Preventable Readmissions to Surgical Services: Lessons Learned and Targets for Improvement

Aaron J Dawes, MD, Greg D Sacks, MD, MPH, Marcia M Russell, MD, FACS, Anne Y Lin, MD, FACS, Melinda Maggard-Gibbons, MD, MSHS, FACS, Deborah Winograd, RN, Hallie R Chung, RN, Areti Tillou, MD, FACS, Jonathan R Hiatt, MD, FACS, Clifford Ko, MD, MS, MSHS, FACS

BACKGROUND: Hospital readmissions are under intense scrutiny as a measure of health care quality. The Center for Medicare and Medicaid Services (CMS) has proposed using readmission rates as a benchmark for improving care, including targeting them as nonreimbursable events. Our study aim was to describe potentially preventable readmissions after surgery and to identify targets for improvement.

STUDY DESIGN: Patients discharged from a general surgery service over 8 consecutive quarters (Q4 2009 to Q3 2011) were selected. A working group of attending surgeons defined terms and created classification schemes. Thirty-day readmissions were identified and reviewed by a 2-physician team. Readmissions were categorized as preventable or unpreventable, and by target for future quality improvement intervention.

RESULTS: Overall readmission rate was 8.3% (315 of 3,789). The most common indication for initial admission was elective general surgery. Among readmitted patients in our sample, 28% did not undergo an operation during their index admission. Only 21% (55 of 258) of readmissions were likely preventable based on medical record review. Of the preventable readmissions, 38% of patients were discharged within 24 hours and 60% within 48 hours. Dehydration occurred more frequently among preventable readmissions ($p < 0.001$). Infection accounted for more than one-third of all readmissions. Among preventable readmissions, targets for improvement included closer follow-up after discharge (49%), management in the outpatient setting (42%), and avoidance of premature discharge (9%).

CONCLUSIONS: A minority of readmissions may potentially be preventable. Targets for reducing readmissions include addressing the clinical issues of infection and dehydration as well as improving discharge planning to limit both early and short readmissions. Policies aimed at penalizing reimbursements based on readmission rates should use clinical data to focus on inappropriate hospitalization in order to promote high quality patient care. (J Am Coll Surg 2014;219:382–389. © 2014 by the American College of Surgeons)

Hospitals are increasingly moving to reduce unplanned readmissions as a method of improving health care quality. With the passage of the Affordable Care Act, the Centers for Medicare and Medicaid Services (CMS) has been tasked with benchmarking and publicly reporting 30-day readmission rates for individual hospitals, beginning with acute myocardial infarction, heart failure, and pneumonia in fiscal year 2013.[1] Underperforming institutions will be subject to financial penalties when the rate of unplanned readmissions exceeds the national benchmark. Legislation is already in place to extend the list of reportable diagnoses by 2015 to include many of importance to surgeons and their patients. Under the Affordable Care Act, only unplanned readmissions are subject to financial penalties because policymakers agree that certain planned readmissions reflect appropriate rather than poor quality clinical

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From the Department of Surgery, David Geffen School of Medicine (Dawes, Sacks, Russell, Lin, Maggard-Gibbons, Winograd, Chung, Tillou, Hiatt, Ko) and the Robert Wood Johnson Clinical Scholars Program (Dawes, Sacks), University of California; and the VA Greater Los Angeles Healthcare System (Dawes, Russell, Maggard-Gibbons, Ko), Los Angeles, CA.

Correspondence address: Aaron J Dawes, MD, Department of Surgery, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, 757 Westwood Plaza B7-11, Los Angeles, CA 90095. email: adawes@mednet.ucla.edu

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care. Efforts to reduce readmission rates must therefore be targeted to identify and address preventable cases among the total readmitted population.

With changes on the horizon, many surgical departments have begun to measure and report their readmission data as a component of quality improvement. Recent reports document readmission rates by individual hospital,[2,3] type of surgical team,[4,5] type of operation,[6-12] underlying disease process,[13-16] or by larger geographic area, including groups of hospitals, states, and even countries.[17-19] Advanced statistical modeling has identified perioperative factors that drive both all-cause and diagnosis-specific readmission rates, such as renal insufficiency, smoking status, and steroid use.[10,20,21] Although few global patterns have emerged, medical patients appear more likely to be readmitted for exacerbations of their underlying comorbidities;[22] surgical patients are more commonly readmitted for complications after their index procedures.[23] There have been no previous studies classifying readmissions after surgery as unpreventable or preventable.

The aims of our study were 3-fold: to describe a population of general surgery patients readmitted to a single hospital within 30 days of discharge; to categorize readmissions as unpreventable or potentially preventable; and to identify targets for improvement among potentially preventable readmissions.

METHODS

All hospital discharges after inpatient admission to a general surgery service at a single academic institution were collected from the University HealthSystem Consortium (UHC) database over a period of 8 consecutive quarters (Q4 2009 to Q3 2011). Based on the structure of surgical services, our sample included patients receiving general, colorectal, oncologic, emergency general, trauma, and endocrine surgical care. Because our goal was to examine the relationship between surgical inpatient care and subsequent readmission, patients who were admitted to a surgical service but did not undergo an operation during their index hospitalization, were also included in our sample. Moreover, because current CMS policies benchmark readmission rates by medical condition, future policies may similarly choose to focus on surgical conditions (eg, small bowel obstruction, trauma) rather than specific surgical procedures. Therefore, surgical conditions treated nonoperatively seemed equally relevant to our goal of providing the broadest possible evaluation of surgical readmissions.

All patients readmitted within 30 days of discharge to any surgical or medical inpatient service were identified for analysis. Based on UHC reporting criteria, readmissions for chemotherapy, radiation therapy, dialysis, labor and delivery, psychiatry, physical rehabilitation, or substance abuse rehabilitation reasons were excluded from our analysis.

Next, we organized a working group of 13 attending surgeons from multiple subspecialties to create classification schemes and define relevant terms. Based on group review of a subset of readmissions, 8 major clinical indications were identified: intestinal obstruction; infection (surgical site infection, intra-abdominal infection, and perioperative medical infection); enterocutaneous fistula-related complication; pain; bleeding; drain malfunction; dehydration; and failure to thrive. Patients readmitted with symptoms of unknown etiology were categorized as "diagnostic evaluation." Patients who did not meet criteria for these groupings were classified as "other."

The working group defined "unrelated" readmissions by 3 criteria: the indication for rehospitalization was not associated with the underlying surgical diagnosis, no direct treatment for the indication was delivered during the index hospitalization, and the indication was not a known surgical complication. A "preventable" readmission was defined as one in which a reasonable improvement in the health care process performed in a timely fashion could have potentially avoided the need for rehospitalization. Readmissions were considered preventable if they fell into any of 3 predefined categories based on targets of improvement: premature hospital discharge, inadequate follow-up, and potential outpatient management. Although no standard exists for this type of analysis, our categories were based on suggested definitions of the Medicare Payment Advisory Commission.[24] Because the goal of our analysis was to evaluate the preventability of the readmission, surgical complications were considered predetermined, and readmissions were not considered preventable if the only method of prevention was eliminating the complication itself. A subsample of readmissions was presented to the working group in a blinded fashion before full review in order to clarify and solidify classification criteria.

Using these definitions, 2 physicians independently reviewed available medical records to categorize each readmission as acute or chronic, related, or unrelated, and by major clinical indication. Three readmission categories were created: acute related to index admission, acute unrelated to index admission, and chronic medical disease. Scheduled readmissions and cases misidentified as readmissions due to coding error were excluded after initial review. Readmissions were then classified as preventable or unpreventable, with preventable cases further organized by target for improvement. Discrepancies

between the reviewers were marked for further review by our multispecialty working group. The overall rate of disagreement was 10% to 15% depending on the clinical indication.

Individual level data collected for readmissions included demographics, time between discharge and readmission, and length of stay. Type of operation performed during the index hospitalization and diagnosis at readmission were determined both by administrative code (Current Procedural Terminology or International Classification of Diseases, 9th Revision, respectively) and by physician review of the medical record. Descriptive statistics were performed for all collected data, including median values with interquartile ranges (IQR) for appropriate quantitative data. Each category was measured as a proportion of all readmissions and, as appropriate, as a proportion of preventable readmissions. The chi-square test of independence was used to compare proportions, and the Wilcoxon rank-sum test was used to compare medians between subgroups. All statistical analyses were performed using Stata/IC, version 13.0 (StataCorp). This study was reviewed and deemed exempt by the Office of Human Research Protection Program at the University of California, Los Angeles.

RESULTS

Of 3,789 patients discharged from surgical services during the study period, 315 (8.3%) were readmitted within 30 days of hospital discharge. Mean age was 55 years, 67% were Caucasian, and 53% were male. Table 1 shows characteristics of the study group, operations performed, and readmission categories. Nearly three-quarters of patients had an operation during their index admission, most often an elective general surgery procedure (23%). The median lengths of stay during the original hospitalization and the readmission were 6 days (IQR 3 to 10 days) and 4 days (IQR 3 to 8 days), respectively. The median time between hospital discharge and readmission was 10 days (IQR 5 to 17 days).

After initial review, 57 readmissions (18%) were excluded from further analysis (Fig. 1). A small proportion of readmissions (n = 14, 4.4%) were determined to be misidentified due to a coding error (eg, index admission was to a nonsurgical service, patient was seen in the emergency department without actual hospital admission, coded readmission was actually a clinic appointment). In addition, 43 readmissions (13.7%) were excluded from further analysis after they were found to be for scheduled clinical activities such as an elective operation or procedure. The remaining 258 readmissions met inclusion criteria and were reviewed for reason for readmission and potential preventability.

Table 1. Patient Characteristics for All Readmissions

	All readmissions (n = 315)	
Patient variable	**n**	**%**
Age, y (mean ± SD)	55.2 ± 1.0	
Sex, male	160	50.8
Race		
White	212	67.3
Other	56	17.8
Asian	25	7.9
Black	22	7.0
Type of admission		
Elective	136	43.2
Emergency	122	38.7
Urgent	34	10.8
Trauma Center	23	7.3
Type of operation		
None	80	28.2
General surgery	64	22.5
Colorectal	47	16.6
Oncology	42	14.8
Emergency	36	12.7
Trauma	10	3.5
Endocrine	5	1.8
Readmission category		
Acute related	186	59.1
Acute unrelated	30	9.5
Logistical	3	1.0
Chronic disease	39	12.4
Coding error*	14	4.4
Scheduled readmission*	43	13.7
Preventable	55	21.3
Poor follow-up	27	8.6
Potential outpatient management	23	7.3
Premature hospital discharge	5	1.6
Index admission LOS, d, median (IQR)	6 (3–11)	
Readmission LOS, d, median (IQR)	4 (3–8)	

*Excluded from further analysis.
IQR, interquartile range; LOS, length of stay.

Reason for readmission

Acute conditions related to the index admission were, by far, the most common indication for readmission in our sample, accounting for 186 (72%) of the 258 reviewed cases. Hospitalization for an acute, but unrelated indication occurred in only 30 of the reviewed cases (9.5%). An additional 39 readmissions (12.4%) were related to chronic conditions not directly addressed during the indexed admission. Most readmissions for chronic disease were due to exacerbations of common medical diagnoses, such as dyspnea, chest discomfort, and chronic pain.

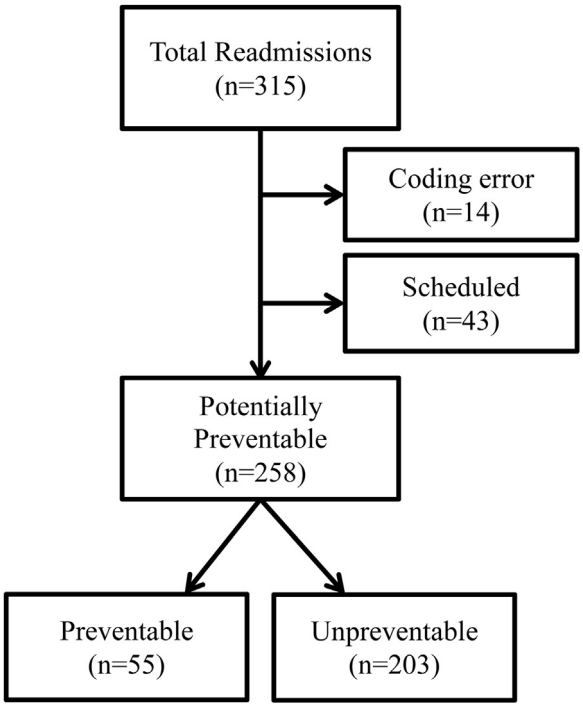

Figure 1. Flowchart of readmission classification.

Others were related to chronic surgical disease, including persistent pancreatic leak, nonhealing surgical wound, and enterocutaneous fistula management. Three patients were found to have been discharged and readmitted for logistical reasons rather than as a part of a clinical treatment plan.

Preventability and targets for improvement

Of the 258 readmissions, 55 (21%) were found to be potentially preventable after physician review. Reason for readmission among this group paralleled the overall sample, with 36 cases (65.5%) due to an acute related diagnosis, 8 (14.5%) due to an acute, but unrelated issue, and 8 (14.5%) due to chronic disease management. The 3 readmissions for logistical reasons were determined to be preventable because improved coordination of care would have avoided the need for rehospitalization.

All preventable readmissions were also categorized by potential targets for improvement. Of the 55 readmissions, 27 (49.1%) could have potentially been prevented by better follow-up care between discharge and readmission. Examples included readmission for dehydration after ileostomy creation in a patient who had yet to been seen in the outpatient clinic, or admission for pain control in a patient who had run out of medication and had not contacted the surgeon's office. An additional 23 preventable readmissions (41.8%) could potentially have been treated in the outpatient setting rather than requiring inpatient admission for continued care. Examples included mild dehydration without previous attempts at oral rehydration, wound infections not requiring complex wound care, and nonspecific abdominal symptoms admitted for observation in the absence of a necessary intervention. The remaining 5 preventable readmissions (9.1%) were determined to have been associated with premature discharge during the index admission. Examples included a post-Whipple pancreatoduodenectomy patient who had never fully tolerated an oral diet on index admission and was readmitted with continued nausea and vomiting, or a patient with a biliary obstruction who had pain at discharge and was readmitted with continued pain and plans for ERCP.

Clinical reason for readmission

Table 2 compares the clinical indication for hospitalization among preventable and unpreventable readmissions. Infection-related readmissions dominated both groups (41.1% and 25.5%, respectively). Although wound infections and perioperative medical infections (eg, pneumonia, urinary tract infection) occurred at similar rates between the preventability subgroups, intra-abdominal infection was more common among the unpreventable subgroup (14.3% vs 1.8%, $p = 0.01$). Dehydration was found to be more common among preventable readmissions than among unpreventable ones (23.6% vs 1.0%, $p < 0.001$).

Length of stay

Lengths of stay during the index admission and readmission are shown in Table 2. The median readmission LOS for unpreventable readmissions was 5 days, compared with 2 days for preventable readmissions ($p < 0.001$). No statistical difference existed in index admission length of stay between preventable and unpreventable subgroups ($p = 0.611$). Of the preventable readmissions, 38% were discharged to home within 1 day and 60% were discharged within 2 days. Readmissions categorized as "potential outpatient management" demonstrated the shortest readmission length of stay of any preventability category (median 1 day, IQR 1 to 4 days).

DISCUSSION

Unplanned hospital readmission rates are increasingly being used as a measure of hospital quality. Surgeons working in the field have focused on identifying perioperative factors associated with readmission in order to guide quality improvement. Recent studies have repeatedly demonstrated that the complexity of medical care precludes total elimination of readmissions, and that

Table 2. Patient Characteristics for Preventable vs Unpreventable Readmissions

Patient variable	Preventable (n = 55), %	Unpreventable (n = 203), %	p Value
Type of admission			0.222
Elective	36.4	47.3	
Emergency	45.4	38.4	
Urgent	10.9	4.9	
Trauma center	7.3	9.4	
Type of operation			0.069
None	35.9	20.2	
General surgery	11.3	27.5	
Colorectal	22.6	15.5	
Oncology	9.4	17.1	
Emergency	15.1	14.5	
Trauma	3.8	3.1	
Endocrine	1.9	2.1	
Readmission category			
Acute related	65.5	73.9	0.2158
Acute unrelated	14.6	10.8	0.4465
Logistical	5.5	0	<0.001*
Chronic disease	14.6	15.3	0.895
Readmission reason			
Intestinal obstruction	10.9	23.7	0.038
Wound complication	16.4	16.8	0.934
Intra-abdominal infection	1.8	14.3	0.010*
Other	16.4	10.3	0.222
Other infection	7.3	9.9	0.552
Fistula	0	6.4	0.053
Pain	10.9	6.4	0.2
Diagnostic evaluation	1.8	5.4	0.258
Bleeding	0	3.0	0.868
Drain malfunction	9.1	2.0	0.010*
Dehydration	23.6	1.0	<0.001*
Failure to thrive	1.8	1.0	0.611
Initial LOS, d, median (IQR)	9 (2–14)	7 (4–11)	0.611
Readmit LOS, d, median (IQR)	2 (1–4)	5 (3–9)	<0.001*

*Statistically significant with $p < 0.05$.
IQR, interquartile range; LOS, length of stay.

although some readmissions may be unnecessary, inappropriate, or discretionary, others reflect clinically appropriate care delivery. Rather than treating all readmissions as unavoidable events, efforts must be geared toward distinguishing preventable from unpreventable readmissions in order to promote the delivery of high-quality care. No surgical study to date has sought to create a workable definition for preventability or to categorize preventable readmissions by targets for improvement.

In our study, all 30-day readmissions from the general surgery service at a single academic medical center during the 2-year study period were described and categorized based on their readmission diagnosis. Only 8% of discharged patients were readmitted, and only one-fifth of these were determined to be preventable after clinician review. When compared with unpreventable readmissions, patients with preventable readmissions had significantly shorter lengths of stay and were more likely to be discharged within 24 or 48 hours (38% and 60%, respectively). More than two-thirds of both overall readmissions and preventable readmissions were due to acute issues related to the index admission, with the most common clinical indication for readmission being infection.

Our overall readmission rate during the study period was comparable to reported values from large academic institutions, including recent data from the American

College of Surgeons NSQIP, which reported a 12.8% 30-day readmission rate for its cohort of more than 500 hospitals.[25] The UHC database was chosen for our study due to its widespread use among academic hospitals. Because we collected data only from our institution, however, discharged patients who returned to outside institutions may have contributed to the slightly lower observed readmission rate within our sample. No attempt was made to adjust our data for demographic or disease-severity parameters, and our results represent only raw tabulations.

We learned multiple lessons from evaluating the preventability of readmissions after surgery that are likely applicable to other institutions. First, most patients were rehospitalized for acute conditions related to their index operation or their initial surgical diagnosis. According to published studies from other tertiary centers, as many as 50% to 80% of surgical readmissions may be directly related to care received during the index admission, depending on the method of determining this association.[26] Hechenbleikner and colleagues[26] evaluated the abilities of UHC and NSQIP to capture relatedness of readmission among colorectal patients, and found that both significantly under-reported the association when compared with clinical chart review. The administrative method, shared by UHC and CMS, identifies similarities between diagnosis-related group, ICD-9, or clinical classification system category on both the index admission and readmission. Structured chart review by trained surgical clinical reviewers—the preferred method for NSQIP—performed only slightly better than administrative coding in their analysis when compared with clinician chart review. Because relatedness helps to determine preventability, it is important to consider the method of data abstraction when interpreting all-cause readmission rates. Moreover, because readmissions for related conditions may be more amenable to process improvements than those for novel or chronic conditions, significant opportunities may exist for targeted interventions if at-risk patients can be identified before discharge.

Second, surgical infection remains a major source of postoperative morbidity and represented the most common reason for readmission in our study. More than one-third of all readmissions in our sample (37.6%) were for infectious reasons, representing a significantly larger proportion of the preventable than the unpreventable subgroups (41.1 vs 25.5%, $p = 0.034$). Previous studies similarly suggest that postoperative infection contributes to between 30% and 40% of all readmissions.[26,27] Because our goal was to describe readmissions and to identify areas for improvement, infections were grouped by target for future intervention: surgical site infections, intra-abdominal infections, and perioperative medical infections such as pneumonia or urinary tract infections. Although wound infections represent the most common site in both subgroups, intra-abdominal infections occurred more frequently in the unpreventable subgroup (14.3% vs 1.8%, $p = 0.01$) suggesting that many of these cases may represent complex disease processes without clear opportunities for care improvement. In addition to process measures aimed at preventing surgical site infections, additional work is needed to identify patients at high risk for less preventable sources of infection and to arrange closer follow-up after discharge to facilitate early diagnosis, prompt treatment, and reduced rehospitalization.

Third, we determined that dehydration was significantly more common among preventable readmissions, and likely represents a high-impact area for quality improvement. Although many potential predictors of readmission vary between studies, the association between new ostomy formation and readmission for dehydration remains persistent, especially among patients undergoing colorectal surgery.[28-31] Dehydration was the most common indication for readmission after ileostomy construction and was responsible for more than 40% of readmissions in 2 studies.[28,29] Because our sample included patients undergoing a wide variety of surgical procedures—only 7.4% of which resulted in new ostomy formation—it is expected that our rate of dehydration would be lower than that for entirely colorectal samples. Nagle and associates[31] published the results of an educational intervention for new ileostomates and compared readmission rates for the pre- and postintervention periods. Not only did the overall readmission rate drop significantly (35.4% to 21.4%), no postintervention patients were readmitted for dehydration over the 7-month study compared with 15.5% of the preintervention group. Interventions aimed at combining patient education and perioperative clinical pathways clearly represent an area for continued development, with the goal of decreasing preventable readmissions from dehydration.

Finally, we learned that a significant proportion of identified readmissions—nearly 20% in our sample—were for planned clinical services, and should be excluded from any metric attempting to measure hospital quality. We found evidence for this classification in written physician notes (typically, discharge summaries or history and physical notes) indicating a pre-existing plan for discharge and readmission. Reasons for this practice were varied. Examples include initial admission after a diagnostic procedure before a planned operation (eg, esophagogastrodueodenoscopy with endoscopic ultrasound before pancreatic tumor resection), and initial emergent admission with completed treatment followed by elective readmission for a planned operation (eg, nonoperative treatment of perforated

diverticulitis followed by planned sigmoidectomy within 30 days). Even though improved coordination of clinical services may have avoided readmission, many of these readmissions represent clinically appropriate examples of serial treatment with a planned delay. In 2010, CMS contracted production of a Readmission Measure aimed at identifying planned readmissions based on evidence of a procedure from a defined list being performed in a nonemergent fashion.[32] Applying this measure to our sample, however, correctly identified only 34.8% of scheduled readmissions.[33] Sellers and coworkers[27] similarly found improved, but imperfect, identification of planned readmissions using NSQIP, with a kappa of 0.67 as compared to clinical record review. Similar to determining relatedness between readmission and index hospitalization, these results call into question the ability of administrative data to make nuanced determinations of clinical outcomes for the purpose of evaluating quality. With quality-based reimbursement strategies on the horizon, policymakers must move beyond the idea that all readmissions are analogous, unavoidable, and representative of poor quality medical care. Instead, better tools based on clinical data should be developed to identify and prevent inappropriate readmissions in order to ensure the continuation of high-quality patient care.

Our study has several important limitations. First, our sample represents a small retrospective cohort from a single academic hospital, and our results may not be generalizable to other institutions. Second, because the UHC database includes only readmissions to the index hospital, our results may systematically underestimate rehospitalization rates by failing to capture readmissions to outside facilities. To the extent that these patients have different clinical reasons for readmission, our results may not represent a comprehensive analysis of factors associated with postsurgical readmission. Many administrative databases share this limitation, and future efforts to track readmissions may benefit from the use of multi-institutional clinical registries. Third, because our purpose was to describe causes for postsurgical readmission and potential sources for improvement, no attempt was made at risk-stratification. Because patient populations and case complexity vary from institution to institution, any attempt to compare readmission rates for the purpose of hospital evaluation must take both preoperative risk profiles and surgical case mix into account. Fourth, without patient level data on socioeconomic or insurance status, we were unable to account for any effect these variables may have had on access to care, treatment decisions, or variation in readmission rate. Finally, there remains no established standard for determining preventability of hospital readmission. We chose an implicit evaluation by 2-physician review in order to make an overall assessment of preventability. We believe this process allows for the most thorough possible evaluation given available clinical data, but its implicit nature limits the reproducibility and generalizability of the results. Moreover, the decision to operate, issues of operative technique, and other clinical decision points (when to discharge, when to schedule follow-up, whether to leave a wound open or attempt closure) were intentionally excluded from our analysis in order to focus on targets for hospital-wide intervention. Despite its potential shortcomings, however, we believe that the granularity and contextual evaluation of clinical chart review remain useful for identifying broad targets for improvement.

CONCLUSIONS

Reducing unplanned hospital readmission continues to challenge physicians, insurers, and hospital administrators. With benchmarks and financial penalties on the horizon, efforts must be geared toward developing a working definition of preventability in order to ensure that reported metrics directly relate to quality of care. Our study suggests that a smaller portion of surgical readmissions may be preventable than has been previously reported. Dehydration and surgical infection continue to represent high-value areas for quality improvement, and interventions aimed at improving patient education and developing perioperative pathways have produced impressive results. Determining preventability remains a challenging process, even after extensive chart review. Administrative records cannot fully capture clinical endpoints such as relatedness and preventability. Although clinical registries perform slightly better, improved metrics must be developed in order to assist hospitals with sustainable quality improvement.

Author Contributions

Study conception and design: Dawes, Sacks, Russell, Lin, Gibbons, Winograd, Chung, Tillou, Hiatt, Ko
Acquisition of data: Winograd, Chung, Ko
Analysis and interpretation of data: Dawes, Sacks, Russell, Lin, Gibbons, Winograd, Chung, Tillou, Hiatt, Ko
Drafting of manuscript: Dawes, Russell, Hiatt
Critical revision: Dawes, Sacks, Russell, Lin, Gibbons, Winograd, Chung, Tillou, Hiatt, Ko

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