Original Article

Risk Factors for Hospital Readmission of Patients With Heart Failure: A Cohort Study

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ABSTRACT

Aim: The aim of this study was to develop a risk factor model for hospital readmission in patients with heart failure. **Background:** Identification of risk factors and predictors of readmission to hospital in patients with heart failure is very crucial for improved clinical outcomes. **Objective:** The objective of the current study was to investigate and delineate the risk factors that may be implicated in putting a patient at greater risk of readmission due to uncontrolled heart failure. **Materials and Methods:** This is a prospective follow-up cohort study of 170 patients with heart failure at a tertiary hospital in Al Ain city in the United Arab Emirates. We have developed a risk factor model based on the recommendations of validated published data. We have used univariate and multivariate logistic regression analyses on structured steps based on the published data. The main outcome was the risk factors for readmission to hospital due to heart failure. **Results:** A final predictive model (10 variables) was produced for unplanned readmission of patients with heart failure. The risk factors identified in the final model with their odds ratios (ORs) and confidence intervals (CIs) were as follows: four or more prescribed medicines (OR = 4.13; CI = 3.5–4.1; $P = 0.003$), more than twice daily dosing regimen (OR = 2.34; CI = 1.0–5.0; $P = 0.023$), poor knowledge of prescribed medications (OR = 4.24; CI = 1.213–14.781; $P = 0.006$), diabetes mellitus (OR = 3.78; CI = 1.6–8.7; $P = 0.006$), edema (OR = 2.64; CI = 1.2–5.6; $P = 0.011$), being house bound (OR = 2.77; CI = 1.2–6.2; $P = 0.014$), and being prescribed diuretics (OR = 3.69; CI = 1.4–9.2; $P = 0.042$). **Conclusion:** The specificity of the developed risk prediction model was 82.2%, the sensitivity was 74.3%, and the overall accuracy was 72.9%. The model can be emulated in population with similar characteristics to prevent early readmission of patient with heart failure.

KEYWORDS: *Heart failure, model, prediction, readmission, risk factors*

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Introduction

Heart failure (HF) is a worldwide medical health problem that contributes to the world's economic burden for chronic disease management. HF is the most common and leading cause of admission and readmission among elderly.[1,2] There is a wide variation in the reported readmission rates across HF populations, facility settings, and follow-up periods. Studies have reported 30-day, 90-day, and 1-year readmission rates between 18% and 32%, 21% and 47%, and 50%, respectively.[3-9] The surge of unplanned 30-day all-cause admission and readmissions for HF results in a total expenditure exceeding US$30 billion in the United States alone.[9]

Satish *et al*.[10] suggested that screening of acute hospitalized patients at risk of adverse outcomes of hospitalization, including unplanned readmissions, could be achieved by using clinical electronic record-abstracted geriatric targeting criteria. Consequently, it is important to identify patients who are at risk of early unplanned readmission due to HF. The state-wide of discharge data set from Pennsylvania in the United States shows that comorbidities and sociodemographic factors, including male sex, age, black race, medicare coverage, and prolonged length of stay, were associated with increased risk of readmission in patients with HF.[11]

A study analyzed 2279 consecutively hospitalized older adults with decompensated HF across 15 hospitals in the United States. This study reported that home health care use was inversely associated with early readmission. Demographic and cardiovascular risk factors and geriatric syndromes were associated with early readmission. Discharge to home health care may reduce early readmission rates in these patients.[12]

Studies have been conducted with the aim of producing hospital readmission risk assessment model, formulating questionnaires based on those models and applying them in practice to enable identification of patients. These studies display a great variation in their methodology and consequent reported results. Hospital readmission logistic regression model needs to incorporate the influence of scheduled visits, unscheduled visits, renal status, adverse drug reactions, abnormal laboratory results, and changes in medication regimen. Recently, there are prediction algorithms to identify patients with HF at high risk of readmission or death post-hospital discharge.

The Gulf acute HF registry (Gulf CARE) in five countries has described the clinical characteristics, management, and outcomes of acute HF patients with high readmission rates.[13] The analysis from multicenter registry, the Gulf Registry of Acute Coronary Events (Gulf RACE), revealed that HF is observed in about one in five patients with acute coronary syndrome in the United Arab Emirates (UAE) with increased in-hospital mortality. The independent predictors of in-hospital HF in multivariable logistic regression were age, hyperlipidemia, diabetes, prior coronary artery disease, and heart rate.[14]

Objective

The objective of the current study was to investigate and delineate the risk factors, which may be implicated in putting a patient at greater risk of readmission due to HF.

Ethics Approval

The study has obtained ethical approval from the research and ethics committee at the hospital. Invited patients who fulfilled the criteria have consented for the access to their clinical data and for the interview part.

Materials and Methods

This was a cohort study conducted at a tertiary hospital in Al Ain city in UAE. The data were collected over a 6-month duration from January 2015 to July 2015. The study population was drawn from the hospital registry and included all patients with HF who were admitted to the hospital during the study period. The sample size was calculated based on the annual admission in the HF hospital registry. The participating subjects (N = 170) were recruited consecutively over the stated given time period. The hospital has a registry for patients with HF. This registry was used to select a total of 170 patients diagnosed with HF (systolic and diastolic HF with and without left ventricular dysfunction), who were admitted sequentially to the tertiary hospital for the management of their HF during the study period.

The inclusion criteria were confirmed diagnosis of HF (systolic or diastolic with or without left ventricular dysfunction), both gender, and currently admitted to the hospital due to HF as the main reason for admission. There were no exclusion criteria. Patient information (medical, medication, demographic, sociodemographic, and socioeconomic) was collected from their clinical profile using a data collection instrument previously developed by Al Deagi *et al*.[15] In addition, each patient was interviewed (by one specified clinical pharmacist who is the main study investigator) during their hospital stay using a structured questionnaire previously developed by Miller[16] to obtain further patient-specific information. Information obtained from the clinical

profile was clarified if necessary during the patient interviews.[16] All data collected were entered into SPSS to facilitate the development of a risk factor model for readmission.

Development of risk factor model

The procedures used to identify the risk factors for readmission and to build a risk factor model were based on the validated procedure published by Hosmer and Lemeshow.[17,18] The cutoff point for risk assessment was set at 0.5, that is, above this point, a patient was at high risk of one or more non-elective unplanned readmissions over a 12-month period.

Statistical analysis

Descriptive statistics was used for variables with means and standard deviation (mean SD).

We have used univariate and multivariate logistic regression analyses on structured steps based on the published data by Hosmer and Lemshow.[17,18]

Model building for study population

Univariate statistical analysis

The application of chi-squared analyses indicated that demographic, medical, and social factors were significantly related ($P < 0.1$) to one or more hospital admissions in the 12 months before the current admission.

Multivariate analysis

Using stepwise backward logistic regression analysis, any variables whose univariable test had a P value of less than 0.1 was a candidate for multivariate modeling. The total number of variables with P value less than 0.1 from the chi-squared tests (likelihood ratio tests statistic) was 30 variables. With reference to the total number of patients in the study population ($N = 170$) and as per the recommendations of Hosmer and Lemshow,[17] the rule of 10 was followed, which suggests a final predictive model with 10 variables (i.e., one-tenth the smaller group of patients).

Entering of the significant variables (either from patient clinical data or patient interview) independently into stepwise backward elimination logistic regression analysis with model entry set at $P = 0.2$, and model removal set at $P = 0.2$,[18] yielded two separate preliminary models for clinical profile and interview data. Repeating this procedure for further elimination with entry and removal values of $P = 0.15$, $P = 0.01$, and $P = 0.05$ yielded final models for both the patient clinical profile data and the patient interview data.

The number of significant variables from the resulting models (the clinical profile and review models) was therefore 14. A further regression was performed to allow the two individual models to be combined with model entry and removal set this time at $P = 0.02$. A final predictive model for unplanned readmission with 10 variables was produced. When the cutoff point for risk assessment was set at 0.5, that is, above this point, a patient is considered to be at high risk of one or more non-elective readmissions 12 months post-discharge.

The Hosmer and Lemeshow goodness-of-fit test gave a chi-squared value of 4.3601 (8 degrees of freedom, $P = 0.8233$); therefore, the model can be regarded as an acceptable fit to the data used. Analysis of pair-wise interactions between variables using a logistic regression entry procedure, with P set at 0.05, illustrated that the interactions did not produce significant P values for log-likelihood ratio tests for final risk model. To check that all variables were independent, the φ coefficient was calculated; all phi coefficients generated from each pair of variables were <0.09; therefore, the variables in the final model can be regarded as independent.

Results

Characteristics of the study population

A total of 170 patients with HF were included in the study; 84 (49.4%) of the patients were males and 86 (50.6%) were females. Thirty-nine males (60.9%) and 25 females (39.1%) were aged less than 65 years, while 45 males (42.5%) and 61 females (57.5%) were aged 65 years or older. Regarding the level of education, 47 (48%) males and 51 females (52%) have received elementary education only, while 37 males (51.4%) and 35 females (48.6%) have received more than elementary education. A total of 34 males (57.6%) and 25 females (42.4%) were still working, while 50 males (45.0%) and 61 females (55.0%) were retired. The mean serum creatinine value was 1.8 mg/dL (SD 0.3) for the readmitted patients versus 1.1 mg/dL (SD 0.2) of one-time admitted patients during the index year. The number of rescheduled visits to the emergency room was calculated based on annual visits without being admitted apart from current readmission index.

Risk factors delineated by univariate and multivariate logistic regressions

With reference to the total number of patients in the study population ($N = 170$ patients), the number of patients with more than one admission was 74 (43.5%), and the number of patients with only one admission (*de novo* admission) was 96 (56.5%). The mean length of stay during the present admission for all patients was 10.3 days (SD 1.2) and at the time of the study the mean number of cardiovascular medications used was 5.5 (SD 0.8).

Review of the clinical profile revealed that 58.1% of the patients had a history of ischemic heart disease, 59.5% had hypertension, and 64.7% had diabetes mellitus. The most frequently prescribed medications received by the study patients included β-blockers, diuretics (thiazide and loop diuretic), mineralocorticoids (spironolactone), angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), nitrates, aspirin, statin, and warfarin. Most of these cardiovascular medications were used in two or less daily doses (69.4%) while 30.6% were used in more than two daily doses regimen [Table 1].

The majority of the study population (93%) were on first-line therapy with β-blockers, ACE inhibitors/ARBs, and furosemide, while some (25%) were on the second-line therapy with mineralocorticoid receptor antagonists (spironolactone). The types of HF included patients with diastolic HF (56%) with preserved left ventricular systolic function, that is, ejection fraction of more than or equal to 50% (Heart Failure with preserved Ejection Fraction, HFpEF), and those with HF with reduced ejection fraction of less than or equal to 40% (Heart Failure with reduced Ejection Fraction, HFrEF) (systolic HF; 44%).

Table 1: Sociodemographic data for patients with heart failure

Variable	Male, *n* (%)	Female, *n* (%)	Total population
Gender	84 (49.4)	86 (50.6)	170
Age			
<65 years	39 (60.9)	25 (39.1)	64
≥65 years	45 (42.5)	61 (57.5)	106
Employment			
Currently working	34 (57.6)	25 (42.4)	59
Retired	50 (45.0)	61 (55.0)	111
Education			
Patients with elementary education only	47 (48.0)	51 (52.0)	98
Patients with more than elementary education	37 (51.4)	35 (48.6)	72
Medications			
Mean number of cardiovascular medications on admission	5.4 ± 1.8	5.5 ± 1.3	5.5 ± 1.6
LOS			
Mean LOS (days)	10.4 ± 2.1	10.2 ± 1.7	10.3 ± 1.8

LOS = length of hospital stay; *N* = frequency.

Table 2: The clinical profile data of patients with heart failure

	Clinical profile data			
Variables	**Overall patient (frequency)**	**Readmitted patients (%)**	**OR**	***P* value**
Age	<65 (64)	53.1	1.87	0.050
	≥65 (106)	37.7		
Occupational status				
Employed	(59)	54.2	1.94	0.040
Retired	(111)	37.8		
Daily dosing regimen (number of daily doses)	>2 (52)	55.8	2.04	0.032
	≤2 (118)	38.1		
Other associated cardiovascular diseases	Yes (55)	54.5	1.93	0.033
	No (115)	38.5		
Diabetes mellitus	Yes (110)	49.1	1.92	0.033
	No (60)	33.3		
Number of prescribed medications	≥5 (132)	48.5	2.63	0.013
	<5 (38)	26.3		
Prescribed ACE inhibitors	Yes (117)	38.5	0.52	0.035
	No (53)	54.7		
Prescribed aspirin	Yes (64)	38.7	0.48	0.038
	No (106)	56.8		
Prescribed diuretics	Yes (146)	46.6	2.61	0.043
	No (24)	25.0		

ACE = angiotensin-converting enzyme; OR = odds ratio.

Variables significantly related to at least one prior hospital admission in the previous 12 months (chi-squared; $P < 0.10$). *P* value was calculated from the likelihood ratio test.

The final clinical profile model for unplanned readmission included seven significantly statistical variables ($P < 0.05$). The specificity of the model was 63.5%, the sensitivity was 83.3%, and the overall accuracy was 74.7% [Table 2]. The final model derived from the patient interview data included seven significant variables. The specificity of the model was 62.2%, the sensitivity was 79.2%, and the overall accuracy was 71.8% [Table 3].

The final logistic regression model for unplanned readmission of patients with HF at Al Ain hospital, UAE contains seven factors: four or more prescribed medications, dosing regimen: more than two dosing times/day, poor knowledge of prescribed medications, diabetes mellitus, patient complaining of edema or swelling in the extremities, patient bound to home as a result of HF disease, and being prescribed diuretics. The seven factors were presented with respective variable coefficient *B*, odds ratio (OR), 95% confidence level, and *P* values [Table 4].

The specificity of the final developed model was 82.2%, the sensitivity was 74.3%, and the overall accuracy was 72.9% [Table 5].

Discussions

The current study model developed for risk factors of readmission to hospital in patients with HF confers diverse population which may have contributed to

Table 3: The patient interview data

Patient interview data				
Variables	**Overall patient (frequency)**	**Readmitted patients (%)**	**OR**	***P* value**
Patients reported skipping dose or doses daily	Yes (109)	49.5	2.01	0.033
	No (61)	32.8		
Patients reported taking extra dose or doses monthly	Yes (20)	25.0	0.39	0.025
	No (150)	46.0		
Prescribed medication knowledge	Poor (148)	46.5	2.97	0.033
	Fair (22)	22.7		
Problems with medication use, e.g., opening container, swallowing	Yes (20)	65.0	2.71	0.040
	No (150)	40		
Patients experienced side-effects with HF medications used	Yes (132)	47.7	2.24	0.037
	No (38)	28.9		
Patients believed that side-effects are the cause of hospitalization	Yes (38)	57.9	2.11	0.043
	No (132)	39.4		
Patients experiencing cough	Yes (97)	51.9	1.87	0.040
	No (93)	36.6		
OTCs number	≤1 (139)	39.6	0.41	0.028
	>1 (31)	61.3		
Education	Primary (98)	50.0	1.88	0.046
	Higher school (72)	34.7		
Patients with table salt restriction in diet	Yes (43)	30.2	0.39	0.039
	No (127)	48.0		
Patients sleeping with extra pillows	Yes (24)	25.0	0.38	0.043
	No (146)	46.6		
Patients taking regular exercise	Yes (32)	28.1	0.44	0.047
	No (138)	47.1		
Patients complaining of edema or swelling in extremities	Yes (89)	51.7	2.02	0.024
	No (81)	34.6		
Patients experiencing orthopnea	Yes (107)	49.5	1.96	0.038
	No (63)	33.3		
Current cigarette smoking	Yes (116)	49.1	2.10	0.029
	No (54)	31.5		
Patients bound to home as a result of HF disease	Yes (120)	48.3	1.98	0.048
	No (50)	32.0		

HF = heart failure; OR = odds ratios; OTC = over-the-counters medications.

Variables significantly related to at least one prior hospital admission in the previous 12 months (chi-squared; $P < 0.10$). *P* value was calculated from the likelihood ratio test.

Table 4: The final logistic regression model for unplanned readmission of patients with heart failure at Al Ain hospital, United Arab Emirates

Variables	Variable coefficient (*B*)	OR	95% CI	*P* value
Four or more prescribed medications	1.407	4.132	3.501–4.132	0.003
Dosing regimen: more than two dosing times/day	0.852	2.345	1.081–5.093	0.023
Poor knowledge of prescribed medications	1.445	4.243	1.213–14.781	0.006
Diabetes mellitus	1.332	3.781	1.642–8.702	0.006
Patient complaining of edema or swelling in the extremities	0.974	2.642	1.252–5.600	0.011
Patients bound to home as a result of HF disease	1.022	2.772	1.231–6.264	0.014
Prescribed diuretics	1.303	3.691	1.482–9.206	0.042

CI = confidence interval; OR = odds ratios.

P value was calculated from the likelihood ratio test.

versatile predictors. Therefore, local population characteristics should be examined to develop a model that best fit to the specific population rather than emulating any internationally predicted model.

We have reviewed 170 patients, readmitted to hospital for the management of HF. Readmission could have been avoided in patients if there had been better assessments, if rehabilitation had been more adequate, if discharge had been more carefully planned, if potential nonadherence with medications and diet had been identified, and if patients had been instructed to seek medical attention when symptoms occur. Much attention has, therefore, been given to identifying patients who are at risk of early unplanned readmissions.

The present study yielded a 10-factor risk model for hospital readmission of HF patients in the UAE. The risk factors included the number of prescribed medications (four or more), more than a twice daily dosing regimen, poor knowledge of prescribed medications, having diabetes mellitus, having renal impairment (reduced creatinine clearance), patient complaining of edema and swelling in the extremities, prescribed thiazide diuretic, unscheduled visits to emergency room, and bound to home as a result of HF.

Modifiable and nonmodifiable clinical factors

Number of prescribed medications

The logistic regression model revealed that patients who were taking four or more prescribed medications were about four times more likely to be readmitted to hospital over a 12-month period. This finding was consistent with previous reports, which indicated that an increase in the number of medications being received by a patient leads to increased admission.

Dosing (more than a twice daily dosing regimen)

The readmission rate in patients who had a dosing regimen, which required them to take prescribed medications, more than twice per day was 55.8%.

Table 5: Observed and predicted values, sensitivities, and specificities from the logistic regression model for unplanned readmission of patients with heart failure

Observed	Predicted		Row totals
	Yes	No	
Yes	45	29	74
No	17	79	96
Column totals	62	108	170

The specificity of this model was 82.2%, the sensitivity was 74.3%, and the overall accuracy was 72.9%.

The logistic regression model revealed that such patients were approximately two times more likely to be readmitted when compared with patients who required less frequent drug administration. While multiple dosing drug regimens are often required for optimal management of chronic diseases, the goals of the therapy are often undermined by poor patient adherence to the prescribed regimen.

Studies from western and Middle Eastern countries indicate that HF is an increasingly frequent reason for hospital admission. Better survival rates post-myocardial infarction, coupled with an aging population, are reasons for this trend.[19] The risk model suggests that, where possible, dosing regimens should be simplified to allow twice daily dosing, in agreement with previously published data.[20]

Knowledge of prescribed medication

The readmission rate in those patients who were assessed for poor knowledge of their prescribed medications (interview data) was 46.5%. In the final model, this increased their risk of readmission by a factor of 4.2.

A multidisciplinary intervention study on rates of readmission of patients with HF revealed that readmission could be reduced by comprehensive education of patients and their families, a prescribed diet, social service consultation, a review of medications, and intensive follow-up. Further work by horn and

colleagues, highlighted the need for patient education within a comprehensive management program for HF patients.[21] With regards to this particular risk factor, the healthcare professionals including clinical pharmacist has a key role to play. Enormous studies have shown that improved outcomes of drug therapy can be achieved via intensive structured education and counseling,[22,23] and the present study lends support to these findings that clinical pharmacist should ensure that HF patients receive medication counseling both at discharge and at outpatient clinics.

Edema and swelling in the extremities

Edema and swelling in the extremities are sign of poorly controlled HF and therefore it was not surprising that patients who complained about edema were more likely to be re-hospitalized (OR = 2.6). The findings support the importance of monitoring weight changes in patients with HF.[24]

Patients bound to home as a result of their HF

It has been shown in two previous studies that bed rest and limited activity are detrimental to exercise tolerance and aerobic capacity while exercise training improves vasodilatation and muscle oxidative capacity in patients with HF.[25,26]

Being housebound was shown in the present study to increase risk of rehospitalization by a factor of 2.8. Being housebound may have both social support and disease severity components, which were not "teased out" in the present study. Nonetheless it is an easy question to ask patients and if a patient is found to be housebound, the intensity of patient education and monitoring should be increased to help avoid early rehospitalization.

Prescribed thiazide diuretic

The readmission rate in those patients who had been prescribed a thiazide diuretic was 46.6% of readmitted patients. The logistic regression model indicated that patients who have received a prescribed thiazide diuretic were over three times more likely to be readmitted. The adverse effects of thiazide diuretics therapy include complications such as hypokalemia and azotemia. Overuse of diuretics in patients with diastolic dysfunction can also lead to hypo-perfusion of vital organs; therefore, a renal electrolyte panel should be checked after adjusting the thiazide diuretic dose.

Renal impairment

The model has shown that renal impairment in patients with HF is a risk factor for readmission to the hospital. The degree of renal impairment as measured by creatinine clearance reflects the increased risk with reduced creatinine clearance values.

Unscheduled visits to the emergency room

The increase in annual number of unscheduled visits to the emergency room for patients with HF has implicated increased risk of readmission due to uncontrolled HF.

Comorbidities: diabetes mellitus

The readmission rate of patients with diabetes was 49.1%; the risk model indicated that having diabetes increased the risk of readmission within 12 months period by a factor of 3.8. Previous studies in the Framingham cohort,[27] as well as the Contemporary Older Cohort Study, identified the presence of diabetes as a significant risk factor for HF. This risk factor is obviously not modifiable; however, it was clear that attention should be given to patients with HF who also have diabetes to help ensure that both conditions are controlled optimally. This was highly important in populations with higher prevalence of diabetes such as our study population.

A recent study of one million patients with HF in four states of the United States has shown readmission rates of 9.4% and 9.17% for the two cohorts (derivation and validation cohorts), respectively. The study reported that the following parameters were associated with higher readmission risk after hospitalization for HF: age younger than 65 years, male gender, first income quartile, African American race, race other than African American or Caucasian, insurance, drug abuse, renal failure, chronic pulmonary disorder, diabetes, depression, and fluid and electrolyte disorder.[28]

In summary, the most important finding of the current study relates to the incorporation of medications as predictors of readmission in the developed model for patients with HF. This has special emphasis on patient's preferences, side-effects, adherence to medications, and knowledge about medications for HF. Therefore, future studies should incorporate insurance schemes, medications, and income in multivariate models for prediction of risk factors for readmission of patients with HF.

Future research should incorporate the clinical disease biomarkers such as pro atrial naturetic peptide and brain naturetic peptide, the New York Heart Association (NYHA) classification of HF, the hemodynamic status of patients (e.g., low blood pressure), quality of life, physiotherapy care, weight of patients, and emergency department early triaging, as factors to be considered in assessing global risk of readmission.

Strength and weakness

The most important strength of the current study was the developed risk factor model that can be emulated by our healthcare professionals to prevent early readmission of patient with HF. The small sample size of the current study may impose some limitations on the generalizability of the risk factor model. The generalization of the developed model deserves greater attention in similar setting with similar population characteristics in patients with HF.

Several factors could be viewed as surrogate markers for disease severity; our risk modeling did highlight the need for improved patient education about prescribed medications, and the problems that can result from diuretic therapy.

It has been observed that patients with diastolic HF were less hospitalized than other forms of HF, but this did not reach significance in the final developed model. It has been reported that referral to HF clinics is known for preventing hospitalizations; however, in the current study, this has not been studied and it may have affected the admission of study patients. It has been documented that the use of ivabradine for suitable patients (to reduce the heart rate) was a known factor to reduce patient admissions for HF. However, in the current study, there were few patients on ivabradine, which may have affected the final model as contributing factor for readmissions of our cohort.

Conclusion

Within a sample of patients admitted to tertiary hospital in the UAE, as a result of worsening HF, the following factors were noted to significantly increase the risk of multiple hospital admissions within a 12-month period: receiving four or more prescribed chronic medications, more than a twice daily dosing regimen, poor knowledge of prescribed medications, presence of diabetes mellitus, impaired renal function (reduced creatinine clearance), trouble with edema and swelling of extremities, and being housebound and prescribed diuretic. The final predictive model for unplanned readmission of patients with HF has specificity of 82.2%, sensitivity of 74.3%, and the overall accuracy was 72.9%. The developed risk model can be emulated by health professionals of similar population characteristics to prevent early readmission of patient with HF.

Impact on practice

- Preventing early readmission in patients with HF.
- Identifying patients with HF at risk of readmission.
- Improving discharge planning for patients with HF.
- Improving scheduled clinical visits.
- Optimizing the use of spironolactone on discharge medication list.
- Boosting the clinical pharmacist's role in patients with HF.

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Conflicts of interest

There are no conflicts of interest.

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