HOSPITAL SYSTEM READMISSIONS

Student Author

Cody Mullen graduated in 2012 from Purdue University with a bachelor's degree in interdisciplinary science, focusing on statistics and healthcare. During the spring 2009 semester, Mullen began work as a Discovery Park Undergraduate Intern (DURI) under Dr. Steve Witz, working for the Center for Assistive Technology. In the summer of 2010, he was selected as an undergraduate research fellow at the Regenstrief Center for Healthcare Engineering (RCHE) researching hospital readmissions. Mullen will be attending Indiana University-Purdue University Indianapolis to pursue a Ph.D. in health policy and management.

Mentor

Steve Witz joined the Regenstrief Center for Healthcare Engineering (RCHE) at Purdue University in January of 2006 as its first director. His 26-year career in hospital administration includes serving as the president and CEO of St. Patrick Hospital and Health Science Center in Missoula, Montana, and senior vice president and chief operating officer at the University of Wisconsin Hospital and Clinic. In addition to serving as a hospital administrator, Witz has held teaching positions at the University of Minnesota, University of Utah, and Brigham Young University. Witz received his bachelor's degree in psychology and his master's degree in public health from the University of Minnesota. In 1986 he completed his doctorate in hospital and healthcare administration at that institution.

Abstract

Hospital readmission rates can be used as an indicator of the quality of health care services and can highlight high-priority research areas to ensure better health. A readmission is defined as when a patient is discharged from an acute care hospital and is admitted back to an acute care hospital in a set amount of days, with 30 days being the current national standard. On average, 19.6% of Medicare patients are readmitted to the hospital within 30 days of discharge and 56.1% within a year (Jencks, Williams, & Coleman, 2009). The hypothesis of this study was that the discharge location, or where a patient went immediately after discharge, would not have a significant effect on readmissions. A data set with all admission records was obtained from a major health provider. These data contain all hospital patients' demographic and diagnosis information. General, women's, and children's hospitals were looked at from a system perspective to study the discharge location of patients as well as the effects of patient demographics on discharge location. By using a z-significance test in Microsoft Excel and SAS 9.2, it was discovered that patients discharged to home have a significantly lower likelihood of readmission. Generally, patients who are discharged to an extended care or intermediate care facility or patients with home health care-related services had a significantly higher likelihood of being readmitted. The findings may indicate a possible need for an institution-to-institution intervention as well as institution-to-patient intervention. Future work will develop potential interventions in partnership with hospital staff.

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HOSPITAL SYSTEM READMISSIONS:

A Care Cycle Approach

Cody Mullen, Interdisciplinary Science, Statistics and Healthcare

INTRODUCTION

In 2003–04, 19.6% of Medicare patients were readmitted to a hospital within 30 days of leaving the hospital. Within a year, this rate had risen to 56.1% (Jencks, Williams, & Coleman, 2009).

A readmission is defined as when a patient is discharged from an acute care hospital and is admitted back to an acute care hospital in a set amount of days. Currently, a 30-day time span between a discharge and subsequent admission is the national standard. It is also estimated that nearly 90% of all readmissions within 30 days were unplanned (Jencks et al., 2009). Some illnesses treated in a hospital may require a patient to have multiple admissions, such as chemotherapy, and these would be classified as planned readmissions. Unplanned readmissions in 2004 were estimated to cost \$17.4 billion (Jencks et al., 2009). In a time of increased public attention to rising health care costs, unplanned readmissions are a clear area for health care providers to make improvements to reduce usage and save money.

One of the leading hypotheses regarding the potential cause of unplanned readmissions is that they result from problems during transitions from the hospital to the next place of care. A recent study examining coordination between the hospital and post-hospital settings reported that, “transitions of care settings challenge patients, families, and providers. After a transition from one care setting to another, patients are often confused regarding medications, fail to complete further recommended evaluation, and do not follow up on outstanding test results” (Ornstein, Smith, Foer, Lopez-Cantor, & Soriano,

2011, p. 544). If the patient goes home, a greater amount of their care falls to the family; however, “roughly 40 percent of all Medicare beneficiaries are discharged to a post-acute setting, and roughly half of these enter a nursing home or distinct part of a nursing home devoted to providing skilled nursing care or rehabilitation services” (Mor, Intrator, Feng, & Grabowski, 2010, p. 57). In these instances, resolving these post-discharge issues to help prevent readmissions becomes the responsibility of the discharge location.

This study looked at the relationship between discharge location and readmission risk to determine whether any discharge location had a statistically significant effect on readmissions. The null hypothesis was that the discharge location (e.g., home, skilled nursing facility, etc.) would not adversely affect the readmissions rate. It was expected that the same percentage of patients being discharged to a certain location would also be readmitted from the location.

METHODS

The data analyses included two steps. First, data was obtained and edited. Data editing was conducted for the purpose of eliminating planned readmissions, such as chemotherapy, as the study focused on potentially preventable readmissions. Second, the data was analyzed by comparing the flow of patients into and out of each hospital and discharge location. Discharge rates to each discharge location were calculated and compared to the readmission rate for each location. The time calculation for days to readmission used the date of discharge from the hospital for the first hospitalization and the date of the first subsequent admission to the hospital.

Data Set

A data set was obtained from a health care provider in the United States. This data set included information from a general acute care, women's, and children's hospital. The initial data set included 127,166 patients with 185,229 admissions over a 3-year period. Planned readmissions, patients in hospice care, those diagnosed with cancer or renal disease, and patients who died during hospitalization were removed from the analysis. The data also did not include mothers admitted to give birth, patients admitted for rehabilitation service, or admittance due to major trauma (defined by a patient's diagnosis code). With these admissions removed, the analysis was done on 98,182 patients with 133,009 admissions.

Flow Analysis

To determine if a discharge location has a readmission rate higher than expected, the discharge rate to each discharge location was compared with the readmission rate from that location. Figure 1 represents the number of patients discharged from a hospital and readmitted, according to discharge location. Patients leaving the hospital are represented by the green line. The green

Figure 1. A simplified example of the flow analysis completed using three discharge locations. The green lines represent 100% of the patients discharged from the hospital and the red lines account for 100% of the patients readmitted to the hospital. If the null hypothesis of the study was found true, the percent of patients going to each discharge location would equal the percent of patients being readmitted from each discharge location.

lines add up to 100% (i.e., all of the patients who leave the hospital are sent to one of the predefined discharge locations). Red lines indicate patients who were readmitted to the hospital and their location immediately prior to readmission. These also add up to 100% (i.e., all the patients who were readmitted to the hospital came from one of the predefined discharge locations).

If the null hypothesis was found true, it would be expected that the percentage of patients sent to a discharge location would be the same as the percentage of patients readmitted from a discharge location, or a calculated value of 0% when patients sent to a location is subtracted from patients readmitted from a location. A positive difference would indicate that more patients are being readmitted from that location than hypothesized and a negative difference would indicate fewer patients being readmitted from that location than hypothesized.

The percentage for each discharge location was tested for significance using a z-test. The study used an alpha of 0.05 for significance. Analysis was conducted on a readmission window of 30, 60, 90, 180, and 365 days. The data was also categorized based on age, type of insurance, and gender. These divisions were used to assist in determining whether the discharge location and subsequent readmission patterns were the same for all patients, or if the pattern varied depending on characteristics of the patient.

The analysis was completed using Microsoft Excel and SAS 9.2. Purdue University's IRB committee approved the project in October 2010.

DATA ANALYSIS

The null hypothesis was found to be false for some discharge locations. This included when the data was analyzed by age, insurance form, and gender.

30-Day Analysis

Figure 2 shows the percentage differences between the in and out flow for each discharge location. Most of the discharge locations were not significant for the overall data set with only 7 of the 19 locations tested showing significance. The 7 that were significant were: left against medical advice, patients discharged home, discharged to an extended care facility (i.e., nursing home), discharged home with home care services (i.e., a health provider visits them at home), an intermediate care facility (i.e., a rehabilitation facility), a long-term care hospital, and a short-term care hospital (i.e., another acute care hospital). Patients who were discharged home had a lower than expected readmission rate whereas the six other locations had higher than expected.

30 Day Discharge Disposition Readmission % - Discharged %

Figure 2. A graph demonstrating the percentage difference between flows in and out of different discharge locations. Bars shaded in red indicate a significantly higher number of patients readmitted from these locations and those shaded in green represent locations with a significantly lower number of patients being readmitted.

When analysis was adjusted for age, it was found that routine discharge home and discharge home with home care services were significantly different from the null hypothesis for all age categories being tested. Discharge to an extended care facility became significant starting at age 45. All other locations were found to follow the null hypothesis. Discharge locations were not different between genders; both genders followed trends similar to the overall data set.

A significant difference was experienced between payer classes. The payer classes tested were HMO (health maintenance organization), Medicaid, Medicaid HMO, Medicare, Medicare HMO, PPO (preferred provider organization), and other. In Figure 3, a table is presented showing which discharge locations were significant for each payer class. Of the seven locations that were significant for all the data, long-term care was not significant for any specific payer class. The other six locations were significant at least once.

60-, 90-, 180-, and 365-Day Analysis

When the analysis was spread out to look at 60-, 90-, 180-, and 365-day windows, the same trends were noticed as with a 30-day window. The four discharge locations that remained significant for the overall data, regardless of time window being analyzed, were: patients discharged home, discharged to an extended care facility (i.e., nursing home), discharged home with home care services, and discharged to an intermediate care facility. Figure 4 shows the percent difference between actual and expected flow across all discharge location and time windows. The discharge locations that are shaded in red had significantly higher readmission rates while those shaded in yellow had significantly lower readmission rates.

When the analysis looked at specific age groups, forms of payment, and gender, the significance was limited to the same four discharge locations that were found for

Discharge Location	Payer Type						
	HMO	Medicaid	Medicaid HMO	Medicare	Medicare HMO	PPO	Other
Left Against Medical Advice							
Routine Discharge Home							
XFR/DSH Extended Care Facility							
XFR/DSH Homecare Related to Admission							
XFR/DSH Short Term General Hospital							

Figure 3. A table of the discharge locations and which payer source had a significantly different flow rate than hypothesized. Red indicates a significantly higher flow back rate for individuals with that payer source for the discharge locations listed, and green indicates a significantly lower flow back rate for individuals with that payer source and discharge location.

Figure 4. A graph demonstrating the percentage difference between flows in and out of different discharge locations. Bars outlined in red indicate a significantly higher number of patients were readmitted from these locations, and those outlined in yellow indicate a significantly lower number of patients were readmitted from these locations. This graph includes information on the 30-, 60-, 90-, 180-, and 365-day period.

Figure 5. This table shows which discharge locations were significant for different age categories and time frames analyzed. Each color represents a specific time frame that was significant. Notice locations could be significant at one age and not another or for a certain time period after discharge.

the overall data set. The number of locations that were significant decreased corresponding to an increase in time for which the analysis was completed. The greatest amount of variation between significance and time frames was experienced when patients were looked at based on their age. Figure 5 shows which time frames were significant for the seven discharge locations.

CONCLUSION

Potentially preventable readmissions are a major issue facing the health care system in America. This study assessed discharge location as a potential proxy to determine whether post-discharge care location influences probability of readmission. It was found that patients who are sent home without any formal aid had a lower than hypothesized readmission rate. Patients who were sent to another institution upon discharge had a higher than expected readmission rate.

Since discharge locations that have a higher readmission rate tend to be institutional locations, such as a nursing home, this indicates a need for improvement in the transition relationship between institutions. Currently, most of the planning done before a patient leaves is conducted between the patient and his or her doctor. This may represent an area in which the discharge location should be involved in planning to reduce avoidable readmissions.

Future research should be conducted to determine the reason for the higher readmission rate from certain discharge locations. Patients who are sent to an outside care facility may be more seriously ill, causing them to need additional care. If this is the case, their likelihood of being readmitted may be higher than the average patient. Research needs to be conducted to see if the increased readmission rate was more strongly linked to the post-hospital recovery location or to patient diagnosis and prognosis.

The shortcoming of this study lies in using one data element, discharge location, as a proxy for what occurred outside of the hospital. A patient may have been sent to a nursing home upon discharge, have received excellent care, and then have been discharged from the nursing home to their home. During the transfer from nursing home to personal home, the illness or lack of continued care may have led to the readmission. The research technique used in this study would not have accounted for the home transition. Research using a more complete data set with additional information about discharge care and home setting would help alleviate this issue.

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