CE 2.5 ANCC Contact Hours

Professional Case Management
Vol. 20, No. 3, 130-137

Surgical Rehospitalization of the Medicare Fee-For-Service Patient

A State-Level Analysis Exploring 30-Day Readmission Factors

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ABSTRACT

Purpose of Study: Surgical readmissions are a concern to the integrity of the Medicare Trust Fund and gaining attention from policymakers concerned about solvency. This study explores factors associated with variation in surgical readmission rates across the states and provides implications for Medicare Case Management.

Primary Practice Setting(s): Acute inpatient hospital settings.

Methodology and Sample: Fifty state-level data and multivariate regression analysis are used. The dependent variable *Surgical Discharge 30-day Readmission Rate* is based on the Medicare Fee-For-Service beneficiary population with Medicare Part A and B insurance coverage and age 65 years or older, rehospitalized subsequent to an inpatient surgical procedure, occurring within 30 days of their last discharge.

Results: Our 2 key explanatory variables—emergency room visit rate and total days of care—are each positively associated with 30-day surgical readmission rate. Age group 65–69 years, native language, physician density, and health care expenditures per capita also influence surgical readmission rate across the states.

Implications for Case Management Practice: Surgical readmission has an association with many different categories of variables—demographic, clinical process, hospital capacity, and patient need. This strongly suggests that Medicare case managers consider the wide range of elements contributing to surgical readmission and take a multifactorial approach to reducing the rehospitalization rate.

Key words: *health literacy, hospital capacity, Medicare Fee-For-Service beneficiary, multivariate regression analysis, patient length of stay, surgical rehospitalization, 30-day readmission*

Potentially preventable readmissions have gained the attention of policymakers concerned in maintaining the solvency of the Medicare Trust Fund. In 2010, one in eight Medicare patients were reported to be rehospitalized within 30 days of postsurgical discharge, with the highest regional rate being 18.3% in Bronx New York, and lowest being 7.6% in Bend Oregon (Robert Wood Johnson Foundation, 2013). This variation in rates suggests that some hospitals and geographic locales are able to minimize their rates better than others (Congressional Research Service, 2010). Readmission costs also vary. According to the Agency on Healthcare Research and Quality (2012), 30-day readmission costs vary by surgical procedure, with the mean cost per stay varying from $6600 for a cesarean section to $13,400 for both a laminectomy or spinal fusion (p. 3). Readmission rates also vary by procedure or condition, ranging from 2% for a cesarean section, to 15.7% for a coronary artery bypass graft, up to 25.1% for congestive heart failure (p. 3).

Since Medicare beneficiary readmissions are a threat to the fiscal integrity of the Medicare program, Medicare reform initiatives in the Patient Protection and Affordable Care Act (ACA) of 2010 (Public Law 111-148) impose penalties upon hospitals with high readmission rates following surgical procedures, beginning Fiscal Year 2015. The Medicare Hospital Readmissions Reduction Program, established by the ACA, financially penalizes hospitals with high readmission rates, thereby giving hospitals a financial incentive to lower these rates. However, not all inpatient hospitals may respond to these initiatives uniformly and variations in state factors (demographic, hospital capacity, condition specific clinical processes) influence readmission rate across geographic regions

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The authors report no conflicts of interest.

DOI: 10.1097/NCM.0000000000000081

Those emergency room visits occurring within 30 days postdischarge after one of six surgeries—minimally invasive heart procedures, coronary artery bypass, hip fracture repair, back surgery, elective abdominal aortic aneurysm repair, and colostomy—were found to be common among Medicare patients, and more than half resulted in readmission for inpatient care from the emergency department (Kocher, Nallamothu, Birkmeyer, & Dimick, 2013).

in the United States. This study explores those factors associated with variation in surgical readmission rates across the states and provides implications for Medicare Case Management.

Factors Influencing Surgical Hospital Readmission

Demographic factors, hospital capacity, need/demand factors, and clinical process factors may influence preventable surgical hospital readmission rates across the states, with literature mixed. Demographics such as age, gender, race, and native language are to be considered for study. Across all age groups 1 to 65+ years and beyond, one in eight surgical hospitalizations led to a 30-day readmission for Medicare, Medicaid, and private payer groups (Agency for Healthcare Research and Quality [AHRQ], 2012a). According to AHRQ (2012a), in 2008 following surgery, Medicare 30-day readmission rates in the 65+-year age group were higher after surgical hospitalization for acute conditions (17%) as compared to chronic conditions (14.3%), whereas readmission rates were higher for Medicaid age groups 18–64 years after surgical hospitalization for chronic conditions. In 2010, 55% of the Medicare population was female, 77% was white non-Hispanic, 43% had health status described as excellent or very good, and 77% were urban residents (Medicare Payment Advisory Commission, 2014, p. 23). Preventable readmissions are also more likely to occur in the elderly and in females (Mistiaen, Francke, & Poot, 2007) as compared with the younger cohort and male gender, respectively. Schmeida and Savrin (2012a, 2012b) found that states with a higher percentage of Caucasian Medicare enrollees had a greater chance for pneumonia 30-day readmission rates to be "worse" than the U.S. national rate. Also, wealthier states (higher median household income) had a greater chance for both pneumonia and heart failure 30-day readmission rates to be "worse" than the national readmission rate. Health literacy and its relationship with native language are a growing area of study that has shown mixed results to date. In Medicare adults enrolled in managed care, Gazmararian et al. (1999) found that native language was related to health literacy. Schmeida and Savrin (2012b) found states with a higher resident population speaking a primary language other than English at home were less likely to be rated "worse" on heart failure readmission than the national readmission rate.

Capacity factors such as physician supply and hospital expenditures may influence surgical hospitalization readmissions. States differ on physician supply and demand. In 2000, physician supply and demand was considered in "equilibrium"; however, with the U.S. population aging, projected demand for specialists was expected to exceed supply for 2005 to 2020. A specialist physician shortfall of 62,000 is projected and "surgical specialties account for more than half of this shortfall, although non-surgical specialties such as cardiology and pathology show demand growing significantly faster than supply" (U.S. Department of Health & Human Services, 2008, p. 70). The relationship between physician geographic density and clinical outcomes varies. Laditka, Laditka, and Probst (2005) found a negative association between primary care physician supply per 100,000 population and preventable hospitalizations for those aged 40–64 years in urban counties (pp. 1154 and 1159), whereas Weinberger, Oddone, and Henderson (1996) found a positive association between postdischarge primary care clinician visit and readmission.

Hospital expenditure is also considered a capacity measure. Better clinical outcomes for Medicare hospitalization may be related to hospital spending on patient care, but studies are mixed. Stukel et al. (2012) found higher spending hospitals to have a lower 30-day readmission rate. However, Fisher et al. (2003) found beneficiaries in higher spending regions to be receiving more services, but not necessarily leading to better clinical outcomes than those in lower spending regions. Similarly, Landrum, Meara, Chandra, Guadagnoli, and Keating (2008) found that higher spending regions were not correlated with better clinical outcomes.

In addition to demographic factors and hospital capacity, patient need factors such as hospital length of stay may be related to hospital readmission rates. Schmeida and Savrin (2012a, 2012b) found that states with more total days of care per 1,000 Medicare enrollees discharged from short-stay hospitals are

more likely to be "worse" than the national readmission rate for 30-day pneumonia readmission, heart failure readmission, and acute myocardial infarction. This may suggest that patients with greater total days of care from a short-stay hospital may be more acutely ill and/or have more comorbidity requiring a longer term of care. Readmission rates can also vary during different postdischarge time periods. In 2008, the readmission rate increased as the number of days postdischarge increased, with the readmission rate 7 to 14 days postdischarge lower than that at 30 days postdischarge, across all insurance types and age groups (Agency for Healthcare and Research Quality, 2011a).

Clinical process factors such as postdischarge physician visit can also influence patient care outcomes. In an effort to prevent surgical rehospitalizations after high-risk procedures, early clinician follow-up visits are recommended (Commonwealth Fund, 2009; Hansen, Young, Hinami, Leung, & Williams, 2011). Primary care visits are found to be associated with lower 30-day rehospitalization rates (Brooke et al., 2014). In addition to clinician follow-up, emergency room visits can be related to readmission rates. Those emergency room visits occurring within 30 days postdischarge after one of six surgeries —minimally invasive heart procedures, coronary artery bypass, hip fracture repair, back surgery, elective abdominal aortic aneurysm repair, and colostomy —were found to be common among Medicare patients, and more than half resulted in readmission for inpatient care from the emergency department (Kocher, Nallamothu, Birkmeyer, & Dimick, 2013). The type of ambulatory surgery procedure may be associated with the rate of rehospitalizations and emergency room visits. Of 193 rehospitalizations (within 30-day postambulatory surgery), only 3.11% came directly from emergency room visits and only 5% of emergency room visits within the 30 days of surgical hospitalization discharge led to inpatient rehospitalization (Mezei & Chung, 1999).

Methodology

This research study is a quantitative secondary data analysis of previously collected 50 state-level data made available to the public domain for study and required not institutional review board approval. The dependent variable *Surgical Discharge 30-day Readmission Rate* is available to the public from the Dartmouth Institute for Health Policy & Clinical Practice (2014). Multivariate regression analysis is used to explore the question: What explains the variation in surgical 30-day hospital readmission performance across the United States for Medicare beneficiaries? Why do some states have higher 30-day readmission rates than others?

The dependent variable *Surgical Discharge 30-day Readmission Rate** is a measure of patients readmitted within 30 days of surgical discharge for 2010. It is based on the 2010 Medicare Fee-For-Service beneficiary population with Medicare Part A and B insurance coverage, age 65 years or older, adjusted for age, sex, and race, based on the Medicare Provider Analysis and Review information (Dartmouth Institute for Health Policy & Clinical Practice, 2013, 2014). The *Surgical Discharge 30-day Readmission Rate** includes all surgical diagnosis related groups for each of the 50 states. The surgical readmission rates varied across the states from 8.7% to 15.5% with the average U.S. rate at 12.4%. States with the lowest rates were Idaho (8.7%), Montana (9.5%), Hawaii and Oregon (9.7%), Utah (9.9%), and Vermont (10%). The highest rates were found in New York (15.5%), New Jersey (14.7%), Illinois and West Virginia (13.6%), and Rhode Island (13.4%) (Dartmouth Institute for Health Policy & Clinical Practice, 2014).

Independent variables chosen for the study are based on previous research and are secondary data collected by funded organizations or government agencies and permissible for public reporting. The two key explanatory independent variables are *Emergency Room Visit*, which is a measure of the percentage of patients having an emergency room visit within 30 days after surgical discharge (all surgical discharges) for year 2010 (Dartmouth Institute for Health Policy & Clinical Practice, 2014), and *Total Days of Care* per 1,000 Medicare enrollees (Centers for Medicare & Medicaid Services, 2008b).

Other independent variables include demographic, hospital capacity, patient need, and condition-specific clinical process. We control for *Female*

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Distribution Rate of Medicare enrollees (Kaiser Family Foundation, 2009), rate of *White Enrollees* (Centers for Medicare & Medicaid Services, 2008a), rate of *Enrollees Age 65 to 69 Years* in Medicare Parts A and B (Centers for Medicare & Medicaid Services, 2005), and *Native Language* (U.S. Census Bureau, 2008). Prior studies (Gazmararian et al., 1999) found a relationship between native language and health literacy, suggesting that *Native Language* serves as a proxy measure for health literacy and is measured as the percentage of the state resident population 5 years and over speaking a primary language other than English at home (U.S. Census Bureau, 2008). We control for 2 hospital capacity (institution) variables: *Active Physician Rate Per 1,000 Resident Population* in a state for 2007, which excludes doctors of osteopathy, physicians with none known address, and inactive physician status (U.S. Census Bureau, 2010); and *Health Care Expenditures Per Capita for Hospital Care*, which measures spending for all privately and publicly funded personal health care services provided by hospitals to patients and billed by hospitals (Centers for Medicare & Medicaid Services, 2011). The patient need variable *Rural Health Clinics* is a measure of the total number of U.S. rural health clinics (Kaiser Family Foundation, 2010) situated within each state.

Clinical process variables include *Emergency Room Visit Rate*, which is the percentage of postdischarge emergency room visits (with or without admission) for 30 days posthospital surgical discharge, and *Primary Care Clinician Rate,* which is the percentage of patients seeing a primary care clinician (restricted to family medicine, general internal medicine, general practice, and geriatrics) within 14 days of posthospital surgical discharge to home (Dartmouth Institute for Health Policy & Clinical Practice, 2011).

Results

Since the dependent variable *Surgical Discharge 30-day Readmission Rate** is a continuous variable, the model was estimated using Ordinary Least Squares Regression. Our findings show that certain demographic, hospital capacity, patient need, and condition-specific clinical process factors have a statistically significant impact on hospital surgical 30-day readmission rates across the states (see Table 1: Best Model). The statistical terminology used in the regression analysis is defined in Table 2.

The R^2 in our best model shows that 51% of the proportion of the variability in *Surgical Discharge 30-day Readmission Rate** across the 50 states is explained by the regression of 6 predicting variables.

TABLE 1
OLS Regression Models—Surgical 30-Day Readmission

	Complete Model		Best Model	
Variables	**Regression Coefficients and Direction of Association**	**Level of Statistical Significance ($p \leq .05$)**	**Regression Coefficients and Direction of Association**	**Level of Statistical Significance ($p \leq .05$)**
Demographic				
Female	−.148 Negative	.266	–	–
White	.015 Positive	.561	–	–
Age 65–69 years	−43.398 Negative	.038	−47.175 Negative	.012
Native language	.108 Positive	.005	.095 Positive	.003
Institution/hospital capacity				
Active physician rate	−.027 Negative	.000	−.027 Negative	.000
Health care expenditures per capita for hospital care	.001 Positive	.052	.001 Positive	.009
Patient needs				
Total days of care	.002 Positive	.007	.002 Positive	.028
Rural health clinics	−.003 Negative	.467	–	–
Condition-specific clinical process				
Emergency room visit rate	.509 Positive	.061	.490 Positive	.029
Primary care clinician visit	.074 Positive	.323	–	–
Adjusted R^2		.425		.436
R^2		.542		.505
N		50		50

Note. Reported findings based on OLS Regression estimates with statistically significant coefficients set at $p \leq .05$. SPSS Statistical Software Version 20.

TABLE 2
Statistical Terminology for Surgical Readmission Regression Analysis

Terminology	Definition
Multivariate Regression Analysis	The technique used for a linear regression model that has more than one independent variable used to predict the values of the dependent variable (Norusis, 1997, p. 455).
Ordinary Least Squares Regression	The statistical technique used when the dependent variable is continuous.
Independent Variable	A variable that can influence another variable, the dependent variable (Norusis, 1997, p. 116).
Proxy Measure	A substitute measure for the actual measure.
N	The population used for drawing conclusions, such as the 50 U.S. states.
Complete Model	A regression model summary when all predicting variables are used. When reported, it shows the reader that the model is not underestimated.
Partial Regression Coefficient	The partial regression coefficient for each independent variable tells how much the value of the dependent variable changes when the value of the independent variable increases by 1 and the values of the other independent variables do not change (Norusis, 1997, p. 462). Statistically significant coefficients are set at $p \leq .05$ and are the probability of falsely rejecting the null hypothesis.
Null Hypothesis	Frame of reference used to evaluate a claim about a population and is very precise, either true or false (Norusis, 1997, pp. 209 and 211).
Positive Coefficient	A positive coefficient suggests that the predicted value of the dependent variable increases when the value of the independent variable increases (Norusis, 1997, p. 63).
Negative Coefficient	A negative coefficient suggests that the predicted value of the dependent variable decreases when the value of the independent variable increases (Norusis, 1997, p. 463).
R Squared (R^2)	The proportion of variability observed in the dependent variable explained by the independent variables (Norusis, 1997).

Note. Data derived from *Guide to Data Analysis* by M. Norusis, 1997. Upper Saddle River, NJ: Prentice Hall.

That is, the independent variables explain the variation of the dependent* variable 51%.

The variables *Female, White*, *Rural Health Clinics,* and *Primary Care Clinical Visit* were dropped in the best model because they were not statistically significant in the complete model. The best model (see Table 1) shows the coefficients for the two key explanatory variables—*Emergency Room Visit Rate* and *Total Days of Care* each remain statistically significant and positively associated with the dependent variable *Surgical Discharge 30-day Readmission Rate** even after controlling for all other variables. We find that as the percentage of emergency room visits increases, there is a greater likelihood for an increase in the surgical readmission rate in the state. This suggests the possibility that surgical patients are more likely to be readmitted through the emergency room versus other ways, such as the clinician's office. We find that *Total Days of Care per 1,000 Medicare Enrollees* is positively associated with the dependent* variable. States with more total days of care per 1,000 Medicare enrollees are more likely to have a higher surgical readmission rate. This finding was expected as other 30-day Medicare readmission studies (Schmeida & Savrin, 2012a, 2012b, 2013) show similar results.

We find the coefficient for *Age Group 65 to 69* to be statistically associated with our dependent* variable and negative. As the percentage of patients aged 65–69 years increases, the percentage of surgery patients being readmitted within 30 days decreases. This finding requires further study, possibly exploring the distribution of procedures in the age group analyzed, elective readmissions as a separate cohort from the nonelective readmissions, and exploring acute conditions as compared to chronic as previously done by AHRQ (2011a, 2012a,). In preliminary modeling, a series of other age groups (0–64, 70–74, 75–80, 81–84, and >85 years) was considered but dropped from our analyses because they largely diminished the overall strength of our model.

The coefficient for *Native Language* (a proxy for health literacy) is statistically significant and positively associated with the dependent* variable (see Table 1). States with a higher resident population speaking a language other than English at home are more likely to have a higher rate of surgical readmissions. This finding is consistent with AHRQ (2011b), which found Chinese and Spanish speakers having higher readmission rates than English-speaking Asians and Latinos. Schmeida and Savrin (2012b), however, found a negative association between home language and higher 30-day readmission rates for heart failure. Although our finding on 30-day surgical readmission requires further study, it may suggest language to be a marker for socioeconomic status with lower socioeconomic groups being associated with an increased risk for readmission. Alternatively, and perhaps language barriers could impair discharge instruction understanding.

The coefficients for both hospital capacity (institution) variables, *Active Physician Rate* and *Health Care Expenditures Per Capita for Hospital Care*, are statistically significant, but in opposite direction (see Table 1). *Active Physician Rate* was negatively associated with the dependent* variable. As active physician rate increases, the likelihood of surgical readmission decreases. Although the literature is mixed on the relationship between physician density and subsequent clinical outcomes, our finding suggests that states with a higher supply (or geographic density) of physicians are less likely to experience surgical readmissions. The coefficient for per capita hospital expenditures was positively associated with 30-day surgical readmission rate. As hospital expenditures increase, the chance for 30-day surgical readmission also increases. On a state level, one possible explanation is that hospitals may be treating more severely ill patients who require the greater per capita spending on treatment or diagnostics or both.

Implications for Medicare Case Management Practice–Lessons Learned

Our study findings provide empirical information for Medicare case managers seeking to improve both inpatient and outpatient hospital performance on Medicare 30-day surgical readmission. Although individual-level inferences cannot be made with our state-level data, our findings provide insight for case management programs and processes seeking to improve upon their readmission rate. Although there are various case management systems and programs, the Patient Protection and Affordable Care Act (Public Law 111-148) serves as a catalyst to lower Medicare beneficiary readmission rates for all. Our study can aid managers in establishing new protocols for preventing penalties imposed by the Affordable Care Act on hospitals with high surgical readmission rates starting in 2015.

First, our two key explanatory variables *Emergency Room Visit* (rate of patient emergency room visits within 30 days of surgical discharge) and *Total Days of Care* per 1,000 Medicare enrollees were both positively associated with *Surgical Discharge 30-day Readmission Rate* across the 50 states. Our emergency room visit finding is a measure of clinical process consistent with Kocher et al. (2013), who found emergency room visits common among Medicare patients who were postsurgical intervention. Total days of patient care, a patient need variable, was positively associated with surgical readmission rate. Although this finding suggests that patients experiencing acute illness or comorbidity may require a lengthier hospital stay, further validation with data is needed. This finding is similar to other state-level 30-day hospital readmission research with regard to pneumonia, heart failure, and acute myocardial infarction (Schmeida & Savrin, 2012a, 2012b, 2013). Case managers may consider exploring this area of interest first, particularly because length of hospital stay is also related to the readmission rate for other medical conditions. Second, the hospital capacity variables—*Active Physician Rate* per 1,000 resident population and *Healthcare Expenditures Per Capita* for hospital care—were also associated with surgical readmissions across the states. Active physician rate, a proxy for physician geographic density, was negatively associated with readmission. Although literature shows the relationship between physician geographic density and clinical outcomes to vary, our finding shows that a greater physician density is associated with fewer surgical readmissions across the states. We also find that states with higher health care expenditures for hospital care to have a higher surgical readmission rate. Third, our demographic variables—*Age Group 65 to 69* years and *Native Language* (speaking a primary language other than English at home)—were related to surgical readmission rates across the states. Age was negatively associated with readmission and native language had a positive association with state surgical readmission rate. The native language finding is consistent with the AHRQ (2011b) research on language barriers and higher hospital readmission rates, but this finding is dissimilar to that of Schmeida and Savrin (2012b), who found that language was negatively associated with the subset of heart failure 30-day readmission rates. Further study is needed to explore to what extent health literacy affects clinical outcomes.

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The most pronounced finding from this study is that surgical readmission rate has an association with many different categories of variables—demographic (age and language), clinical process, hospital capacity, and patient need. This strongly suggests that Medicare case managers must revisit the holistic approach to case management in their attempt to lower the surgical readmission rate in their state. This idea of holistic case management would apply to both inpatient and outpatient surgery readmission.

(age and language), clinical process, hospital capacity, and patient need. This strongly suggests that Medicare case managers must revisit the holistic approach to case management in their attempt to lower the surgical readmission rate in their state. This idea of holistic case management would apply to both inpatient and outpatient surgery readmission. Given our study findings, the holistic case management model would need to incorporate transcultural and psychosocial patient care, take into account institutional capacity and health care resources (cost spending and personnel), as well as patient comorbidity.

Since our study is limited to state-level analysis, case managers need to consider collecting individual-level data on the Medicare patient in their facility, generating profiles of patients at high risk for readmission. Both quantitative and qualitative analyses would provide a more complete patient profile and offset inherent bias that may exist with each method. High-risk patients to consider are the emergency department admission occurring within 30 days of surgical discharge, the comorbid patient, those with a lengthier stay, and beneficiaries speaking a primary language other than English. Aside from language, other demographic data should include age, gender, and race/ethnicity, particularly because these factors were associated with other Medicare 30-day readmission studies (Schmeida & Savrin, 2012a, 2012b, 2013). Hospital capacity factors for analysis include the nurse-to-patient ratio and type of medical specialist(s) commonly required to manage the Medicare surgical readmission patient. This statistical data analysis will assist Medicare case managers to tailor interventions to their facility. Generic interventions to consider are follow-up on primary provider visits and coordination of care for the co-morbid patient. Since severely ill patients often require postdischarge medical management from a multinumber of professionals, oversight and coordination of discharge activities may promote continuity of care. Patients whose primary language or native language is not English may not understand discharge instructions, making them vulnerable for poor recovery and readmission. Mobilize cultural support in the facility to teach postdischarge self-care and evaluate psychosocial needs including access to postdischarge medications prior to patient transition to home.

Although individual-level inferences cannot be made with state-level data used in this study, our findings provide lessons for case managers embedded in the Medicare health system. A limitation to our study is that only state-level analysis can be made. However, our findings on surgical readmission coupled with earlier works (Schmeida & Savrin, 2012a, 2012b, 2013) on medical readmission (pneumonia, heart failure, and acute myocardial infarction) set groundwork for future trend study.

Summary

Our study shows that different categories of variables are important to explaining surgical readmission rates across the states. Demographic, clinical process, hospital capacity, and patient need variables are all associated with surgical readmission. Medicare case managers should consider conducting data analysis of the high-risk patient in their facility, and to use a holistic model in developing protocols to lower their surgical readmission status in their state. We also find that length of patient hospital stay is recurrently associated with state readmission rates—pneumonia, heart failure, acute myocardial infarction, and surgical readmission.

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