Quality of Care Differs by Patient Characteristics: Outcome Disparities After Ambulatory Surgical Procedures

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The surgery literature is filled with reports on racial or gender disparities in quality. However, whether patient demographics are risk factors for complications or death from ambulatory surgical procedures is unknown. This study explores whether racial, age, and gender outcome disparities exist after ambulatory surgeries. Patients studied included adults (>18 years) receiving common ambulatory surgical procedures (N = 3 174 436) in either a freestanding ambulatory surgical center or a hospital-based outpatient department during 1997-2004 in Florida. Results demonstrate that African Americans were at a significantly increased risk for either mortality or unexpected hospitalization in 4 of the 5 procedures examined, even after controlling for confounders. For women, unexpected hospital admission or mortality was less likely to occur after almost all procedures examined. Thus, many of the racial and gender disparities in the inpatient surgical literature are also observed in the ambulatory setting. More research is needed to determine the source of these disparities. (Am J Med Qual 2007;22:395-401)

Keywords: ambulatory surgical procedures; disparities; quality of care; colonoscopy; cataract removal; upper gastrointestinal endoscopy; arthroscopy; inguinal hernia

INTRODUCTION

The surgical literature is filled with reports that document racial or gender inequalities in access to care,[1-4] resource utilization and treatment options offered,[5-10] or patient outcomes.[4,11-19] Most of these studies have focused on the inpatient setting. For example, racial disparities were found to exist in renal[11] and lung[12] transplant outcomes, prostate[13] and bladder[7] cancer treatments, and a variety of cardiovascular surgical procedures.[4,14] Many of these inpatient-based studies found that female gender was associated with poorer outcomes as well.[7,12,14] However, some limited evidence suggests that women may fare better after ambulatory surgeries.[15] Overall, however, little is known about whether patient demographics are a risk factor for complications or death from ambulatory surgical procedures.

During the past few decades, changes in reimbursement schemes[16] and breakthroughs in surgical techniques and anesthesiology[17] have increased the number of ambulatory surgical procedures performed in the United States. Today, ambulatory surgical procedures make up 60% to 70% of all surgeries and have seen a 90% increase between 1997 and 2002.[18]

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Several studies have concluded that ambulatory surgical procedures are safe and generally associated with few complications.[19-21] Studies that have examined risk factors for complications have typically focused on either physician characteristics (eg, board certification, specialty, experience)[19,22-24] or the characteristics of the procedure itself (eg, type of procedure, type of anesthesia used, time in operating room).[19,22,23,25] Even though patient characteristics are frequently used as control variables in multivariate analyses examining outcomes from ambulatory surgical procedures, data on whether these characteristics are independently associated with complications are not well documented.

The purpose of the current study is to determine whether race, gender, and/or age are associated with unexpected hospitalizations or mortality after ambulatory surgery. We examine this issue by applying the most up-to-date risk adjustment methodology for ambulatory procedures and by using a large and comprehensive longitudinal data set.

METHODS

The present study uses 8 years of data that were extracted from several data sources obtained from the state of Florida. Specifically, we used the hospital discharge data set, the ambulatory discharge data set, and vital statistics data for the years 1997 through 2004. Data availability restricted us to procedures of surgeries performed in freestanding ambulatory surgical centers and hospital-based outpatient departments. We were unable to obtain data representing procedures performed in physician offices.

For our analyses, we focused on adult patients aged 18 years or older. In addition, we restricted our sample to those with the most common forms of insurance type in Florida, including Medicare, Medicaid, private indemnity insurance, and all managed care organizations (eg, health maintenance organizations, preferred provider organizations). Excluded insurance types included workers' compensation, Champus (Civilian Health and Medical Program of the Uniformed Services), Veterans Affairs, charity care, or other.

Of the 6 most common ambulatory procedures in Florida during the 8-year study period, we selected 5 for examination. These procedures include colonoscopy, cataract removal, upper gastrointestinal endoscopy, arthroscopy, and repair of inguinal hernia. Debridement of the skin (the fourth most common procedure) was excluded because almost all such procedures took place in the hospital outpatient setting.

Our primary end points were 7-day and 30-day mortality rates after ambulatory surgeries. These were selected because the literature suggests that they are better measures of quality than same-day mortality.[26] Other primary end points of interest were 7-day and 30-day unexpected hospitalizations after ambulatory surgical procedures. Unexpected hospitalizations are an important measure of quality in ambulatory surgical care.[23]

Not all mortality and unexpected hospital admissions are related to the ambulatory surgical procedure. As such, the research team, consisting of physicians and researchers, evaluated hospital admissions and causes of death for each individual procedure. Unexpected hospital admissions deemed unrelated to ambulatory surgeries were excluded. For example, hospital admissions resulting from substance use, HIV/AIDS, psychiatric disorders, and reproductive system disorders were excluded. In addition, deaths related to suicides and homicides were excluded because we believed that there were no direct relationships with any of the ambulatory surgical procedures being examined. In the following we describe the risk adjustment method and the statistical approach used.

Risk Adjustment

The Diagnosis Cost Groups-Hierarchical Condition Categories (DCG-HCC) risk adjustment methodology[27] was used in the current study. The use of this continuously measured variable, constructed to adjust for patient comorbidities (eg, severity of illness), was selected for several reasons. First, evidence suggests that the method is better suited for ambulatory data than other competing methodologies.[28-30] Moreover, the method was previously validated,[31] and allows researchers to control for other patient level demographics. Last, the DCG-HCC methodology is recommended and used by the Centers for Medicare and Medicaid Services.

Statistical Analyses

In all cases, our end points of interest were binary variables. As such, a series of multivariate logistic regression models were specified to analyze the data. Because the outcomes of interest were relatively rare events, we used a pooled cross-sectional design for the

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Table 1

Demographic Characteristics of Study Sample, by Procedure (Total N = 3 174 436)

	Colonoscopy	Cataract Removal	Upper Endoscopy	Arthroscopy	Inguinal Hernia
Total procedures (1997-2004):	1 603 794	778 894	702 555	203 529	89 193
Race/Ethnicity					
White	1 246 748 (77.7%)	549 524 (70.5%)	503 188 (71.6%)	157 885 (77.6%)	69 368 (77.8%)
African American/Black	89 269 (5.6%)	27 879 (3.6%)	52 415 (7.5%)	12 702 (6.2%)	5293 (5.9%)
Hispanic	125 910 (7.9%)	54 675 (7.0%)	83 499 (11.9%)	13 368 (6.6%)	8496 (9.5%)
Unknown or other race	141 867 (8.9%)	146 816 (18.9%)	63 453 (9.0%)	19 574 (9.6%)	6036 (6.8%)
Gender					
Male	722 230 (45.0%)	310 749 (39.9%)	280 952 (40%)	107 794 (53.0%)	80 208 (89.9%)
Female	881 564 (55.0%)	468 145 (60.1%)	421 603 (60%)	95 735 (47.0%)	8985 (10.1%)
Patient age					
18-49 years	317 658 (19.8%)	17 692 (2.3%)	258 375 (36.8%)	95 172 (46.8%)	33 617 (37.7%)
50-64 years	612 159 (38.2%)	86 517 (11.1%)	182 989 (26.1%)	63 667 (31.3%)	21 663 (24.3%)
65-74 years	416 290 (26.0%)	283 904 (36.5%)	143 695 (20.5%)	32 798 (16.1%)	18 730 (21.0%)
75-84 years	222 352 (13.9%)	314 227 (40.3%)	94 311 (13.4%)	11 028 (5.4%)	12 572 (14.1%)
85 years or older	35 287 (2.2%)	76 503 (9.8%)	23 135 (3.3%)	847 (0.4%)	2600 (2.9%)
Payer type					
Medicaid	23 847 (1.5%)	16 444 (2.1%)	28 350 (4.0%)	4366 (2.2%)	2431 (2.7%)
Medicare	607 383 (37.9%)	602 142 (77.3%)	256 513 (36.5%)	44 590 (21.9%)	30 305 (34.0%)
Private insurance	972 564 (60.6%)	160 308 (20.6%)	417 692 (59.5%)	154 573 (75.9%)	56 457 (63.3%)
Facility type					
Freestanding ASC	794 790 (49.6%)	627 264 (80.5%)	305 678 (43.5%)	97 519 (47.9%)	19 535 (21.9%)
Hospital outpatient department	809 004 (50.4%)	151 630 (19.5%)	396 877 (56.5%)	106 010 (52.9%)	69 658 (78.1%)

Note: numbers may not add up to 100%, because of rounding.
ASC, ambulatory surgery center.

years 1997 to 2004. Analysis of the data occurred separately for each of 4 outcomes and for each of the 5 procedures. In each case, the independent variables included race/ethnicity, gender, and 5 categories of age. Race/ethnicity was measured as white, African American/black, Hispanic, or unknown/other. The 5 age categories were 18-49 years, 50-64 years, 65-74 years, 75-84 years, and 85 years or older. All regression models also controlled for payer type (ie, Medicare, Medicaid, private insurance), facility type (ie, freestanding ambulatory surgical center, hospital-based outpatient department), and severity of illness as described earlier in the section on risk adjustment.

The overall study received approval from our university institutional review committee. Data management was conducted with SAS version 9.0 (SAS Institute Inc, Cary, North Carolina) and data analysis was conducted in SPSS version 14.0 (SPSS Inc, Chicago, Illinois).

RESULTS

Overall, 3 174 436 patients received 1 of the 5 procedures examined during the 1997-2004 study period. Demographic patient characteristics, organized by procedure, are displayed in Table 1. Unexpected hospitalizations and deaths were relatively rare events. The rate for 7-day unexpected hospitalization ranged from 0.4% for both arthroscopy and cataract removal to 0.9% for upper gastrointestinal endoscopy. The rate for 30-day unexpected hospitalization ranged from 1.0% for arthroscopy to 3.1% for upper gastrointestinal endoscopy. Likewise, 7-day mortality rates ranged from 0.008% for arthroscopy to 0.4% for upper gastrointestinal endoscopy, and 30-day mortality ranged from 0.022% for arthroscopy to 0.22% for upper gastrointestinal endoscopy.

In multivariate analyses, African American race was a significant predictor of either mortality or unexpected hospital admission in 4 of the 5 procedures examined, even after controlling for confounders (see Table 2). For example, African American patients were 1.34 times more likely than whites ($P < .01$) to experience mortality within 30 days and 1.11 times more likely ($P < .01$) to experience unexpected hospitalization within 30 days after a colonoscopy procedure. In addition, compared with whites, African American patients were significantly

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Table 2

Effect of Patient Characteristics on Mortality and Unexpected Hospital Admission From Ambulatory Surgical Procedures in Florida 1997-2004 (N = 3 174 436)

	Colonoscopy				Cataract Removal				Upper Gastrointestinal Endoscopy			
	Mortality		Hospital Admission		Mortality		Hospital Admission		Mortality		Hospital Admission	
	7-day	30-day	7-day	30-day	7-day	30-day	7-day	30-day	7-day	30-day	7-day	30-day
Race/ethnicity												
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
African American/Black	1.28	1.34**	1.04	1.11**	.635	1.53**	1.50**	1.47**	1.73**	1.50**	1.20**	1.13**
Hispanic	.953	.879	1.14**	1.06**	.866	.893	1.20**	1.17**	.628*	.689**	.828**	.866**
Unknown or other race	1.10	1.23*	1.11*	1.04**	1.40*	1.35**	1.04	1.06**	1.07	1.11	.995	.957*
Gender												
Female	.572**	.688**	.927**	.978**	.676**	.572**	.901**	.931**	.690**	.619**	.919**	.959**
Patient age												
18-49 years	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50-64 years	1.78	1.70**	.768**	.830**	1.31	.936	.943	.992	1.52	1.78**	1.01	1.04*
65-74 years	2.23*	2.60**	.613**	.670**	1.23	1.10	.682**	.673**	2.76**	3.16**	.868**	.847**
75-84 years	6.59**	5.91**	.816**	.903**	2.20	1.76*	.942	.876*	6.02**	5.97**	1.17**	1.08**
85 years or older	11.9**	15.5**	1.18**	1.35**	4.58*	3.75**	1.36*	1.33**	15.54**	16.79**	1.61**	1.50**

	Arthroscopy				Inguinal Hernia			
	Mortality		Hospital Admission		Mortality		Hospital Admission	
	7-day	30-day	7-day	30-day	7-day	30-day	7-day	30-day
Race/ethnicity								
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
African American/Black	.849	.353	1.09	1.06	3.03	2.24*	1.04	1.22*
Hispanic	1.55	.860	1.19	1.05	.840	.922	.852	.867
Unknown or other race	.705	.903	.798*	.829**	.978	1.16	.746	.931
Gender								
Female	3.96*	1.54	.992	.933*	.318	.402*	.808	1.15*
Patient age								
18-49 years	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50-64 years	1.87	.997	1.03	1.04	4.09	3.18	.947	1.14
65-74 years	1.66	1.23	1.05	.710**	12.5	4.26*	.833	1.15
75-84 years	2.19	2.33	1.63**	1.02	64.1*	10.4**	1.43	1.76**
85 years or older	.000	4.26	2.84*	1.61**	59.5*	19.5**	2.01**	2.77**

Note: *$P < .05$, **$P < .01$. Each model controls for all patient characteristics shown in the table as well as patient disease severity, payer type, and facility type.

more likely to experience 7-day (odds ratio [OR] = 1.73; $P < .01$) and 30-day mortality (OR = 1.50; $P < .01$) as well as 7-day (OR = 1.20; $P < .01$) and 30-day (OR = 1.13; $P < .01$) unexpected hospitalization after upper gastrointestinal endoscopies.

Hispanic patients also differed from white patients with respect to outcomes in 3 of the 5 ambulatory surgical procedures examined. However, whereas Hispanics were at increased risk for unexpected hospital admission from colonoscopies (7-day: OR = 1.14, $P < .01$; 30-day: OR = 1.06, $P < .01$) and cataract removal (7-day: OR = 1.20, $P < .01$; 30-day: OR = 1.17, $P < .01$), they were significantly less likely to die (30-day mortality: OR = .689, $P < .01$) or have an unexpected hospitalization (7-day: OR = .828, $P < .01$; 30-day: OR = .866, $P < .01$) from upper gastrointestinal endoscopies.

When considering gender, unexpected hospital admission was less likely to occur for women in all 5 procedures examined; mortality was less likely to occur in 4 of the 5 procedures. With respect to arthroscopies only, women were observed to be at

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higher risk for mortality within 7 days (OR = 3.96; $P < .05$).

Age was found to be significantly related to both mortality and unexpected hospital admission for many procedures. However, although increasing age was usually associated with incremental higher risk of either death or hospital admission, those in the highest age category (85 years or older) were almost always at the most significant elevated risk of poorer outcomes. This risk was as high as 60-fold for 7-day mortality from an inguinal hernia procedure (OR = 59.5; $P < .05$) and 16-fold for 30-day mortality from upper gastrointestinal endoscopy (OR = 16.79; $P < .01$).

We identified several interesting variations in procedure based on facility type (ie, freestanding ambulatory surgical center vs hospital-based outpatient department). Although neither facility type performed better overall, we found important variations in quality outcomes for certain procedures. We believe that the procedure-specific variation in facility type may be related to differences in organizational structure, processes, and strategies between ambulatory surgical centers and hospital-based outpatient departments. We expect to publish an in-depth comparison by facility type separately. However, it is important to note that differences for certain procedures based on facility type do not explain the racial, age, and gender disparities that are presented in the current analysis.

DISCUSSION

Previous literature has documented significant racial and gender disparities in outcomes from many inpatient surgical procedures.[1,3,5,8,10,11,15,32-34] This article focused on the ambulatory setting to determine if such racial and gender disparities in quality of care exist in this underexplored but increasingly important health care setting. Specifically, we examined whether certain patient demographic characteristics were related to mortality and unexpected hospitalization following common ambulatory surgical procedures performed during an 8-year period in Florida.

One main finding of the study is that certain racial and ethnic groups were observed to have poorer outcomes in many of the procedures examined. For example, after controlling for age, gender, patient disease severity, payer type, and facility location, African American and Hispanic patients were more likely than whites to die or have an unexpected hospitalization after colonoscopy, cataract removal, or inguinal hernia repair. African American patients were also more likely than whites to have poorer outcomes (mortality and hospitalization) from upper gastrointestinal endoscopy. However, with respect to upper gastrointestinal endoscopy, Hispanics had significantly better outcomes than whites.

These findings echo the results of several inpatient-based surgical outcomes studies. In a review of the literature, Kressin and Petersen found that racial differences in invasive cardiac procedures were present even after adjustment for disease severity.[35] Moreover, Isaacs et al studied 9 years of renal transplant data and reported that, after controlling for potential confounders, blacks were 1.8 times more likely than whites to suffer graft failures.[11]

Recent studies have found conflicting evidence about the reason for observed racial disparities. Some studies have found that poorer surgical outcomes for Blacks may be explained by the facilities in which they seek care.[4,36-39] However, a conflicting body of literature suggests that facility location does not explain the observed racial disparities in surgical outcomes.[11,14,40] Instead, some studies suggested that either patient behavioral factors[2,9,13] or provider tendencies[8,10] may play a role. It is still unclear why the racial disparities observed in the present study occur. Future research should identify whether the disparities in ambulatory surgical outcomes are occurring at the facility, provider, or patient level.

In the current study, we also found that female gender was frequently an independent predictor of desirable outcomes. Women had significantly lower mortality and/or fewer unexpected hospitalizations in almost all procedures examined. This finding confirms a previous Medicare-focused study, from pooled outcomes data representing 8 ambulatory surgical procedures, that found female gender to be associated with a lower risk of 7-day hospitalization.[15] Women may have better outcomes because some evidence suggests that they are more likely to seek care early and comply with their physicians' recommendations.[41-43] Nevertheless, in our data, female patients were at an elevated risk for 7-day mortality and 30-day hospital admission after arthroscopy and inguinal hernia repair, respectively. More research may be needed to further understand these trends.

In the inpatient setting, age is sometimes,[7,33] but not always,[11] associated with poorer surgical outcomes. A previous study found that older people may safely undergo ambulatory surgery but are at

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increased risk for hemodynamic variation in the operating room.[20] In the present study, we found that increased age was generally associated with an elevated risk of death and unexpected hospitalizations, even after adjusting for severity of illness and other confounders. Patients over the age of 84 were at greatest risk for at least 1 of these poorer outcomes in every procedure examined. However, the magnitude of risk was greatest for certain procedures. For example, those over 84 years of age were 20 to 60 times more likely to die after an inguinal hernia repair. Moreover, the very elderly patients were approximately 15 times more likely to die after an upper endoscopy. Overall, the risk of poorer outcomes seemed to increase, although not always linearly, with age. Knowing the exact additional risk that elderly individuals are subjected to can help physicians better inform their patients about what can be expected after their procedure.

Finally, as opposed to the trends noted above regarding female gender, black race, and age, outcomes in the Hispanic patient population were mixed and difficult to interpret. In some cases, Hispanic patients had better outcomes than whites, whereas in other procedures, they were at an elevated risk for poorer outcomes. More research is needed to understand the relationship between Hispanic ethnicity and quality outcomes.

The current study has several strengths including the use of a comprehensive and longitudinal set of data sources, use of the most appropriate risk adjustment methodology, and the use of several common sets of quality outcome indicators. Despite these strengths, several limitations are also worth mentioning. For example, our data did not include all locations where ambulatory surgical procedures are performed. Besides freestanding ambulatory surgical centers and hospital-based outpatient departments, physicians' offices perform an additional 5% to 8% of procedures, which our data did not include.[44] Moreover, despite the best efforts at risk adjustment, no methodology is perfect. In our study, data limitations restricted our ability to accurately determine secondary diagnoses, so we had to carry out risk adjustment based on primary diagnosis only. For example, when considering differences in race or age with respect to upper gastrointestinal endoscopy, we were able to adjust for the primary diagnosis only (eg, gastritis) and not potentially present secondary diagnoses (eg, esophageal stenosis). Being able to risk adjust based on additional diagnoses would be more ideal. Furthermore, our study is limited to 1 state, where the demographic characteristics of patients may be different from those in other geographic locations. Nevertheless, the high proportion of elderly patients in Florida may foreshadow the demographic trends being projected, as the so-called baby boomer generation ages nationally.

In conclusion, many of the racial and gender disparities documented in the inpatient surgical outcomes literature are observed in the Florida ambulatory setting. If the national goals of equal access to high-quality services are to be realized, more research will be needed to determine the source of these disparities associated with ambulatory surgical procedures. Only then can policies be drafted to reduce racial and gender disparities.

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