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Predictive Performance of the Get-With-The-Guidelines Heart Failure (GWTG-HF) Score for In-Hospital Mortality in Cameroonians Admitted in 2025 at Laquintinie Hospital Douala

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Abstract

Background: The Get With The Guidelines-Heart Failure (GWTG-HF) risk score predicts in-hospital mortality in heart failure patients, but its performance in Sub-Saharan African settings remains largely unevaluated. This study assessed the discriminative ability and calibration of the GWTG-HF score in a prospective cohort at a tertiary hospital in Cameroon. **Methods:** Adults (≥18 years) hospitalized primarily for acute decompensated heart failure (including both de novo presentations and exacerbations of chronic heart failure), confirmed by Framingham criteria plus echocardiography, at Laquintinie Hospital, Douala, Cameroon, between January and December 2025 were included. Exclusion criteria included incomplete data for GWTG-HF variables or alternative primary diagnoses (e.g., acute coronary syndrome as dominant presentation, primary pulmonary embolism, or sepsis without HF decompensation). The primary outcome was in-hospital mortality. As primary external validation, observed mortality was compared with original GWTG-HF predicted probabilities in predetermined risk groups (0 - 33: <1%; 34 - 50: 1% - 5%). Secondary analyses included logistic regression (continuous and quintile-based models). **Results:** Of 193 patients (median age 65 years [IQR 52 -

73], 50.8% male), in-hospital mortality was 16.6% (32 deaths). GWTG-HF score ranged from 6 to 50 (median 29, IQR 23 - 34). The score showed no discriminative ability (AUC 0.494, 95% CI 0.380 - 0.608) and poor calibration, with observed mortality far exceeding expected rates (16.8% in 0 - 33 group vs expected < 1%; 16.0% in 34 - 50 group vs expected 1% - 5%). Continuous logistic regression revealed a non-significant inverse association (OR 0.994 per point, p = 0.818). Quintile-based models showed no increasing mortality gradient (Q1: 25.6%, Q5: 18.4%). **Conclusion:** The GWTG-HF score exhibited limited predictive performance and no clear risk stratification in this Cameroonian heart failure cohort. These findings suggest the need for recalibration or development of alternative tools tailored to Sub-Saharan African populations to improve risk assessment in resource-limited settings.

Keywords

Heart Failure, GWTG-HF Score, In-Hospital Mortality, Sub-Saharan Africa, Risk Prediction, Discriminative Performance

1. Introduction

Heart failure (HF) is a leading cause of morbidity and mortality worldwide, with Sub-Saharan Africa bearing a disproportionate burden due to high mortality (34%), younger patient populations, and limited healthcare access [1] [2]. Unlike Western populations, where ischemic heart disease predominates, HF in Africa is often driven by hypertension, and infectious causes (e.g., HIV, tuberculosis), with these etiological differences, combined with delayed presentation and limited access to guideline-directed therapies, contributing to high in-hospital mortality rates [3] [4]. The high in-hospital mortality rates in HF highlight the need for accurate risk prediction tools to guide personalised care, optimize resource allocation, and support timely clinical decision-making [5].

Amongst the several predictive tools available, such as the Seattle Heart Failure Model, MAGGIC risk score, and ADHERE risk tree [6]-[8], the Get-With-The-Guidelines Heart Failure (GWTG-HF) score, sole reliance on readily available clinical variables at presentation, may enable more rapid and practical in-hospital risk stratification compared to other scores. GWTG-HF was developed in the United States using a cohort of 39,783 patients admitted between January 1, 2005, and June 26, 2007, to 198 hospitals, and predicts in-hospital mortality using seven variables: age, systolic blood pressure, heart rate, blood urea nitrogen, sodium, chronic obstructive pulmonary disease, and race. It showed good discrimination (c-statistic, 0.75) and calibration (Hosmer-Lemeshow = 0.242) [9]. Validated in North America (AUC 0.69) [10], Europe (AUC = 0.71) [11] and North Asia (AUC 0.76) [12], its performance in South Asian cohorts of 300 patients from a tertiary centre showed promise with higher scores in non-survivors (53.92 ± 10.33 vs 63.98 ± 10.17) [13]. Demographic differences, unique HF aetiologies, and healthcare

system constraints may limit its applicability in Sub-Saharan Africa, therefore, current risk prediction tools for HF in Africa are scarce, and reliance on Western models risks misclassification, exacerbating health disparities [3] [4].

The only preliminary study recorded in Sub-Saharan Africa was from Cameroon in 2023 which showed that GWHF score explained 17.41% of the variance in in-hospital mortality with the mean GWHF score higher in non-survivors (38.76 ± 10.95 versus 48.44 ± 6.6, p = 0.013) [14]. However, this study included only 189 patients and did not run full model performance analysis. This current study aimed to evaluate the predictive performance of the GWTG-HF score in a Cameroonian HF cohort, addressing the question: Does the GWTG-HF score accurately predict in-hospital mortality in patients hospitalised for HF in Cameroon? By examining this tool in an understudied population, the study aims to inform global health equity and guide context-specific risk stratification.

2. Methods

2.1. Study Design and Setting

This prospective observational study was conducted at Laquintinie Hospital, a tertiary care facility in Douala, Cameroon's economic hub. The hospital serves an urban population and provides basic echocardiography but has limited access to advanced diagnostics (e.g., cardiac MRI). Cameroon's healthcare system faces challenges such as high out-of-pocket costs and inconsistent availability of heart failure (HF) therapies (e.g., ARNI This prospective design was well suited to evaluate the real-world performance of the GWTG-HF score in a resource-limited setting.

2.2. Participants

Eligible participants were consecutive adults (≥18 years) hospitalized primarily for acute decompensated heart failure (including de novo and acute-on-chronic presentations), diagnosed using Framingham criteria and supported by echocardiography [15] between January 2025 and December 2025. Exclusion criteria included incomplete data required for GWTG-HF score calculation or cases where an alternative primary diagnosis (e.g., acute coronary syndrome as the main presentation, primary arrhythmia without HF decompensation, or non-HF sepsis) was the dominant reason for admission.

2.3. Variables

The primary outcome was in-hospital mortality, defined as death during the index hospitalization. The GWTG-HF score was calculated on admission using published formulas [16], incorporating age, systolic blood pressure, heart rate, blood urea nitrogen, sodium, chronic obstructive pulmonary disease, and race. Additional covariates included sex, comorbidities (e.g., hypertension, diabetes), HF aetiology, and ejection fraction.

2.4. Data Sources and Measurement

Data were prospectively collected from standardized admission forms, laboratory results, and clinical notes by trained study staff. Data quality was ensured through real-time checks, double-entry verification where feasible, and cross-checking against source documents. Patients with incomplete data for core GWTG-HF score variables were excluded prior to analysis to minimize imputation-related bias.

2.5. Bias

Potential selection bias (single-center, hospital-based sample) and information bias (possible incomplete documentation despite prospective collection) were recognized. These were mitigated through consecutive enrolment, standardized data collection protocols, and sensitivity analyses (e.g., complete-case analysis). Due to resource constraints in the setting, certain potential confounders such as NT-proBNP levels [17] or socio-economic status [18] could not be routinely measured or adjusted for in the final models.

2.6. Study Size

No a priori sample size calculation was performed. The study enrolled 193 consecutive eligible patients over the 12-month period, determined by hospital admission volume. This yielded 32 in-hospital deaths, providing reasonable power for AUC estimation in prognostic studies [13], but limiting precision for subgroup analyses (e.g., quintile-specific mortality rates and Hosmer-Lemeshow calibration testing across multiple groups) [19]. The event count exceeds the commonly recommended minimum of 10 events per predictor for logistic regression in key models but constrains detailed risk-stratification comparisons.

2.7. Statistical Methods

Three logistic regression models were developed: 1) continuous GWTG-HF score, 2) score categorized by quintiles, and 3) predefined risk groups. As primary external validation, observed in-hospital mortality was compared directly to expected probabilities from the original GWTG-HF derivation cohort [9]. The ROSE (Random Over-Sampling Examples) technique was applied as a sensitivity analysis to address class imbalance by generating synthetic balanced datasets (using the ROSE R package with default probability $p = 0.5$ for balanced classes) [20] for refitting logistic models; however, primary discrimination (AUC) and calibration (observed vs. expected in original risk groups) were evaluated in the un-resampled, original cohort to preserve real-world performance. All primary analyses were performed using R (version 4.3.1).

3. Results

3.1. Participants

HF constituted 24.8% (n = 248/1000) of all admissions at the cardiology unit in

2025. Of these 248 screened patients, 55 were excluded for the following reasons: echocardiography not done (n = 37), incomplete data for GWTG-HF score variables (n = 18), alternative primary diagnosis (n = 0), age < 18 years (n = 0), resulting in 193 patients with complete data included in the final analysis (Figure 1). Median age was 65 years (IQR 52 - 73), 50.8% were male, hypertension was present in 49.2%, and diabetes in 14.5%. Hypertensive cardiomyopathy occurred in 15.0% (n = 29). Median ejection fraction was 42% (IQR 30% - 59%). Baseline characteristics by in-hospital outcome are shown in Table 1.

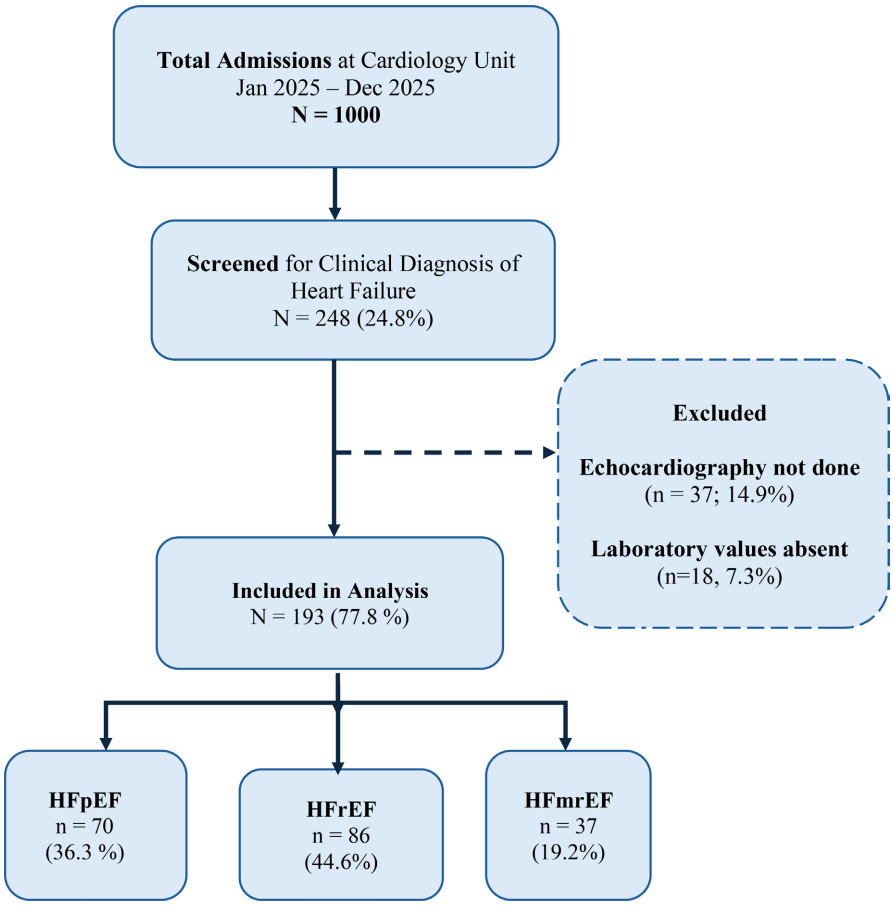

Figure 1. Recruitment flowchart.

Table 1. Baseline characteristics overall and by in-hospital outcome (survivors vs non-survivors), with p-values.

Characteristic	In-hospital Outcome		p-value[b]
	Survived N = 161[a]	Died N = 32[a]	
Sex			0.5
1 = Male	84 (52%)	14 (44%)	
2 = Female	77 (48%)	18 (56%)	
Hypertension			0.016

Continued

0 = No	75 (47%)	23 (72%)	
1 = Yes	86 (53%)	9 (28%)	
Diabetes			0.084
0 = No	134 (83%)	31 (97%)	
1 = Yes	27 (17%)	1 (3.1%)	
Atrial Fibrillation			>0.9
0 = No	147 (91%)	29 (91%)	
1 = Yes	14 (8.7%)	3 (9.4%)	
Chronic Obstructive Pulmonary Disease	7 (4.3%)	0 (0%)	0.5
Age of patient	65.0 [IQR]	63.5 [IQR]	>0.9
Systolic blood pressure (mmHg)	128.0 [IQR]	130.0 [IQR]	>0.9
Heart rate (beats per minute)	91.0 [IQR]	86.5 [IQR]	0.3
Blood Urea Nitrogen	5.0 [IQR]	5.7 [IQR]	0.2
Sodium (mEq/L)	134.6 [IQR]	135.8 [IQR]	0.9
Creatinine (g/L)	1.5 [IQR]	1.5 [IQR]	>0.9
Ejection fraction	42.0 [IQR]	42.0 [IQR]	0.7
LVEF categories			0.9
HFmrEF (41% - 49%)	30 (19%)	7 (22%)	
HFpEF (≥50%)	58 (36%)	12 (38%)	
HFrEF (≤40%)	73 (45%)	13 (41%)	

[a]n (%); Median [IQR]. [b]Pearson's Chi-squared test; Wilcoxon rank sum test. LVEF = Left Ventricular Ejection Fraction.

3.2. Descriptive Data

GWTG-HF score ranged from 6 to 50 (median 29, IQR 23 - 34, mean 28.3). Median score was 28 (IQR 23 - 34) in survivors and 30 (IQR 20.75 - 33.25) in non-survivors (p = 0.918) as shown in **Figure 2**. Quintile group sizes were Q1: 39, Q2: 39, Q3: 39, Q4: 38, Q5: 38. The lowest mortality was reported in the group with lowest score quintile (Q1) as shown in **Figure 3**. Adapted risk groups were ≤25 (n = 63), 26 - 32 (n = 72), and >32 (n = 58).

3.3. Outcome Data

As primary external validation, in the predetermined risk groups derived from the original GWTG-HF model, 143 patients (74.1%) had scores of 0 - 33 (expected mortality < 1%), and 50 patients (25.9%) had scores of 34 - 50 (expected mortality 1% - 5%). Observed in-hospital mortality was 16.8% (24 deaths) in the 0 - 33 group and 16.0% (8 deaths) in the 34 - 50 group.

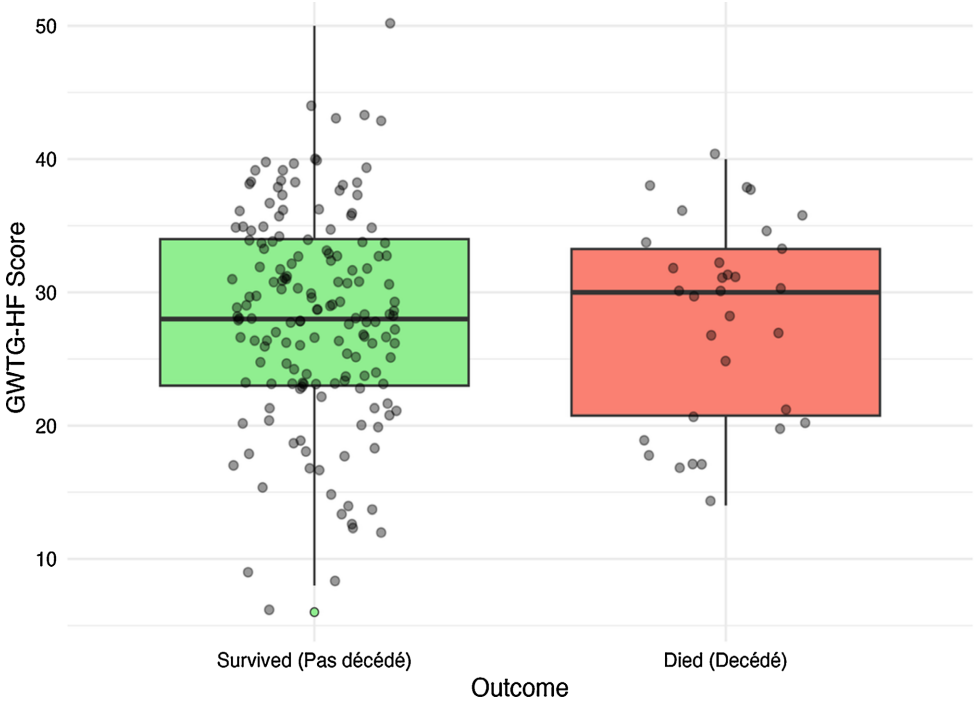

Figure 2. Box plot and jittered points of GWTG-HF score by in-hospital outcome (p = 0.918).

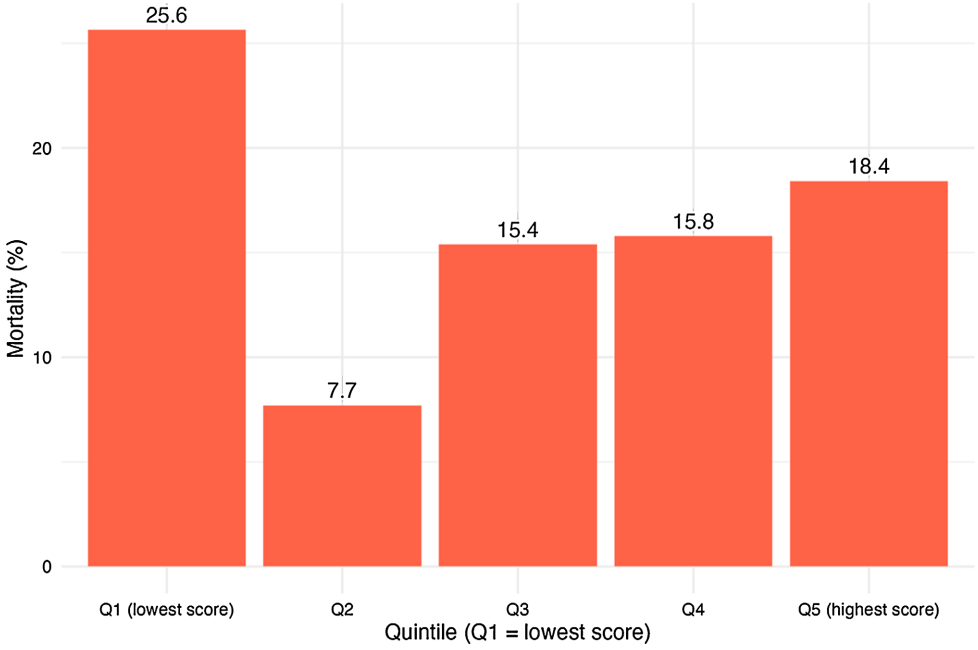

Figure 3. Bar chart of in-hospital mortality (%) by GWTG-HF score quintile.

3.4. Main Results

3.4.1. Continuous GWTG-HF Score

Logistic regression for the continuous GWTG-HF score yielded an odds ratio of 0.994 per 1-point increase (95% CI 0.945 - 1.046, p = 0.818). Area under the ROC curve was 0.494 (95% CI 0.380 - 0.608) (**Figure 4**). Hosmer-Lemeshow goodness-of-fit test p > 0.05.

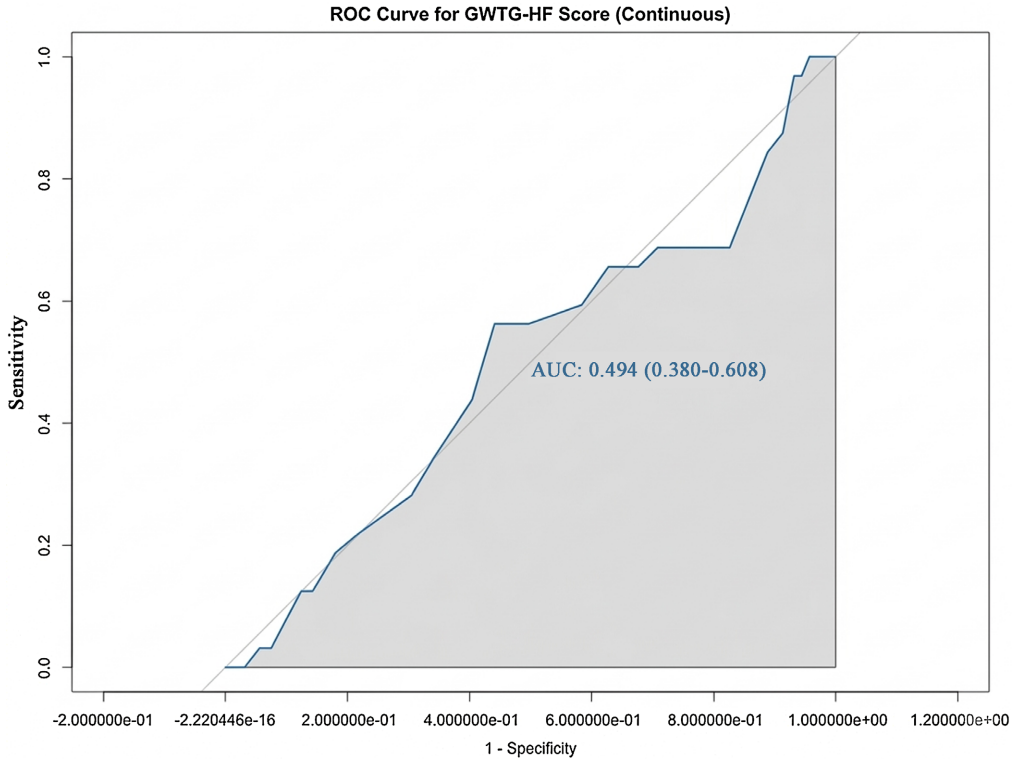

Figure 4. ROC curve for continuous GWTG-HF score.

3.4.2. Quintile-Based Score

Logistic regression using quintiles (reference = Q1) gave the following odds ratios:

- Q2: OR ≈ 0.24 (p = 0.04)
- Q3: OR ≈ 0.53 (p = 0.27)
- Q4: OR ≈ 0.54 (p = 0.29)
- Q5: OR ≈ 0.66 (p = 0.45)

3.4.3. Adapted Risk Groups

Mortality rates were 17.5% (≤25), 16.7% (26 - 32), and 15.5% (>32). No patients had scores > 50.

4. Discussion

As primary external validation, the GWTG-HF score showed poor calibration, with observed mortality substantially higher than expected across groups (AUC 0.494, 95% CI 0.380 - 0.608), with a non-significant inverse association in continuous modeling (OR 0.994 per point, p = 0.818). Mortality rates across quintiles and adapted risk groups remained relatively flat (15.5% - 25.6%), with the highest observed rate in the lowest-score quintile (Q1: 25.6%). In predetermined risk groups, observed mortality was 16.8% in scores 0 - 33 (expected < 1%) and 16.0% in scores 34 - 50 (expected 1% - 5%).

These findings differ from original North American validations where higher scores predicted increased mortality (AUC 0.69 - 0.75) [9] [10] Similar modest performance has been reported in other non-Western settings, including AUC

0.57 (95% CI 0.49 - 0.65) in a Colombian cohort of 379 patients [21], and lower AUCs in subgroups with left heart failure [12]. The compressed score range in this cohort (6 - 50, median 29) and predominance of lower scores (74.1% ≤ 33) likely contributed to the absence of a clear risk gradient. The cohort's characteristics such as median age 65 years, high prevalence of hypertensive and valvular aetiologies, and limited extreme values in predictors such as systolic blood pressure or BUN, may not align fully with the population in which the GWTG-HF score was developed.

The single-center, tertiary urban setting may limit generalizability to rural or primary-care populations in Cameroon or other Sub-Saharan African countries. However, the prospective design, complete data for score calculation, and consecutive enrolment strengthen the internal validity of the findings. Clinicians in similar resource-limited settings should be aware that the GWTG-HF score may not reliably stratify in-hospital risk in this context.

Future research should explore recalibration of the score with local data, incorporation of regionally relevant variables (e.g., access to guideline-directed therapies), or development of alternative risk models tailored to Sub-Saharan African heart failure populations. Multicentre prospective studies and evaluation of additional biomarkers could further refine risk prediction and support equitable cardiovascular care.

5. Conclusions

The GWTG-HF score demonstrated limited predictive performance for in-hospital mortality in this Cameroonian heart failure cohort, with no clear risk gradient and an inverse association in continuous modelling. These results highlight the need for context-specific risk stratification tools in Sub-Saharan Africa.

What is known about the topic?

- The Get-With-The-Guidelines Heart Failure (GWTG-HF) score is a validated risk prediction tool that estimates in-hospital mortality for heart failure patients using readily available clinical variables (age, systolic blood pressure, heart rate, blood urea nitrogen, sodium, COPD, and race).
- The GWTG-HF score has demonstrated good to moderate discriminative performance in North American (AUC 0.69 - 0.75), European (AUC 0.71), and North Asian (AUC 0.76) populations, supporting its utility for risk stratification in high-income and some middle-income settings.
- Data on the performance of the GWTG-HF score in Sub-Saharan Africa are extremely limited, with only one preliminary Cameroonian study (2023) reporting higher mean scores in non-survivors but without conducting a full model performance analysis.

What does this study add?

- This study provides the first comprehensive evaluation of the GWTG-HF score's predictive performance (discrimination and calibration) in a Sub-Saharan African heart failure cohort, demonstrating that the score failed to dis-

criminate between survivors and non-survivors (AUC 0.494, 95% CI 0.380 - 0.608) in this Cameroonian population.

- The study reveals a striking disconnect between observed and expected mortality: patients in the lowest-risk group (GWTG-HF score 0 - 33, expected mortality < 1%) had an observed mortality of 16.8%, while those in the intermediate-risk group (score 34 - 50, expected mortality 1% - 5%) had 16.0% mortality, indicating complete miscalibration of the score in this context.
- The findings highlight that Western-derived risk prediction tools may be inappropriate for Sub-Saharan African populations, where different aetiological profiles, younger patient ages, and healthcare delivery constraints fundamentally alter the relationship between admission variables and mortality outcomes, underscoring the urgent need for region-specific risk models.

Declarations

Reporting Checklist: The authors have completed the STROBE reporting checklist.

Data Availability Statement: Data supporting the findings of this study are available from the corresponding author (SD) upon reasonable request.

Author Contributions: Study concept and design: DS and EMML. Data collection: EMML. Analysis and interpretation of data: EMML. Manuscript writing: all authors. Final approval of manuscript: all authors. FK supervised the study. DS, and EMML had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors agreed to submit the manuscript in its current form.

Ethical Considerations

Ethical approval was obtained from the Regional Ethics Committee for the Littoral under reference: N 2024/CE/CRERSH-LITTORAL. Informed consent was waived due to the observational nature of the study and use of routinely collected clinical data, with patient confidentiality protected through anonymization and secure data handling.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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