

**II - TITLE PAGE**

**Title of project: An Inpatient Multidisciplinary Educational Approach to Reduce 30-day Heart Failure Readmissions**

**Course title: PHPR 896B – Writing a Proposal for a Scientific Study**

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### **III – Abstract**

#### **Background:**

An estimated 5.7 million Americans had heart failure (HF) in 2012 with an economic cost of \$30.7 billion. By 2030 the prevalence of the disease is expected to increase by 46%. Centers for Medicare and Medicaid Services penalizes hospitals for 30-day readmissions. This study evaluated the effect of our multidisciplinary HF intervention on readmissions.

#### **Methods:**

This is a retrospective cohort study.

#### **Data Source:**

Patients were identified from electronic inpatient admission records from January 1 to December 31, 2014. Patients who received any component of intervention were compared to patients who did not receive any intervention. Intervention included student pharmacist medication counselling, HF education, and post-discharge phone calls with Modified Morisky questionnaire. Age, sex, admission/discharge dates, readmission diagnosis, smoking status, ejection fraction, medications, and Charlson Comorbidity Index (CCI) conditions were collected.

#### **Results:**

A total of 221 patients with 249 discrete admissions were identified. No difference in age ( $p=0.42$ ), sex ( $p=0.48$ ), smoking status ( $p=0.10$ ) existed between the groups. No difference in readmissions was found between patients receiving complete intervention and control ( $p=0.41$ ) or patients receiving 1 or 2 intervention components and control ( $p=0.41$ ). Patients with CCI score  $\geq 8$  had greater risk of readmission compared to CCI scores 0-2 (OR 7.7, 95% CI 1.6-36.3,  $p=0.01$ ).

#### **Conclusions:**

This analysis did not identify an intervention impact on 30-day readmissions in patients with HF; high CCI scores were associated with increased readmission risk. The intervention may be best targeted towards patients with high CCI scores as they have the highest readmission rate.

## IV – Background/Introduction

Heart Failure (HF) describes a syndrome that results from impairment of ventricular filling and ejection. In 2012, an estimated 5.7 million Americans were living with HF. This posed a significant economic burden with estimated economic costs of \$30.7 billion. By 2030, the prevalence of the disease is expected to increase by 46%, affecting an additional 8 million people.<sup>1</sup>

Common symptoms include dyspnea, fatigue, exercise intolerance, and fluid retention.<sup>2</sup> Management of patients with HF generally includes assessment of disease severity, managing other chronic disease states like hypertension (HTN) or lipid disorders, then choosing and optimizing pharmacotherapy. Drugs used to manage HF symptoms, improve quality-of-life, and prevent readmissions include digoxin, angiotensin-converting enzyme (ACE) inhibitors, angiotensin-receptor blockers (ARBs), and  $\beta$ -blockers (BB).<sup>3</sup>

Ensuring the appropriate medications have been prescribed at the correct doses<sup>6</sup>, and that patients are adherent to their medication therapy<sup>7,8</sup> have been shown to be effective in reducing readmissions in patients with HF. Various attempts have been made to predict which patients will be readmitted within 30-days. Several factors have been linked to high readmission risk such as high B-type natriuretic peptide (BNP) levels or high cardiac troponin levels.<sup>4,5</sup> However, these factors are difficult to control in patients.

With increasing disease burden, there will also be an increasing economic burden with increased health care expenditures.<sup>1</sup> Readmissions have been targeted as a way to reduce health-care costs and Medicare spending while improving quality.<sup>9</sup> Centers for Medicare and Medicaid Services (CMS) began publically reporting hospital readmission rates in 2009 as a way to incentivize hospitals to improve healthcare and reduce readmissions. In 2012, CMS implemented the Hospital Readmissions Reduction Program (HRRP) which mandated reporting of 30-day readmissions for acute myocardial infarction (AMI), HF, and pneumonia (PNA). CMS imposed penalties on hospitals with excessive readmissions for these illnesses. These penalties came in the form of reduced Medicare reimbursements with 1% reductions in total reimbursements for each subsequent year of excessive readmissions. In 2015, the rules were expanded to include chronic obstructive pulmonary disease (COPD), total hip arthroplasty (THA), and total knee arthroplasty (TKA).<sup>10-12</sup>

Rich et al<sup>16</sup> utilized a multidisciplinary intervention which included a cardiovascular research nurse, a dietitian, social service personnel, and a geriatric cardiologist who provided inpatient education, and intensive post-discharge support. 90-day readmissions in the control group was 54%, and 64% in the treatment group (ARR 13%, 95% CI 2.1-24.3). Blue et al<sup>13</sup> focused on post-discharge care for patients by utilizing specially trained nurses. After a patient was discharged, nurses would arrange regular visits and would be available to patients by phone. All cause readmissions by admissions/patient/month in the control group was 0.174 and 0.124 in the intervention group (RR 0.71, 95% CI 0.54-0.94). Krumholz et al<sup>14</sup> used cardiac nurses to teach patients in an hour-long one-on-one session within two weeks of discharge. Readmissions were lower in the intervention group after adjusting for demographic and clinical characteristics (HR

0.56, 95% CI 0.32-0.96). Murray et al<sup>8</sup> utilized clinical pharmacists to provide a patient-centered verbal instructions and written materials about the medications. Patients who received the intervention had better medication utilization (10.9% difference, 95% CI 5.0-16.7) and lower risk of readmissions (IRR 0.82, 95% CI 0.72-0.93).

We will use a multidisciplinary approach to prevent 30-day heart failure readmissions. Previous studies have focused on post discharge education and support utilizing pharmacists and nurses. Our intervention is more inpatient based, utilizing a broader range of clinicians including student pharmacists, HF educators, nurses, physical therapists (PT), occupational therapists (OT), and dietitians to educate the patients and their families about disease management. We believe that using a broader range of clinical specialties will prevent 30-day readmissions.

## **V – Methods**

### **Intervention**

Northwest Medical Center (NMC) utilizes a HF coordinator (a specialized nurse who also acts as a HF educator) to identify patients admitted with HF. The HF coordinator reviews NMC's daily admission list and BNP report to identify patients with a possible diagnosis of HF. Patient notes, echocardiograms, labs, and medication lists are also reviewed to ensure patients are accurately identified. The HF coordinator then generates a list which is sent to the HF team. This team includes representatives from pharmacy, nursing, case management, outpatient HF clinic nursing, the director of quality, the chief quality officer, dietary, occupational and physical therapy.

Patients and their families and/or caregivers are invited to participate in HF courses, and the student pharmacists attempt to counsel them while they are an inpatient.

The HF course is taught by the HF coordinator, pharmacists, and pharmacy residents using a teaching booklet. Topics covered include basic pathophysiology, importance of medication adherence, instruction on the importance of daily weight measurements, and sodium, fluid, and alcohol restrictions. The major HF medication classes are reviewed like ACE inhibitors, ARBs, BBs, diuretics, and digoxin. The importance of attending a primary care physician appointment within 5 days of discharge is reinforced to all participants.

The student pharmacist counselling component is more individualized than the HF course. The student pharmacists review each patient's chart for HF drugs, and educate the patient about each individual drug and how it relates to the patient's disease state. Student pharmacists counsel patients on tobacco cessation, administer the Modified Morisky Questionnaire (MMQ)<sup>27</sup> to assess medication adherence. The patients are given medication organizers to assist patients with medication adherence. The teach-back method is used to ensure patient understanding.

The last part of the intervention is the follow-up phone call. Student pharmacists call patients within 3 days of discharge to ensure they are measuring their weight daily, and have a scheduled appointment with their primary care provider (PCP). The students also administer an abbreviated MMQ to assess patient medication adherence and identify issues with obtaining prescribed medications.

## Study Design

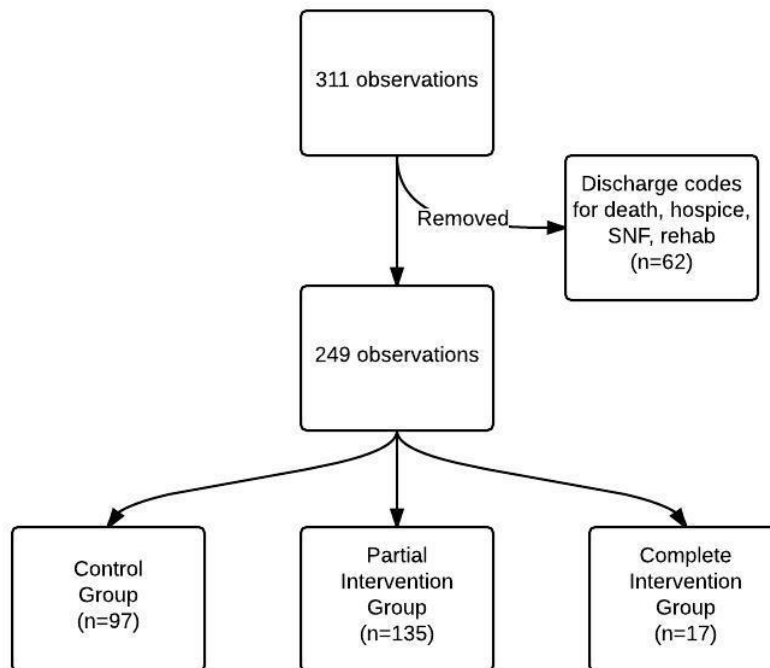


Figure 1

Patients who did not participate in the HF course, or receive student pharmacist counselling, or the follow-up phone call were placed in the control group (n=97). Patients who received one or two intervention components were included in the partial intervention group (n=135). Patients who received all three intervention components make up the complete intervention group (n=17).

A retrospective cohort study design was used to assess the intervention's effectiveness. Patients were included if they were admitted from January 1, 2014 to December 31, 2014 with HF as the primary or secondary diagnosis (Appendix 1). The analysis included 249 total observations with 221 individual patients. Patients who died, were discharged to hospice, a skilled nursing facility (SNF), or an inpatient rehabilitation facility were excluded.

The multidisciplinary intervention contains three components:

1. Individualized medication counseling by student pharmacists
2. Inpatient HF class and/or individualized counseling with the HF coordinator
3. Student pharmacist follow-up phone call

The primary outcome was 30-day readmission status. Other data collected included, age, sex, date of admission, date of discharge, readmission diagnosis, smoking status, ejection fraction, and medication list. Chart review of all patients was performed to collect the data necessary to calculate a CCI (Appendix 3).<sup>28</sup>

ANOVA was performed to determine differences in age, length of stay, and CCI score. Chi<sup>2</sup> was performed to determine difference in sex, smoking status, length of stay groups, and CCI categories. Logistic regression was performed to determine if the odds of readmission differed between the intervention groups. Logistic regression was also used to determine if MMQ was related to 30-day readmissions.

Statistical analysis was performed using Stata 14.1 by StataCorp in College Station, TX. This project was approved by Northwest Medical Center's Institutional Review Board.

## VI – Results

Table 1: Demographics

	Control [n=97]	Partial [n=135]	Complete [n=17]	P-Value
<b>Age</b> (Years, Mean, SD)	74.2 (15.5)	73.7 (13.9)	76.9 (13.9)	0.42
<b>Sex</b> (Male, n, %)	57 (58.8)	71 (52.6)	11 (64.7)	0.48
<b>Smoking Status</b> (Positive, n, %)	17 (17.5)	11 (8.2)	2 (11.8)	0.10
<b>Length of Stay</b> (Days, Mean, SD)	3.16 (3.1)	4.26 (3.3)	4.94 (3.5)	< 0.001
<b>Length of Stay</b> ≤ 2 Days (n)	57	40	1	< 0.001
≥ 3 Days (n)	40	95	16	
<b>30-day Readmits</b> (n, %)	14 (14.4)	24 (17.8)	1 (15.9)	0.41
<b>Modified Morisky Score</b> Not Done (n, %)	97 (100)	57 (42.2)	0 (0)	< 0.001
0-2 (n, %)	0 (0)	69 (51.1)	15 (88.2)	
3-4 (n, %)	0 (0)	7 (5.2)	2 (11.8)	
5-6 (n, %)	0 (0)	2 (1.5)	0 (0)	
<b>CCI Score</b> (median, SD)	4 (1.87)	4 (2.00)	3 (2.25)	0.09
<b>Charlson Comorbidity Index</b> 0-2 (n, %)	16 (16.7)	21 (15.6)	4 (23.5)	0.74
3-7 (n, %)	75 (78.1)	107 (79.3)	11 (64.7)	
≥8 (n, %)	5 (5.2)	7 (5.2)	2 (11.8)	

We identified a total of 221 patients with a total of 249 admissions, and 39 30-day readmissions; 30-day readmission rate for this time was 15.66%.

The average age in the control group was 74.2 years (SD 15.5), 73.7 years (SD 13.9) in the partial intervention group, and 76.9 years (SD 13.9) in the complete intervention group (p=0.42). There were 57 (58.8%) males in the control group, 71 (52.6%) males in the partial intervention group, and 11 males (64.7%) in the complete intervention group (p=0.48). There were 17 (17.5) smokers in the control group, 11 (8.2%) smokers in the partial intervention group, and 2 (11.8%) in the complete intervention group (p=0.10). The average length of stay was 3.16 days (SD 3.1) in the control group, 4.26 days (SD 3.3) in the partial intervention group, and 4.94 days (SD 3.5) in the complete intervention group (p<0.001). There were 14 (14.4%) 30-day readmission in the control group, 24 (17.8%) 30-day readmissions in the partial intervention group, and 1 (15.9%) readmission in the complete intervention group (p=0.41). The median CCI score was 4 (SD 1.87)



in the control group, was 4 (SD 2.00) in the partial intervention group, and was 3 (SD 2.25) in the complete intervention group (p=0.09).

Table 2: Odds of Readmission by Group

	Odds Ratio	P-Value	Confidence Interval
<b>Groups</b>			
Control Group (n=97)	1.00	-	1.00
Partial Intervention (n=135)	1.35	0.44	0.628-2.912
Full Intervention (n=17)	0.38	0.38	0.043-3.320
<b>Charlson Comorbidity Index</b>			
0-2 (n=41)	1.00	-	1.00
3-7 (n=193)	1.79	0.32	0.571-5.595
≥ 8 (n=14)	7.69	0.01	1.625-36.238
<b>Ejection Fraction</b>			
> 50% (n=97)	1.00	-	1.00
40%-50% (n=24)	0.48	0.38	0.097-2.416
< 40% (n=128)	0.85	0.69	0.392-1.850
<b>Demographic Information</b>			
Male Sex	1.19	0.66	0.548-2.595
Smoking Status	0.98	0.98	0.314-3.071
Age	0.97	0.04	0.947-0.999

Table 3: Odds of Readmission by Group with Modified Morisky Score

	Odds Ratio	P-Value	Confidence Interval
<b>Groups</b>			
Partial Intervention (n=78)	1.00	-	1.00
Full Intervention (n=17)	0.15	0.08	0.017-1.287
<b>Charlson Comorbidity Index</b>			
0-2 (n=15)	1.00	-	1.00
3-7 (n=72)	1.61	0.57	0.315-8.189
≥ 8 (n=8)	7.40	0.07	0.865-63.322
<b>Morisky Score Category</b>			
0-2 (n=84)	1.00	-	1.00
3-4 (n=9)	1.95	0.42	0.391-9.704
5-6 (n=2)	omitted	-	1.00

When the CCI was analyzed as a continuous variable, patients had a 36% increased risk of readmission for every one-unit increase in their CCI score (OR 1.36, 95% CI 1.137-1.623). When the CCI scores were categorized 0-2, 3-7, ≥ 8, patients with a CCI score of ≥ 8 had a 7-fold greater risk of being readmitted within 30 days when compared to patients whose CCI scores are 0-2 (OR 7.97, 95% CI 1.624-36.238). After adjusting for the MMQ, patients with a CCI score of ≥ 8 had a 7-fold greater risk of being readmitted within 30 days when compared to the patients whose CCI scores were 0-2 (OR 7.40, 95% CI 0.865-63.322).

We analyzed the patients who had MMQ scores to attempt to identify an impact of medication adherence on readmission status. Higher MMQ scores indicated poorer adherence to medication therapy. Patients with MMQ scores of 3-4 had a 2-fold increase of readmission. Patients with a MMQ score of 3-4 had a 2-fold increased risk of 30-day readmission (OR 1.95, 95% CI 0.391-9.704). Patients with a MMQ Score of 5-6 were dropped from the analysis because of too few observations.

## VII – Discussion

When compared to patients who did not receive the intervention, patients who received all or part of the multidisciplinary intervention did not have reduced 30-day readmissions. When the patients with higher CCI scores were separated into different groups, the most severely ill patients (scores greater than or equal to 8) were more likely to be readmitted within 30-days.

Rich et al<sup>16</sup> utilized a multidisciplinary intervention which included a cardiovascular research nurse, a dietitian, social service personnel, and a geriatric cardiologist who provided inpatient education, and intensive post-discharge support. Our intervention was similar with inpatient education with nurses, dietitian consultations, and follow-up post-discharge phone calls. Where it differed was our programs lack of intensive follow-up services like individualized home visits and consistent phone contact with members of the HF team. 90-day readmissions in the control group was 54%, and 64% in the treatment group (ARR 13%, 95% CI 2.1-24.3).

Blue et al<sup>13</sup> focused on post-discharge care for patients by utilizing specially trained nurses. After a patient was discharged, nurses would arrange regular visits and would be available to patients by phone. Nurses would educate patients about heart failure, and would optimize drug therapy, and diet, and exercise. They would also coordinate care with other health care providers like social workers and psychologists. The number of visits would taper over time. All cause readmissions by admissions/patient/month in the control group was 0.174 and 0.124 in the intervention group (RR 0.71, 95% CI 0.54-0.94).

Krumholz et al<sup>14</sup> used cardiac nurses to teach patients in an hour-long one-on-one session within two weeks of discharge. The nurses would visit the patients who were unable to travel to the meetings. After the initial meetings, nurses would contact the patients weekly for 4 weeks, biweekly for eight weeks, then monthly up to one year. Readmissions were lower in the intervention group after adjusting for demographic and clinical characteristics (HR 0.56, 95% CI 0.32-0.96).

Murray et al<sup>8</sup> incorporated clinical pharmacists in their intervention. When the patient's HF medications, the pharmacists provided patient-centered verbal instructions and written materials about the medications. Timelines were also provided to assist the patient in remembering to take their medications. Electronic monitoring was used to monitor medication adherence. Patients who received the intervention had better medication utilization (10.9% difference, 95% CI 5.0-16.7) and lower risk of readmissions (IRR 0.82, 95% CI 0.72-0.93).

Our study was unable identify an impact of our intervention on 30-day readmissions. Our study had several limitations, the largest of which was the small sample size of the complete intervention group (n=17). Also, because of the retrospective cohort study design, there is a possibility of self-selection bias. Patients with longer hospital stays were more likely to receive the intervention; there was a statistically significant difference in length of stay between the different intervention groups ( $p < 0.001$ ). Although our intervention did combine aspects of other studies which were successful in reducing readmissions, the component that appeared to be missing from our intervention was continued follow up past the initial phone call. The expansion of our program to include phone calls to reinforce the educational component, and encourage

patients to adhere to their medication therapy and life-style changes may provide a measurable impact in 30-day readmissions.

These results suggest that interventions could be better targeted towards patients with the highest comorbidity score, as they are most likely to be readmitted within 30-days. Also, patients with longer hospital stays were most likely to receive the intervention. Patients should be assessed to determine their comorbidity status, so the patients with the highest comorbidity scores can receive the intervention earlier in their hospital stay.

Another possible limitation is NMC's low heart failure readmission rate. Our study population had a 15.7% readmission rate, while the national average during this time frame was 22%.<sup>29</sup> Our intervention may not show an impact because our population has a low readmission rate.

### **VIII – Conclusion**

We did not identify an impact of our intervention on 30-day readmissions in patients with HF. Patients with high CCI scores had an increased risk of being readmitted within 30-days. The intervention may be best targeted towards patients with high CCI scores because they have the highest readmission rate.

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## X – Appendix

Diagnosis Codes:

Diagnosis Code	Plain Text
428.0	Congestive heart failure, unspecified
402.01	Malignant hypertensive heart disease with heart failure
402.91	Unspecified hypertensive heart disease with heart failure
404.01	Hypertensive heart and chronic kidney disease, malignant with CKD stage 1-4, or unspecified
404.03	Hypertensive heart and chronic kidney disease, malignant with CKD stage 5 or ESRD
404.13	Hypertensive heart and chronic kidney disease, benign, with heart failure and CKD stage 5 or ESRD
404.91	Hypertensive heart and chronic kidney disease, unspecified, with heart failure and CKD stage 1-4
428.21	Acute systolic heart failure
428.22	Chronic systolic heart failure
428.23	Acute on chronic systolic heart failure
428.30	Diastolic heart failure, unspecified
428.31	Acute diastolic heart failure
428.32	Chronic diastolic heart failure
428.33	Acute on chronic diastolic heart failure
428.41	Acute combined systolic and diastolic heart failure
428.43	Acute on chronic combined systolic and diastolic heart failure

Drug use in the various intervention groups:

<i>Drug Use Amongst Intervention Groups</i>				
<i>Drug</i>	<i>Control</i>	<i>Partial</i>	<i>Complete</i>	
<i>BB</i>	0	19	5	<i>On drug</i>
	6	73	12	<i>Not on drug</i>
	91	43	0	<i>Missing</i>
<i>Loop Diuretic</i>	0	12	1	<i>On drug</i>
	6	80	16	<i>Not on drug</i>
	91	43	0	<i>Missing</i>
<i>Aspirin</i>	2	56	7	<i>On drug</i>
	4	36	10	<i>Not on drug</i>
	91	43	0	<i>Missing</i>
<i>Thiazide</i>	6	83	14	<i>On drug</i>
	0	9	3	<i>Not on drug</i>
	91	43	0	<i>Missing</i>
<i>Ace/ARB</i>	3	40	11	<i>On drug</i>
	3	52	6	<i>Not on drug</i>
	91	43	0	<i>Missing</i>



<i>Calcium Channel Blocker</i>	6	77	12	<i>On drug</i>
	0	15	5	<i>Not on drug</i>
	91	43	0	<i>Missing</i>
<i>Aldosterone Antagonist</i>	5	67	13	<i>On drug</i>
	1	25	4	<i>Not on drug</i>
	91	43	0	<i>Missing</i>
<i>Vasodilator</i>	6	80	15	<i>On drug</i>
	0	12	2	<i>Not on drug</i>
	91	43	0	<i>Missing</i>
<i>Digoxin</i>	6	84	16	<i>On drug</i>
	0	8	1	<i>Not on drug</i>
	91	43	0	<i>Missing</i>

Charlson Comorbidity Index:

Charlson Weighted Index of Comorbidity	
1	Myocardial Infarct
	Congestive Heart Failure
	Peripheral Vascular Disease
	Cerebrovascular Disease
	Dementia
	Chronic Pulmonary Disease
	Connective Tissue Disease
	Ulcer Disease
	Mild Liver Disease
	Diabetes
	2
Moderate or Severe Renal Disease	
Diabetes with End Organ Damae	
Any Tumor	
Leukemia	
Lymphoma	
3	Moderate or Severe Liver Disease
6	Metastatic Solid Tumor
	AIDS

The Modified Morisky Score:

1. Do you ever forget to take your medicine?
2. Are you careless at times about taking your medicine?
3. When you feel better do you sometimes stop taking your medicine?

4. Sometimes if you feel worse when you take your medicine, do you stop taking it?
5. Sometimes do you forget to refill your prescription medicine on time?
6. Do you know the long-term benefit of taking your medicine as told to you by your doctor or pharmacist?



BP									
Pulse (60-100)									
Patient Weight									
BNP									
Initial of student Counseling and Morisky score									
Daily counseling on new meds (initials)									

Date	Additional Comments

**BACK OF MONITORING FORM**

**HOSPITAL: Modified Morisky Scale Questionnaire:** If patient seems compliant still complete all questions and state “It seems like you are doing well with your medications, but I do have to ask you six questions. There is no right answer and please answer honestly”.

1. Do you ever forget to take your medicine? Y / N
2. Are you careless at times about taking your medicine? Y / N
3. When you feel better do you sometimes stop taking your medicine? Y / N
4. Sometimes if you feel worse when you take your medicine, do you stop taking it? Y / N
5. Sometimes do you forget to refill your prescription medicine on time? Y / N

6. Do you know the long-term benefit of taking your medicine as told to you by your doctor or pharmacist? Y / N

## **FOLLOW UP DISCHARGE PHONE CALL INSTRUCTIONS AND QUESTIONS (only discharged to home patients):**

- All HF patients NOT ON HOSPICE, REHAB, SNF should be called 1-2 days post-discharge on a NMC Phone. No calls should be made after 1900. Any immediate concerns should be reviewed with the ED pharmacist and referred to the ED case manager (cell number 1512). All other issues can be just documented on the form to be reviewed by Ferena or another pharmacist daily for appropriate follow up.
- Messages should not be left for the patient and the questions should be asked of the patient or caregiver (patient preferred).
- Case Management notes in HPP under flow sheet should be reviewed before the first call to identify any case management issues and follow up.

### **Script/Questions:**

**“HI—May I speak to Ms/Mr. X? My name is Ferena and I am a student pharmacist working at Northwest Medical Center. I know you were recently discharged from NMC so I would like to take less than 5 minutes to ask a few important questions:**

1. When is your next physician appointment for follow up (goal is within 7 days post discharge)? Date of appt: \_\_\_\_\_ Physician Name: \_\_\_\_\_
2. IF HOME HEALTH PATIENT BASED ON SPREADSHEET: Has someone called you to schedule a home health visit? Y/N Comments: \_\_\_\_\_
3. Are you weighing yourself every day and writing your weight down? Y/N Comments \_\_\_\_\_
  - a. Do you remember the weight increases that require you to call your physician for immediate follow up (ask the patient to explain)? Y/N Comments: \_\_\_\_\_

### **Since you have been discharged from the hospital:**

4. Do you ever forget to take your medicine? Y / N
5. Are you careless at times about taking your medicine? Y / N
6. When you feel better do you sometimes stop taking your medicine? Y / N
7. Sometimes if you feel worse when you take your medicine, do you stop taking it? Y / N
8. Did you have any issues picking up your **new** medications from the Pharmacy after discharge? Y/N Comments (non-formulary, cost issues, etc) \_\_\_\_\_

**Thank the patient for their time and let them know that someone from NMC may be calling again asking similar questions or additional hospital related questions.**