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Prediction Screening to Identify Heart Failure Patients at High Risk for Readmission

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Prediction Screening to Identify Heart Failure Patients at High Risk for Readmission

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May 2016

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Dedication

I would like to dedicate this work to my husband Drew. Without his ongoing encouragement, love, and support I could have never accomplished this goal. To my beautiful daughters, Carson and Madison who inspire me daily to be a better person, I hope I have in return inspired them to always follow their dreams. I would also like to thank my colleague Suzanne Pilon who has been with me every step of the way and kept me sane throughout this process.

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Introduction

Heart failure (HF) affects greater than 5 million people in the United States (U.S.) and is the primary diagnosis for over one million hospitalizations each year.[1,2] The number of Americans with HF is expected to increase by 25% by the year 2030 with approximately 650,000 new cases being diagnosed each year.[2] The estimated direct and indirect costs of treatment for Americans with HF have reached approximately $40 billion per year and are projected to rise to nearly $70 billion by 2030.[2,3]

Approximately 20% of Medicare beneficiaries hospitalized for HF are readmitted within 30 days of hospital discharge.[1] It is important to note that potentially 40% of all readmissions for HF exacerbation are considered preventable.[4] Heart failure has become a significant financial burden on the U.S. health care system, which led the Patient Protection and Affordable Care Act of 2010 (ACA) to create incentives to reduce readmissions. Section 3025 of the ACA added section 1886(q) to the Social Security Act, establishing the Hospital Readmission Reduction Program (HRRP). The HRRP requires The Centers for Medicare and Medicaid Services (CMS) to reduce payments to inpatient prospective payment system hospitals with excessive readmissions for patients with HF, as well as acute myocardial infarctions (AMI), pneumonia, and the newly added diagnoses of chronic obstructive pulmonary disease (COPD) and total hip and knee arthroplasty.[1]

Transitions of care are highly vulnerable periods for patients living with HF. There are numerous factors contributing to a preventable readmission, such as lack of social support, financial concerns that prevent the patient from complying with the treatment plan, or health care providers failing to recognize a patient's poor health literacy. Since the passage of the ACA in

2010, health care professionals' thinking seems to be changing and some hospitals have made readmission reduction a priority.

Unfortunately, hospitalization and readmission rates remain high despite many interventions being developed to mitigate the repeating cycles of hospitalization, discharge, and readmission for HF. The overall purpose of this practice inquiry project is to determine characteristics that place patients at highest risk for readmission in the HF population and to develop a readmission prediction instrument to determine the likelihood of those patients having a 30 day readmission. A well designed readmission risk prediction instrument has the potential to identify those patients most at risk for readmission upon initial presentation for hospitalization. By identifying these patients at admission, efforts could be aimed at patient education, ensuring early provider follow up after discharge, and utilizing the expertise of a comprehensive multidisciplinary team approach to discharge care planning, which has shown promise with regard to reduction in readmissions.[5]

The first manuscript is an integrative literature review of studies published from 2000 to 2014 that were conducted to identify predictive characteristics specific to HF readmissions. The findings from this review revealed that many factors need to be taken into consideration when determining which patients are at the highest risk for readmission; a fact confirmed by the inability of the studies to find a consistent significant association with specific clinical or demographical characteristics. One of the clinical implications derived from this review of literature is how the care for those high risk HF patients may need to be individualized for those patients with a high number of risk predicting characteristics on admission. The second manuscript is a policy analysis of The Establishing Beneficiary Equity in the Hospital Readmission Reduction Program Act of 2015 which tries to determine what effects it would have

on the penalties many hospitals receive from CMS for excessive HF readmissions in the future, as well as provide other potential policy options for reducing readmission penalties in the HF population. The final manuscript is a write up of the results obtained from a HF survey and follow up for readmissions to create a risk prediction instrument that can be used in the future to determine which patients upon initial presentation to the hospital may require more individualized interventions to prevent an avoidable readmission.

Manuscript 1:

Predicting Risk for Readmission in Patients with Heart Failure: An Integrative Review

Kelly Taylor, BSN, RN

Abstract

Background- Heart failure (HF) has become a significant burden on the healthcare system and is the leading cause of hospitalizations among those 65 years of age and older in the United States. HF is the primary diagnosis for greater than one million hospitalizations per year and has a five year mortality rate of 50%. The estimated direct and indirect costs of treatment for Americans with heart failure have reached approximately $40 billion per year and are projected to rise to nearly $70 billion by 2030.

Purpose-The purpose of this integrative review is to identify which patient characteristics place patients at highest risk for readmission to the hospital for a heart failure exacerbation.

Results-Three studies reported anemia to be a significant predictor for readmission, one found creatinine to be significant while another did not. Data from three studies indicated that previous admissions in the 12 months prior for HF made someone at risk for readmission, low income, co-morbid conditions, and discharge disposition were also found to have an increased risk for readmission.

Conclusions- Predicting readmission risk for the HF population is a complex endeavor with many factors involved. This review showed that many factors, such as laboratory values, previous admissions, and age, need to be taken into consideration when looking for patients at the highest risk for readmission.

Key Words- (congestive) heart failure, readmissions, prediction tools, and risk characteristics

Background

Heart failure (HF) is defined by the American College of Cardiology and the American Heart Association as a complex clinical syndrome that stems from either a structural or functional inability of the ventricles to fill with blood or eject blood efficiently enough to meet the body's demands.[6] Heart failure develops when the circulation of blood through the heart becomes impaired as a result of conditions such as uncontrolled hypertension, myocardial infarction, valve disorder, coronary artery disease, dysrhythmias, drug toxicity, or lung disease.[7]

Approximately 5.1 million adults over the age of twenty in the United States have HF; this number is estimated to increase by 25% by the year 2030 with approximately 650,000 new cases being diagnosed each year.[1] Heart failure has become a significant burden on the healthcare system and is the leading cause of hospitalizations among those 65 years of age and older in the United States. It is the primary diagnosis for greater than one million hospitalizations per year and has a five year mortality rate of 50%.[1] The estimated direct and indirect costs of treatment for Americans with HF have reached approximately $40 billion per year and are projected to rise to nearly $70 billion by 2030.[1,3] According to the Centers for Medicare and Medicaid Services (CMS), the national average for the readmission rate for HF was 22.5% from June 2011 through June 2012.[4]

It is important to note that potentially 40% of all readmissions for HF exacerbation are considered preventable.[5]There are numerous factors contributing to a preventable readmission, such as a lack of social support, financial concerns that prevent the patient from complying with the treatment plan, or health care providers failing to recognize a patient's poor health literacy.

This legitimizes the reality that our healthcare system's discharge processes have not kept up with the magnitude of change in acuity within the HF population.[1]

On March 23, 2010, the Patient Protection and Affordable Care Act (ACA), was approved. One of the healthcare reform act's (HR 3590) key provisions is to reduce readmissions and improve care transitions for patients hospitalized with HF, acute myocardial infarctions, and pneumonia in an effort to save $7.1 billion dollars over a ten year period.[2] This Hospital Readmission Reduction Program (HRRP) is a reimbursement penalty approach for general acute care hospitals that have readmissions deemed excessive by CMS.[2] This has challenged hospitals to identify ways to reduce their readmission rates and prevent avoidable readmissions for these common initial diagnoses. The ability to prevent avoidable readmissions has been linked to having a better understanding of HF and which clinical and social indicators put patients most at risk for readmission.

Hospitalization and readmission rates remain high despite many interventions being developed to mitigate the repeating cycles of hospitalization, discharge, and readmission for HF. One such intervention is the use of a readmission prediction instrument to determine the likelihood of a HF patient having a 30 day readmission. A well designed readmission risk prediction instrument has the potential to identify those patients most at risk for readmission upon initial presentation for hospitalization. Using a prediction instrument would allow interventions to be focused directly at the targeted risk factors during a hospitalization, as well as development of a targeted transitional plan of care prior to discharge. The goal of this systematic review was to synthesize the literature to evaluate which patient characteristics have been identified as the best predictors for readmission in the HF population. Findings from this review may assist health care providers in improving upon or developing a new prediction model that

could potentially decrease the 30 day readmission rates for their specific HF patient population. In addition, limitations of the included studies will be discussed and recommendations will be made for future research.

Methods

Search Strategy

The primary topic of interest in this integrative review was the patient characteristics or variables considered to be predictors for HF related readmissions. Databases searched included: Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE, and Pubmed. Articles were also obtained from references of relevant systematic reviews. Key words used as search terms included (congestive) heart failure, readmissions, prediction tools, prediction models, and risk characteristics. Table 1 presents the summary details of the 19 studies included in this review.

Inclusion/Exclusion Criteria

All articles included in the review met the following criteria: 1) published in a peer reviewed, English language journal since 2000; 2) only research for predictive characteristics specific to HF readmissions; and 3) data from original research. The exclusion criteria included: 1) research related to readmissions for diagnoses other than HF; 2) articles related to prediction characteristics for mortality only; and 3) any study conducted outside the United States.

Results

The initial search identified 76 studies. After applying the inclusion/exclusion criteria, 19 studies were included for this review. See *Figure 1* for the process used to identify appropriate articles, and at what stage articles were excluded.

Of the 19 studies included, the sample sizes ranged from 72-41,776. All studies used convenience samples that met the inclusion criteria. The mean ages ranged from 56.5-79 years of age; the distribution of male to female gender was about even when considering all studies. All included studies measured some type of patient characteristic for its predictive ability for readmission. These characteristics include: clinical values, SES status, different co-morbid conditions, gender and age, the number of prior admissions within the previous 12 month period, and discharge planning provided for patients with HF.

Although four studies [6-9] specifically examined age as a possible readmission risk factor, only two [6,10] found a correlation between being older than 65 and a higher risk of readmission. One study did find significance in decreased functional status as a predictor for readmission regardless of the patient's age.[11] Three studies [12-14] found prior diagnosis of HF, or prior admission within the last year for HF exacerbation as an indicator of readmission risk. No studies were found that specifically disputed these results.

Six research teams[13-17] specifically examined co-morbidities such as atrial fibrillation (A-fib), chronic obstructive pulmonary disease (COPD), diabetes mellitus, and pulmonary hypertension, as predictors for readmission. Two of those studies[13,15] provide evidence that patients with COPD have a higher risk for readmission. One study[13] noted that patients with a history of COPD have a 2.2 fold increased risk of readmission for HF. One study found

pulmonary hypertension as the only co-morbidity to be a risk factor for readmission.[16] One study found diabetes mellitus to have a strong association with readmission in the HF population[11] while another[17] found A-fib to be a significant co morbid condition in predicting readmission in the HF population. That same study found elderly HF patients with A-fib were 64% more likely to be readmitted. However, it did not reach statistical significance after adjustments were made for patient and care variables including: age, race, heart rate >100 beats per minute, and systolic blood pressure >140mmHg. In contrast to these, a study conducted by Armola et al,[8] co-morbidities were not found to be a significant predictor for readmission.

In addition to co-morbid conditions, numerous factors for readmission were investigated, such as ejection fraction (EF), New York Heart Association (NYHA) classification on admission, medications, types and number of physicians involved in the patient's care while hospitalized, serum sodium, serum creatinine, education level of the patient, case management involvement, and follow up plan.[8] Armola et al,[8] also found only the follow up plan specific to the diagnosis of HF and a higher NYHA classification on admission to be significant predictors of readmission. Another study[6] also found higher classes of NYHA to be predictors of readmission.

Five studies[10,11,16,18,19] reported the effects of socioeconomic status (SES) and social support on predicting readmission occurrences for patients with HF. Two of these studies [10,19] found a correlation between low SES and Medicaid insurance and a higher risk of readmission. One study[18] indicated being single and having a higher number of address changes to be significant factors in predicting risk for readmission. In contrast to these findings, one of the studies[16] found those living with family members to be at a higher risk for readmission. Possible explanations for this finding included: a stressful home life increasing the patient's risk for

exacerbation of disease, or family members simply being more aware of the patient's decline and seeking out medical care. Similarly, another study[11] found that an increased level of stress levels among the patient's caregivers could cause an increase in readmissions for this patient population.

Seven of the studies[12-15,20-22] found specific laboratory values to be predictors of readmission. Increased blood urea nitrogen (BUN) and serum creatinine levels were found to be predictors in some studies.[12-14] Anemia (either low hemoglobin or hematocrit levels) were found to be risk factors in three of the studies.[12,20,22] Two studies[15,21] looked at brain-natriuretic peptide (BNP) levels specifically. Of those two, only one study[21] found that the BNP levels predischarge (the day of or the day before discharge) were highly predictive of readmission after acute hospital care for patients with decompensated HF; with a BNP > 700ng/l at discharge being associated with 31% increased risk of readmission. Yet another study[15] did not find elevated BNP levels to be independent indicators of readmission for HF patients.

Two of the studies[18,23] focused on either quality of life or depression as predictors for readmission in HF patients. Armasaringham found depression and anxiety, along with a confirmed recent history of cocaine abuse, to be a significant factor for readmission.[18] Interestingly this was the only study to look at history of drug abuse as a risk factor. In the study by Jiang et al,[23] the Beck Depression Inventory (BDI) score of > 10 was used to determine depression. The BDI is a valid 21 item instrument used to diagnose depression in older adults. With a score ranging from 0-63, the items reflect cognitive, affective, somatic, and vegetative symptoms of depression.[24] The study by Jiang et al[23] also found patients with an ejection fraction (EF) of </= 35% to have a 20% higher incidence of depression, but they concluded that EF alone did not determine readmission risk.

There were three studies[13,25,26] indicating that EF was a significant factor in predicting readmission for patients with HF. But one study[27] found similar results as to Jiang et al,[23] that EF alone does not predict readmission. Although having a preserved EF is considered a better predictor of clinical outcomes, one study found that readmission risk is not significantly different in patients with preserved versus depressed left ventricular function.[28]

One study[9] specifically looked at the CMS' claims-based model which uses a combination of administrative data such as age, sex, co-morbidities, and procedural history to predict 30 day HF outcomes and readmissions. These data were used to develop the HRRP provision of the ACA. In this study, clinical data such as EF, heart rate, hemoglobin, serum creatinine, serum sodium, systolic blood pressure and weight were added to the aforementioned administrative data information. They found that the addition of clinical data to the administrative data only model improved the performance in predicting 30 day mortality for HF patients but only slightly improved the ability to predict readmissions.[9] These slight improvements were found to not be adequate to affect the hospital's performance rankings.

Another factor found to have some significance in predicting readmissions were patients admitted with ischemic HF. These patients have a higher readmission risk and a shorter time to readmission than those with non-ischemic HF.[25] Only four studies[13,15,18,25] identified gender as having a significant association with readmission. Two of these four studies noted the male gender as having a higher risk for readmission.[13,18] The study conducted by Babayan et al[25] noted a higher risk for women with ischemic HF; but found no gender difference in all other etiology groups.

Discussion

Synthesis of Findings

Despite two decades of research on the subject, most U.S. hospitals continue to struggle with readmission rates related to HF.[18] Predicting readmissions for patients with HF is extremely difficult. The studies in this review were taken from all types of hospitals (primary, secondary, and tertiary), some in rural areas, others in more metropolitan cities. They also represented a diverse population in regard to age, gender, race, ethnicity, SES, and insurance providers. As expected, this review showed that many factors need to be taken into consideration when determining which patients are at the highest risk for readmission; a fact confirmed by the inability of the studies to find a consistent significant association with specific clinical or demographical characteristics.

The significant impact of having a previous diagnosis of HF and at least one previous admission for HF exacerbation within the prior 12 months had on readmission rates, were findings that were undisputed by any of the studies in this review. These two factors were found to be consistent risk factors on all studies that examined them. Many hospitals seem to be concerned with looking at length of stay as a predictor for readmission but this review found only one study that established this to be a significant factor .[13]

From this systematic review it is evident that simply looking at individual's laboratory values, such as BNP, serum creatinine, hemoglobin, or serum sodium, and co-morbid conditions still presents a challenge when trying to predict readmission in the HF population. These values need to be considered when looking at a patient's risk for readmission but no single laboratory value or co-morbid condition specifically is indicative of readmission in all patients with HF.[28]

A similar finding among most of the studies is that patients who are 70 years or older are at a greater risk for readmission. Patients in this age group generally have more co-morbidities, take more medications, may have a lower quality of life, and likely are more socially isolated which puts them at a higher risk of hospitalization regardless of diagnosis.

Clinical Implications

One of the clinical implications derived from this review of literature is how the care for those high risk HF patients may need to be individualized for those patients with a high number of risks predicting characteristics on admission. The research available in this review does show a connection between SES, quality of life, and psychosocial issues in predicting risk for readmission. Clinicians attempting to plan interventions for those at highest risk for readmission may find this information helpful in deciding how to individualize their plans of care. Knowing that individuals from a lower SES may have less education, diminished health literacy, and are less likely to have regular medical follow up care can help those clinicians tailor their discharge plans accordingly.

Because HF is such a complex clinical syndrome, the creation or use of a prediction instrument without actually assessing the patients on an individual basis will not be enough to prevent avoidable readmissions in the HF population. It is imperative that those who are taxed with preventing readmissions in patients with HF look at specific characteristics that are unique to their distinct health care organization's population and do not deemphasize the importance of individuality.[1]

Limitations of Present Review

This review did not identify any studies that looked specifically at patient's readmission rates after a comprehensive individualized discharge plan was implemented. This could be important in evaluating the effectiveness of discharge planning and transitional care programs. This information could be helpful in determining key components needed for future interventions or programs for the HF population. The majority of the studies in this review used a convenience sampling which is not as reliable as randomized controlled trials. Some of the studies were also limited by their sample size.

Recommendations for Further Research

Additional research is needed to assess the true preventability of readmissions in HF patients in U.S. health systems. Given the broad variety of factors that may contribute to HF readmission risk, future studies should assess the relative contribution of the predictive ability of different types of patient data. Future studies should also focus on deriving a risk standardized model that identifies those patient characteristics found to be most predictive in certain hospitals or geographical areas. Lastly, given that many studies have reported limited predictive abilities, future studies should further evaluate the value of the clinician's in depth assessment of not only the physical data, but also the psychosocial and environmental issues that may be a cause of a preventable readmission.

Conclusion

This systematic review has found a growing body of evidence regarding the association with a few clinical characteristics as predictors for readmission in HF patients. Although there are some contradictory results, patients with prior admissions in the previous 12 months and

those who were previously diagnosed with HF do have an increased risk for readmission. Some of the research included in this review is limited by sample size or design and further research related to predicting readmissions for patients with HF is warranted.

However, these findings do have implications for clinical practice. Predicting readmission risk for the HF population is a complex endeavor with many factors involved. Despite limitations of current prognostic models, they are generally more accurate than clinical intuition and may provide some benefit in predicting readmissions.[29] Still, better approaches, such as, a combination of current predictive instruments that contain more than just biophysical or socioeconomic information, are needed to identify patients at the greatest risk for readmission. If these patients are identified on admission; interventions throughout the hospitalization could be implemented to assure the patients transition to home is a successful one. According to Albert, [30] simply providing more services may not be the key to effectively decreasing readmission to the hospital, as the type of service, the ongoing communication during the service delivery period, and the quality monitoring for delivery of best practices may be more beneficial than increasing the number of services available.

TABLE 1- Summary Details of Studies Included in Integrative Review

Author/Date	*Sample/Gender*	*Design*	*Setting*	*Results/Conclusions*
Ahmed et al. (2004)	n=944, mean age 79.1, 61% female, 18% African American	Retrospective review of medical records	11 Alabama hospitals	Older adults with HF and A-fib were 64% more likely to be admitted within 30 days (unadjusted hazard ratio=1.64; 95% CI=1.01-2.68). After adjustment for patient and care variables the risk lost its statistical significance (95% CI=0.94-4.65).
Amarasingham et al. (2010)	n=1372, mean age 56.5, 60.8% male, 62.6% African American	Retrospective review of medical records	Parkland Memorial Hospital Dallas, Texas	Automated prediction models such as the ADHERE model performed only slightly better than chance for predicting readmissions (C-statistic 0.73 and 0.56 respectively)
Armoloa, et al. (2001)	n=179	Descriptive design, retrospective chart review	Small Midwestern academic hospital	Age, serum creatinine, and comorbidities not found significant after an independent t-test, serum sodium approaches significance (p=0.032), Those who did not have a follow up plan specific to HF were significant for readmission within

				30 days (p=0.005). Patients with higher NYHA class more likely to be readmitted within 30 days (p=0.002).
Babayan et al. (2003)	n=493, mean age 63, 52% female, 79.1% African American	Retrospective cohort	Johns Hopkins Hospital	Ischemic etiology for HF is a significant predictor of all cause readmission (1.40[1.11-1.76]). Most significant predictor for readmission for recurrent HF was LV systolic dysfunction (2.44[1.46-4.08]).
Felker, et al. (2003)	n=949, mean age 65, 21% male, 21% white	Randomized controlled trial (RCT)	Duke Clinical Research Institute Durham, NC	For composite of rehospitalization hgb is an independent predictor (odds ratio 0.89 per 1g/dl increase 95% CI 0.82-0.97). 12% increase in probability of rehospitalization within 60 days for every 1g/dl decrease in admission hgb value.
Felker et al. (2004)	n=949, mean age 68, 66% male, 65%	RCT	Duke Clinical Research Institute	Independent predictors of rehospitalization

	Caucasian			include the number of HF readmissions in the prior 12 months (odds ratio=1.14, p=0.0002), elevated BUN (odds ratio=1.26 per 5mg/dl increase p=0.0001), lower hgb concentrations (odds ratio=.89 per 1g/dl increase, p=0.006), lower systolic blood pressure (odds ratio=.82 per 10mmHg increase in pressure, p=0.0001)
Hammill et al. (2011)	n=24,163	Retrospective chart review	307 Medicare participating hospitals	Clinical data added to claims data did not significantly improve readmission predictions with AUC at or <0.60. All patients clinical and claims model AUC-0.599, Generalized R^2 0.031, Lowest decile of predicted risk 13.5, highest decile-33.9
Hamner et al. (2005)	n=557, 40% African American	Retrospective descriptive correlational	Large, Southeastern, acute care hospital	Lack of cardiology consult is related to readmission (X^2=14.1, p<0.05), living with family was associated with readmission (X^2=6.7, p<0.05), pulmonary hypertension was the

				only co morbid associated with readmission (X^2=4.6, p<0.05)
Harjai et al. (2011)	n=434, mean age 70, 64% white, 55% male	Retrospective chart review	Ochsner Medical Institute, Louisiana State University Medical Center	Readmission within the prior 6 months significant predictor OR-1.3(95% CI=1.2-1.4), COPD as a co morbid condition OR-2.2(95% CI=1.1-4.5) and male gender OR-2.7(95% CI=1.4-5.25)
Howie-Esquivel et al. (2007)	n=72, mean age 62, 44.4% non white, 65% male	Prospective cohort design	Large academic center in northern California	Women had 2.5 times greater risk for rehospitalization than men, nonwhite ethnicity (HR-2.15{95%CI=1.03-4.50}p=0.04), history of pulmonary problems (HR-1.13{95%CI=1.01-1.28} p=0.03) and symptom stability(HR-0.98{95%CI=0.97-0.99} p=0.02) were independently associated with cardiac re-hospitalization
Jiang et al. (2001)	n=374, mean age 64, 64% male, 71% white	Prospective cohort design	Duke University Medical Center	Major depression group had highest readmissions rates at

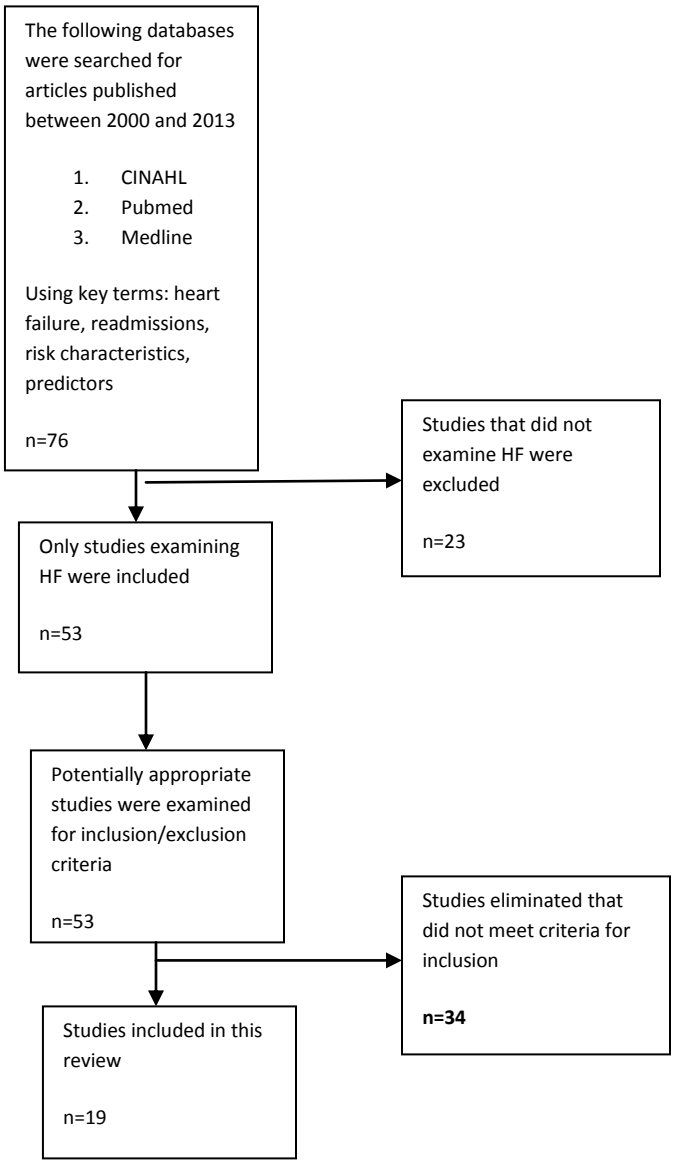
				3 months and 1 year, advanced age significantly associated with readmission at 3 months (OR-1.03{95% CI=1.012-1.05}, p=.002), higher classes of NYHA associated with readmission at 1 year (OR-1.773{95%CI=1.245-2.525}, p=.002)
Kosiborod et al. (2003)	n=2281, mean age 79, 58% women, 90% white	Retrospective chart review	Medicare's National Claims History File for 18 acute care Connecticut hospitals	Anemia is associated with increased risk of readmission for HF patients a 2% higher risk for every 1% lower hematocrit (HR=1.02{95% CI=1.01-1.03}, p=0.0002)
Krumholtz et al. (2000)	n=2176, mean age 78.4, 59% female, 89% white	Retrospective chart review	18 Connecticut hospitals	Found creatinine levels >2.5mg/dl at discharge (HR-1.72{95% CI=1.35-2.18}, p=0.0001), prior admission within 1 year (HR-1.25{95% CI=1.05-1.48}, p=0.012), prior diagnosis of HF (HR-1.23{95% CI=1.02-1.48}, p=0.03), and diabetes (HR-1.17{95% CI=0.99-1.39}, p=0.07) to be significant for readmission

Logeart et al. (2004)	n=127, mean age 69.4, 27.5% female,	Prospective cohort design	Beaujon & Pontoise hospitals	The pre-discharge BNP level,100ng/l increase is most strongly associated with readmission (HR-1.22{95%CI=1.15-1.30}, p=0.0001)
Malki et al. (2002)	n=187, mean age 65, 54% male, 79% African American	Prospective design	Henry Ford hospital, Detroit	No significance found in readmission rates between those with <50% EF and those with >50% EF (p=0.34)
Philbin et al. (2001)	n=41,776 Caucasian or African American only, mean age 74, 57% female, 18% African American	Retrospective design	Non-federal acute care hospitals in New York	Lower income was significant for increased risk for readmission (OR-1.18{95% CI=1.10-1.26}, p=<0.0001
Rathore et al. (2006)	n=25,086, mean age 78.8, 57.7% female, 84.5% white	Retrospective chart review	Medicare beneficiaries hospitalized for HF in the United States	Crude 1-year readmission rates were highest among lower SES patients (71.8%, 67.7%, 67.4%, 65.8%, p=<0.001). Lower SES patients were at a higher risk for readmission (RR-1.08{95% CI=1.03-1.12}, p=<0.001)

Schwarz et al. (2003)	n=128, mean age 77.3, 50% female, 89% white	Prospective, descriptive, predictive design	2 community hospitals in northeastern Ohio	Caregiver informal social support significantly reduced risk of readmission (HR-0.933{95% CI=0.991-1.037}, p=<.01), Caregiver stress and depression increased risk for readmission (HR-1.005{95% CI=1.001-1.008}, p=<.05), Poor functional status increases risk (HR-1.388{95% CI=1.153-1.670}, p=<.001)
Smith et al. (2003)	n=413, mean age 73, 52% male, 76.7% white	Prospective design	Yale-New Haven Hospital	Readmissions for those with depressed EF (</=40%) (HR-1.07{95% CI=0.39-2.97}, p=0.90) Readmissions for those with preserved EF (>/=50%) (HR-1.26{95% CI=0.57-2.78}, p=0.57)

Abbreviations: ADHERE, Acute Decompensated Heart Failure Registry; NYHA, New York Heart Association; LV, left ventricle; Hgb, hemoglobin; BUN, blood urea nitrogen; COPD, chronic obstructive pulmonary disease; BNP, brain natriuretic peptide; SES, socio-economic status; EF, ejection fraction.

Figure 1. *Review Process Flowchart;* abbreviations: HF, heart failure; CINAHL, Cumulative Index to Nursing and Allied Health Literature.



Manuscript 2:

The Effect of Healthcare Policy on Reducing 30 day Readmissions for Patients with Heart Failure

Kelly Taylor, BSN, RN

Problem Statement

Hospital readmission rates for heart failure (HF) patients are a significant financial issue for the Centers for Medicare and Medicaid Services (CMS). Heart failure is the primary diagnosis for over one million hospitalizations a year and the national average 30 day readmission rate for patients with HF is approximately 20%.[2]

On March 23, 2010, the Patient Protection and Affordable Care Act (ACA) was signed into law. This law included Section 3025 the Hospital Readmission Reduction Program. Section 3025 is a reimbursement penalty approach for hospitals with readmissions for HF, along with acute myocardial infarctions (AMI) and pneumonia (PNA) that are deemed excessive by CMS.[31] Excessive readmissions are determined by measuring the readmission rates of a hospital, adjusting for age, sex, and coexisting conditions; these rates are then compared with the national averages to determine the penalty percentage.[31] The excessive readmission ratio, which is used to assign penalties to hospitals, adjusts for variation in the volume and case mix of the hospital. This penalty is applied to all hospitals, except those that are defined as critical access, and includes all cause diagnoses for readmission to the hospital.

Excessive readmission penalties, along with other reimbursement changes, have caused some smaller rural hospitals to become financially strapped, some have even closed due to bankruptcy. As a result, it has become necessary to address the following questions: Should new legislation be addressed to alter the Hospital Readmission Reductions Program to make exceptions for hospitals that serve a higher number of vulnerable HF patients? And would the ACA's ultimate goal of providing better quality of care to patients with HF be attained through more incentives for innovative ideas rather than fear of financial penalties? The following policy

analysis will outline the goals of the Establishing Beneficiary Equity in the Hospital Readmission Reduction Program Act of 2015, and offer other options the U.S. government may use to incentivize hospitals to provide better care to their patients with HF, thereby reducing 30 day readmissions in this population.

Background and Significance

Hospital readmissions are costly and detrimental to both patients and taxpayers. In 2013, approximately 18% of Medicare patients were readmitted within 30 days of discharge which cost Medicare more than $26 billion.[32] The Hospital Readmission Reduction Program allows CMS to penalize hospitals up to 3% of Medicare reimbursement when a large number of their patients are readmitted to any hospital within 30 days of discharge.[32] Centers for Medicare and Medicaid Services estimate about $428 million have been recouped from hospital penalties in the 2014-15 fiscal year.[32] This new law holds hospitals to a higher level of accountability for the quality of care they are providing to their patients and is an important step forward. However, a closer look at the effect of the Hospital Readmission Reduction Program reveals important concerns about the complexity of readmissions and what drives them.

There are now three years of data on hospital penalties and the evidence suggests that those hospitals that care for the most vulnerable patients, the chronically ill and low income patients, are more likely to be penalized than others.[33] Based on 2014 CMS data, safety net hospitals, which are defined as those hospitals in the upper quartile of the Disproportionate Share Hospital (DSH) index, were almost 60% more likely to be penalized than non safety net hospitals.[32] The Medicare Payment Advisory Commission found that those hospitals that have a higher proportion of patients that are elderly, live in poverty, or live with a disability, have a

higher likelihood of receiving penalties incurred by the Hospital Readmission Reduction Program.[32]

Senator Joseph Manchin III (D-West Virginia) supports the idea that hospitals should not be penalized because of the demographic characteristics of their patients. On March 10, 2015, Senator Manchin, along with fellow Senators Roger Wicker (R-MS), Mark Steven Kirk (R-IL), Bill Nelson (D-FL), Sherrod Brown (D-OH), and Rob Portman (R-OH) introduced Senate bill 688, the Establishing Beneficiary Equity in the Hospital Readmission Program Act of 2015, to amend title XVIII of the Social Security Act to adjust the Medicare Hospital Readmission Reduction Program and respond to patient disparities.[34] Co-sponsors of this legislation that have been added since the original development of the bill include Robert Menendez (D-NJ), Michael Bennet (D-CO), Shelley Moore Capito (R-WV), Al Franken (D-MN), and John Boozman (R-AR). On that date, the bill was read before the 114th Congress, 1st Session and sent to the Committee on Finance for review with no further action being taken at this time.[34]

The Establishing Beneficiary Equity in the Hospital Readmission Program Act of 2015 calls for a transitional adjustment for dual eligible (Medicare and Medicaid) patients and socioeconomic status (SES). The bill reads:

> In determining a hospital's excess readmission ratio under clause (i) for purposes of making payments for discharges occurring during fiscal years 2016 and 2017, and before the initial application of clause (iv), and in order to ensure that hospitals that treat the most vulnerable populations are not unfairly penalized by the program under this subsection, the Secretary shall provide for such risk adjustment as will take into account both a hospital's proportion of inpatients who are dual-benefit eligible individuals (as

defined by section 1935(c) (6)) and the socioeconomic status of the patients served by the hospital.[5]

The Establishing Beneficiary Equity in the Hospital Readmission Program Act of 2015 requires CMS to consider the SES of the patient population when calculating penalties for readmissions. The bill addresses the problems created by this provision for safety net hospitals that serve the most vulnerable patients, while preserving the key features of greater accountability that were originally introduced by the Hospital Readmission Reduction Program. The efforts put forth in this bill are consistent with those of the broader health policy community. The National Quality Forum, which is an agency created by Congress to validate quality health measures for federal health programs, recently came out in support of accounting for SES in specific circumstances, such as when calculating penalties for hospital readmissions.[32]

The Establishing Beneficiary Equity in the Hospital Readmission Program Act of 2015 would help ensure greater fairness in the program's incentives by requiring CMS to account for community level factors such as SES and the number of dual eligible patients when calculating risk adjusted readmission penalties. Finding equitable approaches to improving the U.S. health care system has been challenging, but considering SES in readmission rates has been one area of consensus among political parties.[32]

Conceptual Framework

John Kingdon's model of policy streams is a useful tool for analyzing why certain policies can be enacted or implemented at specific times within a specific political and policy context. Kingdon's model of policy streams describes three process streams of activities: the problem stream, the policy stream, and the political stream.[35]

Problem Stream

The problem stream deals with the complex nature of getting policy makers to focus on one particular issue. Policy makers and those who work closely with them rely on indicators to assess the significance of a problem.[35] Soaring readmission rates for patients, especially those with HF, have been an issue for years due to the financial burden it has imposed and is predicted to further impact Medicare spending in the future. As the number of Americans over the age of 65 continues to grow, readmissions for patients with HF will continue to be a problem for CMS. Since the passage of the ACA's Hospital Readmission Reduction Program in 2010, there have been reports of rural hospitals facing numerous reimbursement cuts and readmission penalties causing a steady number of closings over the past few years.[36,37] Changes in indicators, such as these, are what policy makers look for before truly defining an issue as a problem. The increase in evidence of indicators that pointed to an increase in rural hospital closures due to excessive readmission penalties from CMS, helped define this as a problem.

Policy Stream

The second component of Kingdon's conceptual framework is the description of policy subsystems and their policy goals. This includes interest groups, congressional staffers, agency officials, and researchers. Interest groups such as the American Hospital Association, American Medical Association, American Association of Heart Failure Nurses, along with each individual state's Rural Health Association, and Rural Health Hospital Associations would all have a vested interest in any adjustments made to the Hospital Readmission Reduction Program.

The Establishing Beneficiary Equity in the Hospital Readmission Reduction Program Act of 2015 recommends that CMS decrease the readmission penalty imposed on hospitals that care

for the more vulnerable populations. One of the key stakeholders in potential reform of the Hospital Readmission Reduction Program is CMS. They would possibly be losing a substantial amount of money if they have to consider the vulnerability of a hospital's patient population when calculating for readmission penalties. Hospitals and hospital administrators would need to understand what provisions would allow them to have lower penalties for readmissions and how to prove the vulnerability of their patient population to CMS. Any health care provider caring for patients with HF could possibly be affected by an amendment to the Hospital Readmission Reduction Program.

Political Stream

Kingdon identified three major components that make up the political stream: the national mood, organized political forces, and events within the government.[35] Organized political forces, such as interest groups, carry a lot of influence on the administration to deal with the out of control health care finances. Furthermore, media attention to the increasing cost of health care and the financial strain on physicians and hospitals, due to the changes incurred by the ACA has brought increased attention to this issue in Washington.

There is growing concern that rural hospitals may not be able to withstand the large financial penalties being imposed by the current Hospital Readmission Reduction Program. For example, 72% of the patients served by rural hospitals in the state of Kentucky are Medicare or Medicaid eligible, which means almost three quarters of their patients are either elderly, low income, or disabled.[38] Many view the penalties on hospitals that have a high risk for readmission due to their patient population's SES as an unfair stigmatization of this population. Senate bill

688 suggests that the ACA's Hospital Readmission Reduction Program will more accurately measure the quality of care once risk adjustments for SES are implemented.

Although many other countries have a national health care system they seem to be taking a different approach to national health care. Countries such as the United Kingdom (UK), Australia, and New Zealand are striving for greater accountability from their health professionals.[39] For example, the UK's government has proposed tying a substantial portion of their reimbursement to hospitals to a wide ranging and complex set of quality indicators.[39] However, no provisions were found that directly related penalizing hospitals for 30 day readmissions.

It may be an unrealistic expectation that this bill will become law in a timely manner. Therefore, hospitals, administrators, physicians, and advanced practice registered nurses need to be more aggressive at addressing the problem of readmission rates. New interventions tailored around characteristics that place patients at higher risk for readmission, such as low SES, need to be implemented when patients are admitted to the hospital. A multidisciplinary, comprehensive, transitional care plan should be in place upon admission and followed through to their discharge and beyond to ensure patients are receiving the best quality of care.

One option for reducing HF readmission risk other than creating new laws in Congress would be the creation of a comprehensive risk identification instrument for patients admitted with HF, to identify those at the greatest risk for readmission and provide improved transitional care interventions to help reduce readmissions. A well designed readmission risk prediction instrument has the potential to identify those patients most at risk for readmission upon initial presentation to the hospital. Using a prediction instrument would allow interventions to be

focused directly at the targeted risk factors during a hospitalization, as well as the development of a targeted transitional plan of care prior to discharge. Once identified those patients would work closely with the transitional care team while hospitalized to ensure all issues are addressed before discharge.

Correspondingly, Verhaegh et al's[40] findings have suggested that short term readmissions (<30 days) can be avoided by high intensity inpatient interventions that include care coordination by a well trained RN or advanced practice nurse, communication between the patient's primary care provider and the hospital, and a home visit within three days of discharge. There are numerous studies that show a decrease in readmission rates in patients with HF that received a more intense, multidisciplinary team approach to care while hospitalized, throughout the discharge process, and after discharge home.[5, 41-43] Unfortunately, there is little evidence that supports that predictive instruments are being utilized to identify patients with HF at highest risk for readmission.

Transitions of care are highly vulnerable periods for patients living with HF. To make these transitions successful, health care systems would need to create a transitional care team for HF that would rely on members from many disciplines, including nurses, physicians, social workers, and pharmacists. According to Tingley,[1] the benefits of a team based approach is the various assessment perspectives, listening styles, and specialized training the different members offer. Having shared decision making and coordination with the multidisciplinary team supports the outcomes most relevant to each individual patient. According to Popejoy,[33] for transitions from hospitals to be successful there must be available and adequate services to support patients and their families. This reinforces the importance of this team based care also extending into the community once patients are home. By utilizing the expertise of the different disciplines,

patients would be receiving the best possible care which would decrease their risk for readmission.[30]

This option would have the potential to decrease the financial penalties from CMS and could also enhance patient experiences, increase patient satisfaction and improve quality of life for those who received the services.[44] Hospitals with limited resources could start with a smaller version of the transitional care team and increase their staff as the need arises.

Strategies to Move Forward

As we move forward in attempts to reduce costs associated with readmissions, a conscious effort should be made to avoid unfairly penalizing hospitals that provide care to the underserved. Whether Senate bill 688 is the best way to accomplish this or a regulation change that provides incentives for those hospitals trying to improve their transitions of care, it is important to acknowledge that this is an arduous process. As Kingdon[35] noted there is a long process of softening up the system but this process is critical to policy change.

Public support is always important when trying to convince politicians that there is a problem that needs to be addressed. The national mood and public opinion play important roles in setting the policy agenda and policy outcomes. Bringing media attention to the problem is one way to get the public involved. The media highlighting the struggles of the small, rural hospitals due to the financial constraints imposed by CMS penalties would be helpful. When constituents that have lost their local hospitals begin to complain to their state representatives or senators, these leaders may be more inclined to listen. Many government officials still believe that they solved the readmission problem with the passage of the Hospital Readmission Reduction

Program. Getting them to see old problems in a new way is a major conceptual and political accomplishment.

Interest groups are another way to get the attention of politicians. Those groups that have an interest in the CMS readmission penalties include the American Medical Association (AMA), the American Hospital Association (AHA), and the American Nurses Association (ANA), along with individual state associations and the Rural Health Associations and state hospital associations that have many small town rural hospitals which have already closed or are struggling to stay afloat. The financial policy development officers in the state hospital associations need to make their needs known to their senators to push the issue forward.

Conclusion

Patients hospitalized for HF are vulnerable, have complex care management needs, and are at high risk for re-hospitalization.[30]The intention of the Hospital Readmission Reduction Program was to improve the quality of care hospitals are providing patients admitted with HF, AMI, and PNA. The best way to do this may not be through policy change, but for hospitals to recognize the importance of transitions of care for these patients throughout their care continuum, and how the implementation of evidence based interventions and quality strategies are needed to ensure the desired outcomes.

Manuscript 3:

Prediction Screening to Identify Heart Failure

Patients at Risk for Readmission

Kelly Taylor, BSN, RN

Introduction

Approximately 6 million adults over the age of 20 in the United States have HF; this number is estimated to increase by 25% by the year 2030 with approximately 800,000 new cases being diagnosed each year.[2,45] Heart failure has become a significant burden on the healthcare system and is the leading cause of hospitalizations among those 65 years of age and older in the United States. It is the primary diagnosis for greater than one million hospitalizations per year and has a five year mortality rate of approximately 50%.[6] The estimated direct and indirect costs of treatment for Americans with HF have reached approximately $40 billion per year and are projected to rise to nearly $70 billion by 2030.[1,3] It is estimated that approximately 20% of Medicare beneficiaries hospitalized for HF are readmitted within 30 days of hospital discharge.[2]

On March 23, 2010, the Patient Protection and Affordable Care Act (ACA), was signed into law. One of the healthcare reform act's (HR 3590) key provisions is to reduce readmissions and improve care transitions for patients hospitalized with HF, acute myocardial infarctions, and pneumonia in an effort to save $7.1 billion dollars over a ten year period.[4] This Hospital Readmission Reduction Program (HRRP) is a reimbursement penalty approach for general acute care hospitals that have readmissions deemed excessive by the Centers for Medicare and Medicaid Services (CMS).[4] Excessive readmissions are defined by measuring the readmission rates of a hospital, adjusted for age, sex, and coexisting conditions, which are then compared with the national averages to determine the penalty percentage.[32] The excess readmission ratio, which is used to assign penalties to hospitals, adjusts for variation in the volume and case mix of the hospital. This penalty is applied to all hospitals, except those that are defined as critical access, and includes all cause diagnoses for readmission to the hospital. This has challenged

hospitals to identify ways to reduce their readmission rates and prevent avoidable readmissions for these common initial diagnoses.

It is important to note that potentially 40% of all readmissions for HF exacerbation are considered preventable.[5]There are numerous factors contributing to a preventable readmission such as a lack of social support, discretionary dietary sodium intake, financial concerns that prevent the patient from complying with the treatment plan, or health care providers failing to recognize a patient's poor health literacy. Despite two decades of research on the subject, most U.S. hospitals continue to struggle with readmission rates related to HF.[11] The ability to prevent avoidable readmission has been linked to having a better understanding of HF and which clinical and social indicators put patients most at risk for readmission.

In an integrative review of 19 studies, the most common characteristics cited as being predictive of readmission included having the co-morbid conditions of chronic obstructive pulmonary disease and atrial fibrillation, a reduced ejection fraction of $\leq 40\%$, being admitted to the hospital in stage III or IV of the New York Heart Association (NYHA) functional classification, certain laboratory values, living alone, depression, and anxiety. Although these variables were found to be significant predictors in one or more studies reviewed there was at least one study in my review that disputed these results. The only variables that were predictive in all the studies reviewed was being over the age of 70, having been previously diagnosed with HF, and having at least one previous admission within the prior 12 months had on predicting 30 day readmission. The purpose of this study is to identify characteristics that place HF patients at a higher risk for readmission within 30 days of hospital discharge in two regional academic medical centers in central Kentucky. The specific aim of this project is to compile those characteristics and create a risk prediction model to be used in practice to determine those

patients that may need more individualized interventions upon initial presentation to the hospital. Factors assessed for their ability to contribute to future exacerbation and readmissions for patients with HF were chosen based on findings from the studies in the integrative review along with personal clinical experience working with the HF population.

Methods

Sample

This prospective study was conducted using a longitudinal research design protocol in patients admitted with a primary or secondary diagnosis of HF between the dates of February 2015 to February 2106. The Institutional Review Boards (IRB) at the University of Kentucky and the University of Louisville approved this study. Any HF admission between February 2015 and February 2016 was considered the index admission for the study. Inclusion criteria for the study included patients admitted with a confirmed primary or secondary diagnosis of HF; patients were excluded if they had dementia or were mentally incapacitated, had previously had or were being worked up for a heart transplant or left ventricular assistive device placement, were current drug or alcohol abusers, had suffered an acute myocardial infarction or stroke within the past three months, were newly diagnosed with HF, or had a current terminal illness.

Measures

Registered nurses (RN) identified eligible patients from daily screening of HF admissions to the hospitals, as well as referrals from the HF APRN. After inclusion and exclusion criteria were applied patients were approached and asked to sign an informed consent for participation. Demographic variables collected included age, gender, race/ethnicity, marital status, education level, and other relevant data to describe this population. Clinical factors

included left ventricular ejection fraction (EF), Charlson comorbidity index (CCI), serum creatinine levels, serum sodium levels, serum hemoglobin levels, NYHA, and body mass index (BMI). Behavioral variables were assessed using validated and reliable measurement instruments including the Patient Health Questionnaire 9 (PHQ-9) to assess for depressive symptoms (Appendix A), the Brief Symptom Inventory (BSI) was used to assess anxiety level (Appendix B), and the Multidimensional Perceived Social Support Scale (MPSSS) (Appendix C) was used to determine the patients level of perceived social support. The Medical Outcomes Study (MOS) Specific Adherence Scale (Appendix D) was used to assess patient's adherence to treatment plans.

Data were collected from surveys conducted with the patient, as well as from the electronic medical record while hospitalized and transcribed by the RN's into Red Cap. Patient and family interviews were conducted by telephone at 30 and 90 days after discharge to inquire about any hospitalizations within that period.

Data Analysis

Data were analyzed using SPSS version 22 software. Assumptions of normality and possible outliers were reviewed for all data. Initially, descriptive statistics were computed for both groups (patients who had a readmission and those who did not have a readmission). Chi-Square of association and independent t-tests were used to examine bivariate differences between those patients who were readmitted and those who were not readmitted. Cox proportional hazards modeling was used to predict the outcome, *time to readmission*, based on the predictor variables. A P value of $\leq .05$ was considered significant for all.

Results

A study population of 158 patients was obtained. The majority of the sample was white (73%) with the mean age of 62.6 years, there was an equal distribution of male to female subjects (Table 1). The median time to readmission was 68 days. There were eight readmissions that occurred within the first 30 days after discharge and 61 readmissions between discharge days 31-90. Of the 69 readmissions, 28 patients were readmitted due to a HF exacerbation, 20 patients were readmitted due to a non-HF related cardiovascular event, and the remaining 21 patients had various other reasons for readmission.

As noted in Table 1, comparing those readmitted with those not readmitted, there were few differences noted. The data from our sample of HF patients identified that having a higher number of depressive symptoms was significantly different for the re-hospitalized patients compared to the non-hospitalized patients. Table 2 provides the results of the Cox proportional hazards modeling in which we identified no significant models that predicted readmission. Numerous theoretically driven models were tested and still found no significant prediction for the outcome.

Four of the eight variables on the MOS survey, weighing daily, symptom recognition, exercise, and medication adherence were examined to compare the self care behaviors between those patients who had a readmission and those who did not (Figure 1). The only significance between the two groups was that a higher percentage of patients with a re-hospitalization reported weighing daily which is counterintuitive to the belief that patients weighing themselves daily could prevent readmission to the hospital. There was no significant differences observed in the other self care behaviors between patients who had a readmission and those who did not.

Discussion

Predicting HF readmission is highly complex. Many factors may play a role in why HF patients are readmitted. The data from our sample of HF patients identified that having a higher number of depressive symptoms was significantly different for the re-hospitalized patients compared to those who were not re-hospitalized within 90 days of discharge. These data in concert with the existing literature, suggest that assessing depression carefully may provide the best prediction of future events. Results from two of the studies included in the review of literature also found depression to be a significant in HF patients with readmissions.[8,9] This information provides evidence of the importance of assessing a patient's depression status carefully using a validated and reliable instrument, upon the patients admission to the hospital and ensuring those results are addressed accordingly.

The unique contribution of this study is the indication that a comprehensive approach is needed to identify those at risk for readmission and what clinicians can do to decrease those preventable readmissions. As noted from the results of the MOS adherence measurement instrument, prevention of readmission may include the development of specific interventions focused on examining patient's adherence to self care monitoring and how to increase adherence. Additional research is needed to determine how interventions targeting knowledge and adherence in HF patients would decrease the incidence of readmission.

Limitations

Limitations to this study included the small sample size and the low number of patients with an all cause hospitalization. Also, while minimal, the occurrence of missing data is another limitation to this study.

Summary

The findings from this study identified many barriers, as well as potential areas for improvement, to consider when attempting predicting risk for readmission in the HF population. It highlighted the fact that it is difficult to predict which HF patients are at the highest risk for readmission. However, the results of the study did identify having a higher number of depressive symptoms as a potential predictive variable when looking at HF patients at risk for readmission.

TABLE 1-Sample Characteristics and Comparison of Characteristics Between Patients Hospitalized versus Not Hospitalized

Variable	HF (n=158), n (%or Mean (SD), Median (Range)	All cause hospitalization	Not Re-hospitalized	*P*-value
Age	62.6 (13.1), 31-93	69, 63.1 (14.2)	71, 63.0 (10.6)	.97
Gender				.62
Male	78(49.4%)	35 (50.7%)	32(45.1%)	
Female	80(50.6%)	34 (49.3%)	39(54.9%)	
Marital Status				.39
Lives Alone	92 (58.2%)	38 (55.1%)	45 (63.4%)	
Co-Habitates	66 (41.8%)	31 (44.9%)	26 (36.6%)	
Education	12.7 (2.7) 4-21	69, 12.6 (2.8)	71, 12.6 (2.5)	.97
Financial Status				
>Enough	92 (58.2%)	39 (56.5%)	39 (54.9%)	.87
<Enough	66 (41.8%)	30 (43.5%)	32 (45.1%)	
NYHA				1.0
I-II	44 (27.8%)	20 (31.7%)	20 (31.7%)	
III-IV	100 (63.3%)	43 (68.3%)	43 (68.3%)	
Race/Ethnicity				
Black/ African American	41 (25.9%)	16 (11.4%)	25 (17.9%)	.19
White	116 (73.4%)	52 (37.1%)	46 (32.9%)	
Other	1 (0.6%)	1 (.07%)	0 (0%)	
Admit Hemoglobin	12.1 (2.1) 5.8-18.2	69, 12.0 (2.2)	71, 12.1 (1.8)	.63
Admit Creatinine	1.6 (1.3) 0.4-9.3	69, 1.7 (1.4)	71, 1.5 (1.3)	.46
Admit Sodium	138 (4.5) 116-147	69, 138.6 (3.8)	71, 137.8 (5.2)	.27
Ejection Fraction	36.7 (16.5) 10-77	68, 35.9 (14.2)	69, 39.7 (17.9)	.17

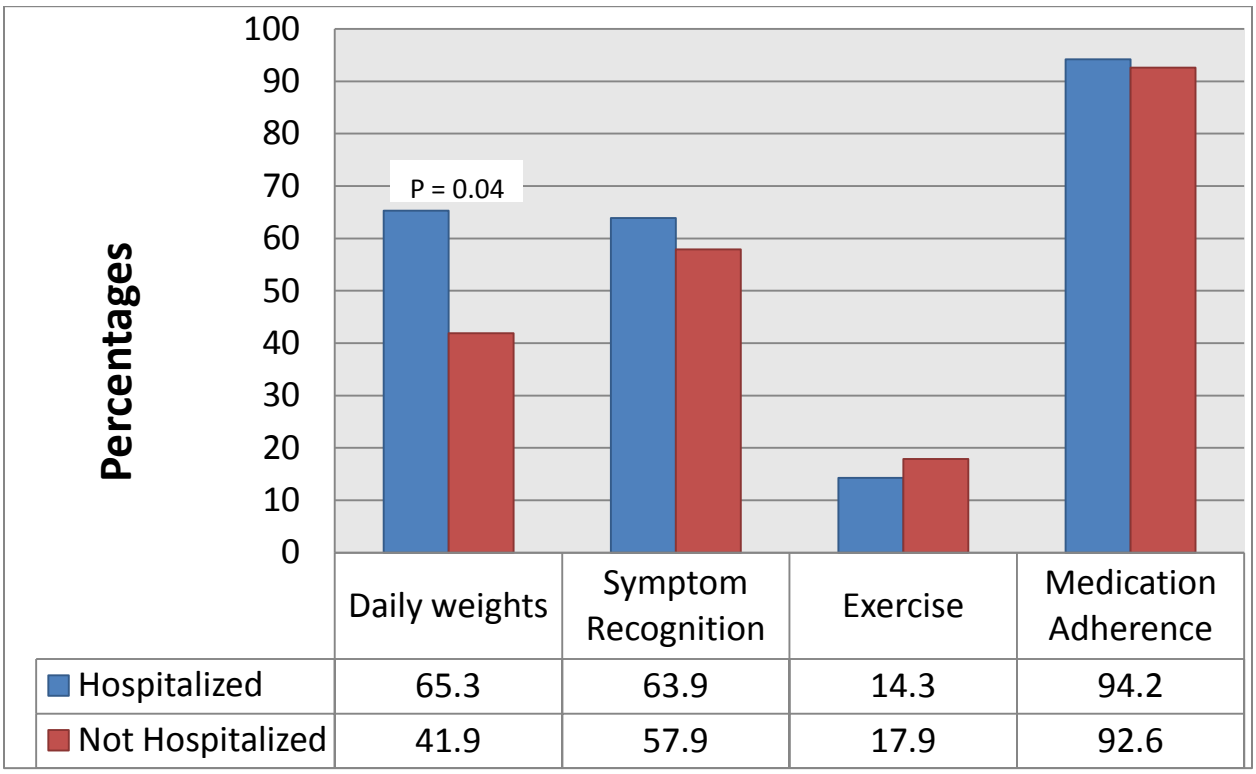
Body Mass Index	4 (2.9%)	2 (2.9%)	2 (2.9%)	.68
Underweight	24 (17.1%)	13 (18.8%)	11 (15.5%)	
Normal Weight	26 (18.6%)	15 (21.7%)	11 (15.5%)	
Overweight	86 (61.4%)	39 (56.5%)	47 (66.2%)	
Obese				
Charlson Co-Morbidity	4.2 (2.1) 1-10	62, 4.4 (2.3)	64, 3.9 (2.1)	.20
BSI Anxiety Score	1.1 (.9) 0-3.8	68, 1.2 (.93)	71, .94 (.81)	.06
PSS Social Support	68.3 (16.9) 12-84	67, 68.8 (17.5)	69, 67.3 (16.1)	.61
PHQ-9 Depression				
0-9 Not Depressed	60 (44.8%)	23 (34.8%)	37 (54.4%)	.03
10>Depressed	74 (55.2%)	43 (65.2%)	31 (45.6%)	

Abbreviations: NYHA, New York Heart Association; BSI, Brief Symptom Inventory; PSS, Multidimensional Scale of Perceived Social Support; PHQ, Patient Health Questionnaire

Table 2-Results, Cox Survival Analysis

Variable	Odds Ratio	95% Confidence Interval	P value
Gender	1.34	0.78-2.33	0.28
Age	1.01	0.98-1.03	0.38
Cohabitation (alone or with someone)	1.09	0.61-1.93	0.75
Education level	1.03	0.93-1.14	0.54
Financial status	0.87	0.68-1.12	0.31
Sodium	1.02	0.96-1.09	0.34
Creatinine	1.03	0.85-1.25	0.70
Hemoglobin	1.03	0.90-1.18	0.64
BSI	1.27	0.94-1.71	0.11
PHQ	0.62	0.35-1.09	0.10
MOS	1.03	0.99-1.06	0.06

Figure 1-Comparison of Selected Self-Care Behaviors Between the Two Groups of Hospitalized and Non-Hospitalized Patients



	Daily weights	Symptom Recognition	Exercise	Medication Adherence
Hospitalized	65.3	63.9	14.3	94.2
Not Hospitalized	41.9	57.9	17.9	92.6

Conclusion

The findings from this practice inquiry project identified many barriers, as well as potential areas for improvement, to consider when attempting predicting risk for readmission in the HF population. It highlighted the fact that it is difficult to predict which HF patients are at the highest risk for readmission. Based on this study, it was not possible to create a prediction instrument to identify HF patients upon admission to the hospital. However, the results of the study did identify having a higher number of depressive symptoms as a potential predictive variable when looking at HF patients at risk for readmission. It also noted from the results of the MOS adherence measurement instrument, prevention of readmission may include the development of specific interventions focused on examining patient's adherence to self care monitoring and how to increase adherence.

HF continues to be one of the most significant burdens on our health care system. Heart failure management will continue to evolve toward prevention based management, as a direct result of financial pressures on health care facilities and clinicians by CMS. With this evolution we, as health care providers, will have a tremendous opportunity to develop more comprehensive methods to improve patient adherence to their medications, daily weight monitoring, symptom recognition, and exercise regimens. Advanced Practice Clinical Nurse Specialists are an essential component to providing quality HF care which will lead to improved resource utilization, decreased economic burden, and better quality of life in the HF population.

Appendix A- PATIENT HEALTH QUESTIONNAIRE

Over the last 2 weeks, how often have you been bothered by any of the following problems? *SHOW CARD 7.*		Not at all	Several days	More than half the days	Nearly every day
1.	Little interest or pleasure in doing things	0	1	2	3
2.	Feeling down, depressed or hopeless	0	1	2	3
3.	Trouble falling asleep or staying asleep, or sleeping too much	0	1	2	3
4.	Feeling tired or having little energy	0	1	2	3
5.	Poor appetite or overeating	0	1	2	3
6.	Feeling bad about yourself – or that you are a failure or have let yourself or your family down	0	1	2	3
7.	Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8.	Moving or speaking so slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9.	Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

Appendix B- BRIEF SYMPTOM INVENTORY

I'd like to read a list of problems people sometimes have. Please tell me how much the problem has distressed or bothered you recently, including today. *SHOW CARD 6.*

		Not at all	A little bit	Moderately	Quite a bit	Extremely
1.	Nervousness or shakiness inside	0	1	2	3	4
2.	Suddenly scared for no reason	0	1	2	3	4
3.	Feeling fearful	0	1	2	3	4
4.	Feeling tense or keyed up	0	1	2	3	4
5.	Spells of terror or panic	0	1	2	3	4
6.	Feeling so restless you couldn't sit still	0	1	2	3	4

Appendix C- MPSSS

For each of the statements below, indicate how much you agree or disagree. ***SHOW CARD 8.***

		Very Strongly Disagree						Very Strongly Agree
1.	There is a special person who is around when I am in need	1	2	3	4	5	6	7
2.	There is a special person with whom I can share my joys and sorrows	1	2	3	4	5	6	7
3.	My family really tries to help me	1	2	3	4	5	6	7
4.	I get the emotional help and support I need from my family	1	2	3	4	5	6	7
5.	I have a special person who is a real source of comfort to me	1	2	3	4	5	6	7
6.	My friends really try to help me	1	2	3	4	5	6	7
7.	I can count on my friends when things go wrong	1	2	3	4	5	6	7
8.	I can talk about my problems with my family	1	2	3	4	5	6	7
9.	I have friends with whom I can share my joys and sorrows	1	2	3	4	5	6	7
10.	There is a special person in my life who cares about my feelings	1	2	3	4	5	6	7
11.	My family is willing to help me make decisions	1	2	3	4	5	6	7
12.	I can talk about my problems with my friends	1	2	3	4	5	6	7

13. How would you rate the quality of support you receive? *READ AND CIRCLE ONE.*

1. Poor
2. Satisfactory
3. Good
4. Very good

Appendix D- Medical Outcome Study Specific Adherence Scale

Please tell me the number that indicates how often you have done each of the following in the past 4 weeks. If an item does not apply, select NA for Not Apply. For example, if you don't smoke cigarettes, select the NA answer. ***SHOW CARD 12.***

		None of the time	A little of the time	Some of the time	A good bit of the time	Most of the time	All of the time	N/A
1.	Exercise regularly	0	1	2	3	4	5	6
2.	Took prescribed medication	0	1	2	3	4	5	6
3.	Cut down on the alcohol you drink	0	1	2	3	4	5	6
4.	Stopped or cut down on smoking	0	1	2	3	4	5	6
5.	Followed a low salt diet	0	1	2	3	4	5	6
6.	Followed a low fat or weight loss diet, if needed	0	1	2	3	4	5	6
7.	Weighed yourself every day to watch your fluid status	0	1	2	3	4	5	6
8.	Monitored your symptoms every day	0	1	2	3	4	5	6

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