

Do hospital factors impact readmissions and mortality after colorectal resections at minority-serving hospitals?

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Background. *Minority-serving hospitals have greater readmission rates after operative procedures including colectomy; however, little is known about the contribution of hospital factors to readmission risk and mortality in this setting. This study evaluated the impact of hospital factors on readmissions and inpatient mortality after colorectal resections at minority-serving hospitals in the context of patient- and procedure-related factors.*

Methods. *More than 168,000 patients who underwent colorectal resections in 374 California hospitals (2004–2011) were analyzed using the State Inpatient Database and American Hospital Association Hospital Survey data. Sequential logistic regression analyses were performed to determine the associations between minority-serving hospital status and 30-day, 90-day, and repeated readmissions.*

Results. *Thirty-day, 90-day, and repeated readmission rates were 11.2%, 16.9%, and 2.9%, respectively. Odds for 30-day, 90-day, and repeated readmissions after colorectal resections were 19%, 20%, and 38% more likely at minority-serving hospitals versus non-minority-serving hospitals, respectively ($P < .01$), after controlling for age, sex, comorbidities, year, and procedure type. Patient factors accounted for up to 65% of the observed increase in odds for readmission at minority-serving hospitals while hospital-level factors contributed roughly 40%. Inpatient mortality was significantly greater at minority-serving hospitals versus non-minority-serving hospitals (4.9% vs 3.8%; $P < .001$). Risk factors significantly associated with readmissions and inpatient mortality included Medicaid/Medicare primary insurance, emergent operation, and ostomy creation. Low procedure volume was significantly associated with increased odds for inpatient mortality.*

Conclusion. *Patient-level factors seemed to dominate the increased readmission risk after colorectal resections at minority-serving hospitals while hospital factors were less contributory. These findings need to be further validated to shape quality improvement interventions to decrease readmissions. (Surgery 2016;■:■-■.)*

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COLORECTAL OPERATIONS are performed across a wide variety of hospitals in the United States from the academic tertiary referral setting to rural communities. Colon and/or rectal resections are indicated for a number of pathologic conditions including colorectal cancer, inflammatory bowel disease, and diverticulitis. In particular, colorectal cancer is a serious health burden and remains a leading cause of US cancer mortality.¹ Barriers to cancer screening and treatment include various socioeconomic factors such as insurance status, income, and race.² Additionally, there is increasing evidence of rural-urban disparities³ with regard to colorectal cancer outcomes highlighting areas of

weakness in the US healthcare system.⁴ Moreover, little is known about outcomes for colorectal cancer and other colorectal conditions in vulnerable patient populations such as those treated in minority-serving institutions.

Colorectal surgery patients are at great risk for postoperative morbidity and 30-day readmissions. Complications after colorectal resection are reportedly as great as 30% including operative site infection (SSI), dehydration, and bowel obstruction.⁵ Thirty-day readmission rates range from 8–25%⁶ and are historically greater than other surgical specialties. For example, Greenblatt et al⁷ found that 65% of patients >65 years old were readmitted after colorectal cancer resections for gastrointestinal complications and infection. Complications, particularly intra-abdominal or organ space SSI, drive readmissions leading to invasive interventions⁵ with estimated costs per readmission at \$9,000.⁸ Prevention of readmissions after colorectal operation could amount to >\$300 million in annual cost savings.⁸

Hospital readmissions are a focal part of the 2010 Patient Protection and Affordable Care Act, specifically the Hospital Readmissions Reduction Program (HRRP) penalizing hospitals with greater-than-benchmark readmissions.^{9,10} Recent studies have found that certain minority-serving hospitals (MSH) such as safety-net hospitals that provide health care to a large proportion of uninsured minorities and Medicaid patients are more commonly penalized under the HRRP program.^{10–12} There is additional evidence demonstrating that Medicare patients are at significantly increased risk for 30-day readmissions after major operative procedures, including colectomy, at MSH versus non-MSH institutions.¹³ Currently, there is a paucity of research exploring outcomes in the MSH setting among colorectal surgery patients. Understanding patient-, procedure-, and hospital-level factors unique to the MSH environment is critical to reducing readmissions after colorectal operation. To address this knowledge gap, we performed a study to analyze the extent to which hospital factors drive readmissions after colorectal resections performed at MSH in the context of patient- and procedure-related factors. Understanding the relative contribution of these determinants may help guide targeted quality improvement interventions aimed at reducing hospital readmissions.

METHODS

Patient selection and data source. We identified 168,590 adult patients who underwent colon and/

or rectal resections as primary inpatient procedures in California between January 2004 and September 2011 using International Classification of Diseases, Ninth Revision (ICD-9) procedure codes ([Supplementary Table I](#)) from the State Inpatient Database (SID) of California. SID is a part of the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Healthcare Research and Quality.¹⁴ The California SID encompasses all discharge records from all non-federal community hospitals in California. The rationale behind using the California SID is mainly due to the fact that California is one of the largest and most diverse states in the United States in terms of race, ethnicity, age, and insurance coverage.

The inpatient database was supplemented by hospital structural data from the 2009 cycle of the American Hospital Association (AHA) Annual Survey. The California SID is a rich repository for patient- and procedure-level data in a racially diverse cohort across a wide range of ages which is further strengthened by linking hospital-level data from the AHA.

Variables. The predictor of primary interest was the minority-serving status of the operative hospital, which was defined as being in the top decile for the proportion of black or Hispanic patients. Out of 491 hospitals in the SID dataset, 49 were classified as MSH. Overall, 374 (76%) hospitals performed colon and/or rectal resections of which 47 (13%) were classified MSH.

Outcomes. We evaluated 3 primary readmission measures or outcomes after colorectal resections as follows: readmissions within 30 days and 90 days of index hospitalization and repeated readmission within 60 days of discharge from the first 30-day readmission. Given the positive correlation between hospital readmissions and mortality rates,¹⁵ we evaluated inpatient mortality during index admission as our secondary outcome. While the 30-day readmission rate has been a widely used measure in the literature and adopted by HRRP, the 90-day and repeated readmissions are also clinically relevant and enabled us to capture delayed effects of the operation. Primary readmission diagnosis codes were classified using the Clinical Classification System provided by HCUP.¹⁶

Covariates. Four sets of covariates were utilized in this study including hospital-level factors in addition to patient- and procedure-related factors. The first set was chosen to imitate the risk-adjusting scheme in the Medicare HRRP and included the patient's age at index admission, sex, Charlson comorbidity score, year of admission, and procedure type (colon versus rectal resection). The second set included patient-

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