Anticipating the Effects of Accountable Care Organizations for Inpatient Surgery

David C. Miller, MD, MPH; Zaojun Ye, MS; Cathryn Gust, MS; John D. Birkmeyer, MD

Importance: Much of the enthusiasm for accountable care organizations is fueled by evidence that integrated delivery systems (IDSs) perform better on measures of quality and cost in the ambulatory care setting; however, the benefits of this model are less clear for complex hospital-based care.

Objective: To assess whether existing IDSs are associated with improved quality and lower costs for episodes of inpatient surgery.

Design, Setting, and Patients: We used national Medicare data (January 1, 2005, through November 30, 2007) to compare the quality and cost of inpatient surgery among patients undergoing coronary artery bypass grafting, hip replacement, back surgery, or colectomy in IDS-affiliated hospitals compared with those treated in a matched group of non–IDS-affiliated centers.

Main Outcome Measures: Operative mortality, postoperative complications, readmissions, and total and component surgical episode costs.

Results: Patients treated in IDS hospitals differed according to several characteristics, including race, admission acuity, and comorbidity. For each of the 4 procedures, adjusted rates for operative mortality, complications, and readmissions were similar for patients treated in IDS-affiliated compared with non–IDS-affiliated hospitals, with the exception that those treated in IDS-affiliated hospitals had fewer readmissions after colectomy (12.6% vs 13.5%, P=.03). Adjusted total episode payments for hip replacement were 4% lower in IDS-affiliated hospitals (P<.001), with this difference explained mainly by lower expenditures for postdischarge care. Episode payments differed by 1% or less for the remaining procedures.

Conclusions: The benefits of the IDSs observed for ambulatory care may not extend to inpatient surgery. Thus, improvements in the quality and cost-efficiency of hospital-based care may require adjuncts to current ACO programs.

gram and other emerging ACOs. In the meantime, however, a better understanding of whether existing IDSs provide more efficient hospital-based care would help policymakers anticipate the likely effects of ACOs in this key clinical setting. Accordingly, we used national Medicare data to evaluate differences in the quality and cost of inpatient surgical care among patients treated in IDS-affiliated hospitals compared with those undergoing surgery in a matched group of non–IDS-affiliated centers.

METHODS

PARTICIPANTS AND DATABASES

This study was based on complete Medicare claims data for a cohort of patients undergoing selected inpatient operations from January 1, 2005, through November 30, 2007. Using methods described previously, we identified (from the MEDPAR file) patients undergoing coronary artery bypass grafting (CABG), hip replacement, back surgery, and colectomy based on the presence of specific procedure codes from the International Classification of Diseases, Ninth Revision (codes available from the authors on request).

We linked the patient records to other CMS files with claims relevant to the surgical hospitalization, including the carrier (ie, physician), outpatient, home health, skilled nursing facility, long-stay hospital, and durable medical equipment files. The study cohorts included patients treated surgically from January 1, 2005, through November 30, 2007. To ensure complete outcome data, we did not include patients who had surgery in December 2007.

IDENTIFICATION OF HOSPITALS AFFILIATED WITH IDSs

We used the Integrated Healthcare Networks Profiling Solution database from IMS Health to identify IDSs in the United States. On a yearly basis, these data are used to generate a rating system that compares IDSs on their performance level and degree of integration. The overall rating system analyzes performance for 33 attributes in the following 8 domains: overall integration, integrated technology, hospital utilization, financial stability, services, access, contract capabilities, and physicians. Domain-specific scores are added to yield an overall score for the IDS; higher scores reflect greater degrees of self-reported integration. On the basis of the overall integration scores, IMS Health publishes an annual list of the top 100 IDSs nationally.

Frequently, IDSs are associated with multiple hospitals. For this analysis, we decided a priori to identify the subset of hospitals that were affiliated with IDSs included in the 2007 list of the top 100 IDSs nationally and that also reported a formal relationship with one or more physician practices. This process yielded a sample of 374 hospitals affiliated with 92 IDSs from 36 states (range for number of hospitals associated with a parent IDS, 1-23) (eFigure; http://www.jamasurg.org). Because we excluded from analysis facilities that performed fewer than 30 of the procedures of interest during the study interval, the final hospital sample sizes for CABG, hip replacement, back surgery, and colectomy were 167 (affiliated with 86 IDSs), 307 (89 IDSs), 209 (87 IDSs), and 240 (87 IDSs), respectively. We refer to these hospitals throughout the article as IDS-affiliated hospitals.

IDENTIFICATION OF COMPARISON HOSPITALS

Next, we identified a comparison sample of hospitals that possessed structural characteristics similar to our sample of IDS-affiliated hospitals but that did not have an IDS affiliation in 2007. To do this, we used data from the American Hospital Association to implement a propensity score-matching approach that identified an equally sized sample of non–IDS-affiliated hospitals (for each procedure) that matched as closely as possible with hospitals in our IDS sample for case volume, bed size, Medicare discharges, and teaching hospital status. On the basis of this approach, the non–IDS-affiliated hospital sample sizes for CABG, hip replacement, back surgery, and colectomy were 167, 307, 209, and 240, respectively.

PRIMARY OUTCOMES

We defined 2 categories of outcomes for this analysis: quality and episode payments. Our measures of quality have been described previously and include operative mortality, postoperative complications, and readmissions. We defined operative mortality as death occurring within 30 days or before discharge from the index surgical hospitalization. Consistent with prior work, complications were ascertained using a subset of serious complications from the Complication Screening Project of Iezzoni et al.

As described previously, we also measured total and component Medicare payments for the surgical episode. We defined surgical episodes as starting on the date of admission for the procedure of interest and continuing until 30 days after the date of hospital discharge. We divided the total payment data into 4 discrete categories: index hospitalization, readmissions, physician services, and postdischarge care. To adjust for intentional variations in Medicare payments (ie, differences in compensation based on regional wages, teaching medical trainees, and caring for underinsured patients, among other factors), payments were also price standardized using methods described previously.

STATISTICAL ANALYSES

As a first step, we used χ² and t tests to compare characteristics of the hospitals and patients in our 2 samples. With patients as the unit of analysis, we then fit procedure-specific multivariable regression models to estimate associations between our quality and cost outcomes and treatment in an IDS-affiliated hospital. We implemented generalized estimating equations or random-effects models to account for clustering of patients within hospitals, and we adjusted the models for patient characteristics, including age, sex, race, admission acuity, comorbidity, and preoperative length of stay. In an effort to account for unmeasured differences in illness severity, we also adjusted for each patient’s Medicare expenditures in the 6 months preceding surgery. Finally, we included in our models several measurable hospital characteristics, including bed size, Medicare discharges, teaching status, and procedure-specific case volumes.

From the cost models, we also calculated for each procedure the case mix–adjusted and price-standardized total and component episode payments for patients treated in IDS-affiliated compared with non–IDS-affiliated hospitals.

We performed all analyses using SAS computerized statistical software, (version 19; SAS Institute, Inc), at the .05 significance level. The University of Michigan Health Sciences and Behavioral Sciences institutional review board determined that this study was exempt from its review.

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The IDS-affiliated hospitals were slightly lower capacity for annual Medicare discharges (Table 1). The mean case volumes were evenly matched across hospitals, both overall (Table 1) and for the procedure-specific cohorts (data not shown).

Although the differences were generally small in magnitude and dependent on procedure, patients treated in IDS hospitals varied from those treated in non-IDS centers according to several characteristics, including race, admission acuity, and comorbidity (Table 2).

In terms of quality measures, unadjusted rates for the individual procedures ranged from 0.6% (hip replacement) to 7.3% (colectomy) for operative mortality, 4.2% (hip replacement) to 7.3% (colectomy) for operative mortality, 4.2% (hip replacement) to 7.3% (colectomy) for postoperative complications, and 8.3% (hip replacement) to 22.7% (CABG) for readmissions.

Adjusted rates for measures of quality were generated and compared with non-IDS hospitals (generally similar for patients treated in IDS hospitals compared with non-IDS hospitals). Adjusted rates for measures of quality were generated and compared with non-IDS hospitals (generally similar for patients treated in IDS hospitals compared with non-IDS hospitals).

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was generally similar for patients treated in IDS and non-IDS hospitals. Total and component episode costs for patients treated in IDS-affiliated hospitals were also largely indistinguishable from those for patients undergoing surgery in non–IDS-affiliated facilities. The one exception was hip replacement, where total payments for patients treated in IDS-affiliated hospitals were approximately $1,000 lower per episode than for patients undergoing the same procedures in comparison hospitals. A major driver of this overall payment difference for hip replacements was smaller outlays for postdischarge care among patients treated in IDS hospitals. 

There are several potential reasons why the benefits observed with IDSs in the ambulatory setting may not translate to complex inpatient surgical care. In particular, the advantages of IDSs for chronic disease care may stem in large part from the availability of shared infra-

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**Table 3. Total and Component Medicare Payments for Surgical Episodes According to Hospital Affiliation With an IDS**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>IDS-Affiliated Hospitals</th>
<th>Non–IDS-Affiliated Hospitals</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total episode</td>
<td>44,799</td>
<td>44,956</td>
<td>−247</td>
</tr>
<tr>
<td>CABG</td>
<td>21,999</td>
<td>22,931</td>
<td>−932</td>
</tr>
<tr>
<td>Back surgery</td>
<td>35,877</td>
<td>36,289</td>
<td>−411</td>
</tr>
<tr>
<td>Colectomy</td>
<td>24,428</td>
<td>24,678</td>
<td>−250</td>
</tr>
<tr>
<td>Readmission care</td>
<td>22,222</td>
<td>22,050</td>
<td>172</td>
</tr>
<tr>
<td>Physician services</td>
<td>17,757</td>
<td>17,616</td>
<td>140</td>
</tr>
<tr>
<td>CABG</td>
<td>2,352</td>
<td>2,288</td>
<td>63</td>
</tr>
<tr>
<td>Hip replacement</td>
<td>833</td>
<td>788</td>
<td>45</td>
</tr>
<tr>
<td>Back surgery</td>
<td>1,572</td>
<td>1,542</td>
<td>31</td>
</tr>
<tr>
<td>Colectomy</td>
<td>1,216</td>
<td>1,301</td>
<td>85</td>
</tr>
<tr>
<td>Physician services</td>
<td>5,450</td>
<td>5,416</td>
<td>34</td>
</tr>
<tr>
<td>Hip replacement</td>
<td>2,423</td>
<td>2,521</td>
<td>−98</td>
</tr>
<tr>
<td>Back surgery</td>
<td>6,192</td>
<td>6,215</td>
<td>−23</td>
</tr>
<tr>
<td>Colectomy</td>
<td>3,181</td>
<td>3,337</td>
<td>−156</td>
</tr>
<tr>
<td>Postdischarge care</td>
<td>3,874</td>
<td>4,151</td>
<td>−278</td>
</tr>
<tr>
<td>Hip replacement</td>
<td>6,330</td>
<td>7,145</td>
<td>−815</td>
</tr>
<tr>
<td>Back surgery</td>
<td>5,891</td>
<td>6,482</td>
<td>−592</td>
</tr>
<tr>
<td>Colectomy</td>
<td>2,273</td>
<td>2,423</td>
<td>−150</td>
</tr>
</tbody>
</table>

Abbreviations: CABG, coronary artery bypass grafting; IDS, integrated delivery system. 

$ Payments are price standardized and case mix adjusted. Index hospitalization is the first hospitalization in which the primary diagnosis would be treated by one of the specified procedures. 

For total episode payments, the only significant difference between IDS-affiliated and non–IDS-affiliated hospitals was among patients undergoing hip replacement ($P < .05$).
Second, our analyses include only a sample of hospitals; it is possible that our findings do not generalize to the entire population of IDS-affiliated hospitals in the United States. Nevertheless, we analyzed a large number of hospitals affiliated with prominent IDSs from across the United States and, as such, our results provide useful insight regarding potential benefits associated with this organizational structure for patients in need of complex, hospital-based care.

Third, because our study was based on administrative data, we also cannot exclude the possibility that our findings are attributable to residual (ie, unmeasured) differences in illness severity across patients treated in IDS-affiliated vs non–IDS-affiliated hospitals. To minimize this risk, we applied several restrictions aimed at making our procedure cohorts as homogeneous as possible, while also adjusting for several measurable patient characteristics, including comorbidities and expenditures in the 6 months before surgery. An additional limitation is our exclusion of beneficiaries enrolled in Medicare managed care plans. To the extent that managed care enrollment is not distributed randomly across IDS-affiliated vs non–IDS-affiliated hospitals, this exclusion could bias our principal findings.

These limitations notwithstanding, our findings have implications for CMS, policymakers, hospitals, and other stakeholders involved in developing and evaluating ACO programs. In reality, it seems somewhat unlikely that reforms aimed at stimulating improvements through greater care coordination and integration will reduce mortality or complications after major inpatient surgery. In contrast to patients with chronic medical conditions, moreover, readmissions after inpatient surgery often reflect the occurrence of complications rather than breakdowns in care coordination or transitions. Thus, for inpatient surgery, improvements in both quality and cost-efficiency are likely to require adjuncts to the payment reforms and shared accountability at the heart of current ACO programs. Given their success to date, payers, policymakers, hospitals, and ACO leadership should consider supporting clinician participation in specialty-based regional collaborative improvement programs as a complementary strategy for reducing morbidity, mortality, and expenditures associated with complex inpatient surgery.23,24

At the same time, however, empiric confirmation that episode costs for hip replacement are lower at IDS-affiliated hospitals provides at least some evidence that accelerating care integration via ACO formation could lead to reduced costs, even with inpatient surgery. Moreover, because outlays for postdischarge care explained most of the difference in hip replacement payments for IDS-affiliated hospitals compared with non–IDS-affiliated hospitals, our results are also informative for CMS and other payers as they move toward implementation of bundled payments around episodes of inpatient surgery. Namely, it seems that payers will have incentives to include expenditures for home health, rehabilitative, nursing, and other services provided after hospital discharge in the payment bundle for inpatient operations, particularly for orthopedic procedures.

Finally, although these data provide useful preliminary insight regarding the relationship between delivery system integration and surgical costs and quality, they also highlight the need to better understand specific attributes of IDSs (eg, governance, physician leadership, and clinical and/or economic integration) that correlate with greater quality and cost-efficiency, as well as the technical processes of care used by high-performing surgeons and hospitals. Identification of these factors would not only allow them to be rewarded by payers and policymakers but could also facilitate exportation of key determinants of high-quality and cost-efficient inpatient care to emerging ACOs.

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Conflict of Interest Disclosure: Dr Birkmeyer has an equity interest in ArborMetrix, Inc, a company that provides software and analytics for assessing hospital quality and efficiency. Dr Miller serves as a paid consultant for UnitedHealth Care (all payments have been donated to the resident education fund in the Department of Urology at University of Michigan).

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Online-Only Material: The eFigure is available at http://www.jamasurg.com.

REFERENCES

Accountable Care Organizations in Surgery

**Location, Location, Location**

Accountable care organizations (ACOs) are a key component of the health care reform legislation, which some believe will improve quality and reduce costs. Findings from prior studies have shown that the quality improvement effect, although small, is real. However, given their use of risk sharing and capitated care payments for common inpatient procedures: implications for episode-based payment bundling. Health Serv Res. 2010;45(6 pt 1):1783-1795.


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