

RESEARCH REPORTS

EFFECTIVENESS OF COMMUNITY PARAMEDICS AT PREDICTING 30-DAY READMISSION IN HEART FAILURE PATIENTS

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ABSTRACT

Objective: Heart failure (HF) patients are at high risk for 30-day hospital readmission which is a negative predictor of patient-centered outcomes. Community paramedicine (CP) has emerged with a goal of reducing readmissions and currently no model exists to accurately predict those at highest risk. We seek to analyze factors associated with readmission among participants in a CP program.

Methods: Design: A retrospective review of consecutive patients with a HF-related diagnosis who received a home visit by a community paramedic after a hospital admission. Setting: A suburban, academic medical center with an established CP program. Inclusion criteria: All patients with a HF-related diagnosis who received a home visit over the study period. Factors including age, sex, hospital length of stay, time to home visit, discharge destination, participation in other transitional care/home health programs, chronicity of heart failure, care team, and perceived risk of readmission by the community paramedics at the time of home visit were retrospectively reviewed and analyzed. The outcome of interest was 30-day, all-cause readmissions.

Results: From 4/7/2017 to 4/6/2018 there were 592 patients who received home visits. The median age was 70 [IQR 60-79] and 41.9% were female. The overall 30-day readmission rate was 11%. For readmitted patients, the median time to home visit was 6 days [IQR 4-11] versus 10 days [IQR 5-23] for those not readmitted ($p < 0.01$). Patients deemed to be at risk for readmission by the community paramedics were readmitted more often than those who were not (OR 2.68, 95% CI [1.59-4.52]).

Conclusion: Along with time to home visit, perceived risk of 30-day readmission at the time of a home visit by a community paramedic correlated with rates of readmission. In the HF population, comprehensive models to predict 30-day readmission might be improved by including a subjective assessment by a trained clinician.

INTRODUCTION

Decreased hospital readmission rate is an important patient centered outcome and is financially advantageous for health systems (Fernandez-Gasso et al., 2017; Kwok et al., 2021). Heart failure (HF) is a common cause for admission and readmission to the hospital with rates of 30-day readmission estimated between 18 and 22% (Fernandez-Gasso et al., 2017; Khan et al., 2021;

Kimmoun et al., 2021; Parizo et al., 2020). Community prevalence of HF is expected to rise due to aging of the population and advancing therapeutics (McCullough et al., 2002). A means to identify HF patients at highest risk for readmission with the goal of providing targeted interventions would be beneficial to patients and health systems alike.

The ability to predict readmission, particularly in the HF population, is limited. Pre-existing prediction scores validated for the general hospitalized population such as HOSPITAL, LACE and LACE+ do not perform well when applied uniquely to the HF population (Ibrahim et al., 2020). In prior attempts to predict readmission, risk variation was unable to be explained by objective measures alone (Philbin & DiSalvo, 1999). Subjective variables have been shown to improve discrimination of predictive models (Huynh et al., 2016) and may be important when deriving heart failure readmission scores (Emdin et al., 2017).

Community paramedicine (CP) programs have been developed to utilize emergency medical services (EMS) clinicians, typically paramedics, in roles that support community health. These programs are often used to support patients who are at risk for high healthcare utilization or require additional assistance navigating the healthcare systems (Chan et al., 2019). Community paramedics often provide in-home services allowing them to develop a holistic impression of the patient's health and social support to address various patient centered outcomes. The aim of this study was to correlate various patient-centered and systemic factors, including the community paramedic's perceived risk of readmission, on 30-day hospital readmission amongst participants in a CP program for heart failure.

METHODS

STUDY DESIGN

This is a retrospective review of consecutive patients who received a home visit by a community paramedic in a CP program for HF. Data regarding perceived risk for readmission was collected prospectively at the end of each home visit. Other variables including age, sex, hospital length of stay, chronicity of HF, time to home visit, presence or absence of transitional care or home health services, discharge destination, and care team members were reviewed retrospectively by a community paramedic who performs home visits. The outcome of interest in this study was all cause readmission to the hospital within 30-days of discharge for patients with a HF-related diagnosis. The study protocol was approved by the University's institutional review board (STUDY00008404).

SELECTION OF PARTICIPANTS

Patients were referred to the CP program either by their care team or discovered via a search of the electronic health record (EHR) for 11 specific discharge diagnosis (ICD-10 codes) pertaining to HF (Figure 1). Patients eligible for a home visit must live within 90 minutes of the medical center, be discharged home or to a short-term rehabilitation facility, and carry a diagnosis consistent with the program's criteria. Adult patients who met criteria for program enrollment and who completed at least one home visit were included in the study. Patients who declined to participate, were readmitted before their first home visit, or otherwise were unable to have a home visit performed, were not included. Patients residing greater than 90 minutes from the medical center or who were

I11.0	Hypertensive disease with heart failure
I13.0	Hypertensive heart and chronic kidney disease with heart failure and stage 1 through stage 4 chronic kidney disease, or unspecified chronic kidney disease
I13.2	Hypertensive heart and chronic kidney disease with heart failure and with stage 5 chronic kidney disease, or end stage renal disease
I50.1	Left ventricular failure
I50.20	Unspecified systolic (congestive) heart failure
I50.21	Acute systolic (congestive) heart failure
I50.22	Chronic systolic (congestive) heart failure
I50.23	Acute on chronic systolic (congestive) heart failure
I50.30	Unspecified diastolic (congestive) heart failure
I50.31	Acute diastolic (congestive) heart failure
I50.33	Acute on chronic diastolic (congestive) heart failure
I50.41	Acute combined systolic (congestive) and diastolic (congestive) heart failure
I50.43	Acute on chronic combine systolic (congestive) and diastolic (congestive) heart failure
I50.9	Heart failure, unspecified

Figure 1: International Classification of Disease, 10th Revision (ICD-10) codes for included heart failure-related diagnoses

discharged to long-term care facilities, long-term acute care hospitals, or skilled nursing care were excluded from the program and therefore also from this study.

SETTING

This study was conducted at a suburban, tertiary care referral center with an active heart failure program. The mission of the CP program is to utilize paramedics outside traditional emergency roles to provide scheduled post-acute home visits for targeted high-risk populations. The goal is to reduce negative outcomes such as 30-day all-cause readmissions. Patients were recruited either in person by a member of the CP team prior to discharge, or via telephone after discharge, with the former being the preferred method. Participation was voluntary.

All community paramedics were certified by the Commonwealth of Pennsylvania (EMT-P) and/or the National Registry of Emergency Medical Technicians (NRP) to the level of paramedic. Beyond what is included in the paramedic curriculum, training for community paramedics included a combination of clinical observation, hands-on skill acquisition for pertinent physical exam techniques, and exposure to nursing-driven follow-up programs that existed prior to the development of the CP program.

Home visits consisted of a patient assessment, including signs and symptoms of compensated versus decompensated heart failure. Community paramedics provided patient education related to medication compliance, diet, review of discharge instructions and care plans, and disease prevention strategies. Laboratory testing and therapeutics, including intravenous diuresis, were available per protocol. The timing of home visit was based upon scheduling and availability and was not directed by disease severity or the perceived need for expedited services.

DATA COLLECTION AND PROCESSING

Documentation of the encounter was included in the health system EHR. At the conclusion of the home visit, the community paramedic documented whether they felt the patient was at risk for 30-day readmission using a binary “yes” or “no” scale which was

documented in EHR. This exercise was performed at the conclusion of each home visit. The community paramedic's decision was purely subjective and not based upon any predetermined criteria or scoring. These data were continually compiled as part of an ongoing quality improvement and quality assurance program then analyzed retrospectively, for the purposes of this study, after ethics approval.

DATA ANALYSIS

Descriptive statistics were performed on the study participants. Continuous variables were reported using mean (standard deviation) and median (interquartile range). For continuous variables, a two-sample T-test was used to compare means. Chi-squared analysis was used to compare categorical variables. Odds ratio and 95% confidence interval were calculated for perceived risk of readmission by the community paramedics. Analysis was performed using SAS (SAS Institute, Cary, North Carolina, USA).

RESULTS

From 4/7/2017 to 4/6/2018 a total of 592 patients who met inclusion criteria were included for analysis (Table 1). The median age was 70 [IQR 60-79] and 41.9% were female. The median hospital length of stay was 4 days [IQR 3-8] and heart failure was a new diagnosis in 13.3% of patients. Most of the patients were discharged home (92%, 545), 80.2% (475) received transitional care services, and 45.2% (267) received home health services. The majority (88.7%) of patients were treated by a cardiologist within the health system. Age, sex, hospital length of stay, chronicity of HF, presence or absence of transitional care or home health services, discharge destination, and care team members did not reach statistical significance to correlate with readmission rate.

The 30-day all cause readmission rate was 11% (65) with 0.6% (4) being readmitted multiple times. For readmitted patients, the median time from discharge to home visit by a community paramedic was 6 days [IQR 4-11] versus 10 days [IQR 5-23] for those not readmitted ($p < 0.01$). Patients who were perceived to be at risk for readmission by the community paramedic at the time of home visit had an 18.2% rate of readmission versus 7.6% in those deemed low risk ($p = < 0.01$).

DISCUSSION

The objective of this study was to correlate patient-centered and systemic factors on 30-day hospital readmission amongst participants in a CP program for heart failure. Our overall, all-cause, 30-day readmission rate was found to be 11%, expectedly lower than the national average. All patients in the study accepted and received a home visit by a community paramedic, which has been shown to decrease readmission rates (A. Burnett et al., 2023; Misra-Hebert et al., 2021; Severson et al., 2023). Patients readmitted prior to their first home visit were excluded and therefore may skew the data slightly towards a lower readmission rate. While other studies have also correlated various objective measurements and risk for readmission in the HF population, no unifying model exists to date (Kansagara et al., 2011; Saito et al., 2016). The Readmission After Heart Failure (RAHF) scale developed by Chamberlain et. el. revealed a readmission rate of 7.58% in their low-risk group compared to the 7.6% observed in this study (Chamberlain et al., 2018).

It was observed that a shorter time to home visit correlated with an increased risk of readmission. It is generally accepted that timely post-discharge follow up is beneficial for hospitalized patients, but other studies have failed to find correlation between timing and risk of readmission (Misky et al., 2010). Patients often have difficulty comprehending hospital discharge instructions (Townshend et al., 2023) and can find the information overwhelming on the day of discharge (Slatyer et al., 2019). In disease processes such as HF that require significant lifestyle modification, patients may benefit from spaced repetition of discharge instruction favoring delayed home visits. It warrants further discussion and research to determine where and when CP can most effectively be integrated into the continuum of post discharge care.

We found that the perceived risk of readmission by the community paramedic at the time of home visit correlated well with rate of readmission. During a home visit, community paramedics are uniquely poised to provide a holistic assessment of a patient’s health. Medication literacy and psychosocial support, for example, influence readmission rates and EMS clinicians are particularly effective in assessing these and other social determinant of health (S. J. Burnett et al., 2023; Naimi et al., 2023). Community paramedics likely integrate objective and subjective data into a comprehensive assessment of the patient’s risk of readmission. Notably, this study was not designed to assess the community paramedic’s medical decision-making process but insight into how they made their decisions could be valuable. This is a promising area for further research.

This study offers a unique perspective suggesting that a trained clinician, in a patient’s home, can provide a reliable assessment of their tendency towards readmission. Validated clinical decision tools for other populations such as the HEART Score (Six et al., 2008) and Well’s Criteria (Wells et al., 2001) give emphasis to clinician impression, or “gestalt.” Subjective variables have been shown to improve discrimination of predictive models including attempts to predict HF readmissions (Emdin et al., 2017; Huynh et al., 2016). The combination of a clinical assessment by a community paramedic combined with other

	Readmission		p-value
	No (n=527)	Yes (n=65)	
Age-median [IQR]	71 [60-180]	65 [58-79]	0.3
Length of Stay a -median [IQR]	4 [3-8]	5 [3-7]	0.61
Time to Home Visit b-median [IQR]	10 [5-23]	6 [4-11]	<0.01
Sex-n(%)			
Female	227 (91.5)	21 (8.5)	0.11
Male	300 (87.2)	44 (12.8)	
Discharged To-n(%)			
Home	483 (88.6)	62 (11.4)	0.46
Inpatient Rehab	44 (93.6)	3 (6.4)	
Home Health-n(%)			
No	289 (89.2)	35 (10.8)	0.9
Yes	237 (88.8)	30 (11.2)	
Heart Failure Type-n(%)			
Chronic	455 (88.7)	58 (11.3)	0.7
New	72 (91.1)	7 (8.9)	
In-network Cardiologist c -n(%)			
No	62 (92.5)	5 (7.5)	0.41
Yes	465 (88.6)	60 (11.4)	
HF Transitional Care Program-n(%)			
No	110 (94)	7 (6)	0.07
Yes	417 (97.8)	58 (12.2)	
Risk for Readmission-n(%)			
No	374 (92.4)	31 (7.6)	<0.01
Yes	153 (81.1)	34 (18.2)	

a. Hospital length of stay, b. Time to home visit by community paramedic, c. defined as cardiologist within the health system. HF = heart failure.

Table 1: Risk factors for readmission versus 30-day readmission

objective measures may facilitate the derivation of a readmission prediction instrument that has eluded investigators thus far.

LIMITATIONS

This study is limited predominantly by its retrospective and observational design and can only comment on correlation of these variables with hospital readmission. While the breadth and scope of CP programs have evolved since the data were collected, the study outcome is related to the fundamental skill of assessing patients with HF which remains relevant to current practice. Confounding variables such as response to prior treatments and history of readmissions may contribute to the CP's decision. We do not know what factors ultimately contributed to the community paramedic's decision to consider a patient at risk for readmission. Qualitative analysis of the decision-making process may shed light on important patient and environmental factors that drive readmissions.

CONCLUSION

In this study, the community paramedics perceived risk of readmission correlated well with readmission rates. Subjective analysis of patients' risk for readmission is a promising avenue to explore and could help identify patients at risk for readmission, which is currently underway. Derivation of future readmission prediction models may utilize subjective analysis by clinicians, such as community paramedics, to optimize their predictive value.

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