Original Article

# Decompensated Heart Failure in the Emergency Department of a Cardiology Hospital

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## Summary

**Background:** **National studies on decompensated heart failure (DHF) are key to the understanding of this condition in our midst.**

**Objective:** **To determine the characteristics of DHF patients in an emergency department.**

**Methods:** **A total of 212 patients diagnosed with decompensated heart failure who had been admitted to an emergency department (EU) of a cardiology hospital were prospectively evaluated. Clinical variables, form of presentation and causes of decompensation were studied. In 100 patients, ancillary tests, prescription of vasoactive drugs, length of hospital stay and mortality were also analyzed.**

**Results:** **There was a predominance of the male gender (56%) and the most frequent etiology was ischemia (29.7%) despite high frequency of valvular (15%) and chagasic (14.7%) etiologies. The most common form of presentation and cause of decompensation were congestion (80.7%) and poor compliance/inadequate medication (43.4%), respectively. In the subanalysis of the 100 patients, systolic dysfunction was the most common cause of decompensation (55%); use of vasoactive drugs occurred in 20%, and mortality was 10%. The comparative analysis between the patients who were discharged and those who died during hospitalization confirmed some criteria of poor prognosis: reduced systolic blood pressure, low cardiac output associated with congestion, need for vasoactive drugs, reduced left ventricular ejection fraction, increased left ventricular diastolic diameter (LVDD) and hyponatremia.**

**Conclusion:** **This study presents information about the profile of decompensated heart failure patients attended on the emergency unit of a brazilian southeast cardiology hospital. Clinical, hemodynamical and ancillary data may provide information for risk assessment in the initial evaluation helping the decision on hospitalization and advanced strategic therapies. (Arq Bras Cardiol 2008; 90(6): 400-406)**

**Key words:** **Decompensated heart failure; emergency unit.**

## Introduction

Heart failure (HF) is currently a public health problem and accounts for a significant number of hospital admissions as well as for high mortality. Decompensated HF (DHF) is a frequent presentation of HF and results in a large number of hospital admissions. North-American data show approximately one million hospital admissions for DHF per year, making it the first cause of hospitalization in the age range above 65 years[1]. In Brazil, DHF is also a common cause of hospital admissions[2].

Because of its epidemiologic and public health importance, much information has been published on DHF in the past years, including the ADHERE (North American)[3] and the EHFS (European)[4,5] reports, in addition to treatment guidelines (including Latin American guidelines)[6]. National[7-11] and Latin-American[12] data on DHF are scarce.

The objective of this study was to determine the characteristics of DHF patients seen in the EU of a cardiology hospital, including form of presentation, etiology, cause of decompensation, clinical and echocardiographic findings, comorbidities, need for vasoactive drugs, length of hospital stay and in-hospital mortality.

## Methods

### Study population

Data from 212 patients consecutively admitted in the ED of *Instituto do Coração (InCor) do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo*

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*(HCFMUSP)* with the diagnosis of DHF were prospectively collected in a period of 150 days.

In an initial analysis, we sought to define clinical variables including gender, age, blood pressure, heart rate, etiology, form of presentation, and causes of decompensation. Next, 100 out of the 212 patients initially assessed and who had an available medical chart (related to the hospital admission period) were retrospectively selected. In addition to the clinical data previously mentioned, the presence of comorbidities, ancillary tests (hemoglobin, renal function, electrolytes and echocardiogram), need for vasoactive drugs, length of hospital stay and mortality were also investigated.

### Criteria

Criteria for the definition of etiology, form of presentation and causes of decompensation were established.

Criteria from the World Health Organization (WHO)[13] were used with adaptations to define the etiologies, which were divided into: ischemic, hypertensive, chagasic, valvular, idiopathic, undefined, and other. For a patient to be classified as having DHF of ischemic etiology, the criteria adopted were history of acute or chronic coronary artery disease and/or coronary angiography showing obstructive lesions consistent with this diagnosis; for hypertensive etiology: history of systemic hypertension (SH) or pressure levels above 140 x 90 mmHg at admission, provided that other possible etiologies had been ruled out; chagasic etiology: positive epidemiological history confirmed by serologic tests; valvular etiology: history of heart valve disease consistent with the findings of heart failure; idiopathic etiology: absence of data consistent with any other etiology; undefined etiology: lack of enough data to define a specific etiology.

The forms of presentation were divided into six: 1) congestion, 2) congestion associated with SH, 3) low cardiac output, 4) low cardiac output associated with congestion, 5) undefined, and 6) other. Criteria for congestion included the presence of two or more of the following signs and symptoms: orthopnea, paroxysmal nocturnal dyspnea, pulmonary rales, elevated jugular venous pressure, presence of hepatojugular reflux, ascites, lower limb edema; congestion associated with SH: signs or symptoms of congestion and pressure levels greater than or equal to 140 x 90 mmHg; low cardiac output was defined by the presence of one of the following signs and symptoms: slowed capillary filling time, sensory alterations, dizziness or diaphoresis associated with systolic blood pressure below 90 mmHg; low cardiac output associated with congestion: signs and symptoms consistent with both low cardiac output and congestion.

The causes of decompensation were divided into eight: 1) poor compliance/inadequate medication, 2) poor compliance/inadequate medication associated with SH, 3) disease progression, 4) ischemia, 5) infection, 6) arrhythmia, 7) undefined, and 8) other. The definition of poor compliance/inadequate medication required the presence of one or more of the following criteria: non-compliance in relation to salt and water restriction or the medication prescribed, inadequate use of the medication prescribed (inadequate dose or administration), use of substances or medications that could potentially lead to decompensation; poor compliance/inadequate medication associated with SH: criteria of poor compliance/inadequate medication previously mentioned associated with blood pressure greater than or equal to 140 x 90 mmHg; progression: exclusion of other causes of decompensation; ischemia: anginal chest pain and/or electrocardiographic changes and/or enzyme curve consistent with this diagnosis; infection: presence of infection in any site associated with HF decompensation; arrhythmia: presence of bradyarrhythmia or tachyarrhythmia associated with HF decompensation.

### Statistical analysis

Continuous variables were expressed as mean and standard deviation and compared using the Student's t test. The chi-square test was used to compare categorical variables (expressed as percentages). Data were considered statistically significant when $p < 0.05$. Logistic regression multivariate analysis was performed so as to independently establish the variables related to in-hospital mortality.

## Results

Data regarding the profile of the patients seen in the emergency department with DHF are shown in Table 1 and in Graphs 1, 2 and 3.

After a retrospective analysis of the available medical charts related to the hospital admission period, more details could be obtained, and are shown in Table 2.

The comparison between genders demonstrated that men predominated in the sample (56%) and that the ischemic etiology (Graph 4) and systolic dysfunction (65.3%) were more frequent among them. The hypertensive etiology predominated among females (Graph 5) and systolic dysfunction was also more frequent, though to a lesser extent than in the male gender (52.6%) (Table 2).

In the comparison between the patients who died and those who were discharged (Table 3), no statistically significant difference was found as regards gender, age, heart rate (HR), diastolic blood pressure (BP), etiology and cause of decompensation. Patients who died presented lower systolic BP (101.43 ± 26.09 x 131.41 ± 44.72). The finding of low cardiac output associated with congestion and need for vasoactive drugs (VAD), regardless of the drug, was statistically significant in relation to mortality. Other data with statistical significance in relation to mortality included lower left ventricular ejection fraction (LVEF) (30.1 ± 8.2% *vs* 47.3 ± 17.2%), higher left ventricular diastolic diameter (LVDD) (7.56 ± 1,1 cm *vs* 6.4 ± 1.2 cm), lower serum sodium level (133.7 ± 7 mg/dl *vs* 137.2 ± 4.5 mg/dl) and longer length of hospital stay (32.3 ± 23 days *vs* 5.58 ± 7 days).

The logistic regression multivariate analysis showed that the independent variables related to in-hospital mortality were the use of dobutamine and dopamine ($p = 0.02$ – Odds Ratio 41, ranging from 7-226).

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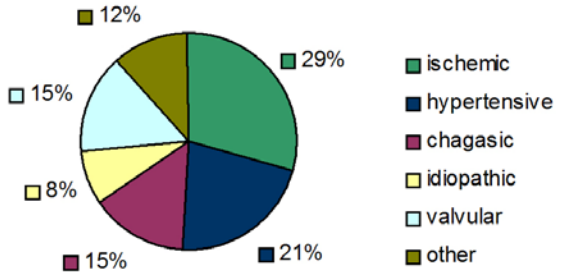
**Table 1 - Profile of the patients admitted to the emergency department with the diagnosis of decompensated HF (n = 212)**

| | |
|---|---|
| **Age** | 59.89 ± 16.67 |
| **Male gender** | 118 (56%) |
| **Systolic blood pressure** | 128.75 ± 48.09 mmHg |
| **Diastolic blood pressure** | 80.58 ± 26.72 mmHg |
| **Heart rate** | 97 ± 21 bpm |
| **Etiology** | |
| Ischemic | 63 (29.7%) |
| Hypertensive | 44 (20.8%) |
| Valvular | 32 (15%) |
| Chagasic | 31 (14.7%) |
| Idiopathic | 17 (8%) |
| Other | 25 (11.8%) |
| **Clinical Presentation** | |
| Congestion | 92 (43.4%) |
| Congestion + SH | 58 (27.4%) |
| Low cardiac output + congestion | 21 (9.9%) |
| Low cardiac output | 11 (5.2%) |
| Undefined | 17 (6.1%) |
| Other | 13 (8%) |
| **Causes of decompensation** | |
| Poor compliance / inappropriate medication | 50 (23.6%) |
| Poor compliance / inappropriate medication + SH | 42 (19.8%) |
| Progression of the disease | 46 (21.7%) |
| Ischemia | 18 (8.5%) |
| Infection | 17 (8%) |
| Arrhythmia | 18 (8.5%) |
| Undefined | 7 (3.3%) |
| Other | 14 (6.6%) |

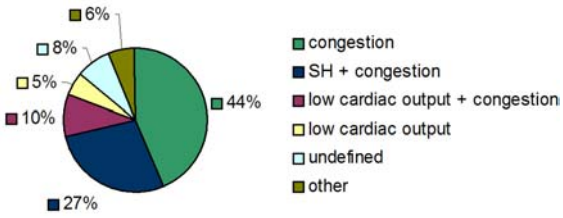
*SH - systemic hypertension.*

## Discussion

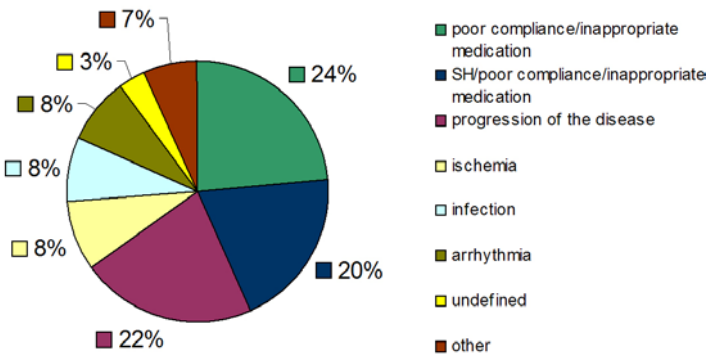
The mean age of the study population (60 years) is lower than that found in available international data[3-5] (mean of approximately 71 years), but consistent with a national study that evaluated hospitalized patients diagnosed with HF[8] (mean of 52 years). The reason may be associated with the lower overall life expectancy of the Brazilian population[2] (due to public health care conditions, difficulty of access to health care, and quality of treatment), a possible lower prevalence of ischemic cardiomyopathy, and the significant number of patients with cardiomyopathy of valvular and chagasic etiology who tend to present HF at younger ages[8]. Another national




*Graphic 1 - Distribution according to etiology (212 patients).*




*Graphic 2 - Distribution according to clinical presentation (212 patients).*




*Graphic 3 - Distribution according to cause of decompensation (212 patients).*

study compared the populations treated in tertiary care hospitals in southern Brazil with those in the United States, and found that the national population had a higher age range (73 years) than the North-American population (67 years); however, only one patient in the national population (a total of 143 patients) presented Chagas disease[9]. The EPICA-Niterói[7] study compared the management of DHF in public and private health services and demonstrated that the age range was lower in public health services (61 vs. 72 years). Another study conducted in a private cardiology hospital in Rio de Janeiro showed a higher mean age[10] (above 70 years).

**Table 2 - Population profile. Analysis of the medical charts available (n = 100)**

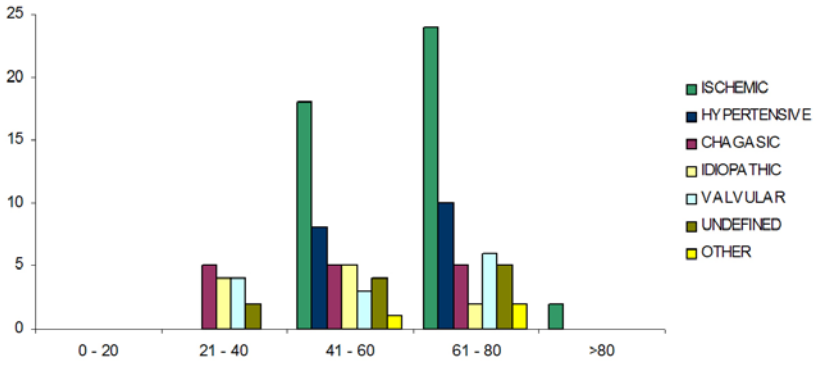
| | |
|---|---|
| **Age** | 58.75 ± 16.9 |
| **Male gender** | 56% |
| **Systolic blood pressure** | 128.58 ± 44.07 mmHg |
| **Diastolic blood pressure** | 78.65 ± 27.11 mmHg |
| **Heart rate** | 94 ± 22 bpm |
| **Diabetes** | 27% |
| **SH** | 48% |
| **Smoking** | 21% |
| **Vasoactive drug** | 20% |
| **LVEF** | 45.62 ± 17.3% |
| LVEF < 45% | 55% |
| Male gender LVEF < 45% | 65.3% |
| Female gender LVEF < 45% | 52.63% |
| **LVDD** | 6.5 ± 1.2 cm |
| **HB** | 13.28 ± 2.44 g/dl |
| HB < 12 | 27% |
| **Sodium** | 136.8 ± 4.9 mg/dl |
| Sodium < 135 | 27% |
| **Urea** | 74.8 ± 51.2 mg/dl |
| Urea > 50 | 61% |
| **Creatinine** | 1.63 ± 1.1 mg/dl |
| Creatinine > 1.5 | 31% |
| **Length of hospital stay** | 8.45 ± 12.9 days |
| **In-hospital mortality** | 10% |

*SH - systemic hypertension; LVEF - left ventricular ejection fraction; LVDD - left ventricular diastolic diameter; HB - hemoglobin.*

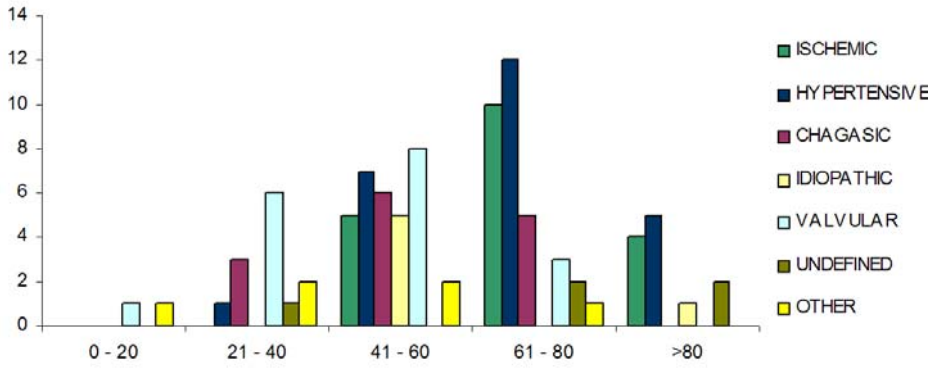
The mean systolic blood pressure was also lower (128.75 mmHg) when compared with the findings of the North American ADHERE study[3] (144 mmHg) and the European EHFS[4,5] study (mean of approximately 134 mmHg). This may be related to the fact that our study population was more severely ill and was selected from a cardiology referral hospital; also, it may have taken too long for patients to seek medical care.

Although the ischemic etiology was the most frequent (29.7%), these figures are lower when compared to international data[3-5] (above 50%). This difference is probably related to the higher frequency of the chagasic, rheumatic and hypertensive etiologies in our midst. Argentinean studies[14] also showed lower frequencies of ischemic cardiomyopathy and suggested that this diagnosis was underestimated due to the less frequent indication of invasive investigation of the etiology of HF using coronary angiography, which is possibly related to socioeconomic issues and access to the test.

Based on national and international data, congestion is significantly the most common presentation of decompensated HF[5,10,15]. Our findings confirmed this observation and also demonstrated a strong association of SH with congestion, which is consistent with a recent national study[10]. Poor compliance/inadequate medication was the most common cause of decompensation. In a previous national study[11], this finding could be associated with possible socioeconomic limitations in our country, including a low cultural level and limited access to treatment (such as medical care, multidisciplinary team and medications). However, international data also show low compliance as a common cause of HF decompensation[5]. Since it is a chronic disease with high morbidity and mortality that leads to a significant number of hospitalizations, treatment follow-up (water and salt restriction and appropriate use of medications that improve symptoms and survival) is key to achieve better results. In this context, studies conducted in HF clinics[16,17] (health units specialized in the treatment of HF




*Graphic 4 - Distribution according to etiology and age range - male gender.*




*Graphic 5 - Distribution according to etiology and age range - female gender.*

patients which include cardiologists, nurses specialized in HF and multidisciplinary staff) have demonstrated a decrease in the number of hospital admissions, as well as improved treatment compliance and quality of life, thus making them an interesting option as a public health policy in HF, together with the supply of medications that improve the symptoms and reduce mortality.

There was a slight predominance of systolic HF (55%) in relation to diastolic HF, and variations are reported in the literature, depending on the population studied[18]. In the male gender, systolic dysfunction was more frequently found (65.3%) when compared with the female gender (52.6%), thus confirming the frequent presence of diastolic dysfunction described in the literature for the female gender[19].

The need for vasoactive drugs, as well as mortality and prolonged length of hospital stay were very frequent. These findings may be attributed to the fact that our patients were possibly more severely ill, since the study was conducted in a cardiology hospital which is a referral for the treatment of advanced HF.

The comparative analysis between patients who were discharged and those who died confirmed some well-established criteria of poor prognosis for HF, including lower systolic blood pressure[20] (101.43 x 131.41 mmHg), clinical presentation of low cardiac output associated with congestion[15], need for VAD[21], reduced LVEF[6] (30 x 47%) and hyponatremia[6] (133.7 x 137.2 mg/dl). However, the multivariate analysis demonstrated that only dopamine or dobutamine were independent variables. Despite the limitation mainly on account of the reduced sample size, these data underscore important aspects of the baseline evaluation of patients who are admitted to the EU, which should be considered for severity stratification. Some information such as renal function and hemoglobin level were unremarkable, despite their being well-established as factors of poor prognosis[6].

In its more severe forms, chagasic cardiomyopathy has high morbidity and mortality[22,23]. Our study on DHF did not show a statistically significant mortality in relation to the chagasic etiology (although this had been suggested by the assessment of the absolute number), which may have resulted from the small sample size.

## Study limitations

The sample size was small when compared with those of international studies; however, it provided significant data on DHF in the EU of a cardiology hospital in a southeastern Brazilian region. Despite the initial prospective evaluation, the analysis of mortality was made retrospectively with an even smaller number of patients, so that the limitation, mainly in relation to the definition of factors of poor prognosis, was evident.

Data regarding the time of onset of symptoms of decompensation were not obtained, and this resulted in that decompensated chronic HF could not be differentiated from acute HF.

Information regarding the medications used at admission, during hospitalization (except for the use of vasoactive drugs) and at hospital discharge was not systematically obtained; therefore, these data could not be analyzed.

## Conclusion

Our data showed a younger population and lower blood pressure levels when compared with international data. There was a predominance of the ischemic etiology; however the hypertensive, valvular and chagasic etiologies were very frequent. The most frequent form of presentation and cause of decompensation were congestion and poor compliance, respectively. There was a predominance of systolic dysfunction as well as of the male gender. In-hospital mortality and the need for vasoactive drugs were high.

In the initial assessment of the patients admitted to the EU, data such as low systolic blood pressure, congestion associated with low cardiac output, reduced LVEF, higher LVDD, hyponatremia, and need for vasoactive drugs may be considered as factors of poor prognosis, and may help the decision on whether to hospitalize the patient and choose more advanced therapeutic strategies.

Because of its large territorial extension and marked intraterritorial epidemiologic differences, national studies on DHF including the different regions are key to improve the

**Table 3 - Comparative data: death and discharge (n=100)**

| | Death (10) | Discharge (90) | Bivariate analysis | Multivariate analysis |
|---|---|---|---|---|
| **Male gender** | 7 (70%) | 49 (54.4%) | | |
| **Age** | 56.2 ± 11.40 | 59.03 ± 17.45 | p = 0.831 | |
| **Systolic blood pressure** | 101.43 ± 26.09 | 131.41 ± 44.72 | p = 0.041 | NS |
| **Diastolic blood pressure** | 75.71 ± 22.25 | 78.96 ± 27.70 | p = 0.721 | |
| **Heart rate** | 98 ± 19 | 94 ± 23 | p = 0.598 | |
| **Etiology** | | | | |
| Ischemic | 4 (40%) | 28 (31%) | p = 0.944 | |
| Chagasic | 4 (40%) | 12 (13%) | p = 0.195 | |
| Idiopathic | 2 (20%) | 11 (12%) | p = 0.909 | |
| **Clinical presentation** | | | | |
| Congestion | 2 (20%) | 39 (43.3%) | p = 0.511 | |
| Congestion + SH | 0 | 28 (31.1%) | p = 0.175 | |
| Low cardiac output + congestion | 4 (40%) | 6 (6.7%) | p = 0.027 | NS |
| Low cardiac output | 1 (10%) | 6 (6.7%) | p = 0.77 | |
| Undefined | 2 (20%) | 4 (4.4%) | p = 0.276 | |
| Other | 1 (10%) | 7 (7.8%) | p = 0.702 | |
| **Causes of decompensation** | | | | |
| Poor compliance/inappropriate medication | 1 (10%) | 25 (27.8%) | p = 0.548 | |
| Poor compliance/inappropriate medication + SH | 0 | 15 (16.7%) | p = 0.216 | |
| Progression of the disease | 3 (30%) | 12 (13.3%) | p = 0.482 | |
| Ischemia | 1 (10%) | 5 (5.6%) | p = 0.866 | |
| Infection | 4 (40%) | 9 (9.9%) | p = 0.091 | |
| Arrhythmia | 0 | 8 (8.9%) | p = 0.760 | |
| Undefined | 1 (10%) | 1 (1.1%) | p = 0.513 | |
| Other | 0 | 15 (16.7%) | p = 0.429 | |
| **Vasoactive drugs** | | | | |
| Dobutamine | 8 (80%) | 8 (8.9%) | p = 0.0001 | p = 0.02 |
| Noradrenaline | 3 (30%) | 0 | p = 0.0001 | NS |
| Dopamine | 4 (40%) | 3 (3.33%) | p = 0.003 | p = 0.02 |
| Nitroglycerin | 3 (30%) | 1 (1.11%) | p = 0.002 | NS |
| Nitroprusside | 2 (20%) | 1 (1.11%) | p = 0.036 | NS |
| **LVEF** | 30.1 ± 8.2% | 47.3 ± 17.2% | p = 0.002 | NS |
| **LVDD** | 7.56 ± 1.1 cm | 6.4 ± 1.2 cm | p = 0.004 | NS |
| **HB** | 14.1 ± 1.8 g/dl | 13.2 ± 2.5 g/dl | p = 0.272 | |
| **Sodium** | 133.7 ± 7 mg/dl | 137.2± 4.5 g/dl | p = 0.031 | NS |
| **Creatinine** | 1.49 ± 0.4 mg/dl | 1.64 ±1.1 mg/dl | p = 0.671 | |
| **Length of hospital stay** | 32.3 ± 23 days | 5.58 ± 7 days | P = 0.0001 | |

*SH - systemic hypertension; LVEF - left ventricular ejection fraction; LVDD - left ventricular diastolic diameter; HB - hemoglobin, NS - non significant.*

understanding of this condition in our midst, as they provide support for more specific treatments and more appropriate health policies.

### Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

**Sources of Funding**

There were no external funding sources for this study.

**Study Association**

This study is not associated with any graduation program.

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