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"Reducing Heart Failure Readmission Rates Through Implementation of Heart Failure Diuretic"

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Rescue Kit: A Program Evaluation

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Abstract

Background and significance: heart disease was the number one cause of death in the United States in 2021, with 696, 962 deaths (Leading Causes of Death, 2022). There are about 6.2 million individuals in the U.S. total with heart failure (Kilgore et al., 2017). About one-quarter of patients with heart failure are readmitted within thirty days of discharge, while one-quarter of hospital readmissions are preventable. Between 2010-2017, over seven million patients were admitted for heart failure in the United States. Eighteen percent had a readmission within thirty days and thirty-one percent had a readmission within ninety days (Khan et al., 2021). Within the Allegheny Health Network, about thirteen percent of patients were admitted with heart failure in 2021 (Kwansy, 2022). To reduce hospital readmissions in my health system, heart failure patients discharged with home health services received a home heart failure diuretic rescue kit (See Appendix A). The protocol for the kit called for the nurse to follow a specific stepwise protocol for administering diuretic therapy and potassium supplementation (See Appendix B). **Purpose:** The purpose of this project is to evaluate the effectiveness of the home heart failure intravenous diuretic kit to prevent the readmission of heart failure patients to the hospital within a thirty-day period. The goal is to establish if the kit helped reduce hospitalization to reduce economic burden and improve morbidity and mortality. **Methods**: The home heart failure kit and protocol were implemented on February 21, 2022. The data that was considered for evaluation includes ordering the kit through the electronic health record, distribution of the kit from the pharmacy to the patient, utilizing the kit and the heart failure protocol at home by the home health nurses, and the knowledge of heart failure symptoms by the patient.

Introduction

Heart failure is the leading cause of mortality in the United States (Tsao et al., 2022). Between 2015-2018, about six million Americans had heart failure with a projected increase to more than eight million by 2030 (Tsao et al., 2022). There are many causes for heart failure, however, the primary focus is that the heart cannot pump blood efficiently to the rest of the body (Graffagnino et al., 2020). The body can compensate to perfuse the rest of the structures. This leads to long-term damage through increased pressure causing excess fluid to accumulate in the lungs or the body tissues (Graffagnino et al., 2020). To compensate, the heart may remodel itself to withstand the increased pressure by thickening its walls or dilating the heart chambers (Graffagnino et al., 2020). Ultimately, the body can no longer withstand the increased volume causing the patient to present to the hospital. In 2014, hospitalizations cost around eleven billion dollars (Jackson et al., 2018). While Medicare covers part of the bill, heart failure incidences continue to rise amongst an aging population (Jackson et al., 2018). With advances in evidence-based interventions, many national initiatives have been set in place to help prevent hospitalizations from heart failure (Jackson et al., 2018). Heart failure has one of the highest readmission rates among chronic diseases (Al-Tamimi et al., 2021). In one prospective-observational single-center study, 42% of patients were readmitted to the hospital (Al-Tamimi et al., 2021). Statistics like this have led to the Hospital Readmissions Reduction Program in conjunction with the Center for Medicare and Medicaid Services (CMS.gov, 2021). This program encouraged hospitals to implement ways to help reduce readmission rates within a thirty-day period (CMS.gov, 2021). Hospitals do not receive full reimbursement from Medicare and Medicaid if they have a higher than expected thirty-day readmission rate (CMS.gov, 2021). A mean cost in hospitalizations averages around eleven million dollars. While the US population

continues to increase, the incidence of heart failure increases (Jackson et al., 2018). Hospitals will no longer be reimbursed for thirty-day readmissions. The hospital that readmits any heart failure patient within a thirty-day period will have a reduction in payment from the Centers of Medicare and Medicaid Services (*Hospital Readmissions Reduction Program* (HRRP), n.d.). To help reduce the number of heart failure readmissions to the local community hospital, a protocol was created to treat heart failure exacerbations within the patients' homes using educational materials and an intravenous diuretic kit implemented by home health nurses.

The heart failure protocol outlines the process home health nurses should follow when a heart failure patient has an exacerbation at home following a hospital discharge. Once the home health nurse identifies that the patient is having symptoms of an exacerbation, the protocol allows the nurse to double the maintenance diuretic and evaluate the effects over the next couple of days. If this is unsuccessful, the nurse then opens the heart failure kit that was discharged home with the patient. The kit includes extra maintenance diuretic tablets, potassium and metolazone tablets, intravenous diuretic, and intravenous supplies. The nurse starts an intravenous line on the patient and delivers the diuretic intravenously and monitors the patient for adverse effects. The protocol also includes orders for blood work to ensure no renal dysfunction or electrolyte imbalances.

Heart failure has many hallmark features. It is primarily defined by diagnostic features rather than a clinical presentation (Gibson et al., 2021). Over the years, stages of heart failure have been developed to classify patients to provide proper treatment (Gibson et al., 2021). Regardless, heart failure is typically caused by a structural or electrical abnormality. The abnormality causes the heart to pump inefficiently and cannot perfuse the rest of the body with blood and oxygen. To deliver blood, the body and heart both compensate. The heart can thicken

its walls or dilate its chambers. The body activates the kidneys to increase pressure, negatively causing sodium retention and fluid accumulation (Graffagnino et al., 2020). Patients present to the hospital when they begin to have worsening signs of heart failure including shortness of breath and lower extremity edema. At this stage in heart failure, oral diuretics typically are ineffective at reducing symptoms because they are not completely absorbed through the gastrointestinal tract (Godino et al., 2022). Intravenous diuretics are indicated at this point, unless there is an underlying cause such as valvular disease, electrical abnormalities, or coronary artery disease. Intravenous diuretics has been shown to be more effective, gradually reducing intravascular volume and decreasing the possibility of post-diuretic sodium retention (Godino et al., 2022). Not only does home intravenous diuretic therapy decrease hospital readmissions, but it also decreases mortality at one-year mark (Godino et al., 2022). For the hospital, preventing readmissions has decreased the amount of expenses with a positive cost-benefit analysis (Godino et al., 2022).

Literature Review

The Duquesne Gumberg Library was the primary source for literature along with Google Scholar and the American Heart Association. Keywords and phrases included heart failure, heart failure readmission, heart failure thirty-day readmission, and heart failure education. Medical personnel know that heart failure readmissions continue to rise. It is noted that there is a higher readmission rate within the first ninety days (31.2%) versus the first thirty days (18%). However, CMS will only take away reimbursement within the first thirty days. Many of the studies conducted have shown a decrease in thirty-day hospital readmission, but these hospitals also have higher post discharge mortality. The recommendation is to assess outcomes after ninety days to evaluate care models. Hospitals may be willing to coordinate better transitional care

programs for a long-term benefit for the patient (Khan et al., 2021). One study specifically focused on patient quality scores to help reduce readmissions. Tabisula (2021) found that when hospitals rush to discharge a patient to avoid costs, the care may be rushed as well. When patients were readmitted, they felt the hospital could have been cleaner, and they were dissatisfied with the staff. The study recommended increased communication about medication to reduce readmission for both heart failure and pneumonia (Tabisula, 2021).

Considering heart failure readmissions, medical staff benefits from comparing patient factors. Several studies came to a consensus that advanced age, multiple co-morbidities, and renal disease were among the highest contributing factors of heart failure readmission (Gusto & Prehn, 2023; Verulava et al., 2022; Umehara et al., 2022). Gusto & Prehn (2023) discussed that a patient's living arrangement was one of the strongest congestive heart failure readmissions, those living alone having the higher readmission rates. One limitation of this study, however, is that only one racial group was included (Gusto & Prehn, 2023). Verulava et al. (2022) looked at medical records of patients who were readmitted in a six-to-nine-month period after initial hospital discharge. Heart failure was proven to be the number one cause of readmission in elderly patients (seventy-five and older) more than likely due to the aging population. The study was simply meant to show a correlation in readmissions with a recommendation to find implementations to reduce hospitalizations (Verulava et al., 2022).

Umehara et al. (2022) also discussed heart failure in elderly and their condition deteriorates with each readmission. The study did go more into depth looking at different physical performance measures including walking speed, hand-grip strength, chair stand tests, and standing balance. After performing a statistical analysis concluding that readmissions were related to a low glomerular filtration rate, low ejection fraction values, and frailty. Unfortunately,

the study only included sixty-nine patients (Umehara et al., 2022). Bradford et al. (2016) also looked at characteristics of their study, male, white, unemployed, and Medicare payer. The study concluded that these characteristics were inconclusive predictors for heart failure readmissions. The study looked at patients across five hospitals with a readmission group of 394 patients (Bradford et al., 2016).

Early follow-up post discharge was a common theme across studies for heart failure readmission. One concern regarding early discharge and subsequent early follow-up was an increase in mortality for hospitalized patients. Kratka et al. (2020) completed a systematic review finding that this was in fact not the case. No studies were able to link mortality to early discharge. The study demonstrated the different initiatives taken in response to the implementation of the Hospital Readmissions Reduction Program also did not cause any harm including follow-up appointments within seven to fourteen days of discharge, patient teaching at time of discharge, and discharge phone calls (Kratka et al., 2020). Early follow-up was defined by Matsukawa et al. (2021) as two weeks. The study concluded that readmission with early follow-up over a two-year period was significantly less and had a lower death rate compared to the non-early follow-up group. Early follow-up visits included medication adjustments, lifestyle education, and physical exams (Matsukawa et al., 2021). Charteris & Pounds (2020) had similar results, however, they also included veterans setting self-care goals.

Description of Project

There have been an increasing number of heart failure readmissions in the community hospital. The purpose of the project is to validate that the implementation of the home heart failure diuretic kit upon discharge is effective in preventing a heart failure readmission within a thirty-day period from initial admission. Goals included increasing patient knowledge about

heart failure symptoms and self-care management with verbal teach back and increase quality of life by reducing the number of exacerbations over a six-month period. One aim was to evaluate the implementation of the home heart failure diuretic rescue kit by interviewing the hospitalists and the cardiology team for ease of identifying high-risk patients and ordering kits through the electronic health record. Evaluation would also be done with the hospital pharmacy team to identify the strengths and weaknesses of utilizing the meds-to-beds program to deliver the home heart failure kit to the patient prior to discharge. The project also aims to evaluate the effectiveness of treating heart failure exacerbation at home versus readmission to the hospital by comparing hospital readmission data six months prior to implementing the heart failure diuretic kit versus six months after implementation, interviewing home health nurses to evaluate utilizing the heart failure kit to treat a home exacerbation, and review ability of patients to follow-up with PCP or cardiologist within a seven-to-fourteen-day period.

The team also looked to evaluate the effectiveness of providing heart failure education to patient both as an inpatient and outpatient by having patient give verbal teach back of symptoms of a heart failure exacerbation and when to report symptoms. Education should include discussing the importance of daily weights, monitoring vital signs, and choosing appropriate low-sodium foods by reading food labels. The project team determined the strengths and weaknesses of implementing the heart failure diuretic rescue kit by discussing barriers with hospitalists, cardiology team, and pharmacy. Home health nurses were also imperative in reviewing barriers to present to stakeholders.

Overview of Methodology

The project is an outcome evaluation looking at the effectiveness of a home heart failure protocol and diuretic kit and education to prevent a heart failure exacerbation. Evaluation of the

program will be done by interviewing the hospitalist teams, cardiology team, pharmacists, and home health nurses. Feedback is to be presented to key stakeholders at weekly hospital readmission meetings to provide solutions to limitations and re-evaluate. Discussion with the interdisciplinary team revolves around ease of identifying high-risk readmission patients, ease of ordering and distributing kit, providing follow-ups, and assessing the patient in an outpatient setting deciding when to initiate the proposed home heart failure protocol.

The community in which the heart failure protocol and rescue kit was implemented is a small community with a community-based hospital. The community has over ten thousand residents (*About Harrision Township - Harrison Township, Allegheny County PA*, 2019). Between 2018-2020, 19.6 per 1000 persons older than 65 years of age were admitted to a hospital with heart failure (Interactive Atlas of Heart Disease and Stroke Tables, n.d.). More recently, in the year 2022, from the community hospital, 228 patients were readmitted, 18% with a heart failure diagnosis (Allegheny Health Network, n.d.).

The W.K. Kellogg Foundation Logic Model was utilized to align project factors and identify short-term and long-term goals (W.K. Kellogg Foundation logic model guide - Resource. 2004). The project invested a cardiology team including a cardiologist and nurse practitioner, nurse navigator, hospitalist team, primary care physician, pharmacy team, dietitian, home health, and IT services. The team met regularly to identify high-risk patients while identifying barriers in the home heart failure protocol and kit and coordinate services for patients both for inpatient and outpatient setting. Short-term goals included proper delivery of the home heart failure kit, coordination of discharge appointments such as home health, PCP, and cardiology, and identify outpatient resources. The long-term goals identified through the logic model comprised of reducing number of thirty-day readmissions and emergency department

visits, improving quality of life, reducing cost of care, and improving morbidity and mortality. Assumptions were made that there would be enough supplies for all heart failure discharges and every discharge would receive a kit before they physically left the hospital. All patients would be receptive to the protocol and providers would only utilize the protocol for a true heart failure exacerbation. Lastly, the assumption was the increased amount or enhanced quality of education would contribute to reduction in heart failure readmissions. External factors affecting the project include limited access to heart healthy food, transportation, and support people. Staffing would be an issue both with home health and the inpatient setting.

Implementation

The heart failure protocol was developed by a team of nurse practitioners and reviewed by board-certified cardiologists. The protocol was presented to the president of a community hospital along with additional key stakeholders including the pharmacy manager, nurse navigator, and the quality team. It was discussed the community hospital would be the pilot hospital to implementing the protocol. Next, pharmacy pulled together kit contents to be delivered to the patient upon discharge. The “Meds to Beds Program” was a key part of the program gathering kit contents and educating the patient. Lastly, the hospitalist team, cardiology team, and primary care providers were educated on the heart failure home diuretic protocol and kit contents. The nursing staff on the stepdown unit was educated since they cared for majority of heart failure patients.

After a patient is admitted with heart failure, the diagnosis keys the patient to be placed on the community hospital heart failure list. Once the patient’s name is on the list, cardiology advanced practice provider (APP) identifies if there is a cardiology consult. Next, a nutrition consult is placed. An interdisciplinary team approach is taken on a daily patient identifying

whether a heart failure patient is a candidate to be discharged home with the heart failure diuretic kit. Acknowledging a patient is a candidate allows the hospitalist team to place a home care consult. The kit could only be utilized if the organization's home health team was chosen. Next, a transitional care coordinator reviews patient chart and speaks with the home health team to assign a nurse and ensure they will follow up with the patient in the next twenty-four to forty-eight hours. The organization's home health team assignment to the patient allows the hospitalist or the cardiology team to place a discharge order for the home heart failure diuretic rescue kit. This triggers the pharmacy to deliver the kit to the patient prior to discharge. The pharmacist reviews the contents of the kit with the patient and reminds them to not open the kit unless done so by the home health nurse. The registered nurse taking care of the patient on day of discharge also educates the patient on putting the kit in a safe place until home health comes to visit the patient. The RN also reviews medications and signs and symptoms of a heart failure exacerbation and when to call. The cardiology team ensures the patient has a follow-up with cardiology within the next one to two weeks.

Within twenty-four to forty-eight hours, the home health nurse visits the patient. They take a weight and vital signs and review signs and symptoms of a heart failure exacerbation. An exacerbation, in this protocol, is defined as a weight gain more than two pounds in twenty-four hours or more than five pounds in a week. If the patient is in worsening heart failure, the nurse begins the heart failure protocol (See Appendix B). The nurse implements the first step of the protocol by doubling the patient's maintenance diuretic for two to three days with follow-up blood work. They are to simultaneously notify either the PCP or the primary cardiologist that the protocol has been initiated. The provider can modify or continue with the protocol as written. Depending on blood work and patient outcomes, the nurse may then either add potassium or

metolazone to patient regimen. If these medications are already part of the regimen, the nurse then skips to intravenous diuretic therapy. Home health nurse will start an intravenous line and administer the appropriate dose of diuretic, and administration will continue for two days. The nurse will stay and observe the patient for an hour post administration to ensure no adverse effects. Blood work will be obtained on the second day of intravenous therapy. If the patient's dry weight goal has not been met, then the nurse is to call the provider to discuss a possible emergency department evaluation. The protocol is completed once patient has reached target weight with resolution of symptoms. Blood work should be obtained to ensure no acute kidney injury or electrolyte imbalance.

Weekly meetings were conducted with pilot program team to evaluate effectiveness of identifying at risk heart failure patients, protocol utilization, and home diuretic kit supplies. Several stakeholders collaborated at each meeting including the cardiology nurse practitioner, nurse navigator, quality manager, pharmacy manager, Chief Medical Officer, President of the hospital, and hospitalist team secretary. Barriers were identified at each meeting, and the protocol was adjusted, or kit contents were modified, to meet the appropriate needs of the community-based patients.

High-risk patients were reviewed daily via a shared heart failure list. Any patient presenting with acute heart failure exacerbation was added to the list. Each patient case was looked at to identify if the hospitalization was truly heart failure-related versus other acute illness or chronic illness exacerbation. If the patient was identified as a heart failure exacerbation, the nurse practitioner would then place an order for a consult if needed as well as a nutrition consult and palliative care consult to align goals of care. The medications were reviewed in compliance with guideline-based therapy in accordance with the American College of Cardiology. A home

care consult was placed to assess patient discharge needs and ensure the patient would receive a home diuretic kit upon discharge with a follow-up from the home health nurse. Cardiology would then schedule patient for a follow-up primarily within a 7-day period. If the office could not accommodate, the patient was scheduled within a 14-day period. Education would be completed with patient by the cardiology nurse practitioner, the registered nurse caring for the patient on the unit, and the pharmacist delivering the home diuretic kit to the patient prior to discharge. Education was also done and documented by the dietitian for diet compliance.

Data Management Plan

The development of the heart failure diuretic kit came from the data compiled by the heart failure team within the cardiovascular institution. Heart failure readmission rates were too high, which means the cardiovascular institute (CVI) was losing money anytime a patient with a chronic disease is readmitted within a thirty-day period (*Hospital Readmissions Reduction Program*, HRRP, n.d.). Data needed from the CVI for this project includes statistics of the number of patients admitted for heart failure, patients discharged home with home health care, patients readmitted within a thirty-day period, and patients who have a follow-up appointment with a cardiologist or their primary care physician within seven to fourteen days. The data was presented both weekly at the local hospital readmission meeting and monthly during the heart failure readmission meetings with several key stakeholders from the cardiovascular institute.

Data was obtained by looking at the patients admitted verses the number of kits dispensed by pharmacy. Home health nurses were to identify the patients that utilized the kit starting at step one of the heart failure protocol; however, the data was very limited due to lack of education and knowledge of patients discharged with kit. Several daily discussions were completed with the hospital and cardiology team. The data utilized here is subjective and based on provider

preference, so comments were combined to create solutions to barriers or limitations. These evaluations were constantly supervised and re-evaluated to modify interventions.

A cost-benefit analysis aided in demonstrating the success of the implementation of a home heart failure diuretic kit (See Appendix C). The cost-benefit analysis of the home heart failure diuretic rescue kit proves it will behoove both the patient and the hospital to be implemented. The cost of the kit, along with the educational materials and the home health nurses' salary, is small compared to the cost of readmission of the patient to the hospital. The net present value over three years is positive, while the benefit-to-cost ratio is 6.7. For every dollar spent on the home heart failure rescue kit, the hospital will earn $6.70 with a 510% return on investment. The overwhelming positive numbers support the implementation of the rescue kit. Heart failure patients will receive appropriate education to help understand their disease while treating exacerbations at home and preventing readmission to the hospital.

Results

The pilot project began tracking results consistently in October 2022 despite implementation beginning six months prior. In October, twenty-five percent of hospital readmissions had a heart failure diagnosis with four kits dispensed. November 2022 had 38.9% of readmissions heart failure-related with only two kits dispensed. The numbers then started to decline in December 2022 with 15.8% readmissions with heart failure diagnosis; no kits were dispensed. January 2022 had 7.1% of readmissions with a heart failure diagnosis with only 1 kit dispensed; February 2022 had 4.8% of readmissions with a heart failure diagnosis with 5 kits dispensed; and March 2022 had one heart failure readmission with 14 kits dispensed by the end of the month (See Appendix D). Data for kit utilization at home could not be collected by the home health team.

Summary

Fortunately, as more kits were dispensed to heart failure patients, the number of heart failure readmissions declined. The hospitalist team provided feedback regarding the identification of heart failure patients at risk for readmission. They asked for more cardiology involvement, forming the team between the cardiology nurse practitioner and hospital nurse navigator. Daily meetings were held reviewing patient cases to ensure appropriate orders were placed for the high-risk patients. Communication was given back to the hospitalist team to create an efficient discharge plan. The process of ordering the home diuretic kit was modified several times within the electronic health record to make the process more efficient. Identifying the diuretic kit contents versus a patient's daily regimen was crucial for all parties involved. IT was able to add "HEART FAILURE DIURETIC KIT" under each of the medications contained in the kit. This allowed the patient and any outpatient provider to identify the patient was discharged with the kit and is not taking duplicate therapy. The discharge paperwork was also modified so the medications were grouped according to daily regimen versus kit contents. This feedback was given by the nursing staff on the unit as they were going through discharge instructions with patient and caregivers. The biggest safety measure identified was patients were opening the kit unsupervised at home despite instructions to put in a safe place until home health visits. A label was created and placed on the front of the kit alerting the patient that the kit should not be touched unless under the supervision of a healthcare provider.

Limitations

One of the main limitations presented involved the home health care team. The problem is the lack of communication between home health and the hospital, PCP, and cardiology team. Despite home health being within network, the home health organization uses a different

electronic system for their documentation. For example, if a patient develops worsening heart failure, the home health nurse appropriately documents their assessment and interventions. The PCP and cardiology team would not be able to view this documentation. The only way the providers know the exacerbation is occurring is if the home health nurse calls the provider's office.

At the beginning of project implementation, it was made known that education was provided to the home health team, hospitalists, and primary care providers within the community by a PowerPoint. As the program developed, it was discovered the education was in fact not given. Orders were being discontinued; home health nurses were sending patients to the emergency room as well as cardiology providers without initiating the heart failure protocol. The nurse navigator and cardiology nurse practitioner independently educated the PCPs in the area as well as the hospitalist teams. Education was sent out to the cardiology team to review the protocol and recommended daily interventions to ensure appropriate orders for all high-risk heart failure patients. The nurse educator at the hospital was contacted and made aware of education needed for nursing staff on the units.

When home health nurses did identify patients with worsening heart failure in their home and notified a provider, the protocol was initiated. However, this was not counted in the data. Home health was notifying the team only when intravenous kit contents were being utilized. This can skew the data because heart failure patients may be utilizing the protocol, but they may not need to reach the intravenous step. The heart failure readmission is still prevented; however, it would be prevented due to the basic care provided to the patient rather than the intravenous supplies themselves. The heart failure readmissions declined as kits were dispensed, however,

kits were not being utilized. Heart failure readmissions are being prevented due to the nonpharmacological interventions being done by the interdisciplinary collaboration team.

Conclusion

Heart failure readmissions cost hospitals and patients. The results from this project demonstrate that early identification of high-risk patients, subsequent teaching, and early follow-ups with a team of providers prevents heart failure readmission within a thirty-day period. The patient benefits from an interdisciplinary team involving pharmacy, hospitalist, cardiology, home health, and the PCP. Teaching the patient about their condition and nonpharmacological measures to prevent an exacerbation has been instrumental in treating the chronic disease. Identifying the appropriate team members while in the hospital aligns the patients' goals of care and plan of care after discharge.

In the future, it would benefit the project to identify ways of tracking protocol utilization rather than kit utilization. This identifies the core reason for prevention of heart failure readmission; pharmacological versus nonpharmacological. One way to evaluate would be to follow several patients at high-risk over a thirty-day-period, following home health charting and regular meetings with the home health nurse. Evaluation could look at the teaching being done at home and interventions done by patient or caregiver to prevent an exacerbation. More attention should be focused on educating the patient while in the hospital to show the patient key findings on assessment and ways to prevent them at home. The home diuretic kit is crucial in the patient care on discharge so any exacerbation can be treated at home. It would be best if the kit could stay in the home past the home health team's thirty-day period with the patient. This idea would be best brought to a government level to persuade health insurance companies to extend in-home care to the patient.

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Appendix A

Home Heart Failure Rescue Kit – Furosemide
Kit to include:

Vial of Furosemide for IV use #1, no refill
Potassium 20mEq po #6 tablets to be used as directed, no refill
Furosemide 40mg po # 4 tablets to be used as directed, no refill
Metolazone 2.5mg po #4 tablets to be used as directed, no refill
IV start kit
0.9% NSS flushes # 8, no refill
Syringes/needles #2, no refill

Home Heart Failure Rescue Kit – Bumetanide
Kit to include:
Vial of Bumetanide for IV use, #1, no refill
Potassium 20mEq po #6 tablets to be used as directed, no refill
Bumetanide 1mg po # 4 tablets to be used as directed, no refill
Metolazone 2.5mg po #4 tablets to be used as directed, no refill
IV start kit
0.9% NSS flushes # 8, no refill
Syringes/needles #2, no refill

Appendix B

CHF Home Care Protocol:

- If patient is involved with Cardiology, add to the POC and notify.
- Skilled Clinician to instruct on Daily Weights. Collaborate with PCP on Target Dry Weight: _____
- Transitional Care Coordinator (TCC) to initiate referral to AHN Home Infusion for IV diuretics and oral Potassium (if Potassium is not already ordered upon discharge).
- Assess for appropriateness of Telehealth.
- Skilled Nurse to instruct on low sodium diet and fluid restrictions.
- Skilled Nurse to obtain BMP and Mg 3 days after hospital discharge.
- Skilled Clinician to obtain weight at SOC on patients own scale. This weight should be reported to Cardiology/PCP. For patients unable to obtain a weight, skilled nurse to obtain abdominal girth and calf measurements.

Recommendation Table: Patient Potassium Replacement Recommendations by Level of Kidney Function
*Please note, these doses are in addition to the patient's baseline dose of potassium chloride.

	Creatinine > 2 mg/dl	Creatinine ≤ 2 mg/dl
K ≤ 3.0---Notify Provider	40 mEq bid	40 mEq tid (or 60 mEq bid)
K 3.1-3.3	20 mEq bid	20 mEq tid (or 40 mEq AM and 20 mEq PM)
K 3.4-3.6	20 mEq daily	20 mEq bid (or 40 mEq daily)
K > 4.5	No change	No change
K ≥ 5.0	Hold all potassium	Hold all potassium

Step 1: Increase Oral Diuretic: initiate if weight gain is >2 pounds in 24 hours or >5 pounds in 7 days.

- Notify Cardiology/PCP of change in condition and the oral diuretic protocol has started. Ask them to send prescription for IV diuretic and oral Potassium if appropriate.
- Obtain BMP if no BMP and Mg has been completed within the last 7 days.
- Skilled Nurse to obtain orders for restart of home diuretic dose from Cardiologist/PCP if diuretics have been placed on hold or discontinued while in the hospital.
- If already on oral diuretic, double daily oral loop diuretic dose for 2 days or increase to the maximum daily dose if doubled dose would exceed the maximum for 2 days.
    - Maximum dose = Furosemide 240 mg, Bumetanide 10 mg, or Torsemide 200 mg.
    - If already at maximum dose, then skip to step 2.
- Skilled nurse to determine/educate on appropriate measuring and recording of urinary output for assessment on next visit.

- Skilled nurse to initiate PRN visit on Day 2 and obtain BMP and Mg. Results should be reported to cardiology/PCP. Determine with Cardiology/PCP if potassium should be started/increased (see included recommendations).
- If weight has not decreased by at least 2 pounds per day, alert the cardiologist and PCP with recommendation to initiate Step 2.
- If weight has decreased by at least 2 pounds per day, alert the cardiologist and PCP with recommendation to continue at increased dose x 2 days or until target weight is reached. Repeat PRN visit and BMP q 3 days until completion of the protocol.

Step 2: Addition of Metolazone

- Add Metolazone 2.5mg p.o. 30 minutes prior to A.M dose of loop diuretic for 2 days.
    - If already on Metolazone 2.5mg daily maintenance dose, give additional 2.5mg for 5mg total.
    - If already taking 5 mg of Metolazone daily then skip to Step 3.
- Skilled nurse to determine/educate on appropriate measuring and recording of urinary output for assessment on next visit.
- Skilled nurse to initiate PRN visit on Day 2 and obtain BMP and Mg. Results should be reported to cardiology/PCP. Determine with Cardiology/PCP if potassium should be started/increased (see included recommendations).
- If weight has not decreased by 2 pounds per day, alert the cardiologist and PCP with recommendation to initiate Step 3.
- If weight has decreased by at least 2 pounds per day, alert the cardiologist and PCP with recommendation to continue at increased dose x 2 days or until target weight is reached. Repeat PRN visit and BMP and Mg q 2 days until completion of the protocol.

Step 3: Initiation of IV diuretic: Make sure that Cardiology/PCP is aware that this protocol is being started.

- Hold oral diuretic and replace with IV diuretic for AM dose. If patient has a PM oral dose, continue PM oral dose of loop diuretic as previously prescribed.
- Continue Metolazone dose from Step 2 while administering the IV diuretic.
- Only administer IVP loop diuretic if SBP is >100.
- Skilled Nurse to insert IV cap and change every four days and PRN. Discontinue IV upon completion of IV diuretic protocol.
- Administer IVP loop diuretic as follows: (IV diuretic recommendation = oral AM dose)

☐ Furosemide 40 mg IVP over 5 minutes daily x 2 days

☐ Furosemide 80mg IVP over 5 minutes daily x 2 days

☐ Furosemide 120 mg IVP over 5 minutes daily x 2 days

OR

☐ Bumetanide 1mg IVP over 5 minutes daily x 2 days
☐ Bumetanide 2mg IVP over 5 minutes daily x 2 days
☐ Bumetanide 3mg IVP over 5 minutes daily x 2 days

- Flush line before and after medication administration with 3 ML 0.9% NS
- RN to remain with patient and assess BP every 15 minutes x's 4.
- Skilled nurse to determine/educate on appropriate measuring and recording of urinary output for assessment on next visit.
- Skilled nurse to initiate PRN visit to obtain BMP and Mg on the 2nd day. If target weight is not reached, discuss with physician the consideration of an ED evaluation.
- Skilled nurse to determine with Cardiology/PCP if potassium should be started/increased (see included recommendations).

Completion of protocol:

- Obtain BMP and Mg 7 days after completion of protocol and notify provider of results.
- Skilled Nurse to communicate with cardiologist and PCP once patient has reached target weight and symptoms have resolved to adjust home diuretic dose and electrolyte replacement to maintain euvolemia.

Recommendation Table:
*For patients who have demonstrated poor response to furosemide, consider a change in diuretic (such as torsemide or bumetanide) for better oral bioavailability. Suggested conversion as follows (Furosemide doses below left correspond to Torsemide and Bumetadine doses as outlined):

Furosemide	Torsemide	Bumetadine
20 mg	10 mg	0.5 mg
40 mg	20 mg	1 mg
60 mg	30 mg	1.5 mg
80-100 mg	40 mg	2 mg

Provider Signature: _____ Date:_____

Appendix C

Table 1

Heart Failure Rescue Kit Costs

Categories	Amount ($)	Participants	Expense	Total Expense
Home Health RN	1 hr/patient, 3x/week	5 nurses to 1 patient each in 1 week	$33/hr (average salary in PA)± $114/week/nurse	$1980/month
Education booklets	$4.30 per booklet*	5 booklets	$21.50	$21.50
Furosemide 10mg/mL vial	1 vial/kit	5 rescue kits	$1.16/vial* $1.16/kit	$5.80
Furosemide 40mg tablet	12 tablets/kit	5 rescue kits	$0.34/tablet* $4.08.kit	$20.40
Metolazone 2.5mg tablet	4 tablets/kit	5 rescue kits	$2.76/tablet*	$55.20
Klor-Con 20mEq tablet	12 tablets/kit	5 rescue kits	$0.63/tablet*	$37.80
3mL normal saline flush	12 flushes/kit	5 rescue kits	$2.19/flush*	$131.40
18g IV catheter	6 catheters/kit	5 rescue kits	$3.02/catheter*	$90.60
Luer-Lock 5mL syringe	6 syringes/kit	5 rescue kits	$0.17/syringe*	$5.10
				Total expense in 30-day period: $2,347.80

Table 2

Tangible and Intangible Benefits

Benefits	Value	Detail
Tangible	*Average cost of hospital readmission in a 30-day period $15,732/patient	Cost to the hospital in a 30-day period per patient
Intangible	Priceless	Patient's quality of life and hospital accreditation
Total		$15,732

Note: * From "A systematic review of medical costs associated with heart failure in the USA" by M. Urbich, G. Globe, K. Pantiri, M. Heisen, C. Bennison, H.S. Wirtz, & G. Di Tanna, 2020, *PharmacoEconomics,* 38(11), 1219–1236.

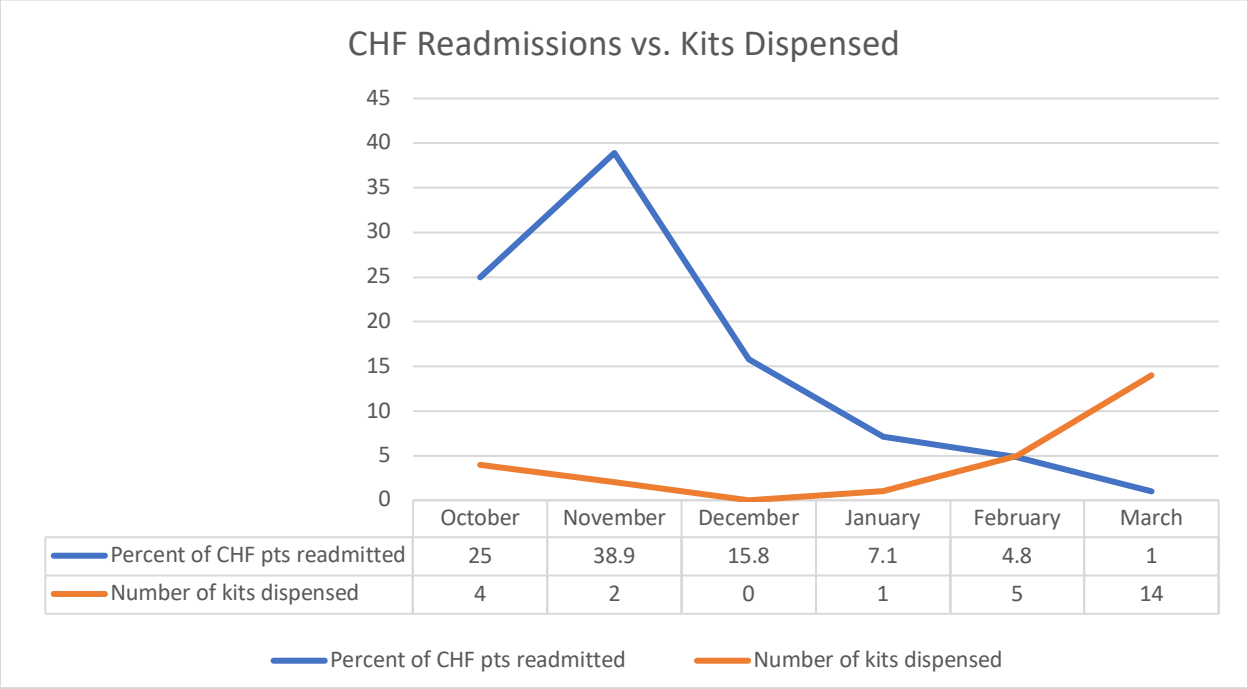
Table 3

Cost-Benefit Analysis

Cost-Benefit Analysis	Expenses	Benefit	Total
Total Costs	$2,347.80		
Benefits		$15,732/patient	
Intangible	Unable to quantify		
Discount Rates/Net Present Value (NPV)	3% for 3 years	1st Year: $15,732-$2,347.80= $13,384.20/(1+3%) =	$12,994.37

	$12,994.37 (NPV)	
	2nd Year: $15,732-$2,347.80= $13,384.20/(1+3%)^2 = $12,615.89 (NPV)	$12,615.89
	3rd Year: $15,732-$2,347.80= $13,384.20/(1+3%)^3 = $12,248.74 (NPV)	$12,248.74
Benefit to Cost Ratio	$15,732/$2,347.80	6.7
Return on Investment	ROI = [($15,732- $2,347.80)/($2,347.80)]X100	570%

Appendix D



(Allegheny Health Network, n.d.)