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RESEARCH ARTICLE

A Comparative Study of Quality Outcomes in Freestanding Ambulatory Surgery Centers and Hospital-Based Outpatient Departments: 1997–2004

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Research Objective. To compare quality outcomes from surgical procedures performed at freestanding ambulatory surgery centers (ASCs) and hospital-based outpatient departments (HOPDs).

Data Sources. Patient-level ambulatory surgery (1997–2004), hospital discharge (1997–2004), and vital statistics data (1997–2004) for the state of Florida were assembled and analyzed.

Study Design. We used a pooled, cross-sectional design. Logistic regressions with time fixed-effects were estimated separately for the 12 most common ambulatory surgical procedures. Our quality outcomes were risk-adjusted 7-day and 30-day mortality and 7-day and 30-day unexpected hospitalizations. Risk-adjustment for patient demographic characteristics and severity of illness were calculated using the DCG/HCC methodology adjusting for primary diagnosis only and separately for all available diagnoses.

Principal Findings. Although neither ASCs nor HOPDs performed better overall, we found some difference by procedure that varied based on the risk-adjustment approach used.

Conclusions. There appear to be important variations in quality outcomes for certain procedures, which may be related to differences in organizational structure, processes, and strategies between ASCs and HOPDs. The study also confirms the importance of risk-adjustment for comorbidities when using administrative data, particularly for procedures that are sensitive to differences in severity.

Key Words. Quality, mortality, hospitalization, outpatient surgery, risk adjustment

Over the past few decades, several factors including improvements in medical technology, anesthesia, and pain management have facilitated the push of surgical services to outpatient facilities (Medicare Payment Advisory

Commission [MedPAC] 2004; Shugarman et al. 2004; Wynn 2004). Today, up to 70 percent of all surgeries performed in the United States take place in the ambulatory setting (MedPAC 2004). Medicare spending on outpatient services has dramatically increased for hospital-based outpatient departments (HOPDs) and freestanding ambulatory surgery centers (ASCs) between 1993 and 2003 (MedPAC 2004). Despite these recent trends and the Institute of Medicine's (2000) suggestion to focus research on adverse events in the outpatient setting, little comparative research on quality outcomes exists. The current study compares quality outcomes for ASCs and HOPDs.

To date, a limited number of studies have examined quality outcomes by location of outpatient care and yielded mixed findings. Vila et al. (2003) compared office-based and ASC-based mortality and found a 10-fold increased death rate in office settings in Florida. These results have been questioned in a reanalysis of the same data by Hancox et al. (2004) and by Venkat et al. (2004). We identified only two studies by Fleisher et al. (2004) and Fleisher, Pasternak, and Lyles (2007) that examined patient outcomes in settings that included both ASCs and HOPDs. Fleisher et al. (2004) used Medicare data to study quality outcomes following 16 combined outpatient procedures. After adjusting for patient demographics and the Charlson comorbidity index, patients treated at HOPDs were at an increased risk of 7-day mortality, emergency department visits, and hospitalization.

The current study builds on previous work, but is different in several important ways. First, using large patient-level, all payer claims data allowed us to study quality outcomes for each of the 12 most common outpatient procedures performed at ASCs and HOPDs in Florida during the 1997–2004 period. Second, we compared outcomes individually for these procedures in order to explicitly examine whether ASCs or HOPDs perform better for certain types of procedures. Third, we used the literature on specialty facilities (especially studies relevant to ASCs) and general hospitals to conceptualize on whether ASCs or HOPDs may provide superior quality care. Fourth, we utilized the Diagnostic Cost Groups/Hierarchical Condition Categories

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(DCG/HCC) for risk-adjustment. Finally, using the DCG/HCC, we applied multiple approaches to risk-adjustment to address the issue of nonreporting of secondary diagnoses in ambulatory surgical data.

BACKGROUND

There are several theoretical reasons why ASCs would have better quality of care when compared with HOPDs. On the other hand, HOPDs have certain characteristics that may give them an advantage over ASCs with respect to quality. In this section, we begin by describing reasons why ASCs may perform better. These reasons include favorable selection of patients, specialization and increased volume for select procedures, newer facilities equipped with the latest technologies, and better staffing. Next, we describe the characteristics of HOPDs and why by virtue of their hospital affiliation, they may potentially have higher quality of care.

Physicians, who are commonly owners of ASCs, may engage in favorable selection of patients because they are more likely to refer relatively healthy patients to their facilities for treatment (Devers, Brewster, and Ginsburg 2003). Sicker and more complex patients may be referred to hospitals because additional resources are present there that may be needed to care for these patients. If favorable selection of patients occurs in ASCs and not fully accounted for by risk-adjustment, ASCs may be portrayed as having better outcomes.

ASCs are also more likely to specialize on certain types of outpatient procedures (MedPAC 2004). This specialization may increase the procedural volume for these procedures and may result in improved patient outcomes (Devers, Brewster, and Ginsburg 2003; Casalino, Devers, and Brewster 2003; Shactman 2005). A well-established body of inpatient literature has found a strong relationship between hospital procedural volume and improved patient outcomes (Chowdhury, Dagash, and Pierro 2007). If a similar relationship exists in the outpatient setting, ASCs would have an advantage for quality.

ASCs tend to have newer and more technologically advanced facilities. Equipped with clinical information systems, these facilities may stimulate the development of effective processes, better coordination and communication among staff, and development of patient-centered organizational cultures (Casalino, Devers, and Brewster 2003; Devers, Brewster, and Ginsburg 2003). All of these factors may have a positive effect on quality of care at ASCs.

Despite ASCs characteristics, HOPDs may have better quality outcomes due to an affiliation with a hospital or larger system. Having access to a hospital's financial and organizational resources may provide HOPDs with the necessary components to improve their quality of care. Additionally, HOPDs associated with health systems are more likely to benefit from system-led patient safety programs, including those that focus on increasing procedural volume for selected ambulatory procedures.

Specifically, previous research found that hospital financial performance was associated with investment in the physical plant, updated equipment, and robust information technology in hospitals, which may be related to improvements in quality performance (Burke et al. 2002; Chaudhry et al. 2006; Menachemi et al. 2006; Bazzoli et al. 2007). Additionally, by virtue of their location, HOPDs have access to other organizational resources such as emergency and intensive care services, advanced anesthesia care, subspecialty care when needed, and/or the ability to immediately transfer patients to other clinical departments or providers. HOPDs may also be affiliated with teaching hospitals that are known to readily engage in quality improvement activities (Hartz et al. 1989; Silber et al. 1995; Mitchel and Shortell 1997; Frezza et al. 2000; Ayanian and Weissman 2002). Together, these characteristics may help HOPDs outperform ASCs with respect to quality of care.

Also, HOPDs that are a part of health systems may use system-wide strategies to improve their overall financial and quality performance (Jiang, Friedman, and Begun 2006; Bazzoli et al. 2000). These strategies may include integration of certain clinical areas, services, and departments (Gillies et al. 1993; Devers et al. 1994; Shortell et al. 2000). Improved coordination of clinical services and integrated processes of care delivery between outpatient and other departments may improve HOPDs quality performance (Shortell et al. 2000). Additionally, large health systems are more likely to pursue specific patient-centered programs, such as Continuous Quality Improvement (CQI), which can positively affect outcomes at HOPDs (Shortell, Bennett, and Byck 1998).

For select ambulatory procedures, HOPDs may actually secure high volumes through several mechanisms. Hospitals may be solo providers of some procedures in certain local markets, especially in rural areas. Given hospitals' market position and commitment to quality improvement programs, private payers may exclusively contract with hospitals for select outpatient services. Hospitals may also redesign their outpatient departments by "specializing" their operating suites (i.e., providing a "limited service" focus) for certain outpatient procedures. Hence, higher procedural volumes for some procedures in HOPDs may lead to improved patient outcomes (Begg et al. 2002).

METHODS

Data and Variables

Three patient-level databases representing the 1997–2004 period were used in this study. The ambulatory patient discharge and the inpatient hospital discharge datasets were obtained from the Florida Agency for Health Care Administration (AHCA), and vital statistics data were obtained from the Florida Department of Health.

The ambulatory discharge data contain unique patient identification numbers, demographic characteristics, primary and up to four secondary diagnoses as classified by International Classification of Diseases (ICD-9), procedure codes based on Current Procedural Terminology (CPT), payer type, and location of care (freestanding ASCs or HOPDs) for all outpatient encounters. Using unique patient identifiers, the ambulatory discharge data were merged with the inpatient and vital statistics datasets. The inpatient hospital discharge data include information on all admissions to acute-care hospitals in Florida. The vital statistics dataset is the state's death registry. Additionally, organizational-level descriptors of ASCs and HOPDs were obtained from the AHCA and the American Hospital Association Annual Survey for 2004, respectively.[1]

We chose to study the 12 most common procedures that were performed in Florida's ASCs and HOPDs during the period 1997–2004. These procedures include arthroscopy, biopsy of the liver, biopsy of the prostate, cataract removal, central venous catheterization, colonoscopy, debridement of skin and other tissues, upper gastrointestinal endoscopy, laparoscopic cholecystectomy, laparoscopic occlusion and fulguration of oviducts, spinal injection for myelography and/or computed tomography, and repair of inguinal hernia. The related CPT codes were grouped together to represent each aggregated procedure (Appendix A).

Approximately 18.9 million outpatient encounters were registered in Florida during the study period, 7,638,680 (about 40 percent) of which were for the 12 study procedures in adult patients (18 years of age and older). We excluded 41,172 observations (0.5 percent) that did not meet our criteria described below, so our sample totaled 7,597,508 observations.

Dependent Variables

We used 7- and 30-day binary variables for mortality and unexpected hospitalization calculated from the date of ambulatory surgery as our quality indicators. Mortality is a quality indicator commonly used in the inpatient setting

(Chowdhury, Dagash, and Pierro 2007). Even though mortality related to the ambulatory surgical setting is rare (Shnaider and Chung 2006), this indicator was used to flag potential quality problems associated with ambulatory surgery (Fleisher et al. 2004, 2007). Shnaider and Chung (2006) proposed unexpected hospital admission as an easily identifiable quality indicator and important outcome measure in the ambulatory surgical setting because it reflects perioperative complications, adds to health care cost, and is disruptive for patients. We used 7-day indicators since as a shorter measure it can reduce the effects of extraneous factors unrelated to outpatient procedures (Fleisher et al. 2004). However, in some instances, it may take longer time for a complication to develop: thus, 30-day indicators were used as well (Warner, Shields, and Chute 1993; Gold et al. 1998; Mezei and Chung 1999; Fleisher et al. 2004, 2007).

In order to distinguish between mortality and hospitalization outcomes, and between different primary procedures, we created an individual data set for each quality outcome and for each procedure. We treated each procedure as a separate event performed on that encounter for each patient, and we also counted adverse outcomes only once in cases when the same patients had multiple encounters for the same procedure. For example, if a patient had two arthroscopies and later died within a 30-day period, his/her mortality could only be counted once (this most commonly occurred for cataract extractions, arthroscopies, and debridements). However, if a patient had a colonoscopy and later a central venous catheterization, this would be represented in two separate data sets.

Given that not all postambulatory discharge mortality and hospitalizations are associated with a given ambulatory procedure, the research team of physicians and researchers discussed each mortality or admission diagnosis category, and, with a high degree of agreement, determined unrelated categories for exclusion. For example, suicides and homicides were excluded as mortality outcomes, and ambulatory patients who later were hospitalized for drug use, HIV/AIDS, or psychiatric disorders were excluded as hospitalization outcomes, because they were likely unrelated to the studied procedures.

Independent Variables and Risk Adjustment

A key independent binary variable was constructed to compare ASCs and HOPDs with respect to quality outcomes. In our analyses, HOPD served as the reference category.

We utilized a continuous measure of severity (i.e., risk scores) that was generated by *Risk*Smart *Stand Alone* V.2.1 software, using the DCG/HCC methodology (DxCG 2005). The DCG/HCC uses all available diagnosis codes (ICD-9-CM) and classifies them in clinically homogeneous and meaningful groups named condition categories (CCs) (Ash et al. 2003; Pope et al. 2004; Petersen et al. 2005; DxCG 2005). The CCs are then hierarchically grouped by severity (HCC) and ranked according to their historical and empirically determined diagnostic costs (i.e., DCG/HCC) (Ash et al. 2003; Pope et al. 2004; Petersen et al. 2005; DxCG 2005). Patients with multiple diagnoses are assigned into a single group with the highest hierarchy, where higher group number indicates increasing severity (Ash et al. 2003; Pope et al. 2004; Petersen et al. 2005; DxCG 2005). These groups are then translated into risk scores by the *Risk*Smart software.

The DCG/HCC method was previously validated in outcomes research that suggested it had better predictive power than other related administrative methodologies (i.e., the Charlson index, the Adjusted Clinical Groups) and self-reported risk-adjustment methods (Ash et al. 2003; Pope et al. 2004; Petersen et al. 2005; Maciejewski et al. 2005). Moreover, the Centers for Medicare and Medicaid Services (CMS) used the DCG/HCC for risk-adjustment in Medicare+Choice capitation payments because the method was deemed transparent, easy to modify, and had good clinical coherence (Pope et al. 2004).

In our ambulatory data, we found that fewer secondary diagnoses were reported among ASCs compared with HOPDs. Furthermore, some ASCs, at least in some years, did not report secondary diagnoses at all during the study period. Thus, we addressed the problem of potential nonreporting of comorbidities by comparing results from models that were risk adjusted using primary diagnosis only with models using all available secondary diagnoses for risk adjustment.

We generated risk scores in two ways. The first set adjusted for primary diagnosis only, while the second set of risk scores adjusted for all available primary and secondary diagnoses. The state-wide average risk scores equaled 1.35 when adjusting for primary diagnosis only and 1.66 when adjusting for all available diagnoses. These state-wide average risk scores were scaled down to 1.00 and the procedure-specific risk scores were modified accordingly to make easy comparisons of descriptive findings.

Given that we used all outpatient encounters in Florida to compute risk scores, the risk scores predicted the severity of illness for each patient relative to that of the average ambulatory patient in Florida for every study year (1997–2004). Hence, relative risk scores above the average represented increased severity, and scores below the average represented decreased severity (Winter

2003; DxCG 2005). To estimate the effects of nonreporting of secondary diagnoses on comparative quality outcomes, we separately estimated regression models for these different types of risk-adjusters, and therefore, two sets of findings are compared.

All regressions included the same independent variables. Patient age was categorized into five groups (18–49 [the reference group], 50–64, 65–74, 75–84, 85, or greater). Race/ethnicity was coded as white (the reference group), African American, Hispanic, or other (including unknowns). We also included a binary variable for sex (female as reference). Patient insurance types included Commercial/PPO (the reference group), Medicare, Medicare HMO, Medicaid, Medicaid HMO, HMO, self-pay, or other. We also controlled for changes over time common to both ASCs and HOPDs by including a set of dummy variables for each year between 1997 and 2004 in our analyses.

Statistical Analysis

We used a pooled, cross-sectional design and compared the estimated differences between ASC and HOPDs with adjusted odds ratios generated from logistic regressions. In all, 96 models were estimated separately for each of the four quality outcomes (7- and 30-day mortality and unexpected hospitalization), 12 procedures, and two types of risk scores (adjusting for primary diagnosis only or all available diagnoses). All models also adjusted for the clustering of outcomes within the same facility. Lastly, analyses of the data were approved by our university Institutional Review Board.

RESULTS

We present the descriptive results showing the distribution of procedures and patient characteristics by location of care in Table 1. We then present the overall severity scores for patients in the current study. We also contrast the risk scores calculated using two different risk-adjustment approaches (i.e., adjusting for primary diagnosis only or for all available diagnoses) (Table 2). Lastly, we synthesize the findings from the regression models and compare results for the two risk-adjustment approaches (Tables 3 and 4).

Descriptive Findings

Information in Table 1 shows that arthroscopy, colonoscopy, and upper gastrointestinal endoscopy were commonly provided in approximately equal numbers in both ASCs and HOPDs. However, biopsies of the prostate and

Table 1: Cumulative Number of Procedures and Patient Demographic Characteristics by Facility Type (1997–2004)

	Ambulatory Surgery Centers (ASC)	*Hospital-Based Outpatient Departments (HOPD)*
Procedures		
Colonoscopy	1,481,157 (52.1%)	1,361,963 (47.9%)
Cataract	1,741,784 (84.1%)	328,408 (15.9%)
Upper gastrointestinal endoscopy	632,515 (46.2%)	736,899 (53.8%)
Debridement of skin and other tissues	3,759 (0.9%)	435,929 (99.1%)
Arthroscopy	183,000 (50.0%)	183,309 (50.0%)
Repair of inguinal hernia	34,284 (22.9%)	115,283 (77.1%)
Central venous catheterization	9,183 (8.9%)	93,730 (91.1%)
Laparoscopic cholecystectomy	2,988 (3.0%)	97,092 (97.0%)
Biopsy of liver	1,897 (2.4%)	76,853 (97.6%)
Laparoscopic occlusion and fulguration of oviducts	21,494 (29.2%)	52,212 (70.8%)
Biopsy of prostate	43,258 (64.2%)	24,082 (35.8%)
Spinal injection for myelography and/or computed tomography	2,077 (3.7%)	54,274 (96.3%)
Patient age		
18–49	392,098 (38.3%)	631,438 (61.7 %)
50–64	552,942 (46.3%)	640,845 (53.7%)
65–74	569,165 (56.7%)	435,314 (43.3%)
75–84	439,329 (60.9%)	281,617 (39.1%)
85 or greater	91,156 (58.7%)	64,189 (41.3%)
Patient race/ethnicity		
White	1,452,216 (48.0%)	1,576,596 (52.0%)
Black	88,522 (34.0%)	171,987 (66.0%)
Hispanic	147,589 (41.2%)	210,913 (58.8%)
Other	356,500 (79.1%)	93,964 (20.9%)
Patient gender		
Male	898,010 (48.9%)	938,491(51.1%)
Female	1,146,817 (50.7%)	1,114,969 (49.3%)
Payer		
Medicare	897,832 (59.5%)	612,007 (40.5%)
Medicare HMO	55,834 (31.3%)	122,429 (68.7%)
Medicaid	30,759 (36.3%)	54,083 (63.8%)
Medicaid HMO	4,374 (15.4%)	24,042 (84.6%)
Commercial/PPO	664,156 (51.4%)	627,337 (48.6%)
HMO	251,665 (35.4%)	459,549 (64.6%)
Self pay	30,532 (43.6%)	39,484 (56.4%)
Other payer	109,675 (48.9%)	114,529 (51.1%)

Note: All patient demographic differences between ASCs and HOPDs were statistically significant at a 0.01 significance level.

Table 2: Relative Risk Scores for Patients Undergoing Outpatient Procedures by Facility Type (1997–2004)

	Risk Scores Adjusted for Primary Diagnoses Only			*Risk Scores Adjusted for Primary and All Secondary Diagnoses*			*Percent Patients with Reported Secondary Diagnoses*	
Procedure	*ASC*	*HOPD*	*p-Value**	*ASC*	*HOPD*	*p-Value**	*ASC*	*HOPD*
1. Colonoscopy	0.83	0.82	<.0001	0.66	0.84	<.0001	44.78	88.15
2. Cataract	1.20	1.18	<.0001	1.00	1.39	<.0001	8.68	59.87
3. Upper gastrointestinal endoscopy	0.92	0.90	<.0001	0.82	1.05	<.0001	47.13	89.05
4. Debridement of skin and other tissues	1.51	2.89	<.0001	1.74	4.45	<.0001	30.20	65.81
5. Arthroscopy	0.62	0.61	<.0001	0.52	0.69	<.0001	61.07	85.54
6. Repair of inguinal hernia	0.71	0.70	.0409	0.47	0.68	<.0001	15.28	52.27
7. Central venous catheterization	4.39	5.08	<.0001	5.50	7.02	<.0001	35.82	65.63
8. Laparoscopic cholecystectomy	0.48	0.55	<.0001	0.31	0.57	<.0001	30.22	59.85
9. Biopsy of liver	0.85	2.28	<.0001	0.77	2.91	<.0001	31.70	51.60
10. Laparoscopic occlusion & fulguration of oviducts	0.19	0.19	.8270	0.01	0.10	<.0001	32.36	47.54
11. Biopsy of prostate	1.13	1.24	<.0001	0.98	1.21	<.0001	28.70	62.67
12. Spinal injection for myelography and/or computed tomography	1.29	1.26	.0725	1.22	1.19	.0928	55.33	65.54
13. Overall average for 12 procedures	1.18	1.47		1.17	1.84		35.11	66.13

Note: **t*-tests compare means of relative risk scores for ASC and HOPD.

Table 3: Summary Findings of Quality Performance by Facility Type, Reporting Odds Ratios and Confidence Intervals with Risk Adjustment for Primary Diagnosis Only

	Mortality (1997–2004)		*Hospital Admission (1997–2004)*	
	7-Day	*30-Day*	*7-Day*	*30-Day*
1. Colonoscopy			HOPD 1.28 (1.18–1.39)‡	
2. Cataract		ASC 0.84 (0.73–0.98)*		ASC 0.87 (0.82–0.93)‡
3. Upper gastrointestinal endoscopy	ASC 0.66 (0.52–0.84)‡	ASC 0.73 (0.64–0.84)‡		ASC 0.88 (0.83–0.93)‡
4. Debridement of skin and other tissues			HOPD 2.11 (1.67–2.67)‡	HOPD 2.04 (1.68–2.46)‡
5. Arthroscopy			HOPD 1.24 (1.08–1.41)†	
6. Repair of inguinal hernia			HOPD 1.50 (1.26–1.79)‡	
7. Central venous catheterization			HOPD 1.40 (1.18–1.67)‡	
8. Laparoscopic cholecystectomy			HOPD 1.76 (1.18–2.64)†	
9. Biopsy of liver				
10. Laparoscopic occlusion and fulguration of oviducts				HOPD 1.36 (1.10–1.68)†
11. Biopsy of prostate				
12. Spinal injection for myelography and/or computed tomography			ASC 0.18 (0.09–0.35)‡	ASC 0.18 (0.11–0.27)‡

Notes: Blank cells denote no statistically significant differences at the 0.05 significance level; ASC denotes that Ambulatory Surgical Centers were statistically significantly "better" quality performers in this category; HOPD denotes that hospital-based outpatient departments were statistically significantly "better" quality performers in this category.

*Significance level <0.05.

†Significance level <0.01.

‡Significance level <0.001.

cataract removals were provided mostly in ASCs, and the remaining seven procedures were performed predominantly in HOPDs.

Overall, a higher proportion of patients in the 18–49 and 50–64 age categories received care in HOPDs (Table 1), but older patients received care

Table 4: Summary Findings of Quality Performance by Facility Type, Reporting Odds Ratios and Confidence Intervals with Risk Adjustment for All Available Diagnoses

	Mortality (1997–2004)		*Hospital Admission (1997–2004)*	
	7-Day	*30-Day*	*7-Day*	*30-Day*
1. Colonoscopy			HOPD 1.46 (1.34–1.58)‡	HOPD 1.16 (1.10–1.22)‡
2. Cataract			HOPD 1.14 (1.04–1.25)‡	
3. Upper gastrointestinal endoscopy		ASC 0.87 (0.76–0.99)*	HOPD 1.10 (1.02–1.18)*	
4. Debridement of skin and other tissues			HOPD 2.23 (1.77–2.81)‡	HOPD 2.19 (1.82–2.64)‡
5. Arthroscopy			HOPD 1.30 (1.13–1.49)‡	
6. Repair of inguinal hernia			HOPD 1.69 (1.41–2.03)‡	HOPD 1.25 (1.10–1.42)‡
7. Central venous catheterization			HOPD 1.45 (1.22–1.73)‡	
8. Laparoscopic cholecystectomy			HOPD 1.88 (1.26–2.82)‡	
9. Biopsy of liver				
10. Laparoscopic occlusion and fulguration of oviducts			HOPD 1.38 (1.03–1.86)*	HOPD 1.39 (1.12–1.73)‡
11. Biopsy of prostate				
12. Spinal injection for myelography and/or computed tomography			ASC 0.18 (0.09–0.35)‡	ASC 0.18 (0.12–0.27)‡

Note: Blank cells denote no statistically significant differences at the 0.05 significance level; ASC denotes that Ambulatory Surgical Centers were statistically significantly "better" quality performers in this category; HOPD denotes that hospital-based outpatient departments were statistically significantly "better" quality performers in this category.

*Significance level <0.05.

‡Significance level <0.001.

more often in ASCs. Racial and ethnic distribution also varied by facility type; for example, nonwhites, received surgical care in HOPDs more frequently. Also, a greater percentage of Medicare patients (59.5 percent) and a slightly higher percentage of private patients (51.4 percent) received care at ASCs for the most common outpatient procedures. Patients in managed care plans and those covered by Medicaid were more likely to receive care in HOPDs. Each of these differences were significant at the $p < .01$ level.

The average risk scores by procedure for both types of risk adjustment are displayed in Table 2. The majority of patients (64.8 percent) were relatively healthy, having risk scores below 1.00. Average risk scores were elevated (i.e., above 1.00) for patients undergoing cataract removal, debridement of skin and other tissues, biopsy of prostate, and spinal injection for myelography and/or computed tomography. Patients receiving central venous catheterization had risk scores that were most above the average (Table 2).

Although we found higher risk scores in ACSs for five procedures when calculating risks based only on primary diagnosis (colonoscopy, cataract removal, upper gastrointestinal endoscopy, arthroscopy, and repair of inguinal hernia), the statistical significance of these differences may not be clinically meaningful and are likely due to the large sample sizes (Table 2).

The relationship between risk scores for ASCs and HOPDs for these five procedures (colonoscopy, cataract removal, upper gastrointestinal endoscopy, arthroscopy, and repair of inguinal hernia) reversed when we adjusted for all available diagnoses (Table 2). Also, for procedures in which HOPDs had higher risk scores adjusting for primary diagnosis only, the gap became greater when adjusting for all available diagnoses. These changes may reflect either lower severity of cases treated in ASCs or nonreporting of secondary diagnoses by ASCs, which underscores the importance of risk-adjusting with all available diagnoses.

Logistic Regression Models

Tables 3 and 4 present results generated from the regression models comparing ASC and HOPD quality performance across all studied procedures and both risk-adjustment approaches. For mortality outcomes in the models with both sets of risk scores (i.e., adjusting for primary diagnosis only and for all available diagnoses), there was no difference in performance between ASCs and HOPDs for 10 of the 12 procedures. For the two procedures where a difference existed (cataract removal and upper gastrointestinal endoscopy), the results were sensitive to the risk score used, and are discussed below.

For unexpected hospitalization outcomes, HOPDs performed consistently better in seven out of 12 procedures when risk-adjusted for primary diagnosis only (Table 3), and for nine out of 12 procedures when adjusting for all available diagnoses (Table 4). ASCs performed better for only one procedure (spinal injection for myelography and/or computed tomography), which stayed significant using both risk-adjustment approaches.

Results Sensitive to Risk-Adjustment

This section focuses on five procedures (cataract, colonoscopy, upper endoscopy, arthroscopy, and repair of inguinal hernia) for which the risk-adjustment method changed the results (Tables 3 and 4). For mortality outcomes, ASCs performed better for two procedures (cataract and upper gastrointestinal endoscopy) when risk-adjusted for primary diagnosis only, but the statistically significant results disappeared for certain outcomes when risk-adjustment included all diagnoses. Specifically, ASCs had significantly lower 7-day mortality than HOPDs for upper gastrointestinal endoscopy (OR = 0.66, CI: 0.52, 0.84) with the risk-adjustment for primary diagnosis only. In 30-day mortality models, the odds of dying were lower in ASCs after cataract removal (OR = 0.84, CI: 0.73, 0.98) and upper gastrointestinal endoscopy (OR = 0.73, CI: 0.64, 0.84) (Table 3). However, when we estimated the same models with risk scores adjusting for all available diagnoses, the only statistically significant difference remained for upper gastrointestinal endoscopy at 30 days (OR = 0.87, CI: 0.76, 0.99).

For unexpected hospitalizations risk-adjusted for primary diagnosis only, HOPDs performed better following three procedures (colonoscopy, arthroscopy, and repair of inguinal hernia) at 7-days, and ASCs performed better in the remaining two procedures (i.e., cataract removal and gastrointestinal endoscopy) with respect to 30-day hospitalizations (Table 3). When risk-adjusting with all available diagnoses, HOPDs performed better in all five procedures with respect to 7-day and 30-day hospitalizations (Table 4). Specifically, the odds of 30-day unexpected hospitalizations for procedures performed at ASCs were lower relative to HOPDs for cataract removal (OR = 0.87, CI: 0.82, 0.93) and gastrointestinal endoscopy (OR = 1.10, CI: 1.02, 1.18). These results became statistically insignificant, however, when all diagnoses were included in risk adjustment (Table 4). Furthermore, HOPDs showed outcomes that were significantly better for 7-day hospitalization for these procedures when we risk-adjusted using all available diagnoses (Table 4).

The adjusted odds ratios that suggested fewer hospitalizations in HOPDs increased in magnitude in the models that risk-adjusted for all available diagnoses (Table 4). For example, in the colonoscopy models, the odds ratio of 7-day hospitalization for colonoscopy performed in ASCs relative to HOPDs increased from 1.28 to 1.46 when using all available diagnoses for risk-adjustment (Tables 3 and 4).

DISCUSSION

In this study, there are two major sets of findings. First, we found that although neither organizational type (ASCs or HOPDs) performed better overall, there appear to be important differences in quality outcomes for certain procedures. These differences may be related to variations in organizational structures, processes, and strategies between ASCs and HOPDs. Second, we demonstrated the importance of risk-adjustment for all comorbidities when using administrative data, particularly for procedures that are sensitive to differences in severity of illness.

Differences in quality outcomes between ASCs and HOPDs may be related to the complexity of certain procedures and to the degree of specialization for others. For more complex procedures, HOPDs may have an advantage by being affiliated with hospitals. However, for one procedure, there is an indication that the increased specialization of ASCs may have resulted in decreased unexpected hospitalizations.

Patients treated at HOPDs had lower odds of unexpected hospitalization after undergoing colonoscopy, debridment of skin and other tissues, arthroscopy, repair of inguinal hernia, laparoscopic cholecystectomy, and laparoscopic occlusion and fulguration of oviducts in the models that used both types of risk-adjustment. These procedures require more invasive manipulations with probable involvement of complex clinical services and skills. Therefore, HOPDs may have hospital resources to prevent or decrease complications including unplanned hospitalizations. For example, HOPDs may mobilize emergency, anesthesia, high-tech services, or hospital specialists to care for patients experiencing complications during these outpatient procedures. Additionally, HOPDs may have adopted and followed certain hospital-wide surgical safety initiatives, treatment protocols, or guidelines that could potentially reduce complications requiring hospitalizations for their patients.

Conversely, ASCs had lower hospitalizations for spinal injection for myelography and/or computed tomography when risk-adjusting using both methods. ASCs may solely specialize in diagnostic imaging procedures, which potentially increase the volume of services, improve clinical processes and experiences, and result in better quality performance.

Our findings also make a methodological contribution, highlighting the importance of reporting and utilizing all secondary diagnoses for risk-adjustment. We found that for five procedures in particular, the exclusion of secondary diagnoses from the risk-adjustment method gave unstable results that may lead to misleading conclusions. These mixed findings may be explained by either the actual lower severity of cases treated in ASCs (possibly due to favorable selection), or by their nonreporting of secondary diagnoses, which would result in different conclusions about ASCs' quality performance relative to HOPDs.

If ASCs did in fact under-report comorbidities, several responses may explain this. ASCs may specialize in certain procedures (e.g., cataract removal), and thus have a narrower clinical outlook and do not need to take comorbid conditions into account in their treatment plan. In addition, ASCs may not have the incentive to report secondary diagnoses (if their payment does not take secondary diagnoses into account), nor the capacity to report more complex diagnostic information (e.g., lacking trained personnel who know how to assess and code comorbidities and procedures). Future research needs to estimate the effects of nonreporting on risk adjustment, and, consequently, on comparisons of quality outcomes for outpatient procedures performed in ASCs. Future research also needs to evaluate the effects of nonreporting of secondary diagnoses on ASC and HOPD payment mechanisms. This is particularly important given the current CMS proposal to change ASC payments from being based on historical costs to being aligned with the HOPD payment system that is based on the costs and clinical similarities of procedures (GAO 2006).

Several limitations should be considered in the interpretation of our results. Mortality and hospitalizations are rare events for patients undergoing an ambulatory procedure. Therefore, as standard errors become large, it becomes increasingly difficult to detect statistical differences when they exist. In addition, unexpected hospitalization may be affected by extraneous factors unrelated to the location of care such as patients' tendencies about when to seek help for adverse events. Moreover, the quality of administrative data relies on the accuracy of provider coding, which may be subject to bias (Romano and Mark 1994; Iezzoni 1997). Finally, despite the robustness of our data, our study is limited to a single state, so future research should validate the current findings using data from additional geographic locations.

Notwithstanding these limitations, several policy recommendations are proposed. Major payers, such as Medicare, should take into consideration providers' quality performance when determining reimbursement strategies and/or when directing beneficiaries to certain types of providers. Based on the results of this study, major purchasers of outpatient services may consider HOPDs for more invasive procedures (e.g., laparoscopic surgeries, repairs of inguinal hernia) in order to reduce costs associated with unplanned hospitalizations. Similarly, ASCs should be used for diagnostic procedures, such as spinal injection for myelography and/or computed tomography.

Lastly, efforts should be made to facilitate complete administrative data collection and reporting by all outpatient surgical providers, so that it is possible to identify and to direct patients to true high-quality performers. Accurate reporting of secondary diagnoses is also important for development of transparent and fair ambulatory surgical payment systems as major payers may start using diagnoses-based risk-adjustment methods, such as the DCG/HCC, for setting up their payment rates (GAO 2006).

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Note

1. In Florida, the majority of ASCs (93 percent) were for-profit organizations: 58.4 percent were corporately owned, 33.5 percent were partnerships, and 1.4 percent were individually owned. Ninety-six percent of ASCs were located in urban areas. During the study period, the number of ASCs increased from 204 to 286. On the other hand, the number of HOPDs has been steady over the same period ($n = 198$). Almost half of HOPDs (45.2 percent) were affiliated with for-profit hospitals. A total of 5.7 percent of HOPDs were part of teaching hospitals. The majority of HOPDs (87 percent) were located in urban areas. This information on ASCs and HOPDs in Florida follow similar trends in the national data (MedPAC, 2004).

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SUPPLEMENTARY MATERIAL

The following supplementary material for this article is available online:

Appendix A. Aggregation of Ambulatory Surgery Procedures into 12 Groups.

This material is available as part of the online article from: http://www.blackwell-synergy.com/doi/abs/10.1111/j.1475-6773.2007.00809.x (this link will take you to the article abstract).