Is a Low Readmission Rate Indicative of a Good Hospital?

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BACKGROUND: Hospital readmissions are an increasing focus of health care policy. This study explores the association between 30-day readmissions and 30-day mortality for surgical procedures.

STUDY DESIGN: California longitudinal statewide data from 1995 to 2009 were analyzed for 7 complex procedures: abdominal aortic aneurysm repair, aortic valve replacement, bariatric surgery, coronary artery bypass grafting, esophagectomy, pancreatectomy, and percutaneous coronary intervention. Hospitals were categorized based on observed-to-expected (O/E) ratios for 30-day mortality and 30-day readmissions. Hospitals were considered “high” or “low” outliers if the 95% confidence intervals of their O/E ratios excluded 1 and “expected” if they included 1. Hospitals that were outliers in at least 1 metric were classified as “discordant” if their readmission and mortality rates were not both “high” or both “low,” and “poorly discordant” in the particular scenario of high mortality with “expected” or “low” readmission rates.

RESULTS: A total of 1,090,071 patients and 299 hospitals were analyzed for 7 procedures, representing a total of 1,150 clinical encounters. The overall 30-day mortality was 3.79% and the 30-day readmission was 12.69%. Of the total, 729 (63.3%) had “expected” O/E ratios for both outcomes. Among outliers, 358 (85.0%) were “discordant” and 100 (23.8%) were “poorly discordant.”

CONCLUSIONS: Hospital readmission rate alone is a limited measure of quality given the poor correlation between hospital readmission and mortality rates. In this study, 85% of hospital outliers were “discordant” for readmission and mortality. Furthermore, almost a quarter of these discordant hospitals had “expected” or “low” readmission but “high” mortality rates. Quality metrics that focus exclusively on readmission rates overlook these discrepancies. (J Am Coll Surg 2015;220:169–176. © 2015 by the American College of Surgeons)

Reducing hospital readmission rates has become an important focus in both policy and quality improvement.1–3 Much of this focus has been driven by new policies of the Centers for Medicare and Medicaid Services (CMS) that penalize hospitals with higher than expected readmission rates. So far, the emphasis has been on medical conditions—pneumonia, myocardial infarctions and heart failure—where lapses in coordinating postdischarge care as well as generalized physiologic vulnerability secondary to hospitalization have been postulated as the biggest drivers of readmission.4,5 Over time, CMS will expand its readmission penalty program to include surgical procedures, starting with total hip and knee arthroplasty in 2015. As such, there is a growing body of literature exploring rates and reasons for readmissions to identify potential interventions to lower readmission rates.

Low readmission rates have been associated with significant cost reductions.6,7 However, the validity and reliability of readmission rates as a quality measure are not well established and remain controversial.4,5 Thirty-day readmission rates are not a previously established quality metric, and the correlations between readmission rates and other quality metrics are being studied more closely.8

Risk-adjusted mortality is among the more clearly defined and well-established measures of hospital quality, considered the gold standard in many cases. As such, any novel quality metric—especially one tied to reimbursement—should be validated in relation to hospital mortality rates. There has been concern that...
hospital readmission rates and mortality rates may actually have an inverse relationship. Specifically, readmission and mortality are competing risks in that patients who die during a hospitalization or shortly after cannot be readmitted. As a result, hospitals with higher-than-expected mortality rates might have lower readmission rates. However, the frequency with which this trend is observed has not been described and it is also possible that mortality and readmission rates represent 2 different aspects of hospital quality.

In this study, we hypothesized that 30-day mortality and 30-day readmission rates for a set of complex surgical procedures will not display a strong association. Specifically, we hypothesized that a significant number of hospitals will have high mortality rates but normal or low readmission rates. Therefore, quality metrics that focus exclusively on readmissions will overlook such discrepancies. We classified hospitals based on their observed-to-expected outcomes rates into the categories, “higher than expected,” “expected,” and “lower than expected,” and we studied the distribution of hospitals into each of the categories for both outcomes.

METHODS

We performed a retrospective analysis of the longitudinally linked California Office of Statewide Health Planning and Development (OSHPD) patient discharge database from 1995 to 2009. The database contains all inpatient admissions in nonmilitary hospitals in the state of California. Each hospital is identified by a unique identifier regardless of whether it is part of a larger health care system. The database includes admission and discharge data, diagnoses, procedures performed during the hospitalization, and demographic data. Each patient is identified by a unique record linkage number, which allows patients to be tracked through hospitals and years. Records from the patient discharge database were linked with the California Death Statistical Master File to obtain data on out-of-hospital mortality. The linkage methodology has been described previously.

Seven complex procedures were included in the analysis: abdominal aortic aneurysm repair (AAA repair), aortic valve replacement (AVR), bariatric surgery, coronary artery bypass grafting (CABG), esophagectomy, pancreatectomy, and percutaneous coronary intervention (PCI). All patients who were discharged between 1995 and 2009 were included. Patients who had undergone multiple procedures were included in the analysis only once, for the procedure they had first. These procedures were selected because of their use by the Leapfrog Group quality standards and were identified in the same method as described by the Leapfrog Group.

Procedures were identified as follows: abdominal aortic aneurysm repair (ICD-9-CM procedure codes 38.34, 38.44, 38.64, 39.25, 39.71, excluding patients younger...
than 18 years old), aortic valve replacement (procedure codes 35.21, 35.22, excluding patients younger than 20 years old), bariatric surgery (procedure codes 44.31, 44.38, 44.39, 44.69, 44.95, 43.7, 45.50, 45.51, 45.90, 45.91, 43.82, 43.89, 43.5, 43.6, 44.93, or 44.99 and an obesity diagnosis code, excluding patients younger than 20 years), coronary artery bypass grafting (36.10—36.17, 36.19, excluding patients younger than 18 years), esophagectomy (42.4, 42.40—42.42, 43.99), pancreatectomy (52.51, 52.53, 52.6, 52.7, excluding patients younger than 18 years), percutaneous coronary intervention (00.66, 36.01, 36.02, 36.05, 36.06, 36.07, excluding patients younger than 18 years).

The outcomes studied were 30-day readmission and 30-day mortality. A 30-day readmission was defined as any unscheduled admission to an acute care hospital within 30 days of discharge. Patients who died during their index episode were excluded from the denominator when calculating a readmission rate. This definition was based on current CMS standards for defining readmissions. Both hospital type of care and whether an admission is scheduled are data elements in the OSHPD patient discharge database. Both inpatient and out-of-hospital mortality were captured in the 30-day mortality measure.

Variables used in risk adjustment were age (by category), ethnoracial group, sex, length of stay (by category), and Charlson index. Age, ethnicity, race, sex, and length of stay are all data elements already present in the OSHPD patient discharge database. The Charlson index is a measure of the severity of a patient’s comorbidities based on the presence of certain diagnoses combined in a weighted formula and calculated via ICD-9 diagnosis codes based on the method described by Romano and colleagues.

An observed-to-expected (O/E) analysis was performed in order to classify hospitals into 1 of 9 groups, as outlined in Figure 1. Independent variables used in risk adjustment were age, race, sex, length of stay, and Charlson index. Two types of analysis were performed in order to generate the expected rates of 30-day readmission and 30-day mortality for each patient. First, a multilevel mixed-effects logistic regression was performed using all data from a hospital for each procedure as an aggregate and controlling for admission year and procedure type as independent variables and hospital as a second level variable to control for the nonrandom distribution of patients within the same hospitals. Second, a similar regression was performed for hospital-year data, controlling both for clustering within the same hospital and the longitudinal re-sampling of hospitals each year. Using the results of these regressions, the expected rates of 30-day readmission and 30-day mortality were similarly calculated in 2 ways. First, using all the data from a hospital as an aggregate, and second, using the previous 3 years of data to predict the expected rate for the next year (for example, using 1995 to 1997 data to predict the expected rates of readmission and mortality for 1998). The derived expected rates for each hospital were divided into the observed rates for the hospital, generating O/E ratios for 30-day readmissions and 30-day mortality and corresponding 95% confidence intervals. This observed-to-expected methodology mirrors that described by CMS in coming up with risk-adjusted readmission and mortality measures.

Hospitals were analyzed separately for each procedure and excluded if they had a low volume with 13 cases used as the threshold for esophagectomy, 11 cases for pancreatectomy, and 25 cases for all other procedures. Hospitals that were outliers in at least 1 of the outcomes were categorized into one of 8 groups, labeled A through H. They were classified as high or low in either 30-day readmission or 30-day mortality if the O/E ratio was statistically significantly different from 1.0, ie, had 95% confidence intervals excluding 1.0, and were classified as expected if their O/E ratio was not statistically significant. Several trends were explored among the categorized hospitals: the percentage of hospitals that were not outliers in either outcome, the proportion of hospitals that were discordant for the 2 outcomes, and the rate of poor discordance. Discordant hospitals were defined as those that were outliers in at least 1 outcome and had readmissions and mortality rates that did not correlate, ie, they did not have low mortality and low readmissions or high mortality and high readmissions. Poorly discordant hospitals were those that had higher than expected mortality but either expected or lower than expected readmission rates, ie, hospitals that would not be singled out based on their readmission rates but their higher than expected mortality rate points to a quality problem. Once all hospitals or hospital-years were analyzed for each procedure, the total rate of discordance and poor discordance was calculated for each procedure separately and for all procedures combined. Some hospitals were counted multiple times in the combined rate.

Statistical analysis was performed with Stata SE statistical software, version 13 (StataCorp LP). This study was exempt from review as designated by the University of California San Diego Human Research Protections Program.

RESULTS

A total of 1,090,071 patients in 299 unique hospitals were analyzed. Demographic information for the study population is presented in Table 1. The median age of patients...
was 65 years, 37.8% were female, the majority of patients were non-Hispanic white (72.2%), and most patients had a Charlson index of 1 or 2 (54.4%). The overall 30-day mortality rate of the population was 3.79% (n = 40,239 of 1,090,071 patients), and the 30-day readmission rate was 12.69% (n = 134,665 of 1,061,173 patients eligible for readmission). Of readmitted patients, 43.08% (n = 58,014) were readmitted to a different hospital at least once within 30 days of discharge.

When O/E ratios were calculated using aggregate hospital data, the sum of the hospitals analyzed for each procedure was 1,150, with some hospitals counted multiple times (Table 2). Of these, 729 had 30-day readmission and 30-day mortality rates that fell within the expected range for that procedure in that hospital. However, 25 had a higher than expected readmission rate and lower than expected mortality rate (group A), 10 had lower than expected readmission rate but higher than expected mortality rate (group D), and 90 had readmission rates within the expected range but higher than expected mortality (group E).

Table 3 shows the hospital classification with O/E ratios calculated using the previous 3 years of data to predict the next year. The sum of the hospital-years analyzed was 5,521. There were 4,848 hospital-years that fell within the expected limits in both outcomes. Of these hospitals, 111 had readmission rates within the expected range but higher than expected mortality rates (group E), 2 had low readmission but high mortality rates (group D), and 10 had high readmission but low mortality rates (group A). The breakdown of outliers for each procedure is further elucidated in Table 3.

The important trends analyzed for each procedure and for all procedures are shown in Table 4. There were 63.4% of hospitals and 87.8% of hospital-years that had 30-day readmissions and 30-day mortality rates that were within the expected range for both outcomes. Among outliers, 85.0% of hospitals and 94.5% of hospital-years were classified as discordant, signifying that their mortality and readmission rates did not correlate directly, ie, did not have either low readmissions and low mortality or high readmissions and high mortality. Furthermore, 23.8% of hospitals and 16.8% of hospital-years were classified as poorly discordant, or having a higher than expected mortality rate despite an expected or lower than expected readmission rate.

DISCUSSION

Our study suggests that although some association exists between mortality and readmission rates, there is no consistent pattern among outlier hospitals. For example, most hospitals fall within the expected range for both 30-day readmission and 30-day mortality rates. However, among outlier hospitals, more than half were discordant, or not in the high mortality, high readmissions (group B) or the low mortality, low readmissions (group C) groups. We also found that a number of hospitals achieve a lower than expected mortality rate but have a higher than expected readmission rate (Tables 2 and 3, group A). Such hospitals would be penalized under a system that focuses on readmission rates alone despite having lower than expected mortality rates. However, a larger group, representing 23.8% of hospitals and 16.8% of hospital-years, contained hospitals that had either expected or lower than expected readmission rates but higher than expected mortality rates, ie, were poorly discordant (Tables 2 and 3, groups D and E). These hospitals would not be single...
out by policies focusing on readmissions, although their higher than expected mortality rates point to a likely quality problem. Overall, we cannot conclude that 30-day readmissions and mortality rates are closely related metrics. Although most hospitals fall within the expected range for both outcomes, an exclusive focus on reducing readmissions will overlook some hospitals with high mortality rates while penalizing some hospitals with low mortality rates. This calls into question the validity of 30-day readmission rate as a stand-alone quality indicator.

Despite its importance, measuring quality is often dependent on the use of quality indicators that are poorly defined or not appropriately validated. The reliability and validity of every instrument must be demonstrated in every field, including hospital quality. There are several approaches to validation, including construct validity, face validity, and content validity.21,22 Face validity, although the most common and simplest approach, simply ensures that a metric appears to be logical, and as such, is open to significant bias. Content validity is also open to subjectivity and bias because there is no consensus on an all-encompassing definition of quality.23 As such, the arguable best approach to testing a new quality metric is establishing construct validity by correlating it to a “gold standard.” Although such a standard may not always exist, it can be argued that hospital mortality rate should be considered the gold standard for hospital quality. So, any new proposed measure should be validated in relation to hospital mortality measures. Given the results of our study, risk-adjusted readmission rates appear to be limited indicators of quality because they do not correlate closely to mortality.

Several previous studies in medical patients have looked at the association between 30-day readmissions and mortality rates and other quality metrics. Krumholz and colleagues24 looked at the relationship between

### Table 2. Hospital Classification Based on Aggregate Hospital Data

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>AAA repair</th>
<th>AVR</th>
<th>Bariatric</th>
<th>CABG</th>
<th>Esophagectomy</th>
<th>Pancreatectomy</th>
<th>PCI</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>High readmission, low mortality</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>10</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>High readmission, high mortality</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>11</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Low readmission, low mortality</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>17</td>
<td>1</td>
<td>0</td>
<td>18</td>
<td>43</td>
</tr>
<tr>
<td>D</td>
<td>Low readmission, high mortality</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>E</td>
<td>Expected readmission, high mortality</td>
<td>37</td>
<td>8</td>
<td>13</td>
<td>6</td>
<td>10</td>
<td>9</td>
<td>7</td>
<td>90</td>
</tr>
<tr>
<td>F</td>
<td>Expected readmission, low mortality</td>
<td>35</td>
<td>11</td>
<td>2</td>
<td>23</td>
<td>2</td>
<td>3</td>
<td>23</td>
<td>99</td>
</tr>
<tr>
<td>G</td>
<td>Expected mortality, high readmissions</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>22</td>
<td>6</td>
<td>5</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>H</td>
<td>Expected mortality, low readmissions</td>
<td>4</td>
<td>5</td>
<td>19</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1,150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Classification of 299 hospitals into 1 of the above 8 categories based on O/E (observed/expected) ratio. Analysis is based on using aggregate hospital data for the 15 years in the study. Data are reported as number of hospitals.

### Table 3. Hospital Classification Based on Hospital-Year Analysis

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>AAA repair</th>
<th>AVR</th>
<th>Bariatric</th>
<th>CABG</th>
<th>Esophagectomy</th>
<th>Pancreatectomy</th>
<th>PCI</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>High readmission, low mortality</td>
<td>727</td>
<td>832</td>
<td>596</td>
<td>1,161</td>
<td>117</td>
<td>162</td>
<td>1,253</td>
<td>4,848</td>
</tr>
<tr>
<td>B</td>
<td>High readmission, high mortality</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>C</td>
<td>Low readmission, low mortality</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>D</td>
<td>Low readmission, high mortality</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Expected readmission, high mortality</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>25</td>
<td>3</td>
<td>3</td>
<td>56</td>
<td>111</td>
</tr>
<tr>
<td>F</td>
<td>Expected readmission, low mortality</td>
<td>7</td>
<td>11</td>
<td>4</td>
<td>49</td>
<td>0</td>
<td>0</td>
<td>39</td>
<td>110</td>
</tr>
<tr>
<td>G</td>
<td>Expected mortality, high readmissions</td>
<td>18</td>
<td>16</td>
<td>44</td>
<td>68</td>
<td>4</td>
<td>7</td>
<td>105</td>
<td>262</td>
</tr>
<tr>
<td>H</td>
<td>Expected mortality, low readmissions</td>
<td>4</td>
<td>4</td>
<td>37</td>
<td>38</td>
<td>2</td>
<td>0</td>
<td>56</td>
<td>141</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>764</td>
<td>872</td>
<td>696</td>
<td>1,365</td>
<td>126</td>
<td>173</td>
<td>1,525</td>
<td>5,521</td>
</tr>
</tbody>
</table>

Classification of 299 hospitals into 1 of the above 8 categories based on O/E (observed/expected) ratio for each procedure. Analysis is based on using hospital data from the previous 3 years to predict the expected complication rate for the next year. Data are reported as number of hospitals.

AAA, abdominal aortic aneurysm; AVR, aortic valve replacement; CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention.
risk-adjusted readmission and mortality rates in medical patients hospitalized with acute myocardial infarction, pneumonia, and heart failure, and found no association between readmission and mortality rates for acute myocardial infarction and pneumonia and only a weak positive association for heart failure. They concluded that readmission and mortality reflect different aspects of quality and have a different set of predictors. Chen and associates examined the relationship between cost of care and a variety of quality metrics including readmission and mortality rates. They noted that lower cost of care and lower readmission rates did not correlate with higher mortality rates. Gorodeski and coworkers looked at the association between risk-adjusted mortality and readmission rates in heart failure patients and did find a correlation—a higher rate of readmissions was associated with a lower mortality rate during the index episode.

Multiple reasons may be postulated as to why hospital readmission rates do not correlate strongly with hospital mortality rates. Some hospitals may have lower readmission rates due to high mortality rates because patients who die during or shortly after hospitalization cannot be readmitted. We did identify a number of hospitals that may fall in this category—hospitals with higher than expected mortality rates, with some having expected readmissions and others even having lower than expected readmissions. Another possible reason for the inconsistent correlation between readmissions and mortality is that hospitals with lower mortality rates may be achieving relatively better outcomes for more complex patients who subsequently have a higher risk of readmission. In such cases, demographic and comorbidity-based risk metrics may be insufficiently capturing the complexity of some patients. It is difficult to quantify how frequently this contributes to the discrepancy between readmission and mortality rates.

Describing the prevalence of nonoutlier hospitals (those who fall into the expected rate for both readmission and mortality), discordant hospitals (those that have readmission and mortality rates that do not correlate) and poorly discordant hospitals (those that have higher than expected mortality rates but expected or lower than expected readmission rates). A-H refer to the categories described in Figure 1 and quantified in Tables 2 and 3.

Table 4. Rates of Discordance and Poor Discordance

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Based on hospital-level analysis, %</th>
<th>Based on hospital year-level analysis, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discordance rate, (A + D + E + F + G + H)/(all outliers)</td>
<td>Poor discordance rate, (D + E)/(all outliers)</td>
</tr>
<tr>
<td></td>
<td>Nonoutlier hospitals, (expected in both outcomes)/(all hospitals)</td>
<td>Discardance rate, (A + D + E + F + G + H)/(all outliers)</td>
</tr>
<tr>
<td>AAA Repair</td>
<td>64.7</td>
<td>98.9</td>
</tr>
<tr>
<td>AVR</td>
<td>70.1</td>
<td>89.5</td>
</tr>
<tr>
<td>Bariatric surgery</td>
<td>59.7</td>
<td>85.7</td>
</tr>
<tr>
<td>CABG</td>
<td>31.3</td>
<td>78.3</td>
</tr>
<tr>
<td>Esophagectomy</td>
<td>88.3</td>
<td>95.2</td>
</tr>
<tr>
<td>Pancreatectomy</td>
<td>87.8</td>
<td>100</td>
</tr>
<tr>
<td>PCI</td>
<td>34.0</td>
<td>72.4</td>
</tr>
<tr>
<td>Total</td>
<td>63.4</td>
<td>85.0</td>
</tr>
</tbody>
</table>

A-H refer to the categories described in Figure 1 and quantified in Tables 2 and 3. AAA, abdominal aortic aneurysm; AVR, aortic valve replacement; CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention.
and clinical factors have been found to have poor predictive power and discriminative ability.\cite{24,29,30} On the other hand, mortality is closely correlated with patient comorbidities and other clinical factors and therefore reflects more closely on the quality of care received in the hospital.\cite{31-35} Models predicting mortality based on clinical factors have been found to have superior predictive power and discriminative ability relative to those for readmissions.

This distinction in the aspects of care that mortality and readmissions are capturing is especially relevant when considering surgical quality improvement. Risk-adjusted mortality is more closely correlated to surgical outcomes and direct sequelae. Conversely, readmission rates reflect a central aspect of patient care and subsequent outcomes that is nonetheless more detached from surgical outcomes. Although both aspects of quality are undeniably important, relying on readmission rates alone to determine quality may be incomplete.

There are several important strengths of our study. First, we capture both readmission and mortality rates reliably by being able to track patients through hospitals and time in the entire state and by linking to data on both in- and out-of-hospital mortality. It has previously been shown that relying on same-institution readmission data misses a significant proportion of readmissions.\cite{36} Furthermore, we capture a variety of patients from a variety of institutions. By not relying solely on CMS-based data, we can better evaluate 30-day readmission rates as a generalizable quality metric.

There are several limitations to our study. We risk adjust broadly based on Charlson comorbidity score and demographic characteristics, but a procedure-specific risk factor adjustment may more accurately capture risk factors. However, this is unlikely to result in significant alteration in our results and conclusions because we analyzed trends and not absolute numbers of hospitals. Furthermore, we only correlated 30-day readmission rates to 30-day mortality rates. We did so because higher than expected mortality rates are an unequivocal indicator of poor quality and as such, hospital mortality rate may be considered a gold standard for hospital quality. However, it may be instructive to compare 30-day readmission rates with other quality outcomes such as length of stay, patient safety indicators, and various process measures if available. Lastly, although we observed trends in discordance and poor discordance among hospitals that were outliers in at least 1 of the 2 outcomes, most of the hospitals in the study fell within the expected readmissions, expected mortality category. This points to the likely existence of some association between readmission and mortality rates, which would benefit from further elucidation.

**CONCLUSIONS**

Overall, we found that 30-day hospital readmission rates are a limited metric of quality. We support this conclusion with data showing that some hospitals have expected or better readmissions with unacceptably high mortality rates while others achieve significantly low mortality rates at the expense of 30-day readmissions. Although reducing readmission rate is important for reducing costs and may reflect aspects of patient care such as discharge planning and post-discharge follow-up, readmission rates should be avoided as sole metrics of hospital quality. Instead, hospital readmission rates should be interpreted in conjunction with hospital mortality rates. More studies are needed to further qualify the utility of readmission rates as a quality metric.

**Author Contributions**

Study conception and design: Parina, Chang, Talamini

Analysis and interpretation of data: Parina, Chang, Rose, Talamini

Drafting of manuscript: Parina, Chang, Rose

Critical revision: Parina, Chang, Rose, Talamini

**REFERENCES**