Research

Original Investigation

Hospital Readmission After Noncardiac Surgery
The Role of Major Complications

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IMPORTANCE Hospital readmissions are believed to be an indicator of suboptimal care and are the focus of efforts by the Centers for Medicare and Medicaid Services to reduce health care cost and improve quality. Strategies to reduce surgical readmissions may be most effective if applied prospectively to patients who are at increased risk for readmission. Hospitals do not currently have the means to identify surgical patients who are at high risk for unplanned rehospitalizations.

OBJECTIVE To examine whether the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) predicted risk of major complications can be used to identify surgical patients at risk for rehospitalization.

DESIGN, SETTING, AND PARTICIPANTS Retrospective cohort study of 142 232 admissions in the ACS NSQIP registry for major noncardiac surgery.

MAIN OUTCOMES AND MEASURES The association between unplanned 30-day readmission and the ACS NSQIP predicted risk of major complications, controlling for severity of disease and surgical complexity.

RESULTS Of the 143 232 patients undergoing noncardiac surgery, 6.8% had unplanned 30-day readmissions. The rate of unplanned 30-day readmissions was 78.3% for patients with any postdischarge complication, compared with 12.3% for patients with only in-hospital complications and 4.8% for patients without any complications. Patients at very high risk for major complications (predicted risk of ACS NSQIP complication >10%) had 10-fold higher odds of readmission compared with patients at very low risk for complications (adjusted odds ratio = 10.35; 95% CI, 9.16-11.70), whereas patients at high (adjusted odds ratio = 6.57; 95% CI, 5.89-7.34) and moderate (adjusted odds ratio = 3.96; 95% CI, 3.57-4.39) risk of complications had 7- and 4-fold higher odds of readmission, respectively.

CONCLUSIONS AND RELEVANCE Unplanned readmissions in surgical patients are common in patients experiencing postoperative complications and can be predicted using the ACS NSQIP risk of major complications. Prospective identification of high-risk patients, using the NSQIP complication risk index, may allow hospitals to reduce unplanned rehospitalizations.

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Hospital readmissions are widely believed to be an indicator of suboptimal care and for that reason have become a major focus of efforts by the Centers for Medicare and Medicaid Services (CMS) to improve outcomes and reduce health care costs. The substantial variability in hospital readmission rates among patients hospitalized for acute myocardial infarction and heart failure suggests that ample opportunities exist for reducing readmission rates among medical and surgical patients.[1] Preventable hospital readmissions have many causes, including fragmented and poorly coordinated care, unsafe transitions between inpatient and outpatient settings, and medical errors.[2,3] Specific interventions such as reducing nurses' workload, comprehensive discharge planning, and early physician follow-up have been found to be effective in lowering hospital readmission rates.[4-8] Strategies to reduce surgical readmissions may be more effective if they are focused on patients who face the highest risk of readmission. This requires an evidence-based method to identify surgical patients at elevated risk for readmission.

Recently, a single-center study using data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) determined that postoperative complications were associated with a 4-fold increase in the risk of hospital readmission.[9] If these findings hold true across a much larger group of hospitals, this would indicate that stratifying surgical patients by their risk of developing postoperative complications might help identify those patients who are most likely to be readmitted. To examine the potential association between the risk of complications, as predicted by the ACS NSQIP complication model, and subsequent readmission of patients undergoing noncardiac surgery, we analyze data from hospitals that participate in ACS NSQIP. We hypothesized that surgical patients with a high baseline risk of complications are significantly more likely to be readmitted than those at low risk. Because 400 hospitals in the United States currently participate in ACS NSQIP and each of these hospitals receives information on individual patient risk of major complications,[10] it should be feasible to rapidly implement a system to identify patients with an elevated risk of readmission if complications are a major driver of hospital readmissions. Leveraging the existing ACS NSQIP data infrastructure in this manner may help US hospitals achieve CMS's goal of reducing hospital readmissions by 20% and generating $2.5 billion of annual savings in health care costs.[2,11]

Methods

Data Source

This analysis was conducted using data from the ACS NSQIP participant use data file for patients having noncardiac surgery in 2011. The ACS NSQIP participant use data file includes detailed information on patient demographic characteristics, admission source, preoperative risk factors, and 30-day postoperative mortality, complications, and readmissions for patients undergoing major surgery.[12] It defines 30-day readmission outcome as any rehospitalization occurring within 30 days of the surgical procedure and includes a data field to identify unplanned readmissions.[12] It also includes the estimated probability of complications for general and vascular surgical cases.[10] Data quality is achieved through the use of trained surgical clinical reviewers and auditing of participating sites. Patient data are abstracted from the medical record, operative log, anesthesia record, interviews with the attending surgeon, and telephone interviews with patients. A systematic sampling strategy is used to avoid bias in case selection and to ensure a diverse surgical case mix.[13]

Study Population and Outcomes

For our primary study sample, we identified 172 745 patients who met the following criteria: (1) underwent general, vascular, or orthopedic surgery; (2) were discharged alive with a postsurgery length of stay (LOS) of 30 days or less; and (3) did not undergo a prior operation within 30 days. We only included records from hospitals that participated in NSQIP's Classic module (which includes the full set of clinical variables). We excluded records with missing information on American Society of Anesthesiologists (ASA) physical status (617), readmission status (17 324), operation performed within 30 days of the index surgery (2545), and surgical complexity (4372). Patient records with missing information on sex (147), functional status (301), weight and height (4158), and comorbidities (49) were also excluded. The final analytic sample consisted of 143 232 records (82.9% of eligible cases) (eFigure 1 in Supplement). This study was exempted from review by the institutional review board at the University of Rochester, and the requirement for informed consent was waived owing to the retrospective design of the study.

Statistical Analysis

The primary outcome was unplanned hospital readmission within 30 days of the index surgical procedure. For our main analysis, we estimated the independent association between unplanned 30-day readmission and the ACS NSQIP predicted probability of major 30-day complications, controlling for ASA physical status and surgical complexity. We adjusted for the variation in time at risk of the readmission outcome using the log of the postdischarge period as an offset[14,15] (because 30-day rehospitalization is measured from the surgery date, patients with longer hospital LOS are less likely to be readmitted than patients with shorter LOS, all else being equal). In addition to using work relative value units as a measure of surgical complexity, we included separate intercept terms for the type of procedure by *Current Procedural Terminology* code group (eTable 1 in Supplement). We constructed categorical variables to specify the risk of 30-day major complications based on the empirical distribution of the predicted risk of major complications: (1) very low risk, 0 to 25th percentile (≤1% risk of major complication for ACS NSQIP model); (2) low risk, 26th to 50th percentile (>1%-3.5%); (3) moderate risk, 51st to 75th percentile (>3.5%-6.5%); (4) high risk, 76th to 90th percentile (>6.5%-10%); and (5) very high risk, greater than 90th percentile (>10%).

We used 2 different methods to calculate each patient's predicted probability of 30-day complication. In the first approach, we used the estimated probability of 30-day complication provided in the ACS NSQIP database (eTable 2 in

Supplement). In the second approach, we calculated the probability of major complication after first estimating a nonparsimonious logistic regression model for a composite complication outcome, which is similar but not identical to the composite complication outcome used by ACS NSQIP[16] (eTable 2 in Supplement). Risk factors included in the customized composite complication model are shown in eTable 3 in the Supplement. In addition to work relative value units as a measure of surgical complexity, we included separate intercept terms for the type of procedure by *Current Procedural Terminology* code group (eTable 1 in Supplement). We assessed the performance of our composite complication model using measures of discrimination (C statistic) and calibration (Hosmer-Lemeshow statistic).

To estimate the population attributable fraction (PAF) of in-hospital and postdischarge composite complications (as defined earlier), we conducted a secondary analysis. We first estimated the independent association between unplanned readmissions and complications, controlling for patient risk using the same set of risk factors described earlier. We then used the Stata routine PUNAF (StataCorp LP) to calculate the PAF based on the approach described by Greenland and Drescher.[17] The PAF is calculated by comparing a hypothetical scenario in which none of the patients had a complication with the real-world scenario captured by the actual data. The PAF of unplanned readmissions due to complications was calculated for in-hospital and postdischarge complications. A second analysis was performed in which each of the individual complications was specified separately in the readmission model to estimate the PAF for each individual complication.

Because ACS NSQIP defines 30-day readmissions as rehospitalizations occurring within 30 days of the surgical procedure, it is possible that patients with long hospital LOS would be less likely to be readmitted because the at-risk period is shorter. Because we have varying exposure times across patients, we examined the robustness of our results by performing a sensitivity analysis in which we limited our analytic sample to patients with (1) postprocedure hospital LOS of 14 days or less and (2) postprocedure hospital LOS of 7 days or less. Statistical analyses were performed using Stata SE/MP version 11.2 software (StataCorp LP). Robust variance estimators were used.[18] A 2-sided significance level of .05 was used for all tests.

Results

Exploratory Analyses
The rate of unplanned admissions in our sample of 143 232 patients undergoing major noncardiac surgery was 6.8%. Patients with unplanned 30-day readmissions compared with those without unplanned 30-day readmissions tended to be older (61 vs 57 years, respectively), be more likely to be either partially dependent (6.8% vs 2.8%) or totally dependent (1.8% vs 0.5%), have increased baseline severity of disease with an ASA physical status of 3 (55.0% vs 38.2%) or 4 (12.6% vs 4.7%), and undergo surgery as inpatients (87.5% vs 59.4%) (eTable 3 in Supplement). Our initial exploratory analyses revealed that the most important predictor of unplanned 30-day readmis-

Figure 1. Thirty-Day Unplanned Readmission Rates for Noncardiac Surgery by Inpatient and Outpatient Complications
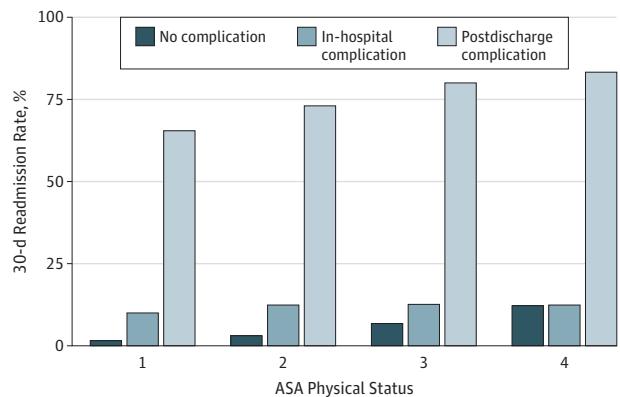
Unadjusted 30-day unplanned readmission rates for patients, stratified by baseline severity of disease (American Society of Anesthesiologists [ASA] physical status) and occurrence of either in-hospital complication or postdischarge complication. A 30-day unplanned readmission is defined as any unplanned readmission occurring within 30 days of the surgical procedure. Patients who had both in-hospital and postdischarge complications were categorized as having postdischarge complications.
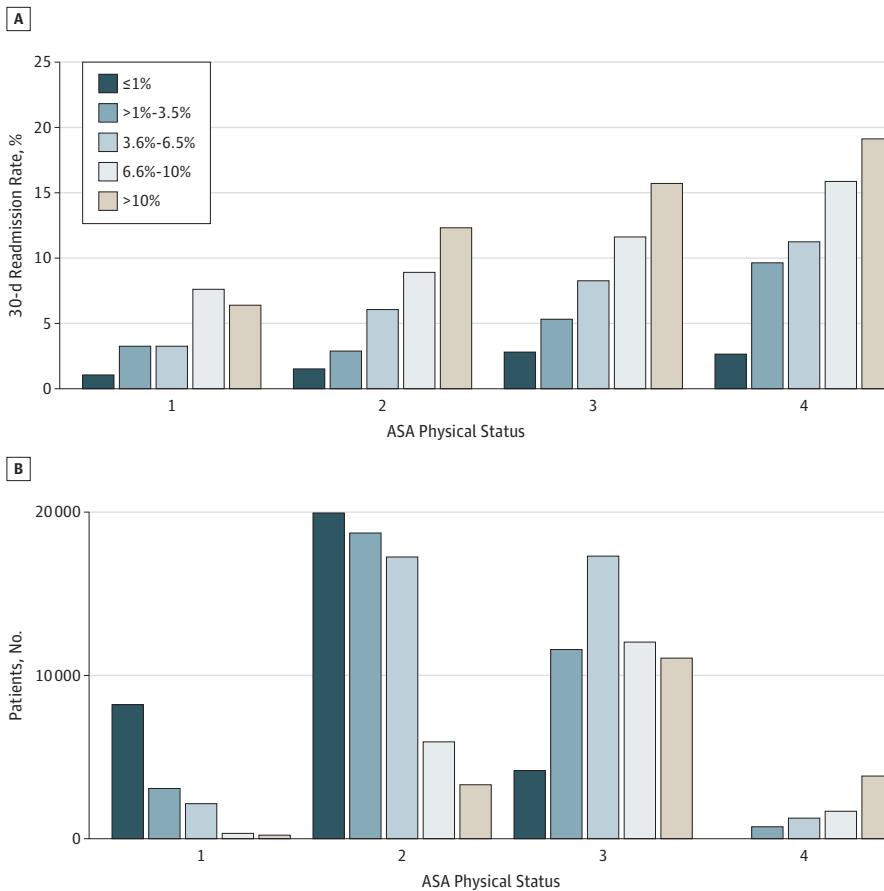
sions was not baseline severity of disease but rather the occurrence of complications (**Figure 1**). The rate of unplanned 30-day readmissions was 78.3% for patients with any postdischarge complication, compared with 12.3% among patients with in-hospital complications and 4.8% for patients with no complications. We then stratified patients by ASA physical status and ACS NSQIP calculated probability of major complication (as supplied by ACS NSQIP) and found that an increased risk of complications was strongly associated with an elevated rate of 30-day unplanned readmission (**Figure 2**).

Results of Multivariate Analyses
In our multivariate analyses, after controlling for baseline severity of disease and surgical complexity, the strong association between the risk of 30-day unplanned readmission and the predicted risk of major complications persisted (**Table 1**). Patients at very high risk for major complications (predicted risk of ACS NSQIP complication >15%) had 10-fold higher odds of readmission compared with patients at very low risk for complications (adjusted odds ratio [AOR] = 10.35; 95% CI, 9.16-11.70). Patients with a high (AOR = 6.57; 95% CI, 5.89-7.34) or moderate (AOR = 3.96; 95% CI, 3.57-4.39) risk of complications experienced a lower but still elevated risk of readmission (7- and 4-fold higher odds, respectively) relative to patients at low risk for complications.

After adjusting for severity of disease and surgical complexity, patients with a predischarge complication had 2-fold higher odds of readmission (AOR = 2.09; 95% CI, 1.86-2.35), whereas patients with a postdischarge complication had 61-fold higher odds of readmission (AOR = 61.11; 95% CI, 55.87-66.83). The PAF of postdischarge complications for unplanned readmissions was 26.16% (95% CI, 25.55%-26.77%), whereas predischarge complications did not account for a substantial fraction of readmissions (PAF = 2.35%; 95% CI, 1.91%-2.78%) (**Table 2**). Among the individual components of the com-

Figure 2. Thirty-Day Unplanned Readmission Rates for Noncardiac Surgery by American Society of Anesthesiologists (ASA) Physical Status and American College of Surgeons National Surgical Quality Improvement Program Risk of Complications

A, Unadjusted 30-day unplanned readmission rates for patients, stratified by baseline severity of disease (ASA physical status) and calculated risk of any major complication (provided by American College of Surgeons National Surgical Quality Improvement Program). B, Number of patients in each stratum.

Table 1. Risk of 30-Day Readmission as a Function of Risk of Any Major Complication[a]

Risk or ASA Physical Status	ACS NSQIP Risk of Major Complication		Customized Risk of Major Complication	
	AOR (95% CI)	P Value	AOR (95% CI)	P Value
Risk of any major complication				
Very low	1 [Reference]		1 [Reference]	
Low	2.17 (1.96-2.42)	<.001	2.20 (1.98-2.44)	<.001
Moderate	3.96 (3.57-4.39)	<.001	4.02 (3.63-4.46)	<.001
High	6.57 (5.89-7.34)	<.001	5.88 (5.26-6.58)	<.001
Very high	10.35 (9.16-11.70)	<.001	9.46 (8.42-10.62)	<.001
ASA physical status				
1	1 [Reference]		1 [Reference]	
2	1.46 (1.29-1.65)	<.001	1.42 (1.26-1.61)	<.001
3	2.29 (2.02-2.60)	<.001	2.20 (1.94-2.49)	<.001
4	3.45 (3.00-3.97)	<.001	3.29 (2.86-3.79)	<.001

Abbreviations: ACS NSQIP, American College of Surgeons National Surgical Quality Improvement Program; AOR, adjusted odds ratio; ASA, American Society of Anesthesiologists.

[a] See text for description of risk categories for major complications. Predicted risk of major complications is based on ACS NSQIP calculated risk.

posite complication outcome, postdischarge wound complications (PAF = 9.60%; 95% CI, 9.20%-10.00%) and sepsis (PAF = 4.84%; 95% CI, 4.61%-5.06%) accounted for the greatest proportion of readmissions. The complication model exhibited good discrimination (C statistic = 0.79). Model calibration was acceptable (Hosmer-Lemeshow statistic = 55.5)

given the large sample size (143 232 patients) and the sensitivity of the Hosmer-Lemeshow statistic to large sample sizes.[19]

When we limited our analytic sample to patients with (1) postprocedure hospital LOS of 14 days or less and (2) postprocedure hospital LOS of 7 days or less, our findings were unchanged (eFigure 2, eFigure 3, and eTable 4 in Supplement).

Table 2. Risk of 30-Day Readmission as a Function of Occurrence of Major Complications

Complication	At Risk, No.	Readmission, No.	30-d Readmission Rate, %	AOR (95% CI)	PAF (95% CI), %
Any[a]					
Predischarge	3709	456	12.3	2.09 (1.86-2.35)	2.35 (1.91-2.78)
Postdischarge	3591	2811	78.3	61.10 (55.87-66.83)	26.16 (25.55-26.77)
Cardiovascular[b]					
Predischarge	306	44	14.4	1.67 (1.21-2.32)	0.23 (0.06-0.39)
Postdischarge	106	87	82.1	48.88 (29.26-81.64)	0.88 (0.78-0.97)
Pneumonia[b]					
Predischarge	559	62	11.1	1.30 (1.01-1.66)	0.20 (0.00-0.40)
Postdischarge	179	141	78.8	50.79 (34.26-75.29)	1.44 (1.31-1.57)
Renal[b]					
Predischarge	289	36	12.5	1.48 (1.00-2.18)	0.12 (0.00-0.25)
Postdischarge	150	133	88.7	76.20 (46.42-125.09)	1.23 (1.13-1.33)
CNS[b]					
Predischarge	120	12	10.0	0.94 (0.50-1.75)	0.00 (0.00-0.07)
Postdischarge	73	61	83.6	79.46 (39.28-160.75)	0.54 (0.48-0.61)
Sepsis[b]					
Predischarge	874	108	12.4	1.56 (1.27-1.92)	0.54 (0.27-0.81)
Postdischarge	561	487	86.8	61.78 (47.68-80.04)	4.84 (4.61-5.06)
Thromboembolic[b]					
Predischarge	434	64	14.8	1.89 (1.41-2.53)	0.28 (0.12-0.43)
Postdischarge	509	352	69.2	37.97 (30.57-47.16)	2.94 (2.73-3.15)
Wound[b]					
Predischarge	1067	154	14.4	2.24 (1.80-2.79)	0.71 (0.48-0.95)
Postdischarge	1843	1425	77.3	39.86 (34.95-45.45)	9.60 (9.20-10.00)
Graft failure[b]					
Predischarge	117	25	21.4	2.45 (1.46-4.11)	0.11 (0.03-0.18)
Postdischarge	113	76	67.3	20.97 (13.03-33.73)	0.48 (0.39-0.58)

Abbreviations: AOR, adjusted odds ratio; CNS, central nervous system; PAF, population attributable risk.

[a] Results of analysis examining the independent association between any complication and unplanned readmission, controlling for baseline patient risk and surgical complexity.

[b] Results of analysis examining the independent association between individual complications and unplanned readmission, controlling for baseline patient risk and surgical complexity.

Discussion

If, as we hypothesized, the occurrence of postoperative complications is strongly associated with unplanned hospital readmissions, it should be possible to use this relationship to prospectively identify surgical patients who are at increased risk for readmission. To determine whether the hypothesized association exists, we examined a cohort of more than 140 000 surgical patients in ACS NSQIP. We determined that unplanned readmissions are, in fact, strongly and independently associated with an increased risk of serious postoperative complications. Complications that occurred after hospital discharge were much more likely to be associated with rehospitalization than complications that occurred during the patient's index hospital stay. Surgical patients who experienced a postdischarge complication had 61-fold higher odds of rehospitalization compared with patients with no postoperative complications. In comparison, patients who experienced a complication during their hospitalization had only 2-fold higher odds of rehospitalization. Patients with the highest risk of complication (top 10th percentile) had 10-fold higher odds of rehospitalization, and patients in the next highest risk category (10th-25th percentile) had nearly 7-fold higher odds of rehos-

pitalization. Based on these findings, we conclude that a patient's risk of developing a serious postoperative complication is a powerful predictor of unplanned rehospitalization.

The 6.8% unplanned rehospitalization rate for surgical patients we report is much lower than the 15% national all-cause rehospitalization rate reported by Jencks et al[20] for Medicare beneficiaries undergoing surgery. In part, this reflects differences in how rehospitalization rates were calculated in our study. The ACS NSQIP participant use data file only reports rehospitalizations that occur within 30 days after surgery as opposed to CMS's definition of early rehospitalizations as those that occur within 30 days of hospital discharge.[20] Although Jencks and colleagues did not examine the role of postoperative complications for rehospitalization, a recent large multicenter study of patients undergoing colorectal surgery based on the linked Surveillance, Epidemiology, and End Results Program–Medicare data set determined that postsurgical complications were associated with a higher risk of rehospitalization.[21] A small single-center study based on ACS NSQIP data reported a similar association between in-hospital and postdischarge complications and early rehospitalization. To our knowledge, we are the first to study the association between the risk of postoperative complications and the rate of unplanned rehospitalizations in a large, nationally representative cohort of patients undergoing general surgery. We are

also the first to observe that it is postdischarge complications that appear to drive surgical readmissions, as opposed to postoperative complications that occur during the index hospitalization.

Our findings are important because of their practical implications for patient safety and cost reduction. Nonpublic report cards like ACS NSQIP aim to improve patient outcomes by providing hospitals with feedback on patient risk and subsequent outcomes.[10] This information, although useful for benchmarking, does not necessarily help hospitals pinpoint and correct the causes of bad outcomes. Although public reporting increases transparency and promotes accountability, it has not yet been shown to lead to dramatic improvements in health care outcomes[22]—even when tied to financial incentives.[23] Perhaps the real promise of quality measurement resides in its use to prospectively identify groups of patients who face a particularly high risk for a poor outcome due to preventable or manageable complications—so these patients can be provided with evidence-based risk-reduction strategies to improve their likelihood for a good outcome. For surgical patients undergoing noncardiac surgery, postdischarge complications appear to be a powerful, important driver of unplanned rehospitalization. Having shown that the risk of rehospitalization is closely predicted by the risk of major complications, it should be feasible for ACS NSQIP hospitals to identify high risk for rehospitalization using the ACS NSQIP prediction model. Although the complication risk index is not currently available in real time, ACS NSQIP could provide participating hospitals with the means of calculating a patient's risk index at the time of data collection. Physicians and hospitals could then use this information to guide efforts to reduce the likelihood of rehospitalization through early detection and treatment.

Our study is limited in certain respects. First, the ACS NSQIP definition of 30-day readmissions is based on the number of days since surgery as opposed to the usual post–hospital discharge period. The decision by ACS NSQIP to use this nonstandard definition was made so that rehospitalizations would be measured at the same point as other 30-day surgical outcomes such as mortality and major complications. Because of this, patients with longer hospital LOS may be less likely to show up in the ACS NSQIP database as rehospitalized because a readmission is counted only if it occurs within 30 days of the surgery. Because high-risk patients are more likely to have a complicated hospital course and a longer hospital LOS, the use of this nonstandard definition for 30-day readmission probably underestimates the true incidence of unplanned admissions and thereby weakens the strength of the association between complications and unplanned readmissions. However, the results of our sensitivity analysis, in which we only considered patients with a hospital LOS of 7 days or less, were essentially identical to those of our original analysis. This suggests that our findings are relatively robust despite the use of a nonstandard period to define rehospitalization.

Second, our analysis is based on a self-selected sample of hospitals participating in ACS NSQIP. Because these hospitals tend to be more focused on quality improvement, our findings may not be generalizable to all acute-care hospitals. However, the fact that ACS NSQIP includes a diverse population of academic, rural and nonrural, and large and small hospitals[24] makes this concern less compelling than it otherwise might be. Although studies based on Medicare data are more generalizable because Medicare data are population based, the accuracy of administrative data for measuring surgical complications is less than ideal[25] and thus less suitable for exploring the association between the risk of complications and subsequent unplanned rehospitalizations.

Finally, it can be argued that our finding that patients with postdischarge complications are likely to be rehospitalized is tautological and self-evident. However, to argue this is to miss the larger point of this analysis, namely that because postdischarge complications are a major driver for rehospitalizations and ACS NSQIP provides hospitals with a robust means to prospectively calculate the risk of complications, ACS NSQIP could be readily extended to help hospitals identify and manage patients through careful monitoring and timely postdischarge care, thereby reducing their risk of adverse outcomes including unplanned rehospitalization.

Conclusions

There is broad agreement on the need to reengineer incentives in health care to promote high-quality care. However, most physicians and hospitals, although not perfect, are already strongly incentivized to provide high-quality care by their ethical calling and sense of professionalism. Measuring the end products of health care such as mortality, complications, and rehospitalizations—and reporting that information after the fact to health care professionals, patients, and third-party payers in the form of report cards—may not be sufficient to achieve the best possible outcomes. We need to reengineer our data infrastructure to prospectively provide risk information to physicians and other health care professionals before, not after, complications occur. Providing physicians and hospitals with the tools to identify, in real time, patients who are at high risk for poor outcomes may be the key to preventing poor outcomes down the line. Risk stratification provides physicians the opportunity to intervene and prevent poor outcomes before they occur. In the case of surgical readmissions, our findings suggest that it should be feasible to implement early detection of high-risk patients by calculating their risk of major complications on admission with ACS NSQIP. Although this score is not currently available at the time of admission, it may be cost-effective for the ACS to create this functionality and for CMS to provide incentives to encourage every acute-care hospital to adopt and use ACS NSQIP. If it is successful at flagging high-risk patients and reducing the need for unnecessary rehospitalizations, the payoff will be immediate and substantial.

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Invited Commentary

Forecasting Hospital Readmission After Surgery
Data and the Hard-to-Measure Role of Culture

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Much debate has surrounded the definition and role of hospital readmission in the science of quality improvement. Most of these discussions have focused on this fundamental question: how can we make sure quality measurement is fair? In our opinion, benchmarking performance and improving quality require a better understanding of the clinical, behavioral, and socioeconomic details of what brings our patients back to the hospital. Moreover, targeted strategies aimed at reducing readmission rely on knowing more about the

risk factors for readmission such as those elucidated in the article by Glance et al.[1]

In the most detailed study of surgical readmission of its kind, Glance and colleagues demonstrate that prehospital and preoperation characteristics can predict risk not only for postoperative complications but also for readmission. They also describe the close association of readmissions with complications that develop in the postdischarge period. At the bedside level of care, knowing this information matters. They also inform formal efforts to prevent readmission such as better discharge teaching,

home health support, follow-up calls, early clinic visits, and even home monitoring. These interventions can be applied in addition to patient education efforts ranging from educational handouts and printed medication lists to in-house tutorials with nurse educators using tablet technology. Formation of multidisciplinary teams including discharge coordinators, home care specialists, social workers, and clinicians also allows a multifaceted approach to securing a safe discharge.[2] As suggested in this article, outpatient support is important. Services such as 24-hour telephone assistance by nurses and other health care professionals make patients feel more comfortable taking care of their issues at home. If problems do arise and are sufficiently concerning, patients can be directed toward outpatient clinics or acute care facilities as opposed to the emergency department and ultimately an inpatient stay for an issue that could have been resolved on an outpatient basis. The solution to the problem of readmission requires resources. For efforts to work in reducing readmission, money will need to be invested in better support of patients from the recovery room to the last follow-up visit.[3]

In making conclusions about readmission rates, it is important for data collection to be standardized. We have previously observed that readmission rates vary widely by the method of data collection.[4] Despite widespread public support for quality improvement through benchmarking, registry participation by US hospitals remains limited. Maturation and widespread adoption of national registries in surgery are an important future direction for fair benchmarking. If data collection is not standardized and independent to minimize self-reporting bias, then we may be unfairly punishing hospitals that do a good job of capturing data and rewarding hospitals that do a lousy job of data collection.

While this article informs the science of quality improvement, we should not be naive enough to think that readmission is driven only by medical characteristics. This study nicely details clinical predictors, but we must also remember that social, economic, and cultural characteristics can influence readmission rates. However, unlike clinical data, these factors are difficult to measure and are thus often omitted from the scientific conversation. Accounting for these differences may be a critical prerequisite before penalizing hospitals that disproportionately and admirably care for populations at higher risk for readmission.

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