

Predictors of In-Hospital Mortality in Patients Hospitalized for Heart Failure

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Background

- Prognostic stratification using readily available clinical data can assist clinical decision making in heart failure

- A risk model could be used to inform hospitals about the expected in-hospital mortality of their patients

Objective

- To derive and validate a predictive model for in-hospital mortality in patients hospitalized with heart failure.

Methods

Get With The Guidelines-HF Module

- 35,019 patients from 195 participating hospitals
- Information on consecutive eligible patients entered into the Patient Management Tool (Outcomes Sciences, Inc, Cambridge, MA)
- Standardized data elements and definitions

Statistical Analysis

- The study population was randomly divided into derivation (70% and validation (30%) cohorts
- Multivariable logistic regression using GEE identified predictors of in-hospital mortality
- Candidate predictor variables included demographic, medical history and laboratory variables collected at admission (Table 1)
- Performance of model evaluated in validation sample
- Risk score generated from effect estimates

Results

Table 1. Population Characteristics and Candidate Predictor Variables

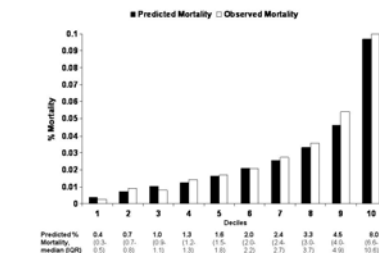
Age: mean (SD)	72 (14)
Sex: male	49%
Race: white	72%
Atrial arrhythmia	32%
Diabetes	42%
COPD	28%
Peripheral vascular disease	12%
CAD	48%
Cerebrovascular disease	14%
Ischemic etiology of HF	46%
Depression	10%
Ejection fraction %: median (IQR)	39 (25-55)
Ejection fraction <40%	49%
BUN: median (IQR)	25 (17-38)
Sodium: median (IQR)	138 (135-141)
Hemoglobin: median (IQR)	12.0 (10.6-13.5)
Creatinine: median (IQR)	1.3 (1.0-1.8)
Heart Rate: median (IQR)	82 (70-98)
Systolic blood pressure: median (IQR)	137 (118-158)

- In hospital death occurred in 977 (2.8%)
- The model had good discrimination with a c-index of 0.75 in both derivation and validation datasets
- Model calibration was excellent. (Hosmer-Lemeshow p=0.189 in derivation and p=0.604 in validation cohort)

Table 3. GWTG-HF Risk Score for In-Hospital Mortality

Systolic BP	Points	Heart Rate	Points	Sodium	Points	Total Score	Probability of Death
<50-59	28	≤79	0	<130	4	0-33	<1%
60-69	26	80-84	1	131	3	34-50	1-5%
70-79	24	85-89	3	132	3	51-57	>5-10%
80-89	23	90-94	4	133	3	58-61	>10-15%
90-99	21	95-99	5	134	2	62-65	>15-20%
100-109	19	100-104	6	135	2	66-70	>20-30%
110-119	17	≥105	8	136	2	71-74	>30-40%
120-129	15			137	1	75-78	>40-50%
130-139	13	BUN	Points	138	1	≥79	>50%
140-149	11	≤9	0	≥139	0		
150-159	9	10-19	2				
160-169	8	20-29	4	Age	Points		
170-179	6	30-39	6	≤19	0		
180-189	4	40-49	8	20-29	3		
190-199	2	50-59	9	30-39	5		
≥200	0	60-69	11	40-49	8		
		70-79	13	50-59	11		
COPD	Points	80-89	15	60-69	14		
Yes	2	90-99	17	70-79	16		
No	0	100-109	19	80-89	19		
		110-119	21	90-99	22		
Black	Points	120-129	23	100-109	25		
Yes	0	130-139	25	≥110	27		
No	3	140-149	27				
		≥150	28				

Figure. Predicted and Observed Mortality Rates by Deciles of Risk



Limitations

- Because we only had information on in-hospital mortality, the overall mortality rate was low
- Data were collected from the medical record and thus are dependent on the accuracy of documentation
- The score was not validated in a separate population

Conclusions

- Commonly available clinical variables predict in-hospital mortality
- The GWTG-HF risk score can identify patients at high risk of in-hospital death to aid clinical decision making
- The risk score could be used to provide GWTG hospitals information about the expected mortality rates of patients with heart failure admitted to their hospital

