As health care expenses continue to increase, policymakers face the challenge of improving quality while reducing cost. Unplanned hospital readmissions increase the total cost of care; the estimated cost to Medicare for unplanned readmissions in 2004 was $17.4 billion. The WHO has suggested that unplanned readmission is a key undesirable outcome of patient care, and the Center for Medicare and Medicaid Services now col-
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lects and reports readmissions and other quality measures through the Hospital Quality Alliance program, which will soon become available to the public (http://www.hospitalcompare.hhs.gov). The Center for Medicare and Medicaid Services has defined readmission as an admission to a hospital within 30 days after discharge from the index hospitalization. Therefore, 30 days was set as a target of our quality improvement initiative. By 2013, readmissions data may be used to deny reimbursement for preventable causes.

Recent efforts have focused on recognizing the causes of unplanned readmissions to identify targets for quality improvement initiatives. These efforts often rely on tracking patient admissions and subsequent unplanned readmissions using administrative claims billing data. The use of administrative data may allow for the automated detection of suboptimal patient outcomes and potential targets for quality improvement. The University HealthSystem Consortium, or UHC, is an alliance of 116 medical centers. Members use the data from UHC to identify areas to improve patient safety, quality of care, and benchmarking.

However, implementing improvement strategies based on such data assumes accurate identification of complications that are directly attributable to a prior hospital admission. Relying on inaccurate interpretations of administrative data may wrongly attribute reasons for readmission or even incorrectly identify complications, which could lead to misguided interventions that are potentially costly and may adversely affect patient outcomes.

Our objective was to assess whether the “all-cause” readmission rate, as reported by the UHC (without using the database’s drill-down capabilities), appropriately reflects the UCSF Medical Center hospital’s clinically relevant readmission rate for spine surgery patients and to identify predictors of readmission.

Methods

Data for 5780 consecutive patient encounters managed by 10 spine surgeons at the UCSF from October 2007 to June 2011 were abstracted from the UHC data set using the Clinical Data Base/Resource Manager. The UHC reported the UCSF readmission rate based on this data set, and we separately performed a manual chart review of each patient and calculated a readmission rate based on our review. We did not include emergency department visits as they are not considered “admissions” by the UHC. Two spine fellows performed the chart review to determine reasons for readmission. The hospital administrative data were extracted to calculate direct costs. Univariate logistic regression was performed to evaluate possible predictors of readmission. Each covariate was examined one at a time. Admission status, admission risk of mortality, length of stay greater than 5 days, and age were important factors. A two-sample t-test was used to test the difference in direct cost between readmission and nonreadmission cases.

The risk-of-death variable was based on a score generated by the 3M All-Patient Refined Diagnostic Grouper, which assigns a likelihood of a patient’s dying before discharge. This score is included in the Clinical Data Base/Resource Manager database. The 3M algorithm for assigning a score is in part based on the number of organ systems associated with a patient’s chronic conditions. The risk of death has 4 levels ranging from mild to moderate to major to extreme.

Results

Of the 5780 patient encounters, the UHC data set identified 281 cases (4.9%) in which patients were rehospitalized within 30 days of the previous discharge date. The main reasons for readmission were infection, planned staged surgery, and “nonoperative management” (Table 1). Nonoperative management included admission for fever workup, pain control, aspiration of seroma, and so on. These cases did not require surgical intervention.

Using a strict 30-day, all-cause readmission algorithm to calculate hospital readmissions resulted in an artificially high rate of readmissions from the surgeon’s point of view. Based on our manual chart review, 69 cases (25% of the 281 total readmissions) should be excluded from the readmission rate because 39 cases were planned as staged procedures, 14 surgical cases were cancelled or rescheduled at index admission due to unpredictable reasons (Table 2), and 16 cases were unrelated to spine surgery (Table 3).

Planned staged cases were typically part of a circumferential spine approach. All of the patients in these cases were discharged after the first stage of surgery and brought back electively within 30 days for the second.

The key reasons for surgery being cancelled preoperatively on the 1st day of the index admission were coagulopathy (2 patients), cardiac issues such as arrhythmias (2 patients), respiratory issues (2 patients), lack of preop-

### TABLE 1: Reasons for all-cause readmission

<table>
<thead>
<tr>
<th>Reasons for Readmission</th>
<th>No. of Cases (%)</th>
</tr>
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<tbody>
<tr>
<td>infection at index site</td>
<td>125 (39.8)</td>
</tr>
<tr>
<td>nonoperative management*</td>
<td>42 (13.4)</td>
</tr>
<tr>
<td>staged procedure</td>
<td>39 (12.4)</td>
</tr>
<tr>
<td>hematoma or seroma</td>
<td>20 (6.4)</td>
</tr>
<tr>
<td>CSF leak or dural repair</td>
<td>17 (5.4)</td>
</tr>
<tr>
<td>non–spine-related issue</td>
<td>16 (5.1)</td>
</tr>
<tr>
<td>failed instrumentation</td>
<td>14 (4.5)</td>
</tr>
<tr>
<td>op cancelled at index admission</td>
<td>14 (4.5)</td>
</tr>
<tr>
<td>restenosis†</td>
<td>10 (3.2)</td>
</tr>
<tr>
<td>wound dehiscence</td>
<td>10 (3.2)</td>
</tr>
<tr>
<td>fracture</td>
<td>5 (1.6)</td>
</tr>
<tr>
<td>hardware explantation</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>deformity</td>
<td>1 (0.3)</td>
</tr>
</tbody>
</table>

* Most readmissions were for intravenous pain medication. Others included workup for abdominal pain after anterior lumbar interbody fusion, replacement of a nonfunctional peripherally inserted central catheter line, and workup for meningitis.

† Restenosis was due to recurrent disc herniation or tumor recurrence mandating repeat decompression.
Unpredictable Reason for Cancellation/Rescheduling | No. of Cases
--- | ---
lack of time on OR schedule | 4
cardiac arrhythmia | 2
coagulopathy | 2
respiratory difficulty | 2
lack of preop workup or clearance | 2
intraop seizure after skin incision | 1
patient left against medical advice | 1
total | 14

* OR = operating room.

The reasons for the remaining 212 clinically relevant readmissions were infection (125 cases) (Fig. 1), nonoperative management (42 cases), CSF leak (17 cases), and hardware-related issues (14 cases) (Table 1).

Univariate logistic analysis revealed that patients with an urgent or emergency admission status for their index admission were more likely to be readmitted within 30 days than those admitted electively (OR 9, 95% CI 6–13; p < 0.001). Patients with length of hospital stay longer than 5 days during their index admission were more likely to be readmitted than patients staying 0–4 days.

The purpose of the study was to assess the clinical relevance of using the all-cause readmission rate for benchmarking hospital spinal service performance. The
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results of our study show that the all-cause readmission rate as reported by UHC included hospital readmissions for spine surgery patients that were not clinically relevant. This caused an overestimation of the relevant 30-day readmission rate by 25% (Fig. 1) and resulted in a cost variance of more than $3 million.

We found that the current all-cause readmission algorithm inappropriately included readmissions for planned staged procedures; surgery cancelled at index admission due to unpredictable reasons; and non–spine-related readmissions. These cases accounted for 25% of total readmissions. From the clinician’s point of view, this 25% of readmission cases was appropriate and unavoidable. Efforts to curtail such readmissions would be unnecessary and potentially use resources that could be directed elsewhere.

Administrative claims data have been identified as an easily accessible way to measure quality of care in the hospital setting. The use of administrative data has been shown to be valid for comparing death rates across hospitals, and methods have been developed to better analyze administrative data for profiling hospital performance for the treatment of patients with heart failure and acute myocardial infarction. However, there is concern about the relevance of such data because their use was originally developed for billing purposes. Prior studies have also highlighted the limitations of using administrative claims data, especially for determining detailed information. Yuen et al. showed that claims data could accurately identify index cases of breast cancer but could not differentiate patients based on cancer stage, which may be an important distinction in evaluating a hospital’s quality of care. Additionally, Ko et al. evaluated the accuracy of administrative claims data for identifying procedures and findings during colonoscopy. They found high sensitivity and specificity for polyp detection and removal but low sensitivity for tumor detection and incomplete colonoscopies. Additionally, claims data show poor sensitivity for specifics about colonoscopy procedures, and it has been proposed that some of these specifics be used to evaluate quality. Thus, relying on claims data to provide quality measures is not ideal if the claims data cannot show accurate information about the metrics of interest. Drilling down the data and identifying clinically relevant cases are necessary to achieve accuracy.

Deyo et al. used Medicare claims data to assess readmissions within 30 days for patients undergoing either spinal decompression or complex fusion (7.8% vs 13.0%, respectively). Our study revealed some of the inaccuracies of calculating readmission rates based on such administrative data sets. These data sets should be reviewed by clinicians to find the clinically relevant issues.

One other recent study has tried to analyze administrative data claims for readmission but did not use UHC data. To the best of our knowledge, our study is the first of its kind to analyze data our hospital submitted to UHC for spine surgery readmissions with a focus on whether the readmissions were appropriate.

As UHC uses hospital administrative claims, these data analyses are similar to what payers may use to compare hospitals to benchmark performance. Our analysis demonstrates the need to drill down into the data (which the UHC database allows) if meaningful conclusions are to be drawn from such claims data. Surgeons must be involved in this process to improve clinical accuracy.

The UHC algorithm permits queries that allow specification of both providers and index procedures. This allows for exclusion of nonsurgical cases. Additionally, hospitals need to accurately indicate planned staged procedures as “elective.” This would exclude planned staged surgeries in the readmission rate calculation.

The strength of this study is the large patient cohort at a large spine center and the comparison of the UHC data with manual chart review. There are some limitations to this study. We only evaluated readmissions to our institution; patients readmitted to other hospitals would not have been counted in this study.

Conclusions

Our results highlight the importance of using accurate information and surgeon input when determining quality benchmarks for spine surgery patients. Specifically, benchmarking algorithms for defining hospitals’ readmission rates must take into account planned staged procedures and cancelled procedures and eliminate readmissions due to reasons unrelated to spine surgery. Current administrative algorithms overestimate clinically relevant readmission rate and cost. This overestimated rate may then be used by payers (that is, Medicare) to deny payment for clinically unavoidable readmissions. Developing more sophisticated algorithms with spine surgeons’ input will increase the reporting accuracy. Surgeons can play a vital role to help improve benchmarking and improve the value of health care provided.

Disclosure

Dr. Berven is a consultant for Medtronic, DePuy Spine, and Globus Medical; he has an ownership stake in AccuLIF. Dr. Deviren is a consultant for Medtronic, NuVasive, Guidepoint, and Stryker. Dr. Ames is a consultant for DePuy, Medtronic, and Stryker; is employed by UCSF; holds a patent with Fish & Richardson, P.C.; owns stock in TranS1, Doctors Research Group, and Visualase; and receives royalties from Aesculap and Lanx. Dr. Mummaneni is a consultant for DePuy and receives royalties from DePuy, Quality Medical Publishers, and Thieme Publishers.

Author contributions to the study and manuscript preparation include the following. Conception and design: Amin, Takemoto, Mummaneni. Acquisition of data: Tu, Amin, Na, Takemoto. Analysis and interpretation of data: Tu, Amin, Chaier, Na, Takemoto, Mummaneni. Drafting the article: Amin, Chaier. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Tu. Statistical analysis: Na, Takemoto. Administrative/technical/material support: Berven, Chou, Mummaneni. Study supervision: Mummaneni.

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