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Obtaining a follow-up appointment before discharge protects against readmission for patients with acute coronary syndrome and heart failure: A quality improvement project

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ABSTRACT

Background: Cardiac patients have a high risk of readmission following hospital discharge. The aim of our project was to examine the factors associated with increased readmission rate, with a view to eventually decrease the rate of readmission for patients admitted to the hospital due to acute coronary syndrome (ACS) or heart failure.
Methods: Patients admitted to the cardiac step-down unit at a single private hospital from 2015 to 2016 were included in our study. Interventions that were employed included: (1) improved pre-discharge follow-up appointment scheduling, (2) medication education by a pharmacist, and (3) timely discharge planning. Our primary outcome of interest was all-cause rate of hospital readmission within 30 days. We conducted a multivariate analysis to determine the factors that were predictive of readmission rate.
Results: 578 patients were included in the study and 402 were diagnosed with ACS (69.9%). The rate of readmission was 14.2% for patients with heart failure, compared to 7.5% for patients with ACS. Following the bundle of interventions, patients were significantly more likely to receive an appointment (45.6% vs. 75.4%, $p < 0.001$), medication education from a pharmacist (38.5% vs. 56.7%, $p = 0.006$), and a timely discharge (47.1% vs. 76.0%, $p < 0.001$). Readmission rate was comparable following the intervention (8.6% vs. 9.7%), but patients that received an appointment had 0.374 times lower odds of being readmitted ($p = 0.004$).
Conclusions: While our package of interventions did not lead to a significant decline in our readmission rate, patients who received a follow-up appointment prior to discharge were strongly protected against readmission.

1. Introduction

Hospital readmission is an area that is frequently identified as an important indicator of the quality of care provided by a hospital. Readmission leads to higher costs for healthcare and can be associated with worse outcomes for patients [1]. Moreover, it has been found that approximately 27% of readmissions are avoidable [2]. As such, many countries have policies in place that aim to reduce the rate of readmission [3]. In 2013, the United States began to implement financial disincentives for hospitals with unacceptable readmission rates [4].

Cardiac disease is a common cause for hospitalization. Acute coronary syndrome and congestive heart failure account for approximately 3.8% and 2.9%, respectively, of total hospital discharges [5]. These conditions are also associated with a high risk of readmission to the hospital after the patient has been discharged [6]. The 30-day all-cause readmission rate for patients with a chief diagnosis of acute coronary syndrome is in the 10–20% range [6–9], whereas the rates are higher for patients with heart failure, ranging from 20 to 30% [6,10,11].

Having appropriate discharge planning in place is important so that patients remain as healthy as possible following their discharge from hospital. However, it has been shown that 1 in 5 patients suffers from an adverse event following hospital discharge [12]. It has been demonstrated that proper discharge planning may reduce the rate of readmission to the hospital [13]. Multiple interventions have been attempted to reduce the readmission rate prior to discharge, including patient education, medicine reconciliation, and scheduling of follow-up appointment prior to discharge, yet these appear to have a minimal impact unless they exist as a bundle of interventions [14].

At our institution, we found that many patients who were being discharged from the cardiac step-down unit were not receiving optimal

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discharge planning. As a result, a package of interventions was implemented to improve the discharge process, which included pharmacist education, receiving a follow-up appointment prior to discharge, and completing discharge instructions for patients before 10 am. The aim of this study was to determine whether our quality improvement project for improving the discharge process reduced the 30-day all-cause readmission rate for patients with either acute coronary syndrome or heart failure. We hypothesized that there would be a reduction in readmission rate following our package of interventions.

2. Methods

This study was approved by the Johns Hopkins Aramco Healthcare institutional review board. We conducted a prospective, longitudinal pre-post interventional study.

2.1. Participants

We collected data on a convenience sample of 578 patients that were admitted to the cardiac step-down unit with a discharge diagnosis of acute coronary syndrome (ACS) or heart failure between January 2015 and December 2016 at Johns Hopkins Aramco Healthcare (JHAH) Hospital in Saudi Arabia. This is a private hospital for the employees of Saudi Aramco oil company and their families. Aramco patients that present to an outside hospital are routinely transferred to JHAH.

2.2. Process

In 2014, staff members working in the cardiology step-down unit recognized that there was a need to improve the discharge planning process for patients being discharged. Patients were frequently leaving the hospital without follow-up appointments and without receiving education with a pharmacist on how to correctly take their medications. An interdisciplinary team of physicians, nurses, case managers, and pharmacists was formed to address these issues. A quality improvement specialist was appointed to champion this initiative and a Lean Six Sigma (LSS) approach was used.

2.2.1. Lean Six Sigma

LSS is a combination of the Lean and Six Sigma models for process improvement. The Lean model was developed by Toyota in the 1950s and focuses on streamlining processes to minimize waste. In the field of healthcare, it can be used to streamline communication and facilitate discharges. Six Sigma, developed in the 1980s by Motorola, focuses on reducing variation in system performance and improving customer satisfaction; it can be applied in the medical field to reduce medical errors and improve patient satisfaction. The LSS model for process improvement consists of 5 main steps: define, measure, analyze, improve, and control. The goal of this approach is to develop processes and systems that are well organized, efficient, and replicable. LSS can be used to improve workflow, improve quality of care, and improve patient satisfaction by identifying and solving problems. In our study, LSS was used to identify a problem in the system and help guide possible solutions.

From our experience, we noticed that the discharge process for patients in our unit was highly variable and poorly organized, with many patients not receiving follow-up appointments or pharmacist education on how to take their medications. An Ishikawa fishbone diagram was used to brainstorm possible factors contributing this issue. These factors were grouped into four categories: manpower, customer, policy, and process. This analysis revealed several important discoveries: 1) patients were having difficulty scheduling appointments on their own after discharge because the clinic was full, 2) pharmacists were unable to see the patient prior to discharge if the discharge order was not in early enough, 3) resources needed for adequate discharge planning were unavailable on weekends and after-hours, and 4) pharmacist was not being notified when the patient was ready for education. Based on these findings, several interventions were implemented and their success was measured and monitored throughout the process. Minor adjustments were made to the interventions as needed as issues were discovered.

2.3. Interventions

There were three main interventions that were implemented starting in April 2015. First, an administrative clerk was assigned the role of scheduling follow-up appointments for patients, as opposed to relying on patients to schedule their own appointment. Follow-up appointments were scheduled for approximately 1 week after discharge for heart failure patients and 2 weeks after discharge for ACS patients. If an appointment was not able to be made before the patient was discharged, then the patient was called by the hospital and informed of their follow-up appointment time. Second, a pharmacist was involved with morning rounds and was charged with providing medication education to patients. Third, physicians were encouraged to enter their discharge orders for the patient the day prior to the patients expected discharge date. The purpose of this intervention was to enable patients to receive their discharge instructions before 10 am on the day of their discharge so that staff would have time to schedule a follow-up appointment for the patients and so that a pharmacist would have time to meet with the patient to provide medication education.

2.4. Measures

Baseline data was collected from January 2015 to March 2015, and data following the interventions was collected from April 2015 to December 2016.

Three process measures were tracked over the course of the study: (1) whether an appointment was scheduled for patients, (2) whether patients received education from a pharmacist, and (3) whether patients received a timely discharge (discharge before 10 am on the day of discharge). These data were obtained and tracked by a quality improvement specialist. The primary outcome measure was the 30-day all cause readmission rate, which was obtained by retrospectively reviewing patient hospital charts. Other patient-related data were also collected, including patient demographics, diagnosis (ACS or heart failure), and hospital length of stay.

2.5. Analysis

Statistical analysis was performed using STATA 12 (StataCorp, College Station, Texas, USA). A p-value of <0.05 was considered statistically significant. We performed sample size calculations to determine the number of patients we would need in our study. We determined that we would need a minimum of 500 patients in our study to perform a multiple logistic regression model with readmission rate as the independent variable and five predictor variables, given a readmission rate of 10% [15]. Using $\beta = 0.2$ and a two-sided $\alpha = 0.05$, we calculated that we could detect a 20% difference between our predictor variables (appointment, early discharge, education) before and after the intervention with 500 patients. We also calculated the number of participants required to detect a difference in readmission rate of 1% before and after our intervention [16].

The Student's t-test was used to compare patient age and length of stay before and after the intervention, whereas the chi square test was used to compare sex, patient diagnosis, and whether the patient received an appointment, pharmacist education, or a timely discharge before and after the intervention. The chi square test was also used to compare the readmission rate for patients by their discharge diagnosis, whether they received an appointment, and whether they were admitted before or after the package of interventions was implemented.

Multivariate logistic regression was used to model factors that predicted whether the patient received an appointment, pharmacist education, and timely discharge. We deemed that all predictor variables collected were relevant, and thus all predictor variables were included in each model. Multivariate analysis was also used to examine the relationship between the predictor variables and readmission rate. The variables chosen for inclusion in the model was based on selecting the model with the lowest AIC. We examined all multivariate models for collinearity using the variance inflation factor, and no substantial collinearity was found in the models.

3. Results

During the study period, data was collected on 70 patients prior to and 508 patients after the package of interventions was implemented. The mean age for patients in the study was 65.7 years (SD = 2.4 years) and 61.1% of patients were male. The mean length of stay for each patient was 3.7 days (SD = 2.5 days). Four hundred and two (69.6%) patients were diagnosed with ACS and 176 (30.4%) patients were diagnosed with heart failure. Table 1 contains data on the patients in our study population, stratified by whether they were admitted before or after the package of interventions was implemented. Patients were significantly more likely to receive an appointment ($p < 0.001$), pharmacist education ($p = 0.006$), and timely discharge ($p < 0.001$) after the package of interventions were implemented. The compliance over time for each of the process measures (receiving an appointment, pharmacist education, and timely discharge) is illustrated by the run chart in Fig. 1.

Table 2 illustrates the factors that were predictive of patients receiving an appointment, pharmacist education, and timely discharge on multivariate analysis. Patients admitted during the intervention phase

Table 1
Patient characteristics.

Characteristic	Pre-intervention ($N = 70$)	Post-intervention ($n = 508$)	P-value
Age mean (SD)	66.8 (12.7)	65.6 (12.4)	0.431
Male *N* (%)	44 (62.9)	309 (60.8)	0.744
Heart failure *N* (%)	24 (34.3)	152 (29.9)	0.457
Length of stay mean (SD)	3.7 (3.2)	3.7 (2.4)	0.950
Received an appointment *N* (%)	31 (45.6)	358 (75.4)	<0.001
Received pharmacist education *N* (%)	25 (38.5)	271 (56.7)	0.006
Received timely discharge *N* (%)	33 (47.1)	386 (76.0)	<0.001