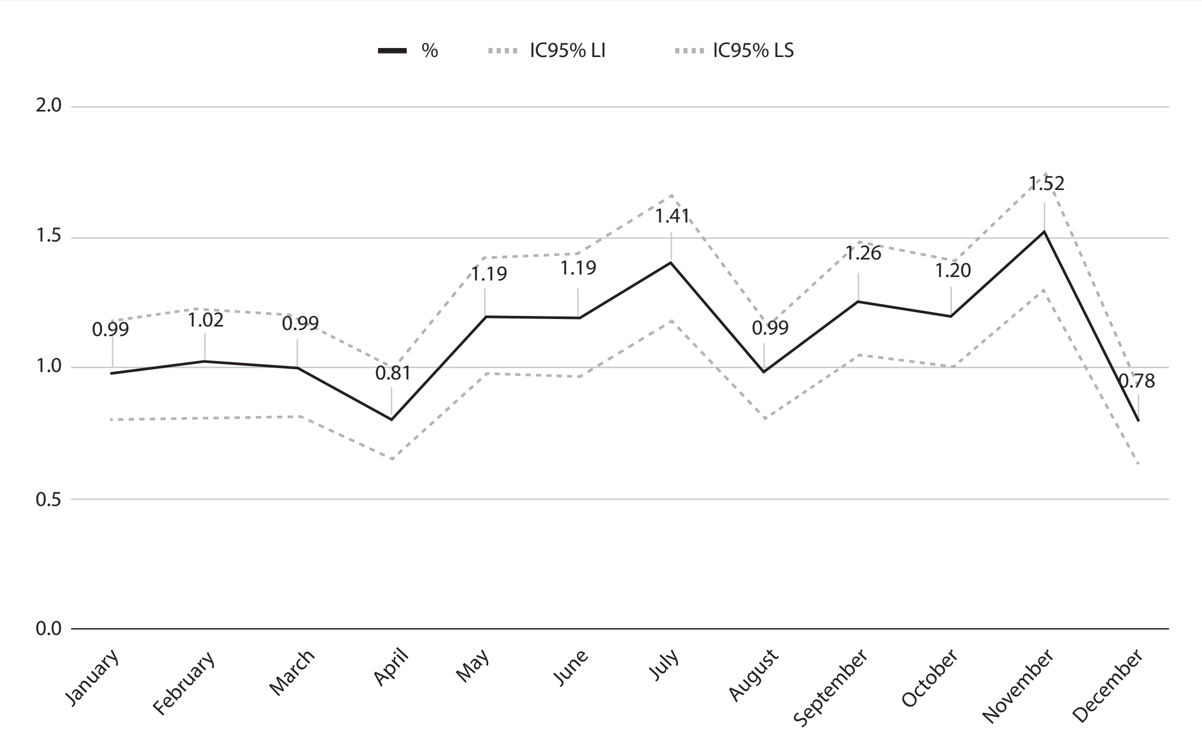
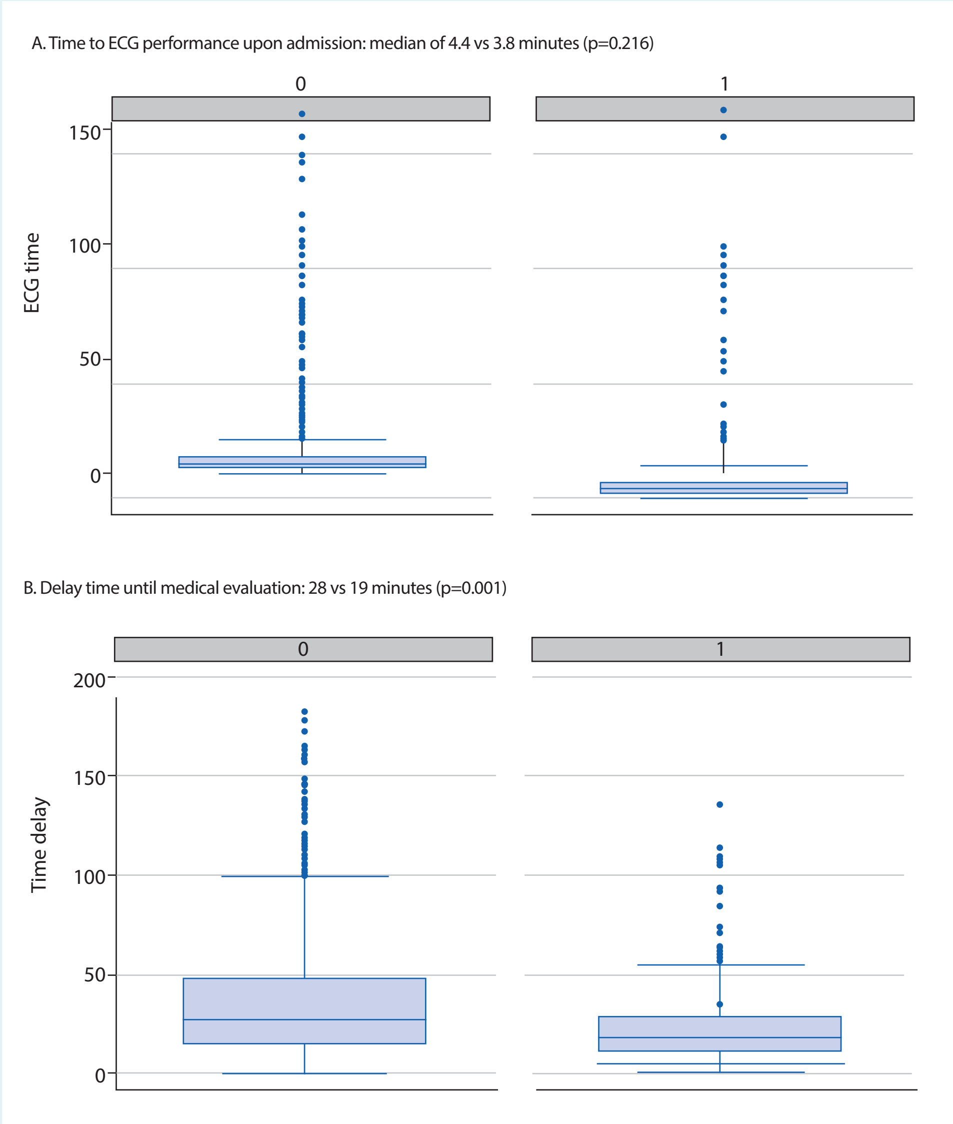


Figure 1. Frequency of Chest Pain Unit consultations in the emergency department, during the year 2021, stratified by month.

Table 1. Clinical and demographic characteristics of patients in the Chest Pain Unit during 2021

Characteristics	n: 1469	Hospitalized (n: 206)	Non-hospitalized (n: 1263)	p-value
Sociodemographic				
Age, in years *	62.92 (15.91)	69.61 (13.25)	61.83 (16.04)	0.001
Male gender	52.69% (774)	64.56% (133)	50.75% (641)	0.001
Cardiovascular history				
Hypertension	48.40% (711)	61.17% (126)	46.32% (585)	0.001
Dyslipemia	31.99% (470)	39.81% (82)	30.72% (388)	0.010
Overweight	19.54% (287)	19.90% (41)	19.48% (246)	0.886
Smoking	19.06% (280)	22.33% (46)	18.53% (234)	0.198
Diabetes	11.57% (170)	17.48% (36)	10.61% (134)	0.004
Chronic kidney disease	3.68% (54)	6.31% (13)	3.25% (41)	0.030
Sedentary lifestyle	1.09% (16)	1.94% (4)	0.95% (12)	0.204
Hospitalization in a coronary care unit during the previous year	9.66% (142)	12.14% (25)	9.26% (117)	0.196
Attention times				
Time to electrocardiogram (from arrival to its performance), in minutes **	4.33 (2.48-7.5)	3.8 (2.2-7.1)	4.4 (2.5-7.6)	0.216
Delay/waiting time (from arrival to being seen by a doctor), in minutes **	25.98 (13.71-45.63)	18.18 (11.4-29.5)	27.19 (14.86-48.75)	0.001
Medical attention time (from being seen by a doctor until closure of the emergency episode), in minutes **	135.38 (63.51-234.78)	100.7 (39.2-170.1)	138.9 (72.6-245.1)	0.001
Patient's total time (from arrival to closure of the emergency episode), in hours **	2.81 (1.66-4.48)	2.1 (0.9-3.3)	2.9 (1.8-4.7)	0.001
Cardiology follow-up time (from arrival to medical evaluation by a specialist), in minutes **	137.1 (63.9-206.9)	74.6 (25.2-155.4)	148.6 (90.5-229.1)	0.001

*Mean (standard deviation)
**Median (25th percentile - 75th percentile)



ECG: electrocardiogram, 1: Hospitalized, 0: Non-hospitalized.

Figure 2. Attention times, stratified by hospitalization.

emergency departments [21]. Inevitably, the results demonstrate that laboratory tests, chest x-ray, and echocardiograms were more frequently performed on patients who were subsequently hospitalized. This could be interpreted as an information bias related to more severe cases; that is, the higher baseline cardiovascular risk of these individuals. In line with this, the factors associated with hospitalization (age, male gender, and preexisting cardiovascular conditions) were consistent with those described in the literature [22]. Healthcare professionals may feel the pressure of opposing forces between clinical reality and the need to publish successful key performance indicators in an environment of increasing demands and cost containment [23].

Some limitations should be mentioned. Firstly, this is a single-center study, which may affect external validity. Secondly, it is a retrospective analysis, and it was not feasible to collect additional variables of interest due to the nature of data capture in the study. Thirdly, since patients often present with multiple issues or reasons for consultation, the data collection method (restricted to patients admitted to the UDT) might be controversial. In other words, other patients with chest pain or coronary-related issues could have been excluded due to misclassification during triage (false negatives: initially assigned to other areas, but later reclassified to UDT). On the other hand, as a strength, we have not found previous studies that have described this topic in a local or regional emergency department, making these data highly relevant for management. Another positive aspect was the consecutive sampling of all consultations, which avoids selection bias related to sampling.

Table 2. Laboratory characteristics and treatment of patients in the Chest Pain Unit during 2021.

Characteristics	n: 1469	Hospitalized (n: 206)	Non-hospitalized (n: 1263)	p-value
Complementary tests and treatment in the emergency department				
Electrocardiogram	91.15% (1339)	92.72% (191)	90.89% (1148)	0.393
Laboratory	70.80% (1040)	95.63% (197)	66.75% (843)	0.001
Troponin	59.29% (871)			
Chest X-ray	29.34% (431)	49.51% (102)	26.05% (329)	0.001
Echocardiogram	7.69% (113)	18.93% (39)	5.86% (74)	0.001
Cardiology Follow-up	25.32% (372)	43.69% (90)	22.33% (282)	0.001
Aspirin	5.03% (74)	33.01% (68)	0.48% (6)	0.001
Beta-blockers	2.04% (30)	3.88% (8)	1.74% (22)	0.044
Inotropic drugs	0.34% (5)	1.94% (4)	0.08% (1)	0.001
Nitrates/Nitrites	4.69% (69)	25.24% (52)	1.35% (17)	0.001
Hospitalization	14.02% (206)	N/A	N/A	N/A
Laboratory results				
Hct, frequency (%)	67.32% (989)	95.14% (196)	62.78% (793)	0.001
Hct, value **		41.35 (37.1-44.0)	39.8 (37.2-42.3)	0.002
CPK, %	22.12% (325)	37.86% (78)	19.55% (247)	0.001
CPK, U/mL**		88.50 (63-140)	83.00 (60-123)	0.095
Troponin, frecuency (%)	59.29% (871)	86.40% (178)	54.86% (693)	0.001
TnT, number of measurements		1 (1-1)	1 (1-1)	0.712
> 1 TnT measurement	21.69% (189/871)	23.03% (41/178)	21.35% (148/693)	0.628
TnT, first value in pg/mL **		19.7 (9.6-66.2)	8.1 (5.5-12.4)	0.001
Creatininemia, frecuency (%)	66.71% (980)	93.68% (193)	62.31% (787)	0.001
Creatininemia, value in mg/dL **		0.93 (0.78-1.13)	0.88 (0.73-1.04)	0.002
BNP, frecuency (%)	8.30% (122)	27.18% (56)	5.22% (66)	0.001
BNP, value in pg/mL**		994.8 (181.8-3344.5)	415.3 (123.8-1690)	0.044

Hct: Hematocrit, CPK: Creatine Phosphokinase, TnT: Troponin T, BNP: Brain Natriuretic Peptide
*Mean (standard deviation)
**Median (25th percentile - 75th percentile)

In conclusion, the majority of patients with chest pain receive early attention. The assessment of the potential severity of this condition involves clinical judgment and basic tools (electrocardiogram, cardiovascular history, and physical examination). The role of nursing in this process is paramount, as they are not only responsible for accurate triage in the UDT, but also for performing the initial ECG and providing initial patient care. Most patients undergo laboratory testing (70%) and cardiac marker assessment with troponin (60%). However, only a few were hospitalized (14%), probably those with higher risk. Future studies will be necessary to explore the characteristics of patients who were admitted without troponin measurement (probably the most severe cases), the associated healthcare costs (e.g., troponin curve, mortality), and/or the clinical outcomes of hospitalized patients after discharge [24].

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Author contributions

MFGR: Conceptualization, Data Curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing - Original Draft, and Writing - Review & Editing. IMB: Conceptualization, Data Curation, Validation, Visualization, Writing - Original Draft, and Writing - Review & Editing. ASP: Conceptualization, Validation, Visualization, Writing - Original Draft, and Writing - Review & Editing. BM: Conceptualization, Data Curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualization, Writing - Original Draft, and Writing - Review & Editing. FC: Visualization, Writing - Original Draft, and Writing - Review & Editing. MEZ: Visualization, Writing - Original Draft, and Writing - Review & Editing.

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