

Predictors of prolonged admission after outpatient female pelvic reconstructive surgery

Andrea M. Simi BAS¹  | Graham C. Chapman MD² |
Jacqueline Zillioux MD³  | Sarah Martin MD³  | Emily A. Slopnick MD³

¹Case Western Reserve University School of Medicine, Cleveland, Ohio, USA

²Division of Urogynecology and Pelvic Floor Disorders, Department of Obstetrics and Gynecology, Cleveland Clinic Foundation, Cleveland, Ohio, USA

³Department of Urology, Glickman Urological and Kidney Institute, Center for Female Pelvic Medicine and Reconstructive Surgery, Cleveland Clinic Foundation, Cleveland, Ohio, USA

Correspondence

Andrea M. Simi, BAS, Case Western Reserve University School of Medicine, Cleveland, OH, USA.

Email: axs1702@case.edu

Abstract

Objectives: This study aimed to determine factors associated with prolonged hospital admission following outpatient female pelvic reconstructive surgery (FPRS) and associated adverse clinical outcomes.

Methods: Using the National Surgical Quality Improvement Program database, we identified outpatient FPRS performed 2011–2016. Isolated hysterectomy without concurrent prolapse repair was excluded. Surgeries were classified as major or minor for analysis. The primary outcome was prolonged length of stay (LOS), defined as admission of ≥ 2 days. Secondary outcomes included complications, readmission and reoperation associated with prolonged LOS. We abstracted data on covariates, and following univariable analysis, performed backward stepwise regression analysis.

Results: A total of 29645 women were included: 12311 (41.5%) major and 17334 (58.5%) minor procedures. A total of 6.9% (2033) had a prolonged LOS. On full cohort multivariable regression analysis, patient characteristics associated with prolonged LOS were older age (odds ratio [OR]: 1.1 per 10 years, confidence interval [CI]: 1.06–1.1, $p < 0.001$), frailty (OR: 1.8, 95% CI: 1.3–2.6, $p = 0.001$), and Caucasian race (OR: 1.2, CI: 1.02–1.3, $p = 0.024$). Associated surgical factors included having a major surgical procedure (OR: 1.3, CI: 1.2–1.4, $p < 0.001$), use of general anesthesia (OR: 2.0, CI: 1.5–2.6, $p < 0.001$) and longer operative time (OR: 2.0, CI: 1.8–2.2, $p < 0.001$). The occurrence of any complication (10.3% vs. 4.7%, $p < 0.001$), hospital readmission (4.3% vs. 1.7%, $p < 0.001$), and reoperation (2.7% vs. 1.0%, $p < 0.001$) were more likely with prolonged LOS.

Conclusions: After outpatient FPRS, 6.9% of patients experience an admission of ≥ 2 days. Prolonged LOS is more common in patients who are older, frail and Caucasian, and in those who have major surgery with long operative time and general anesthesia.

KEYWORDS

ambulatory surgical procedures, frailty, length of stay, pelvic floor disorders, pelvic organ prolapse, reconstructive surgical procedures

1 | INTRODUCTION

In recent years, there has been a strong shift toward outpatient surgery for low-risk female pelvic reconstructive surgery (FPRS).^{1,2} In a database of claims from three large US health insurers, outpatient pelvic organ prolapse (POP) procedures increased 18.5% ($p = 0.132$), while inpatient procedures decreased 52.2% ($p = 0.002$) from 2010 to 2013.² Outpatient FPRS is an attractive option that can improve efficiency and decrease healthcare costs, while providing comparable safety and clinical outcomes.³ Multiple studies of FPRS have validated the safety and efficacy of outpatient protocols, with greater than 77% success in ambulatory discharge.^{4–8} From 2010 to 2020, 79.1% of one surgeon's 1793 FPRS cases were discharged on the day of surgery, with no association found between same day discharge and 30-day readmission or ED visits.⁸ This finding further supports a growing body of literature demonstrating the advantages and minimal complications of same-day discharge.^{4–6,8–10}

However, the clinical benefits and financial savings associated with outpatient surgery are diminished when patients experience readmission and/or an extended hospital stay following outpatient surgery.⁵ Both readmission rate and prolonged length of stay (LOS) have been used as indicators of quality of care in outpatient surgery. The Centers for Medicare and Medicaid Services (CMS) reduces payments to hospitals with excess readmissions.¹¹ Furthermore, CMS utilizes 30-day hospital readmissions and a compound metric of postoperative inpatient admissions and return visits to the hospital within a week of postsurgical discharge as measures of quality care.^{11,12} Thus, understanding the prevalence of and factors associated with readmission and prolonged postoperative LOS is crucial. While prior studies have reported on feasibility of same day discharge or readmission after outpatient FPRS, prolonged stay following outpatient surgery remains largely unexplored.^{1,4,7,13–16}

Our objective was to determine the patient and surgical factors associated with a prolonged hospital admission following outpatient FPRS, as well as the association of prolonged stay with clinical outcomes. We hypothesized that age, frailty, and undergoing a major surgical procedure would be associated with a prolonged LOS. An improved understanding of these factors will help us better select patients suited for the outpatient

setting, inform postoperative expectations and patient counseling, implement targeted strategies to reduce complications, prolonged LOS and readmission, and maximize the clinical and financial benefits of outpatient FPRS.

2 | MATERIALS AND METHODS

We performed this retrospective cohort study using 2011–2016 data from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database. Surgeries labeled as outpatient and elective were included. “Outpatient” surgery in NSQIP is defined by each individual contributing hospital and may indicate same day or extended outpatient admission. Current procedural terminology codes were used to identify FPRS procedures, including POP repair with or without concurrent hysterectomy, midurethral sling placement, sling revision, and vaginal mesh revision (Table 1). We excluded cases of isolated hysterectomy performed without a concurrent prolapse repair procedure. Based on author experience and estimated average operative time, surgeries were categorized as major (sacrospinous ligament or ilioococcygeus suspension, uterosacral ligament suspension, sacrocolpopexy, hysterectomy, or any case with concomitant hysterectomy) or minor (isolated midurethral sling placement, colpocleisis, anterior and/or posterior colporrhaphy, enterocele repair, perineorrhaphy, revision or removal of vaginal mesh, or sling revision, without a concurrent major procedure). Revision of vaginal mesh can be major or minor depending on the clinical situation. In this dataset, the median operative time of a mesh revision surgery was 64 min, so it was considered minor.

The primary outcome was prolonged LOS, defined as admission of 2 or more days, after outpatient FPRS. For analysis, patients were stratified into LOS of <2 and ≥ 2 days. In the United States, most women are offered outpatient FPRS with same day discharge or overnight observation following major surgery. We chose 2 days as a prolonged admission because a two night stay would not be anticipated.⁷ Furthermore, when Medicare calculates LOS for benefit coverage and quality of care metrics, LOS is calculated using nights of hospital stay, rather than hours of stay.¹⁷ Primary analysis was performed to assess for factors associated with prolonged LOS.

TABLE 1 Procedures and anesthesia types performed during outpatient female pelvic reconstructive surgery

	Overall n (%)
Overall	29645
Major	12311 (41.5)
Sacrocolpopexy	4403 (14.9)
Uterosacral ligament suspension	3672 (12.4)
Sacrospinous ligament or iliococcygeus suspension	3016 (10.2)
Concurrent hysterectomy	2432 (8.2)
Hysteropexy	348 (1.2)
Minor	17 334 (58.5%)
Anterior and/or posterior colporrhaphy	14 105 (47.6)
Midurethral sling placement	14 479 (48.9)
Sling revision	442 (1.5)
Vaginal mesh revision	434 (1.5)
Colpocleisis	437 (1.5)
Anesthesia type	
General	27 904 (94.1)
Regional	29 (0.1)
MAC or IV sedation	736 (2.5)
Epidural or spinal	898 (3.0)
Local	41 (0.1)
None	7 (0.02)

Abbreviation: MAC, monitored anesthesia care.

Secondary analysis examined operative time, complications, readmission and reoperation associated with prolonged LOS, as reported to NSQIP within 30 days of surgery. For multivariable analysis, a long operative time was defined as greater than 75th percentile of all surgeries in the cohort. For sensitivity analysis of major and minor procedures, a prolonged operative time was calculated as >75th percentile within that subgroup.

We abstracted data on covariates including all available patient demographics, medical comorbidities, and surgical characteristics reported to NSQIP for analysis.¹⁸ The NSQIP Modified Frailty Index-5 was used as a measure of patient medical comorbidity burden and functional status. This score has been validated in multiple surgical fields and previously utilized in the pelvic floor surgery patient population.^{19–22} The Modified Frailty Index-5 considers five preoperative diagnoses that are reported to NSQIP, including hypertension requiring medication, diabetes mellitus, congestive heart failure, chronic obstructive pulmonary disease, and dependent

functional health status, to calculate a frailty score. The frailty score is a sum of the number of these conditions with which a patient is diagnosed divided by 5. A score of ≥ 0.4 indicates frailty.^{20,21} Complications were analyzed as a composite rate, defined as the incidence of any complication, as well as by each individual complication reported to NSQIP.¹⁸ Urinary tract infection (UTI) and superficial surgical site infection were considered minor complications, while the remaining complications were considered major. The postoperative complications with an incidence of $\geq 0.1\%$ in our cohort are identified in Table 4. As a sensitivity analysis, we stratified patients into those who underwent surgical procedures considered major and those who underwent only minor procedures.

2.1 | Statistical analysis

Descriptive statistics were performed to assess cohort patient characteristics, perioperative details and 30-day outcomes. Variables were assessed for normality of distribution. Patients with and without prolonged LOS were compared using student's *t* test, Wilcoxon rank-sum test, or Chi-square tests, as appropriate. Factors significant on univariate analysis with $p < 0.05$ were included in the multivariate logistic regression. Backward stepwise multivariable logistic regression analyses were performed to identify predictors of prolonged LOS as well as 30-day complications. All results yielding $p < 0.05$ were deemed statistically significant. Statistical analysis was performed using Stata version 15.1 (StataCorp).

3 | RESULTS

3.1 | Overall cohort

A total of 29645 women underwent outpatient FPRS between 2011 and 2016, including 12311 (41.5%) major and 17334 (58.5%) minor surgeries (Table 1). Mean patient age was 57.4 ± 13.1 years. Most patients were either discharged same-day ($n = 9778$ [33%]) or observed overnight ($n = 17824$ [60.2%]), while 2033 (6.9%) were admitted for at least 2 days postoperatively and thus classified as prolonged LOS. Patients who had a prolonged LOS were older (mean: 59.4 vs. 57.2 years, $p < 0.001$) and more likely to be frail (11.4% vs. 8.8%, $p < 0.001$) (Table 2). Prolonged LOS was also associated with having a major surgical procedure (8.8% vs. 5.5%, $p < 0.001$), general anesthesia (7.1% vs. 3.0% with nongeneral anesthesia, $p < 0.001$), and a longer operative time (median: 136 vs. 96 min, $p < 0.001$) on univariate

TABLE 2 Patient factors associated with prolonged LOS after outpatient FPRS

	Overall cohort <i>n</i> (%) 29 645	LOS <2 days <i>n</i> (%) 27 612 (93.1)	Prolonged LOS ≥2 days <i>n</i> (%) 2033 (6.9)	<i>p</i>
Age (years), mean ± <i>SD</i>	57.4 ± 13.1	57.2	59.4	<0.001
Race—White	24205 (81.7)	22479 (81.4)	1726 (84.9)	<0.001
Diabetes	3028 (10.2)	2779 (10.1)	249 (12.3)	0.002
Current smoker	3422 (11.5)	3231 (11.7)	191 (9.4)	0.002
Obesity	10968 (37.1)	10229 (37.1)	739 (36.4)	0.540
Dependent functional status	109 (0.4)	96 (0.4)	13 (0.6)	0.036
Congestive heart failure	16 (0.05)	15 (0.05)	1 (0.05)	0.923
History of CAD	119 (0.4)	112 (0.4)	7 (0.3)	0.673
COPD	577 (2.0)	525 (1.9)	52 (2.6)	0.039
Dyspnea	1079 (3.64)	993 (3.6)	86 (4.2)	0.141
Hypertension	11 038 (37.2)	10 188 (36.9)	850 (41.8)	<0.001
Dialysis	13 (0.04)	13 (0.05)	0 (0)	0.328
Ascites	9 (0.03)	7 (0.03)	2 (0.1)	0.068
Disseminated cancer	33 (0.1)	30 (0.1)	3 (0.2)	0.612
Chronic steroid use	546 (1.8)	503 (1.8)	43 (2.1)	0.342
Bleeding disorder	227 (0.8)	206 (0.8)	21 (1.0)	0.152
History of stroke	113 (0.4)	108 (0.4)	5 (0.3)	0.305
Chronic alcohol use	30 (0.1)	29 (0.1)	1 (0.1)	0.445
>10% weight loss in 6 months	25 (0.1)	22 (0.1)	3 (0.2)	0.309
Open wound or wound infection	63 (0.2)	60 (0.2)	3 (0.2)	0.510
Preoperative transfusion of >4 units	7 (0.02)	7 (0.03)	0 (0)	0.473
Frail (Frailty-5 score ≥0.4)	2663 (9.0)	2432 (8.8)	231 (11.4)	<0.001

Abbreviations: FPRS, female pelvic reconstructive surgery; LOS, length of stay.

TABLE 3 Backward stepwise multivariable logistic regression analysis of patient and surgical factors associated with prolonged LOS

Variables	Overall		Major surgery		Minor surgery	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Older Age (per 10 years)	1.1 (1.06–1.1)	<0.001	1.1 (1.05–1.2)	<0.001	1.1 (1.03–1.2)	0.003
Frailty	1.8 (1.3–2.6)	0.001	2.3 (1.4–3.8)	0.001	1.4 (0.8–2.4)	0.189
Race—White	1.2 (1.02–1.3)	0.024			1.3 (1.1–1.6)	0.004
Current smoker	0.9 (0.8–1.1)	0.191			0.8 (0.7–1.03)	0.104
General anesthesia	2.0 (1.5–2.6)	<0.001	2.0 (1.2–3.5)	0.01	1.7 (1.2–2.3)	0.003
Long operative time	2.0 (1.8–2.2)	<0.001	1.6 (1.4–1.8)	<0.001	3.2 (2.8–3.6)	<0.001
Major surgery	1.3 (1.2–1.4)	<0.001				

Abbreviation: LOS, length of stay.

analysis. On multivariable logistic regression analysis, patients were more likely to have a prolonged LOS if they were older (odds ratio [OR]: 1.1 per 10 years, confidence interval [CI]: 1.06–1.1, $p < 0.001$), frail (OR: 1.8, 95% CI: 1.3–2.6, $p = 0.001$), Caucasian (OR: 1.2, CI: 1.02–1.3, $p = 0.024$), or underwent a major surgical procedure (OR: 1.3, CI 1.2–1.4, $p < 0.001$) under general anesthesia (OR: 2.0, CI: 1.5–2.6, $p < 0.001$) with a long operative time (OR: 2.0, CI: 1.8–2.2, $p < 0.001$) (Table 3).

Table 4 details 30-day postoperative adverse events, readmissions, and reoperation rates. Overall, 1495 (5.0%) of patients developed a complication, most commonly a UTI ($n = 1040$ [3.5%]). Patients with prolonged LOS were more likely to experience any complication (10.3% vs. 4.7%, $p < 0.001$). Specifically, patients with prolonged LOS were more likely to be diagnosed with a UTI (5.8% vs. 3.3%, $p < 0.001$), an organ space infection (0.9% vs. 0.3%, $p < 0.001$), pneumonia (0.2% vs. 0.1%, $p = 0.02$), and septic shock (0.15% vs. 0.01%, $p < 0.001$). An intraoperative blood transfusion was also more common in the prolonged LOS cohort (3.1% vs. 0.2%, $p < 0.001$). On multivariable logistic regression analysis, the incidence of any postoperative complication remained more likely in patients with a prolonged LOS (OR: 1.5; CI: 1.4–1.6, $p < 0.001$). Patients with a bleeding disorder (OR: 2.1, CI:

1.4–3.2, $p = 0.001$) were also more likely to experience a complication, adjusting for frailty, obesity, preoperative dyspnea and having a major surgery (Table 5).

Hospital readmission was required in 553 (1.9%) patients, and patients who had a prolonged LOS were more likely to be readmitted (4.3% vs. 1.7%, $p < 0.001$). Overall, 331 (1.1%) patients underwent reoperation, which was also more likely after a prolonged admission

TABLE 5 Backward stepwise multivariable logistic regression analysis of patient and surgical factors associated with a complication after outpatient FPRS

Variables	Overall	
	OR (95% CI)	<i>p</i>
Prolonged LOS ≥ 2 days	1.5 (1.4–1.6)	<0.001
Major surgery	1.1 (1.00–1.2)	0.044
Frailty	1.4 (0.9–2.0)	0.128
Obesity	1.1 (1.00–1.2)	0.055
Bleeding disorder	2.1 (1.4–3.2)	0.001
Dyspnea	1.3 (1.0–1.6)	0.076

Abbreviations: FPRS, female pelvic reconstructive surgery; LOS, length of stay.

TABLE 4 30-day adverse events after outpatient FPRS

	Overall <i>n</i> (%)	LOS <2 days <i>n</i> (%)	Prolonged LOS ≥ 2 days <i>n</i> (%)	<i>p</i>
Any complication	1495 (5.0)	1285 (4.7)	210 (10.3)	<0.001
Any major complication	378 (1.3)	283 (1.0)	95 (4.7)	<0.001
Deep wound infection	25 (0.1)	23 (0.1)	2 (0.1)	0.821
Organ space infection	101 (0.3)	82 (0.3)	19 (0.9)	<0.001
Wound dehiscence	37 (0.1)	36 (0.1)	1 (0.1)	0.317
Intraoperative blood transfusion	111 (0.4)	49 (0.2)	62 (3.0)	<0.001
Sepsis	53 (0.2)	50 (0.2)	3 (0.2)	0.730
Pneumonia	20 (0.1)	16 (0.1)	4 (0.2)	0.020
Deep vein thrombosis	21 (0.1)	17 (0.1)	4 (0.2)	0.027
Pulmonary embolism	27 (0.1)	24 (0.1)	3 (0.2)	0.382
C. diff infection	12 (0.1)	11 (0.1)	1 (0.1)	0.788
Any minor complication	1165 (3.9)	1036 (3.8)	129 (6.4)	<0.001
Superficial wound infection	134 (0.5)	120 (0.4)	14 (0.7)	0.099
Urinary tract infection	1040 (3.5)	923 (3.3)	117 (5.8)	<0.001
Reoperation	331 (1.1)	276 (1.0)	55 (2.7)	<0.001
Readmission	553 (1.9)	466 (1.7)	87 (4.3)	<0.001

Note: Only complications with incidence $\geq 0.1\%$ were included.

Abbreviations: FPRS, female pelvic reconstructive surgery; LOS, length of stay.

(2.7% vs. 1.0%, $p < 0.001$). The most common reoperation was revision or removal of sling, which was performed in 45 patients.

3.2 | Major surgery cohort

A total of 12311 patients (41.5%) underwent a major procedure, with or without a concurrent minor procedure (Table 1). Mean age was 58.1 ± 12.6 years. Most patients were observed overnight following their major surgery ($n = 9370$ [76.1%]), while 1079 (8.8%) had prolonged LOS. Prolonged LOS was associated with older age (OR: 1.1 per 10 years, CI: 1.05–1.2, $p < 0.001$), frailty (OR: 2.3, CI: 1.4–3.8, $p = 0.001$), general anesthesia (OR: 2.0, CI: 1.2–3.5, $p = 0.01$), and a long operative time (OR: 1.6, CI: 1.4–1.8, $p < 0.001$) (Table 3). Similar to the overall cohort, patients with a prolonged LOS were more likely to develop a complication (10.6% vs. 4.9%, $p < 0.001$), require readmission (3.8% vs. 2.1%, $p < 0.001$) or undergo reoperation (2.7% vs. 1.1%, $p < 0.001$). In this cohort, the most common reoperation was sling revision/removal (12 cases), as patients often underwent concomitant major and minor procedures. Insertion of a ureteral stent occurred in 10 cases and cystoscopy was performed in 8 cases.

3.3 | Minor surgery cohort

A minor surgery, without concomitant major procedure, was performed in 17334 (58.5%) patients, including 10223 sling placements, 8547 anterior and/or posterior colporrhaphies, 437 colpocleises, and 809 sling or other vaginal mesh revision or excision procedures. Patients undergoing minor surgery had a mean age of 56.9 ± 13.3 years. Most patients were discharged same-day ($n = 7916$ [45.7%]) or after overnight observation ($n = 8464$ [48.8%]), while 954 patients (5.5%) had prolonged LOS. A prolonged LOS was associated with older age (OR: 1.1 per 10 years, CI: 1.03–1.2, $p = 0.003$), Caucasian race (OR: 1.3, CI: 1.1–1.6, $p = 0.004$), general anesthesia (OR: 1.7, CI: 1.2–2.3, $p = 0.003$), and long operative time (OR: 3.2, CI: 2.8–3.6, $p < 0.001$), adjusting for frailty and smoking (Table 3). Patients who required a longer LOS were more likely to experience a complication (10.1% vs. 4.5%, $p < 0.001$) and require readmission (4.8% vs. 1.4%, $p < 0.001$) or reoperation (2.7% vs. 1.0%, $p < 0.001$). The most common reoperation in this cohort was removal or revision of a sling (33 cases), followed by cystoscopy (15 cases) and treatment of wound dehiscence (9 cases).

4 | DISCUSSION

Outpatient surgery for pelvic floor conditions is becoming more commonplace, yet some patients receive additional inpatient care. In our cohort, most patients (60.2%) who underwent surgery for POP, urinary incontinence or other pelvic floor conditions were observed overnight, with 6.9% experiencing a prolonged LOS of ≥ 2 days. This pattern was consistent in sub-analysis by major and minor surgery. The rate of prolonged LOS found in our study is consistent with prior literature, in which 4.8%–9.7% of patients experience prolonged LOS of ≥ 2 nights following gynecologic and urologic procedures.^{10,13,23} While an overnight stay following outpatient FPRS is common practice in the United States for higher risk patients, this incidence of prolonged LOS highlights the opportunity for improvement of postoperative patient experience and outcomes when clinically safe and feasible. Factors examined in this study may not necessarily be causative of prolonged LOS but addressing these associations can facilitate better patient selection and surgical optimization.

Patient demographic factors found to correlate with prolonged LOS can inform more appropriate patient selection for outpatient surgery, direct patient counseling and, when modifiable, may be adjusted to maximize postoperative outcomes. Numerous past studies have supported our finding that advanced age is associated with prolonged LOS after surgery.^{10,13,24–26} This association (OR: 1.1) can be utilized to more accurately advise patients about their likelihood for prolonged postoperative stay, which our results indicate would increase at a rate of roughly 10% per 10 years of age. While age may be associated with more comorbid conditions, frailty, defined by a composite of medical comorbidities, was also found to independently correlate with prolonged LOS. Prior studies have shown similar associations between baseline comorbidities and LOS.^{13,23–25} While patient age is a fixed condition, frailty and comorbid conditions may be modified to maximize patient health status before outpatient FPRS. Prehabilitation, or preoperative intervention aimed at preparing the patient for the physiologic stress of surgery, was initially applied in the context of thoracic and abdominal surgery and is increasingly being studied for application in urologic surgery.²⁷ Prehabilitation before radical cystectomy has resulted in faster functional recovery.²⁸ Additionally, implementation of enhanced recovery after surgery (ERAS) protocols and prehabilitation has decreased prolonged LOS for patients undergoing robot-assisted radical prostatectomy.²⁹ Prehabilitation and optimization of medical comorbidities before outpatient FPRS may be beneficial in reducing prolonged LOS and warrants further investigation.

The association of Caucasian race with prolonged postoperative LOS must also be investigated further. Previous studies have examined the relationship between race and surgical outcomes and have revealed an increased likelihood of postoperative complications for minority women undergoing POP repair, colpopexy and MUS.^{30–33} As such, it has been shown that women undergoing FPRS are vulnerable to health disparities. In contrast, race was not significantly associated with postoperative complication in our study. The data instead suggests that white patients have a longer LOS than non-white patients for reasons other than a complication. It is possible that inherent racial biases may play a role in clinical decision making, but additional investigation is needed.

Operative factors associated with prolonged LOS should also be considered. This study found that longer operative time, undergoing major surgery, and general anesthesia were independently associated with extended LOS. These findings were consistent with previous studies that report association between long operative time and prolonged LOS.^{13,23–25} However, prior studies have shown mixed results regarding the association of major surgical procedures. A study of prolonged LOS following hysterectomy found that the 75th percentile of LOS was 1 day for minimally invasive (laparoscopic or robotic-assisted), 2 days for vaginal and 3 days for abdominal hysterectomy, demonstrating that a more invasive surgical route results in a longer LOS.²⁴ In contrast, a study of risk factors for prolonged LOS following laparoscopic gynecologic surgery did not find surgical complexity to be associated with prolonged LOS and noted similar risk estimates for prolonged LOS when low complexity procedures were excluded from multivariate analysis.¹⁰ While surgical complexity, operative time and anesthetic method may be inherently linked, recognizing these associations with prolonged LOS can better inform postoperative expectations and introduce surgical streamlining when possible.

Consistent with our findings, the association of general anesthesia with unanticipated admission following outpatient surgery has been previously documented in a broad cohort of patients at a tertiary care center (OR: 20.8 among a cohort of surgeries ≥ 60 min).³⁴ In a study of unplanned admission following ambulatory general surgery cases, 25% of patients were admitted for anesthesia-related reasons, such as postoperative nausea or vomiting, drowsiness, abnormal vital signs or lasting anesthesia.³⁵ The high rate of general anesthesia use reported in this study is consistent with previously quoted rates of GA for FPRS in the United States.³⁶ While use of general anesthesia and longer, more complex surgical procedures are necessary and

worthwhile in specific cases, an effort should be made to streamline surgical procedures and minimize use of general anesthesia when possible to reduce patient admissions and prolonged stay. Spinal epidural anesthesia, monitored anesthesia care and local anesthesia are promising alternatives. When studied in the context of outpatient vaginal pelvic floor surgery, spinal anesthesia was found to be safe and not associated with an increased risk of postoperative urinary retention.^{37,38} Additionally, a prospective study of 20 women undergoing vaginal hysterectomy and pelvic floor reconstruction reported no significant difference in 24 h postoperative pain scores between those who received local anesthesia with IV sedation and those who received combined spinal-epidural regional anesthesia.³⁹ Alternative methods of anesthesia in the context of outpatient FPRS should be considered as a potential mechanism to reduce prolonged LOS.

Prolonged LOS following outpatient FPRS is associated with increased complication risk, readmission and reoperation in our cohort. UTI and delirium are two primary considerations for older patients, who we have identified as more likely to have a longer LOS. Increased age has previously been associated with risk for catheter-associated UTI (CAUTI) and delirium in the hospital setting.^{40,41} Delirium, which can start elderly patients on a downward slope of loss of independence and impaired physical strength, occurs at an incidence of 6%–56% among the general hospitalized population, with prevalence increasing with patient age.⁴¹ Importantly, prolonged LOS and diagnosis and management of complications incurs greater hospital costs, diminishing the intended financial savings of outpatient surgery. While the greatest costs are incurred within 24 h of surgery, complications have been associated with higher total charges (\$30,896 vs. \$9,239) in a study of patients undergoing major surgery.^{25,42} Importantly, the association of prolonged LOS with complications, readmission and reoperation does not necessarily imply causation. While postoperative complications may result from a prolonged LOS, perioperative complications may be the primary reason for a longer admission. Additionally, patient factors associated with prolonged LOS may also be confounders responsible for increased perioperative complications, readmission or reoperation. Understanding these caveats, careful patient selection and preoperative optimization for outpatient FPRS may nonetheless help minimize complications and maximize financial benefits.

Overall, this study highlights patient and surgical factors that can inform better patient selection and postoperative expectations for FPRS. However, the retrospective study design and use of the NSQIP database present certain study limitations. NSQIP only includes data within 30 postoperative days, and our study

therefore does not assess longer term outcomes. Furthermore, NSQIP defines a surgery as “outpatient” or “inpatient” according to the definition set by each individual reporting institution and is limited in the included data. For example, NSQIP does not specify extent and location of surgical revision of vaginal mesh, making the classification of these procedure as major or minor surgery more challenging. Furthermore, the use of a retrospective database based on coding confers inherent inaccuracies and missing data due to coding errors. While we limited our study to surgeries that, in the authors' experience, are performed outpatient, this may not be consistent across institutions. Similarly, the setting of “outpatient” surgery is undefined and could be a hospital setting or freestanding ambulatory surgery center, which may impact admission rates. Lastly, some factors and complications that were not significantly associated with a prolonged LOS in this study may still be important to consider due to their clinical severity and significance.

In conclusion, after outpatient FPRS, 6.9% of patients require a prolonged postoperative LOS of at least 2 days in this national sample. In this complete cohort, prolonged LOS is more common in patients who are older, frail and Caucasian and in those who undergo a major surgery with long operative time and general anesthesia. Associations largely hold true in sub-analysis of major and minor surgery cohorts. Acknowledgement of these associations may help identify appropriate surgical candidates for outpatient surgery, direct pre-operative medical optimization and operative safety improvements and inform postoperative expectations.

1. Procedures and anesthesia types performed during outpatient FPRS
2. Patient factors associated with prolonged LOS after outpatient FPRS
3. Backward stepwise multivariable logistic regression analysis of patient and surgical factors associated with prolonged LOS
4. 30-day adverse events after outpatient FPRS
5. Backward stepwise multivariable logistic regression analysis of patient and surgical factors associated with a complication after outpatient FPRS

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trial registration. All authors were involved with manuscript drafts, edits, and revisions.

ORCID

Andrea M. Simi  <http://orcid.org/0000-0001-9017-313X>

Jacqueline Zillioux  <http://orcid.org/0000-0002-9170-3056>

Sarah Martin  <http://orcid.org/0000-0002-7983-6411>

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