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Impact of Heart Failure Transitions of Care Program: A Prospective Study of Heart Failure Education and Patient Satisfaction

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Abstract

Purpose: The purpose of the study is to evaluate the impact of heart failure medication education on 30-day all-cause readmission rates and patient-reported satisfaction scores. **Methods:** This single-center pilot study was conducted at a 396-bed tertiary-care hospital in the Midwest from September 2017 to December 2018. For research purposes, patients were divided into 2 groups. The control group was looked at retrospectively and included patients who received education by the nurse educator. The intervention group was reviewed proactively and included patients who received education by a pharmacy student. The purpose of the study was to compare readmission rates among patients who received medication education from pharmacy students with those who received the same education by the heart failure nurse educator. The primary outcome was 30-day all-cause readmission rate among those with a diagnosis of heart failure. The secondary endpoints included patient satisfaction scores by phone survey. The patient satisfaction phone survey was conducted by a single pharmacist 1 week after patient education was provided. **Results:** For the primary endpoint, there were 222 patients in the treatment group compared with the control group of 941 patients. The treatment group resulted in 30 (13.5%) of the 222 patients being readmitted within 30 days compared with the control group where 186 (19.6%) of the 941 were readmitted ($P = .0395$). The risk reduction in odds ratio and relative risk of readmission was 0.63 (confidence interval [CI] = 0.42-0.96) for the treatment group and 0.68 (CI = 0.48-0.98) for the control group. For the secondary endpoint, 56 patients were called 1 week after discharge, and there was no significant difference in overall patient satisfaction between groups. **Conclusion:** This study demonstrated that heart failure medication education provided by the pharmacist or pharmacy student resulted in improved patient outcomes and ultimately a reduction in 30-day all-cause readmission rates.

Keywords

patient education, cardiovascular, clinical services, cost-effectiveness, outcomes research, schools of pharmacy

Introduction

Patients with heart failure (HF) have a significant impact on the health care system in the United States. Heart failure is the fourth leading cause of death attributed to cardiovascular (CV) disease and affects an estimated 6.5 million adults. Further studies estimate that more than 8 million adults will be affected by HF by 2030, leading to a total cost of $69.7 billion in the health care system.[1] Major risk factors associated with HF include coronary heart disease, diabetes, and hypertension. Research through the National Center for Health Statistics indicates that one-third of US adults are affected by at least one of these risk factors.

Approximately 1 million patients are hospitalized each year for HF.[2] In 2011, the leading cause of 30-day readmissions for Medicare patients was HF, and it costs approximately $1.75 billion.[3] To encourage improvement in patient outcomes, the Hospital Readmission Reduction Program of the Centers for Medicare and Medicaid Services established a rule in 2012, which reduced reimbursement to hospitals that have readmission rates within 30 days.[4] Therefore, it is extremely important to provide a multidisciplinary approach to care to ensure patients are on correct pharmacotherapy and stay adherent to their medications.

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Many studies have been conducted to determine reduction of readmission rates among HF patients; however, these studies have not adequately been powered to detect a difference.[5-7] Furthermore, there is limited research that has specifically evaluated the impact of student-led counseling prior to patient discharge. While one published study determined there was no significant difference in readmission rates through pharmacy student–led and pharmacy resident–led counseling to HF patients, it did find an estimated cost avoidance of $4241.[6]

Other small studies have shown a favorable effect at reducing readmission rates through pharmacy-led education.[8,9] One study found favorable outcomes in transition of care with pharmacy resident–led counseling, with a reduction of 30-day HF readmission rate from 28.1% to 16.6%. However, this study has several limitations, including a small sample size of only 30 patients.[8]

Due the limitations of these studies, more research needs to be done with pharmacist-led counseling to HF patients to determine whether there is improvement in health care outcomes, hospital readmission rates, and health care spending.[6]

Methods

This single-center pilot study was conducted at a 396-bed tertiary-care hospital in the Midwest from September 2017 to December 2018 and was approved by the institutional review board. For research purposes, patients were divided into 2 groups. The control group was looked at retrospectively and included patients who received education by the nurse educator. The intervention group was reviewed proactively and included patients who received education by a pharmacy student. The purpose of the study was to compare readmission rates among patients who received medication education from pharmacy students with those who received the same education by the HF nurse educator. Patients who met inclusion were older than 18 years; diagnosed with HF, counseled by a fourth-year pharmacy student, pharmacist, or HF educator; English speaking; and were able to provide verbal consent to the survey. Patients were identified by the HF educator who is a registered nurse designated to teach patients with an active diagnosis of HF. Patients with complex drug regimens and prior hospitalizations were given priority to receive education by the pharmacy student. Patients who were newly diagnosed with HF were also given priority. In some instances, family members were also educated, especially in circumstances where they were the primary caregiver. The teaching was broken down into 3 parts: disease state, diet, and medication education. Pharmacy students took over the medication portion but the HF educator continued to provide diet and disease state information. Fourth-year pharmacy students were provided in-depth education on HF medications, including their indication and contraindications, mechanism of action, side effects, and adverse reactions. The medication handout used by the pharmacy student can be found in Figure 1, this table was adapted from the heart failure education booklet entitled "ACTively Living with Heart Failure", a patient education resource provided by the health network.[10] The pharmacist would use the "see one, do one, teach one" approach where they would first model a HF medication education, and then the student would complete one with the pharmacist in the patient's room. If the pharmacist confirmed the student was ready, they could provide the education independently. Once the education was completed, the pharmacy student then documented this education in a spreadsheet and in the electronic patient chart. The pharmacist or attending physician was instructed to follow-up with patient questions when the student could not answer them. Patients educated by the pharmacy student were provided with verbal education and a written medication information handout that was written at a sixth-grade reading level. The primary outcome was 30-day all-cause readmission rate among those with a diagnosis of HF. Readmission rates were captured via a report obtained for quality measures as a tracking necessary for benchmarking HF readmissions. The secondary endpoints included patient satisfaction scores by phone survey. The patient satisfaction phone survey, which can be found in Figure 2, was conducted directly by a single pharmacist 1 week after patient education was provided.

Statistical Analysis

Inferential statistical methods for this study applied χ^2 with Yates correction for categorical data and Student's t test for continuous data. Statistics in R program was used for analysis.

Results

On average, the patients in the treatment group were 70 years old with a chronic HF diagnosis. Figure 3 summarizes the baseline characteristics of the treatment group. Patients were educated on a variety of medications as summarized in Figure 4.

For the primary endpoint, there were 222 patients in the treatment group compared with the control group of 941 patients. Furthermore, in the treatment group, 214 (96.4%) of the 222 patients were educated by pharmacy students and 8 (3.6%) of the 222 patients were educated by the pharmacist during the training of the pharmacy student. The treatment group resulted in 30 (13.5%) of the 222 patients being readmitted within 30 days compared with the control group where 186 (19.6%) of the 941 were readmitted ($P = .0395$) as depicted in Figure 5. The risk reduction in odds ratio and relative risk of readmission was 0.63 (confidence interval [CI] = 0.42-0.96) for the treatment group and 0.68 (CI = 0.48-0.98) for the control group.

Your Heart Failure Medications

There are several types of heart failure medications. Work with your healthcare provider to identify which medications you have been prescribed and the reason you are taking each of them. Taking your medications as prescribed will help manage your heart failure and symptoms.

Ask your healthcare provider and pharmacist what you should expect from your medications and ways to prevent or reduce side effects. Also, be sure to find out when to call your healthcare provider for help managing serious side effects.

Drug Class	Your Doctor Prescribed	How It Works	Side Effects	Notes
Angiotensin Converting Enzyme (ACE) Inhibitor	Lisinopril (Zestril, Prinivil) Enalapril (Vasotec) Benazepril (Lotensin) Captopril (Capoten) Quinapril (Accupril) Ramipril (Altace)	• Relaxes blood vessels which causes a decrease in pressure on the heart. This results in a lowering of blood pressure.	Low blood pressure (dizziness or feeling light-headed). Cough (dry, no mucus, production). Change in kidneys' ability to filter things out of the body. Increase in potassium. Allergic reaction (face, lips, tongue swelling)	Your doctor may change your dose over time. Lab tests will be monitored (potassium, and kidney function). **Seek medical attention if** swelling of the face, lips, or tongue occur.
Angiotensin Receptor Blocker (ARB)	Candesartan (Atacand) Losartan (Cozaar) Valsartan (Diovan)	• Relaxes blood vessels which causes a decrease in pressure on the heart. This results in a lowering of blood pressure.	Low blood pressure (dizziness or feeling light-headed). Change in kidneys' ability to filter things out of the body. Increase in potassium. Allergic reaction (face, lips, tongue swelling.	Similar to ACE inhibitor. Your doctor may change your dose over time. Lab tests will be monitored (potassium, and kidney function). **Seek medical attention if** swelling of the face, lips, or tongue occur.
Beta Blocker	Bisoprolol (Zebeta) Metoprolol succinate (Toprol XL) Carvedilol (Coreg) Carvedilol CR (Coreg CR)	• Blocks certain hormones in the body that can increase blood pressure. • Decreases the pressure on the blood vessels and heart which causes a decrease in blood pressure and heart rate.	Low blood pressure or heart rate (dizziness or feeling light-headed). Decreased energy or ability to exercise. Depression.	Your doctor may increase the dose over time. Do not stop taking this medication without help from your doctor. **Speak to your doctor if** you have any mood changes or other side effects.
Diuretic	Furosemide (Lasix) Bumetanide (Bumex) Torsemide (Demadex) Chlorothiazide (Diuril) Amiloride (Midamor) Chlorthalidone (Hygroton)	• Helps remove fluid from the body, which reduces swelling and improves breathing. Takes less effort for the heart to pump.	More frequent urination; loss of potassium, magnesium, or sodium from body; kidney problems; will lower your blood pressure (may make you dizzy); high blood sugar; gout; impotence; dehydration.	The dose may change depending on how much fluid is stored in your body. Potassium supplement may be prescribed, by your healthcare provider.
	Hydrochlorothiazide or HCTZ (Microzide, Hydrocot) Indapamide (Lozol) Metolazone (Zaroxolyn) Triamterene (Dyrenium)			
Aldosterone antagonist	Spironolactone (Aldactone) Eplerenone (Inspra)	• Blocks the effect of certain hormones that may damage the heart, decreases strain on the heart.	May cause changes in kidney function; low blood pressure (may cause dizziness); breast swelling, tenderness, or enlargement (in men and women); increase potassium in the body	Monitor potassium levels while on this medication, if levels are high, you may need to restrict or avoid high-potassium food.
Peripheral Vasodilator	Hydralazine/Isosorbide dinitrate (BiDil)	• Decreases the amount of work the heart has to work against and lowers blood pressure. • Two separate medications used together.	Low blood pressure (may cause dizziness); fast heart rate; headache; lupus; swelling in the legs; nausea and vomiting; flushing	**Call your healthcare provider** if you have side effects.
Digitalis Preparation	Digoxin (Lanoxin)	• Slows heart rate and improves the contractions of the heart.	*If drug level is too high:* may cause some slowing of heart rate; yellow-tinted vision; loss of appetite; stomach pain; nausea or vomiting; diarrhea; heart rhythm problems; tiredness or weakness.	**Call your healthcare provider** if you have bothersome side effects. May require checking medication levels.
Angiotensin Receptor – Neprilysin Inhibitor(ARNI)	Valsartan-Sacubitril (Entresto)	• This medication works by relaxing blood vessels and decreasing sodium and fluid in the body • May be used in place of an ACE inhibitor or ARB	Lowers blood pressure (may cause dizziness); change in kidney function; increase potassium in the body; swelling of the mouth, lips, or tongue.	**Get medical help right away if** mouth lips, or tongue become swollen. May need tests to monitor potassium and kidney function while on this medication.
I_f Channel Blocker	Ivabradine (Corlanor)	• Decreases your heart rate	May increase blood pressure; cause brief brightness in vision	Your doctor will increase your dose over time if tolerated.

Figure 1. *(continued)*

Tips to help you remember to take your medication:

- ***Use a pill box*** to keep your medications organized and make it easier to remember your medications and the time of day they should be taken. A pill box will also help you determine how many days of medication you have left to better help you remember to fill your medications.
- ***Make a schedule*** of your medications and the times of day they should be taken. Create a schedule of your daily routine and when the best time to take your medication will be.
- ***Set an alarm*** if you are having trouble remembering to take your medication. An alarm can serve as a gentle reminder that can help you remember.
- ***Ask for help*** from a family member or friend to set up your medications.
- ***Enroll in automatic refills*** at your pharmacy which will allow you to enjoy more free time and less time ordering your medications.
- ***Use a mail order pharmacy*** if you have difficulties with transportation or live far from a pharmacy. A mail order pharmacy will deliver medications right to your door and help you decrease the number of trips you are taking to the pharmacy.
- ***Ask for 90-day supplies*** of your medications which will allow you to worry less about refilling your medication as you will have to reorder your prescription less often.

Contact your healthcare provider or pharmacist if you have any questions regarding your medications. It is important to attend follow-up appointments so your healthcare provider can make necessary changes. Taking your medications as prescribed will help manage your heart failure and symptoms. Speak with your healthcare provider or pharmacist if you have any difficulties taking your medications.

Figure 1. Medication education handout.

	Questions	Answer Choices
1	I understand why I am taking my heart failure medications	Strongly Agree Agree Neutral Disagree Strongly Disagree
2	I am aware of the side effects associated with my heart failure mediations	
3	How well do you feel you understand your heart failure medications	Scale 1-5 (1 being not at all and 5 being completely)
4	During the heart failure medication education were all of your questions answered	Yes or No
5	Have you scheduled a follow-up appointment with your doctor	

Figure 2. Phone survey questions used to assess patient satisfaction.

For the secondary endpoint, 56 patients, from both the control and treatment group, were called 1 week after discharge to conduct a phone survey and there was no significant difference in overall patient satisfaction between groups. This secondary analysis was stopped early due to no significant difference and the time constraints/feasibility of the pharmacy resident calling patients directly. Although 56 patients were called, only 20 answered after 2 attempts of calling. The phone survey results are summarized in Figure 6.

Discussion

The mean cost for a HF readmission is $9051 (range = $8990-$9113).[11] The financial incentive to reduce readmission rates

Male:Female (n:n)	127:95
Age (mean (±CI))	69.7 (±1.9)
Patients with new onset HF diagnosis (ratio(%))	16/221 (7.2%)
Patients with chronic HF diagnosis (ratio(%))	205/221 (92.8%)
Patients that received pillbox at discharge (ratio(%))	52/222 (23.4%)

Figure 3. Baseline characteristics for treatment group (n = 222).
Note. CI = confidence interval.

Patients on ACE-I or ARB in hospital (ratio(%))	80/222 (36.0%)
Patients on beta-blocker in hospital (ratio(%))	158/222 (71.2%)
Patients on diuretic (ratio(%))	172/222 (77.5%)
Patients on aldosterone antagonist (ratio(%))	59/222 (26.6%)
Patients on peripheral vasodilator (hydralazine or isosorbide or both) (ratio(%))	46/222 (20.7%)
Patients on digoxin (ratio(%))	23/222 (10.4%)
Patients on sacubitril/valsartan (ratio(%))	5/222 (2.3%)
Patients on ivabradine (ratio(%))	2/222 (0.9%)

Figure 4. Medications educated on at discharge (n = 222).
Note. ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker.

to avoid penalties is imposed by the *Centers for Medicare and Medicaid Services*. The transition of care is vital to the proper medical management in patients with HF, both while the patient is admitted and on discharge from the hospital. Patients with HF often have complex treatment regimens and multiple comorbid conditions, making adherence difficult. Clinical pharmacists remain an integral part of the health care team, as their clinical knowledge and expertise has been shown to improve medication adherence through patient education. The Heart Failure Society of America and American College of Clinical Pharmacy Cardiology Practice and Research Network recommend using a pharmacist to resolve common drug-related problems and improve outcomes in HF patients.[12]

Pharmacy involvement through HF medication education had a positive impact on readmission rates. A reduction in readmission rates also decreases cost, which may help justify the cost for a dedicated pharmacist. This study was one of the first of its kind to look at pharmacy student-ran HF medication education. The sample size of this study was another strength along with the length of 15 months.

Overall, there are some key limitations of this study. First, this project was dependent on pharmacists having fourth-year pharmacy students on rotation each month. Some studies have shown seasonal trends of HF hospitalizations, which demonstrate increased admissions and mortality during the winter months. The 396-bed tertiary-care hospital had pharmacy students consistently during this high-risk period. When pharmacy students were not available, the HF nurse educator provided all the education, including the medication portion. Another limitation was that it was difficult to classify HF. As data was extracted from medical records, there was a wide variability in the way physicians classified HF. In the treatment group, approximately 62% were classified with systolic HF, which is defined as ejection fraction of 40% or less, leaving 38% of patients classified with diastolic HF, defined as ejection fraction greater than 40%. It would have been interesting to look more in depth at trends regarding the classification of HF; however, due to limited information in medical records, this was not clear. Complexities of documentation in the medical record also made it challenging to obtain baseline characteristics for the control group, but it is recognized that more detailed information would have been beneficial. Another limitation of the health system included the fact that the staffing model does not currently support a dedicated unit-specific pharmacist to provide recommendations to optimize the treatment regimen; therefore, it is not certain that all HF patients are being treated with evidence-based treatment regimens. It was noted that only 36% of patients were on an ACE-I (angiotensin-converting enzyme) or ARB (angiotensin receptor blocker) at the time of discharge. The reason was unclear given Guideline-directed medical therapy. This was identified as a potential opportunity for increased pharmacist involvement and area for future focus. During the time of the study, on average, 25% of the patients followed up with a heart specialist at the tertiary care hospital clinic. This number is expected to continue to increase as services expand.

Conclusions

This study demonstrated that HF medication education provided by the pharmacy team resulted in improved patient outcomes and ultimately a reduction in 30-day all-cause readmission rates. There was no reported significant difference in overall patient-reported satisfaction regarding the phone survey 1 week post discharge. The results also identified an opportunity to expand the service and strengthen support for pharmacy involvement in providing excellent patient care.

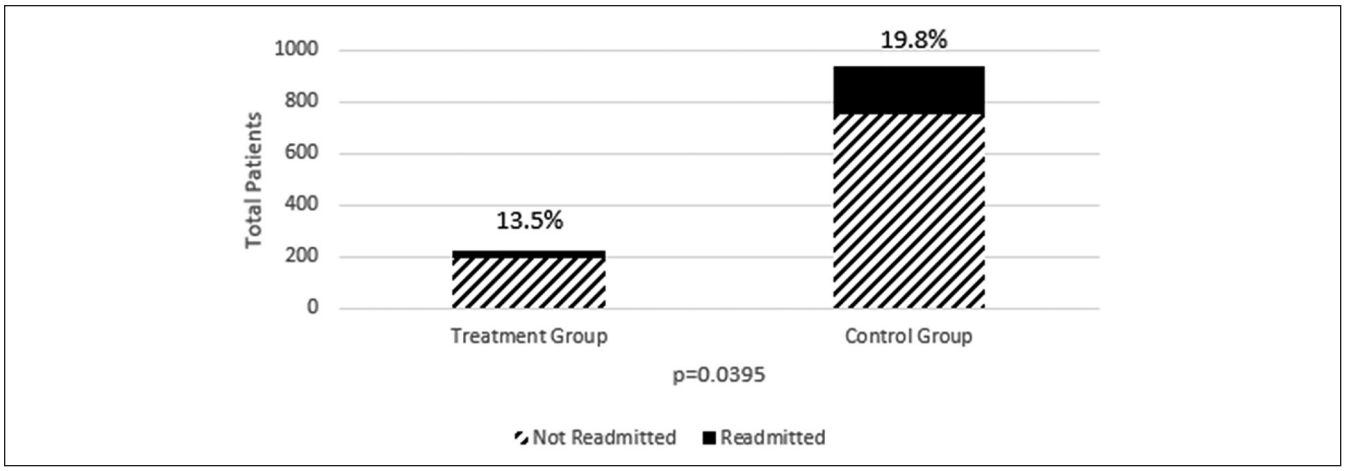

Figure 5. All-cause readmission data for treatment versus control group.

Question		Answer Range	Control Group (n=8)	Treatment Group (n=12)
1	I understand **why** I am taking my heart failure medications.	Strongly agree Agree Neutral Disagree Strongly disagree	6 strongly agree 2 agree	5 strongly agree 6 agree 1 neutral
2	I am aware of the **side effects** associated with my heart failure medications.		3 strongly agree 4 agree 1 strongly disagree	3 strongly agree 7 agree 1 neutral 1 disagree
3	How well do you feel you understand your heart failure medications	Scale of 1-5 with 1 being not at all and 5 being completely	Mean Score 4	Mean Score 4.25
4	During the heart failure medication education were all your questions answered?	Yes or no	7 yes 1 no	All answered yes
5	Have you scheduled a follow-up appointment with your doctor?		All answered yes	All answered yes

Figure 6. Phone survey results.

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