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Surgical Quality among Medicare Beneficiaries Undergoing Outpatient Urologic Surgery

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Abstract

Introduction and objective—The cost-efficiency gains achieved from moving procedures to ASCs and the office may be mitigated if the quality of surgical care at these facilities is not comparable to that of the hospital. Motivated by this, we assessed short-term morbidity and mortality for patients by location of care.

Methods—Using a national sample of Medicare claims (1998 – 2006), we identified elderly beneficiaries who underwent one of 22 common outpatient urologic procedures. After determining the facility type at which each procedure was performed, we then measured 30-day mortality, unexpected admissions, and postoperative complications. Finally, we fit multivariable logistic regression models to evaluate the association between occurrence of an adverse event and the ambulatory setting where surgical care was delivered.

Results—Over the study period, there was a substantial increase in the frequency of nonhospital-based outpatient surgery. Compared to ASCs and the office, hospitals treated more women ($P<0.001$). Their patients also tended to be less healthy ($P<0.001$). While patients experienced fewer postoperative complications following surgery at an ASC, procedures performed outside the hospital were associated with a higher likelihood of a same-day admission [ASC: OR, 6.96 (95% CI, 4.44 – 10.90); office: OR, 3.64 (95% CI, 2.48 – 5.36)]. However, it is important to note that, with case-mix adjustment, the probability of any adverse event was exceedingly low across all ambulatory settings.

Conclusions—These data indicate that small, but measurable variation in surgical quality exists by location of care delivery.

Introduction

Of the 72 million surgical procedures performed annually in the United States, over 70% occur in an outpatient setting.¹ Although most occur in hospital outpatient departments,² improved technology and anesthesia have facilitated movement of many procedures away from the more expensive hospital environment to other outpatient facilities, including

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freestanding ASCs and the office. In 2009 alone, nearly 16 million surgical procedures were performed at these facilities.^{3, 4} While the trend towards delivery of surgical care in less resource-intensive practice settings may be associated with economic advantages, effects of this migration on surgical quality are uncertain.

In fact, there are at least two reasons to believe that surgical quality may vary by location of care. On one hand, hospitals have access to more organizational resources (e.g., intensive care services and the ability to immediately transfer patients to other clinical departments) than other outpatient facilities,⁵ which may help their performance. On the other hand, ASCs and the office tend to have a “limited-service” focus and are more likely than hospitals to specialize on certain types of procedures.⁶ Insofar as this specialization allows them to secure high procedural volumes, ASCs and the office may enjoy improved outcomes.^{7, 8}

To better understand the influence of location of care on surgical quality, we used national Medicare claims to examine risk-adjusted morbidity and mortality among patients undergoing common outpatient urologic procedures performed in hospitals, ASCs, and the office. The findings reported herein serve to inform policymakers and payers on the appropriateness of movement of patients and procedures from the more expensive hospital setting to lower-intensity outpatient facilities.

Methods

Subjects and databases

For our study, we analyzed a 5% national sample of Medicare beneficiaries (1998 – 2006). Using HCPCS codes, we identified patients 65 years and older with continuous enrollment in Medicare parts A and B who underwent endoscopic bladder, urethral, or ureteral surgery; microwave therapy for prostate enlargement; prostate biopsy; shockwave lithotripsy; urethral dilation; or urodynamic procedures (Appendix Table 1). We focused on these procedures for two reasons. Our preliminary analysis indicates that these procedures account for nearly 95% of all ambulatory urologic procedures. Furthermore, these procedures can be performed in each of the surgical locations of interest (i.e., hospitals, ASCs, and the office). Because services provided to Medicare Advantage patients are not consistently captured in claims files, we excluded these patients from our study.

Next, we developed a three-level categorical variable, specifying the location of care: (i.e., hospital, ASC, or office), using appropriate Place of Service codes from Medicare’s carrier file. We then determined the date of surgery from the surgeon’s claim. We considered each procedure as an independent event such that it was possible for some patients to have more than one procedure in our analysis.

Measures of surgical quality

From the Medicare files, we assessed rates of operative mortality, hospital admission, and postoperative complications. We defined operative mortality as death occurring within 30 days of surgery or death during hospitalization that began within 30 days of surgery.⁹ To determine rates of unexpected hospitalization, we considered both same-day admission (i.e., on the day of the procedure) and subsequent admission within 30 days of the procedure.¹⁰ We identified 30-day postoperative complications using ICD-9 CM diagnosis codes (Appendix Table 2).¹¹

Statistical Analysis

For our initial analytic step, we examined the distribution of procedures across outpatient surgery settings and how it changed over the study period. We then made comparisons

between patients based on the location where their procedure was performed. In particular, we examined differences between patients with respect to their age, gender, race (white, black, or other), comorbid status (assessed using an adaptation of the Charlson index¹²), and area of residence (Northeast, Midwest, South, or West), using appropriate parametric and nonparametric statistics.

Finally, we evaluated the relationship between surgical quality and the location where care was delivered. With the patient serving as our unit of analysis, we fit a series of multivariable logistic regression models for each of our binary outcomes. We accounted for case- mix differences, adjusting our models for those patient characteristics described above. Given the potential correlation of observations (i.e., multiple observations on the same subject and patients clustered within facilities), we used robust variance estimators.¹³ We used our full models to produce predicted probabilities of each adverse event.

We carried out all analyses using the SAS statistical package (SAS, version 9.1; SAS Institute, Cary, NC). All tests were two-tailed, and we set the probability of Type 1 error at 0.05. The Institutional Review Boards of the University of California at Los Angeles and the University of Michigan approved our study.

Results

Over the study period, surgical activity at ASCs and the office increased for nearly every procedure with a concomitant decline in hospital utilization. For instance, the frequency of ASC- and office-based endoscopic bladder surgery rose from 4.5% and 81.7% in 1998 to 8.2% and 85.1%, respectively, in 2006 (Figure 1). The one exception to this trend was shockwave lithotripsy, where procedure rates at each care setting remained relatively flat.

There were significant differences between patients with respect to their gender, race, level of comorbidity, and area of residence when stratified by outpatient surgery setting (Table 1). Specifically, women and black patients were less likely than men and white patients, respectively, to be treated at an ASC or in the office ($P<0.001$ for each comparison). In addition, lower acuity cases were concentrated at nonhospital facilities. For instance, the proportion of patients with a Charlson score of “0” was 59.1% at hospitals versus 82.6% and 62.9% at ASCs and in the office, respectively ($P<0.001$). There were also significantly more ambulatory surgery visits to ASCs and the office among patients who resided in the South ($P<0.001$).

On multivariable regression, male gender, increasing age, and level of comorbidity were associated with higher odds of an adverse event (Table 2). Compared with hospitals, rates of postoperative complication were significantly lower at ASCs (Table 2). However, procedures performed outside the hospital were associated with a higher likelihood of a same-day admission [ASC: OR, 6.96 (95% CI, 4.44 – 10.90); office: OR, 3.64 (95% CI, 2.48 – 5.36)]. After adjusting for case mix differences, the probability of an adverse event was low across all ambulatory surgery settings (Figure 2).

Discussion

Our findings highlight a national trend toward increased use of lower-intensity ambulatory settings for several common outpatient urologic procedures. Outcomes varied significantly by location of care with ASCs outperforming hospitals on one dimension of surgical quality—a difference likely related to favorable patient selection. While hospital-based surgery was associated with a lower rate of same-day admission, it is important to note that the probability of any adverse event was exceedingly low, regardless of location of care.

To date, much of the literature on ambulatory surgical care in nonhospital-based facilities has focused on the issue of physician ownership and overuse.^{14, 15} Little empirical work has assessed the relationship between surgical quality and the setting for ambulatory surgery. Our results are concordant with prior research, showing ASCs and hospitals to have similar risk-adjusted postoperative mortality.⁵ However, unlike Vila and colleagues,¹⁶ we found death rates at ASCs and the office to be both low and comparable. This finding may relate, in part, to increased state-level regulation of office-based surgery.¹⁷

We also observed more frequent same-day admissions following outpatient surgery in ASCs versus hospitals. This observation contrasts with that from a previous Medicare analysis.¹⁸ It may be a reflection of the limited organizational resources at ASCs. For instance, a cautious urologist could exercise clinical judgment and admit a less healthy patient following an ASC-based surgery because the hospital would be better equipped to handle problems if they occurred. Alternatively, it may reflect decreased staffing hours at ASCs or efficiency priorities, whereby urologists at these facilities have a lower threshold to admit patients in order to maximize throughput rather than holding on to them in the post-anesthesia care unit.

Our study has several limitations that merit further discussion. First, there is clear selection bias in our study population. While we attempted to adjust for differences in case mixes between hospitals, ASCs, and the office, it is entirely possible that urologists recommend certain settings based on information that is not readily available in billing claims. Second, we used HCPCS codes to identify procedures of interest. Medical coding, which is intended for billing and reimbursement, may not accurately reflect how complex a surgery was. To the extent that significant heterogeneity in procedure complexity exists within a given procedure code, this could also account for quality differences across locations of care. Third, we used Medicare claims exclusively for our analysis, and our findings may not be generalizable to nonelderly Americans.

Limitations notwithstanding, our study has both clinical and policy implications. From a clinical perspective, these data highlight the need to consider a patient's age and level of comorbidity when planning an outpatient procedure. As expected, we observed that older patients and those with more comorbid illnesses had higher odds of an adverse event. Being able to identify subgroups of patients at risk for an adverse event following ambulatory surgery will allow for more effective targeting of care delivery. From a policy perspective, large payers, like Medicare, may use our data to inform their payment systems for providers. For instance, they might consider directing patients to certain nonhospital-based facilities given the comparable quality that they provide.

Conclusions

In summary, we observed variation in surgical outcomes by location of care. However, adverse events following outpatient urologic surgery are exceedingly rare, regardless of location of care. Additional studies are needed to determine how episode costs vary across hospitals, ASCs, and the office. Insofar as ASCs and the office are more convenient for patients and/or increase surgeon productivity, these facilities may provide higher value care.

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Appendix

Appendix Table 1

Identifying the study population.

Procedure Type	HCPCS	Description
Endoscopic bladder surgery	51700	Bladder irrigation, simple, lavage and/or instillation
	52000	Cystourethroscopy (separate procedure)
	52310	Cystourethroscopy, with removal of foreign body, calculus, or ureteral stent from urethra or bladder (separate procedure); simple
	52204	Cystourethroscopy, with biopsy
	52214	Cystourethroscopy, with fulguration (including cryosurgery or laser surgery) of trigone, bladder neck, prostatic fossa, urethra, or periurethral glands
	52224	Cystourethroscopy, with fulguration (including cryosurgery or laser surgery) or treatment of MINOR (less than 0.5 cm) lesion(s) with or without biopsy
	52234	Cystourethroscopy, with fulguration (including cryosurgery or laser surgery) and/or resection of; SMALL bladder tumor(s) (0.5 to 2.0 cm)
Endoscopic urethral surgery	51715	Endoscopic injection of implant material into the submucosal tissues of the urethra and/or bladder neck
	52281	Cystourethroscopy, with calibration and/or dilation of urethral stricture or stenosis, with or without meatotomy, with or without injection procedure for cystography, male or female
Endoscopic ureteral surgery	52005	Cystourethroscopy, with ureteral catheterization, with or without irrigation, instillation, or ureteropyelography, exclusive of radiologic service
	52332	Cystourethroscopy, with insertion of indwelling ureteral stent
Microwave therapy	53850	Transurethral destruction of prostate tissue; by microwave therapy
Prostate biopsy	55700	Biopsy, prostate; needle or punch, single or multiple, any approach
	55859	Transperineal placement of needles or catheters into prostate for interstitial radioelement application, with or without cystoscopy
Shockwave lithotripsy	50590	Lithotripsy, extracorporeal shock wave
Urethral dilation	53600	Dilation of urethral stricture by passage of sound or urethral dilator, male; initial
	53660	Dilation of female urethra including suppository and/or instillation; initial
Urodynamics procedures	51725	Simple cystometrogram
	51726	Complex cystometrogram
	51741	Complex uroflowmetry
	51784	Electromyography studies of anal or urethral sphincter, other than needle, any technique
	51795	Voiding pressure studies; bladder voiding pressure, any technique

Abbreviation: HCPCS, Healthcare Common Procedure Coding System.

Appendix Table 2

Identifying postoperative complications.

ICD-9 Code	Description of Complication
415.11	Iatrogenic pulmonary embolism and infarction

ICD-9 Code	Description of Complication
458.2	Iatrogenic hypotension
512.1	Iatrogenic pneumothorax
518.5	Pulmonary insufficiency following trauma and surgery
598.2	Postoperative urethral stricture
995.0	Other anaphylactic shock
995.4	Shock due to anesthesia
997.00	Nervous system complications
997.01	Central nervous system complication
997.02	Iatrogenic cerebrovascular infarction or hemorrhage
997.09	Other nervous system complications
997.1x	Cardiac complications
997.2x	Peripheral vascular complications
997.3x	Respiratory complications
997.4x	Digestive complications
997.5x	Urinary complications
997.61	Neuroma of amputation stump
997.62	Infection (chronic)
997.69	Other
997.79	Vascular complications of other vessels
997.9x	Complications affecting other specified body systems, not elsewhere classified
997.91	Hypertension
997.99	Other
998.0	Postoperative shock
998.00	Postoperative shock
998.1	Hemorrhage or hematoma or seroma complicating a procedure
998.10	Hemorrhage or hematoma or seroma complicating a procedure
998.11	Hemorrhage complicating a procedure
998.12	Hematoma complicating a procedure
998.13	Seroma complicating a procedure
998.2x	Accidental puncture or laceration during a procedure
998.3x	Disruption of operative wound
998.4	Foreign body accidentally left during a procedure
998.5x	Postoperative infection
998.6x	Persistent postoperative fistula
998.7	Acute reaction to foreign substance accidentally left during a procedure
998.80	Other specified complications of procedures, not elsewhere classified
998.81	Emphysema (subcutaneous)(surgical) resulting from a procedure
998.83	Non-healing surgical wound
998.89	Other specified complications

ICD-9 Code	Description of Complication
998.9	Unspecified complication of procedure, not elsewhere classified
999.1	Air embolism
999.2x	Other vascular complications
999.3x	Other infection
999.5	Other serum reaction
999.7	Rh incompatibility reaction
999.8	Other transfusion reaction
999.9	Other and unspecified complications of medical care, not elsewhere classified

Abbreviation: *International Classification of Diseases, 9th Revision, Clinical Modification*.

Figure 1.

Distribution of selected urologic procedures across ambulatory surgery settings over the study period.

Abbreviations: ASC, ambulatory surgery center; HOPD, hospital outpatient department.

Note: In the bar chart, black, grey, and white shading indicate the HOPD, ASC, and office, respectively.

Figure 2.

Predicted probability of an adverse event following surgery, stratified by ambulatory setting.

Abbreviations: ASC, ambulatory surgery center; HOPD, hospital outpatient department.

Note: In the bar chart, black, grey, and white shading indicate the HOPD, ASC, and office, respectively. **Models adjusted for case mix (i.e., patient age, gender, race, comorbid status, area of residence) and calendar year.**

Table 1

Differences in case mix across ambulatory care settings.

Patient Characteristic	Ambulatory Care Setting			P-Value
	HOPD (n=33,802)	ASC (16,798)	Office (233,971)	
Patient age (SD)	75.4 (6.8)	74.9 (6.5)	75.4 (6.7)	<0.001
Female, %	38.2	31.5	33.8	<0.001
Race, %				<0.001
White	89.6	91.0	90.2	
Black	7.7	7.2	5.6	
Other	2.7	1.8	4.2	
Charlson, %				<0.001
0	59.1	82.6	62.9	
1	23.1	9.4	22.3	
2	17.8	8.0	14.8	
Area of residence, %				<0.001
West	8.3	12.5	16.7	
South	34.2	59.1	38.5	
Midwest	37.8	17.0	24.4	
Northeast	19.7	11.4	20.4	

Abbreviations: ASC, ambulatory surgery center; HOPD, hospital outpatient department; SD, standard deviation.

Table 2

Adjusted odds of an adverse event following outpatient surgery.

Covariate	Odds Ratio (95% Confidence Interval)			
	Same-Day Admission	Subsequent Admission	Postoperative Complication	30-Day Mortality
Location of care				
HOPD *	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
ASC	6.96 (4.44 – 10.90)	0.94 (0.88 – 1.01)	0.69 (0.57 – 0.83)	0.92 (0.61 – 1.39)
Office	3.64 (2.48 – 5.36)	0.97 (0.94 – 1.02)	0.91 (0.82 – 1.00)	0.98 (0.79 – 1.21)
Age				
65 – 74 *	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
75 – 84	1.51 (1.28 – 1.78)	1.30 (1.26 – 1.34)	1.22 (1.13 – 1.31)	1.18 (0.98 – 1.43)
85	2.75 (2.25 – 3.36)	1.70 (1.63 – 1.77)	1.23 (1.10 – 1.38)	1.91 (1.55 – 2.34)
Gender				
Male *	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Female	0.66 (0.56 – 0.78)	0.83 (0.80 – 0.85)	0.70 (0.64 – 0.75)	0.95 (0.80 – 1.12)
Race				
White *	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Black	1.13 (0.85 – 1.50)	0.97 (0.91 – 1.02)	0.97 (0.84 – 1.12)	0.82 (0.59 – 1.15)
Other	0.53 (0.33 – 0.86)	0.86 (0.80 – 0.93)	0.91 (0.76 – 1.09)	0.83 (0.53 – 1.32)
Charlson score				
0 *	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
1	2.33 (1.98 – 2.73)	1.35 (1.31 – 1.39)	1.26 (1.17 – 1.36)	1.67 (1.41 – 1.99)
2	4.18 (3.38 – 5.18)	2.38 (2.28 – 2.49)	1.81 (1.61 – 2.03)	3.21 (2.62 – 3.92)
Area of residence				
West *	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
South	0.99 (0.80 – 1.24)	1.06 (1.02 – 1.11)	0.86 (0.78 – 0.95)	0.97 (0.77 – 1.22)
Midwest	1.11 (0.87 – 1.40)	1.09 (1.04 – 1.14)	0.94 (0.84 – 1.04)	0.97 (0.76 – 1.25)
Northeast	0.89 (0.69 – 1.15)	0.86 (0.82 – 0.91)	0.73 (0.65 – 0.82)	0.97 (0.75 – 1.26)

Abbreviations: ASC, ambulatory surgery center; CI, confidence interval; HOPD, hospital outpatient department; OR, odds ratio.

* Indicates referent group.

Shaded table cells denote statistically significant associations.