All cause 30-day readmission in hospitalized patients with acute myocardial infarction

Background:

The American Heart Association 2022 Heart Disease and Stroke statistics indicates the incidence of acute myocardial infarction (AMI) between 2005 to 2014 was 605,000 new cases and 200,000 recurrent attacks, with a majority of cases involving Medicare patients. AMI is one of the four high-risk readmission diagnoses that can lead CMS to reduce reimbursements to institutions. Health systems are striving to implement measures directed towards reducing preventable complications related to hospitalization, improving communication and coordination of care with other healthcare providers, and overseeing successful transitions of care upon hospital discharge to reduce readmission rates.

Determining predictors that may be contributing to these readmission rates would allow health systems and clinicians to proactively identify and target patients who are the most likely to benefit from readmission preventative interventions. An example of a preventative intervention is the utilization of a Transitions of Care (TOC) pharmacist to ensure patients transition successfully by providing pre- and post-discharge services. TOC pharmacist services include optimizing discharge medication reconciliations (DCMR) and providing post-acute medication reviews (PMR) to assess adherence to medications and enhance patients' disease state understanding. The purpose of this study is to evaluate predictors of all cause 30-day AMI readmissions including TOC pharmacist services to streamline additional preventative interventions.

Methodology:

This was an IRB-approved, retrospective, multi-centered, observational cohort that was conducted at a large healthcare system composed of 15 hospitals. Patients were included if they were 65 years of age or older and had a primary diagnosis of ST-elevation myocardial infarction (STEMI) or non-ST-elevation myocardial infarction (NSTEMI) between April 2020 and May 2022. Patients were excluded if during the index hospitalization they were COVID positive; received a coronary artery bypass graft (CABG); expired; discharged to long-term acute care (LTAC), hospice, another health system, psychiatric facility, or court/law enforcement facility; or left against medical advice (AMA).

The primary outcome was all cause 30-day readmission with the following predictors: discharge medications (high intensity statin, beta-blocker, angiotensin converting enzyme inhibitor (ACEi)/angiotensin receptor blocker (ARB), dual antiplatelet therapy (DAPT), nitroglycerin), length of stay (LOS), vasopressor utilization during admission, co-morbid diseases (hypertension, chronic kidney disease, diabetes, and chronic obstructive pulmonary disease), body mass index (BMI), gender, total medications at discharge, percutaneous intervention (PCI) with stent, severity of illness, TOC pharmacist services, and discharge disposition. Using Stata 15.1 software, logistic regression was performed to analyze AMI patient data for 30-day readmissions. A pilot study (n = 196) was conducted to obtain estimates of the covariates. Based on these calculations, to detect a 40% reduction in readmission with an alpha of 0.05 and a power of 80%, a total sample size of 2000 patients was required. Average marginal effects (AME) were calculated for each significant predictor in the regression model, which estimates the average change in the probability of readmission while all other variables are held constant.

Results:

Baseline characteristics are outlined in Table 1. Of the predictors evaluated, patient's age (OR 1.03, 95% CI 1.01 – 1.05; p= 0.002), number of medications at discharge (OR 1.05, 95% CI 1.02 – 1.09; p= 0.001), and DAPT therapy (OR 1.7, 95% CI 1.1 – 2.67; p= 0.024) were statistically significant predictors that increased hospital readmissions. ACEi/ARB therapy (OR 0.73, 95% CI 0.54 – 0.98; p= 0.039) and PMR (OR 0.46, 95% CI 0.22 – 0.96; p= 0.039) were statistically significant predictors that reduced hospital readmissions (Table 2). AME modeling for binomial predictors demonstrated that PMR and ACE/ARB therapy reduced readmission by 7% (95% CI -0.138 to -0.003; p= 0.041) and 2.9% (95% CI -0.058 to -0.001; p= 0.041), respectively. Conversely, DAPT increased readmissions by 4.3% (95% CI 0.010 to 0.075; p= 0.010).

Conclusion:

According to current AHA/ACC guidelines, a post-hospitalization plan of care is essential to help reduce readmission rates and should address several complex issues, including, but not limited to, medication adherence, follow-up, dietary interventions, and physical activity. Based on this study, TOC pharmacists should target patients who are of an advanced age, have an extensive medication list, and who are discharged on DAPT to further reduce readmissions. TOC pharmacists should also ensure ACEi/ARB therapy is initiated, when appropriate, as this can reduce hospital readmissions by 2.9%. While DCMR was not a significant predictor, this study supports PMR in reducing AMI readmissions, which should prompt further investigation into additional resource allocation in this space. Limitations of the study include the retrospective cohort design and the diminished internal validity due to a lack of a standardized method for performing TOC elements.

Presentation objective:
To determine and evaluate predictors of all cause 30-day AMI readmissions including TOC pharmacist services to streamline additional preventative interventions.

Self-assessment:

1. TOC pharmacists can aid in reducing hospital readmissions for AMI patients by which of the following:
    a. Ensuring a post-acute medication review is performed for specified at-risk patients at discharge
    b. Providing patient counseling and education on new drug therapy management
    c. Producing guideline directed medication recommendations to providers at discharge
    d. **All of the above**

Table 1: Characteristics	(n=2000)
Age, mean (SD)	76.93 (7.86)
Female sex	927 (46.35)
BMI - mean (SD)	28.08 (6.34)
LOS (days) - mean (SD)	4.15 (3.85)
Severity of illness - mean (SD)	2.3 (0.9)
Discharge Med Total - mean (SD)	12.05 (5.01)
30-day readmissions	255 (12.7)
Ethnicity/Race	
White	1668 (83.4)
Hispanic	148 (7.4)
Black	113 (5.7)
Other/unknown	61 (3.1)
Cardiac Status	
Stent	1408 (70.4)
Vasopressor Use	494 (24.7)
Discharge Disposition	
ALF	26 (1.3)
Home	1166 (58.3)
Home Health	547 (27.35)
SNF	261 (13.05
Comorbidities	
CKD	434 (21.7)
COPD	281 (14.05)
Diabetes	750 (37.5)
Hypertension	1601 (80.05)
PAD	335 (16.75)
Discharge Medications	
ACEi/ARB	1158 (57.9)
Beta-Blocker	1681 (84.05)
DAPT	1629 (81.45)
Nitroglycerin	864 (43.2)
Statin	1660 (83)
Severity of illness*	
1	355 (17.75)
2	933 (46.65)
3	469 (23.45)
4	243 (12.15)
TOC Services	
DCMR	1211 (60.55)
PMR	976 (48.8)
Both elements	794 (39.7)

Characteristics are listed as no. (%) unless otherwise noted.

Abbreviations: BMI, body mass index; LOS, length of stay; ALF, assisted living facility; SNF, skilled nursing facility; CKD, chronic kidney disease; COPD, Chronic obstructive pulmonary disease; PAD, peripheral artery disease; ACEi/ARB, Angiotensin converting enzyme inhibitor/Angiotensin receptor blocker; DAPT, dual antiplatelet therapy; TOC, transitions of care; DCMR, discharge medication reconciliation; PMR, post-acute medication reviews

*Severity of illness: disease-related group medical coding based on discharge diagnosis abstract data

Table 2: Primary Endpoints

Predictors	OR (95% CI)	P value
Discharge Med Total	*1.05 (1.02 – 1.09)*	*0.001*
LOS	1.02 (0.98 – 1.07)	0.24
BMI	0.99 (0.96 - 1.01)	0.35
Age	*1.03 (1.01 – 1.05)*	*0.002*
Gender	1.06 (0.79 – 1.43)	0.68
Ethnicity/Race *(reference variable white)**		
Black	0.68 (0.33 – 1.41)	0.31
Hispanic	1.18 (0.7 – 2)	0.54
Other	0.8 (0.35 – 1.81)	0.6
Comorbidities		
CKD	1.1 (0.79 – 1.5)	0.55
COPD	1.04 (0.69 – 1.5)	0.84
Diabetes	1.3 (0.94 – 1.8)	0.11
Hypertension	0.97 (0.65 – 1.4)	0.89
PAD	1.2 (0.83 – 1.7)	0.32
Discharge medications		
ACEi/ARB	*0.73 (0.54 – 0.98)*	*0.039*
Beta-Blocker	0.93 (0.61 – 1.4)	0.72
DAPT	*1.7 (1.1 – 2.67)*	*0.024*
Nitroglycerin	0.85 (0.62 – 1.2)	0.31
Statin	1.11 (0.74 – 1.67)	0.6
Cardiac Status		
Vasopressors	1.23 (0.87 – 1.74)	0.23
Stent	1.13 (0.79 – 1.6)	0.51
Discharge Disposition *(reference variable home)**		
ALF	2.16 (0.8 – 5.8)	0.13
Home Health	1.38 (0.97 – 1.96)	0.07
SNF	0.84 (0.51 – 1.38)	0.5
Severity of illness *(reference variable 1)**		
2	1.3 (0.76 – 2.28)	0.32
3	1.7 (0.96 – 3.15)	0.07
4	1.4 (0.7 – 2.8)	0.32
TOC Elements		
DCMR	1.4 (0.93 – 2.1)	0.1
PMR	*0.46 (0.22 – 0.96)*	*0.039*
Both	1.2 (0.52 – 2.7)	0.67

Abbreviations: LOS, length of stay; BMI, body mass index; ALF, assisted living facility; SNF, skilled nursing facility; CKD, chronic kidney disease; COPD, Chronic obstructive pulmonary disease; PAD, peripheral artery disease; ACEi/ARB, Angiotensin converting enzyme inhibitor/Angiotensin receptor blocker; DAPT, dual antiplatelet therapy; TOC, transitions of care; DCMR, discharge medication reconciliation; PMR, post-acute medication reviews

*Reference variables were utilized for categorical predictors to perform logistical regression.