GYNECOLOGY

Safety of same-day discharge for minimally invasive hysterectomy for endometrial cancer

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BACKGROUND: Same-day discharge is becoming increasingly common for women who undergo minimally invasive hysterectomy. For women with endometrial cancer, there are limited data to describe the safety of same-day discharge.

OBJECTIVE: To examine trends and outcomes of same-day discharge for women with endometrial cancer who underwent minimally invasive hysterectomy.

STUDY DESIGN: The National Surgical Quality Improvement Program database was used to identify patients who underwent minimally invasive hysterectomy based for endometrial cancer from 2011 to 2016. The cohort was limited to women discharged on the day of surgery/postoperative day 0 or postoperative day 1. Multivariable models were used to examine clinical, demographic, and procedural characteristics associated with discharge on postoperative day 0. Multivariable models also were developed to examine the association between same-day discharge and readmission.

RESULTS: A total of 17,935 patients who underwent minimally invasive hysterectomy were identified. Of those discharged within 1 day, 1828 (12.4%) were discharged on postoperative day 0 and 12,892 (87.6%) were discharged on postoperative day 1 or after. The rate of same-day discharge rose from 5.6% in 2011 to 16.3% in 2016 ($P<.001$). In a multivariable model, more recent year of surgery was associated with same-day discharge whereas older age (≥70 years old), chronic obstructive pulmonary disease, and hypertension were associated with a decreased likelihood of same-day discharge. Similarly, obese women were 15% less likely to have a same-day discharge than normal-weight women (risk ratio, 0.85; 95% confidence interval, 0.75—0.97). Hispanic women (risk ratio, 1.61; 95% confidence interval, 1.35—1.92 compared with white women) and those who underwent lymphadenectomy (risk ratio, 1.17; 95% confidence interval, 1.07—1.29) were more likely to have a same-day discharge. The readmission rate was 2.3% in those women discharged on the day of surgery compared with 3.1% in women discharged on postoperative day 1 ($P=.051$). In a multivariable model, there was no association between same-day discharge and readmission (risk ratio, 0.99; 95% confidence interval, 0.71—1.38). Among women discharged on the day of surgery, a longer operative time and the occurrence of a perioperative complication were associated with readmission.

CONCLUSION: Same-day discharge for minimally invasive hysterectomy for endometrial cancer is increasing. In selected patients, there is no increased risk of readmission with same day discharge.

Key words: discharge, endometrial cancer, hysterectomy, readmission, same day

Over the past 2 decades, minimally invasive surgical techniques have been widely adopted for hysterectomy for both benign and malignant conditions.[1] Compared with abdominal hysterectomy, minimally invasive hysterectomy is associated with lower rates of complications and improved postoperative recovery and return to normal activities.[2−16] Postoperative hospitalization is typically shorter after minimally invasive hysterectomy, and many women may be candidates for discharge on the day of surgery, so-called same-day discharge.

A number of studies in women undergoing hysterectomy for benign indications have suggested that same-day discharge is feasible and not associated with an increased risk of adverse perioperative outcomes.[2−16] To date, data examining same-day discharge for women undergoing minimally invasive hysterectomy for endometrial cancer have been more limited.[17−22] Several small studies have suggested that same-day discharge is safe in selected women with endometrial cancer.[18,20,22] However, there is concern for same-day discharge for women with endometrial cancer compared with those undergoing hysterectomy for benign indications, as these patients tend to be older, the procedure is often longer, and they often undergo concurrent procedures such as lymphadenectomy. As such, most reports have shown that only a small percentage of women with endometrial cancer are discharged on the day of surgery, and objective selection criteria for same day discharge are largely lacking.

The objective of this study was to determine the outcomes of same-day discharge after minimally invasive hysterectomy for endometrial cancer. Specifically, we sought to determine the association between same-day discharge and the occurrence of perioperative complications and hospital readmissions. A secondary objective was to create a preoperative risk calculator for length of stay and readmission.

Methods

We used data from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Participant Use Data File to identify patients who underwent laparoscopic hysterectomy

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AJOG at a Glance

Why was this study conducted?

As same-day discharge is becoming increasingly safe and routine for minimally invasive hysterectomy for benign conditions, we wanted to evaluate the trends, safety, and readmission rates for same-day discharge after minimally invasive hysterectomy for endometrial cancer.

Key findings

From 2011 to 2016, the rate of same-day discharge for minimally invasive hysterectomy for endometrial cancer increased from 5.6% to 16.3%. There was no difference in overall complications and readmission rates for patients discharged the same day of surgery as compared with those discharged on postoperative day 1.

What does this add to what is known?

As same-day discharge continues to increase and become routine for other minimally invasive gynecologic surgeries, it seems that in select patient populations with endometrial cancer, same-day discharge is also safe and feasible. With larger databases or a prospective study design, a preoperative risk calculator could be developed to better guide physicians and patients about discharge planning after minimally invasive hysterectomy for endometrial cancer.

(Current Procedural Terminology codes 58541−58544, 58548, 58550−58554, 58570−58573) for uterine cancer (*International Classification of Diseases, Ninth Revision* codes 179, 182.x; *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* codes C54.x) from 2011 to 2016. NSQIP collects variables on demographic characteristics, preoperative, intraoperative conditions, and 30-day postoperative outcomes of patients undergoing major surgical procedures in inpatient and outpatient services.[23] Data are extracted from medical chart by certified surgical clinical reviewers under a systematic sampling process that requires each participating hospital to submit data from 42 of the 46 eight-day cycles equally spaced throughout the year. Data quality is ensured by conducting an inter-rater reliability audit regularly. Patients who had missing data in sex, length of stay, and operative time; who had operative time less than or equal to 30 minutes; and who were discharged dead or have unknown discharge status were excluded.

Demographic variables included age (<50, 50−59, 60−69, 70−79, ≥80 years), race/ethnicity (white, black, Hispanic, other), year of operation, and body mass index (body mass index, normal <25 kg/m^2, overweight 25−29 kg/m^2, obese ≥30 kg/m^2). Preoperative variables included diabetes mellitus (insulin dependent or non-insulin dependent); cigarette smoking in the previous year; functional status (independent, partially, or totally dependent); history of severe chronic obstructive pulmonary disease, ascites, and congestive heart failure within 30 days before surgery; hypertension requiring medication; acute renal failure, requiring or on dialysis; open wound; steroid use; >10% of weight loss within 6 months before surgery; bleeding disorder; transfusion of ≥1 unit of red blood cells within 72 hours before surgery; serum albumin (<3.5, 3.5−4, >4 g/dL); and American Society of Anesthesiologists classification score (≤1, 2, 3, 4−5). Operative time was classified into quartiles. We identified concomitant procedures including anterior, posterior, and incontinence repair; oophorectomy; colpopexy; and lymphadenectomy using Current Procedural Terminology codes. Patients with missing data of race/ethnicity, body mass index, and functional status were grouped as unknown.

Primary and secondary outcomes

The primary outcome was readmission to the same or another hospital for any reason within 30 days of the surgery. Secondary outcomes included postoperative complications within 30 days of the surgery, including wound infection (superficial, deep, and organ or space surgical-site infection) and the composite metrics of severe complications (sepsis, shock, cardiac arrest, myocardial infarction, pulmonary embolism, ventilation >48 hours, unplanned intubation), intermediate complications (pneumonia, acute renal failure, urinary tract infection, cerebrovascular accident or stroke with deficit, coma, and deep-vein thrombosis or thrombophlebitis), and any complications (severe and intermediate).

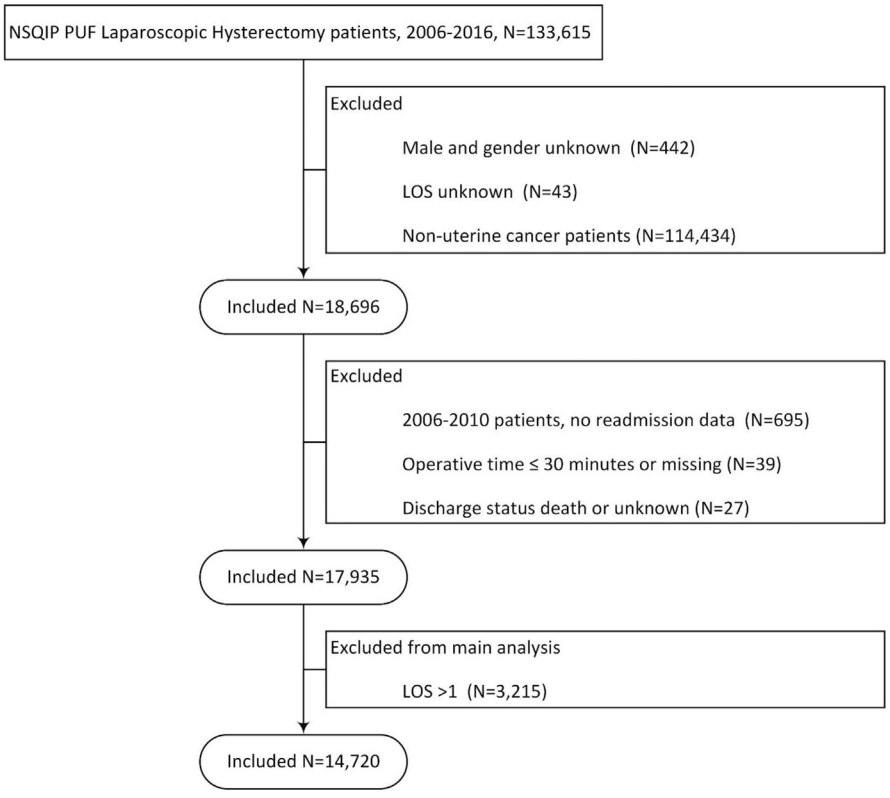
Statistical analysis

The trend of same-day discharge over time was plotted among all patients and tested using the Cochran−Armitage trend test. Then, we restricted the cohort to patients who were discharged on the same day or on postoperative day (POD) 1 and similarly analyzed the trend in same-day discharge. Patient characteristics were compared between the 2 groups using χ^2 tests. To examine factors associated with same-day discharge, we fit Poisson model, including age, race/ethnicity, year, body mass index, lymphadenectomy, diabetes, cigarette smoking, functional status, chronic obstructive pulmonary disease, congestive heart failure, hypertension, steroid use, American Society of Anesthesiologists class, operative time quartiles, any wound infection, severe, and intermediate complications. To examine the association with readmission, we fit similar models also adjusted for day of discharge. We also analyzed the risk of readmission stratified by day of discharge. All analyses were performed with SAS, version 9.4 (SAS Institute Inc, Cary, NC). A P value of <.05 was considered statistically significant.

Results

A total of 17,935 patients who underwent minimally invasive hysterectomy were identified (Figure 1, Figure 2, A). Within the cohort of patients discharged on the same day or on POD 1, 1828 (12.4%) were discharged on the same

FIGURE 1
Flowchart of cohort selection



LOS, length of stay; *NSQIP PUF*, American College of Surgeons National Surgical Quality Improvement Program Participant Use Data File.

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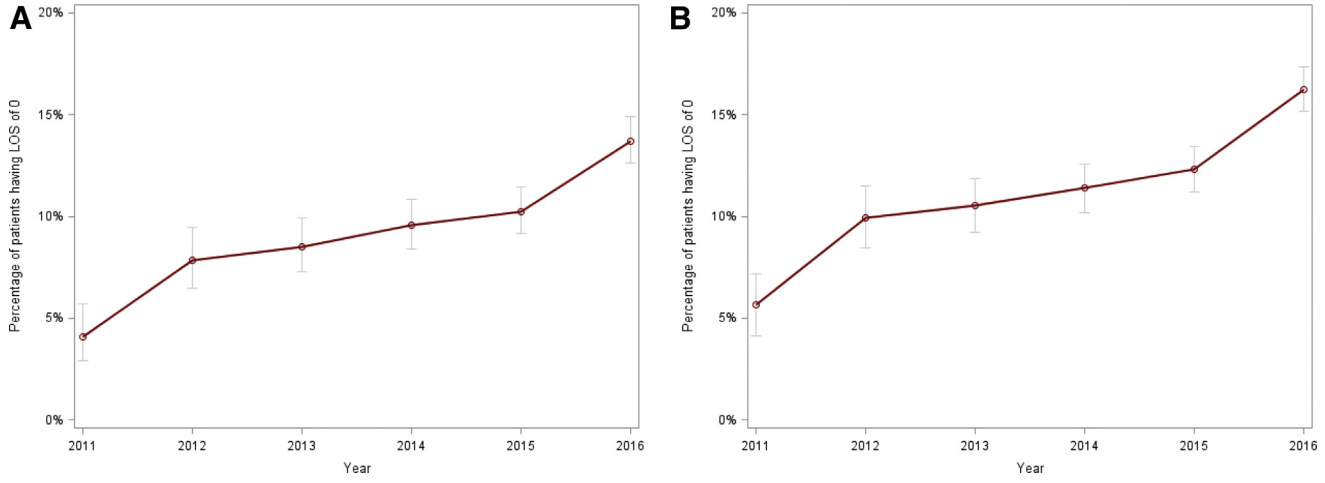
day, whereas 12,892 (87.6%) were discharged on POD 1. The rate of same-day discharge rose from 5.6% (95% confidence interval [CI], 4.1−7.2%) in 2011 to 16.3% (95% CI, 15.2−17.4%) in 2016 ($P<.001$) (Figure 2, B).

The rate of same-day discharge declined with age from 15.6% of women <50 years of age to 8.1% among women >80 years of age ($P<.001$) (Table 1). Likewise, the rate of same-day discharge declined with increasing body mass index from 16.3% among normal-weight women, to 13.7% in overweight women and to 11.0% in obese women ($P<.001$). Same-day discharge was less common among those with a greater American Society of Anesthesiologists classification score, women with diabetes mellitus, and those with lower albumin levels ($P<.001$ for all).

In a multivariable model, more recent year of surgery was the strongest predictor of same-day discharge (Table 2). Compared with women treated in 2011, the risk ratio (RR) for same-day discharge for those operated on in 2016 was 2.38 (95% CI, 1.78−3.18). Older women, those with chronic obstructive pulmonary disease, and women with hypertension on medications were less likely to have a same-day discharge.

FIGURE 2
Same-day discharge among women who underwent minimally invasive hysterectomy



Percentage of same day discharge among **A,** all patients ($P<.001$); and **B,** patients who were discharged on the same day or on postoperative day 1 ($P<.001$).

LOS, length of stay.

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TABLE 1
Demographic, clinical, and procedural characteristics of patients discharged on the same day compared with those discharged on POD 1

	POD 0		POD 1		
	n	(%)	n	(%)	*P* value
All	1828	(12.4)	12,892	(87.6)	
Demographics					
Age, y					<.001
<50	242	(15.6)	1310	(84.4)	
50–59	577	(14.0)	3555	(86.0)	
60–69	696	(12.2)	5028	(87.8)	
70–79	254	(9.8)	2330	(90.2)	
≥80	59	(8.1)	669	(91.9)	
Race/ethnicity					<.001
White	1119	(10.2)	9853	(89.8)	
Black	66	(8.0)	763	(92.0)	
Hispanic	142	(16.9)	699	(83.1)	
Other	246	(30.7)	555	(69.3)	
Unknown	255	(20.0)	1022	(80.0)	
Year of operation					<.001
2011	49	(5.6)	820	(94.4)	
2012	147	(10.0)	1330	(90.0)	
2013	218	(10.5)	1851	(89.5)	
2014	308	(11.4)	2395	(88.6)	
2015	405	(12.3)	2885	(87.7)	
2016	701	(16.3)	3611	(83.7)	
Body mass index					<.001
Normal	374	(16.3)	1924	(83.7)	
Overweight	413	(13.7)	2595	(86.3)	
Obese	1032	(11.0)	8336	(89.0)	
Unknown	9	(19.6)	37	(80.4)	
Preoperative conditions					
Diabetes					<.001
No	1522	(13.0)	10,226	(87.0)	
Insulin	71	(9.7)	662	(90.3)	
Non-insulin	235	(10.5)	2004	(89.5)	
Cigarette smoking	141	(7.7)	1047	(8.1)	.55
Functional status					.06
Independent	1821	(12.5)	12,764	(87.5)	
Partially dependent	4	(4.3)	89	(95.7)	
Totally dependent	0	(0.0)	12	(100.0)	
Unknown	3	(10.0)	27	(90.0)	

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TABLE 1
Demographic, clinical, and procedural characteristics of patients discharged on the same day compared with those discharged on POD 1 *(continued)*

	POD 0		POD 1		
	n	(%)	n	(%)	*P* value
Chronic obstructive pulmonary disease	13	(0.7)	225	(1.7)	.001
Ascites	2	(0.1)	6	(0.05)	.28
Congestive heart failure	1	(0.1)	29	(0.2)	.13
Hypertension on medication	823	(45.0)	7026	(54.5)	<.001
Acute renal failure	1	(0.1)	5	(0.04)	.75
Dialysis	1	(0.1)	29	(0.2)	.13
Open wound	3	(0.2)	40	(0.3)	.28
Steroid use	28	(1.5)	180	(1.4)	.65
Weight loss	6	(0.3)	45	(0.3)	.89
Bleeding disorder	11	(0.6)	173	(1.3)	.01
Transfusion	3	(0.2)	13	(0.1)	.44
Albumin, g/dL					<.001
<3.5	23	(7.0)	304	(93.0)	
3.5–4	222	(8.0)	2560	(92.0)	
>4	502	(9.6)	4737	(90.4)	
Unknown	1081	(17.0)	5291	(83.0)	
American Society of Anesthesiologists classification score					<.001
≤1	62	(16.9)	305	(83.1)	
2	1007	(14.0)	6185	(86.0)	
3	745	(10.8)	6142	(89.2)	
4–5	14	(5.1)	260	(94.9)	
Intraoperative conditions					
Total operation time, quartiles					<.001
Low	702	(19.0)	2996	(81.0)	
Medium low	497	(13.4)	3207	(86.6)	
Medium high	374	(10.2)	3288	(89.8)	
High	255	(7.0)	3401	(93.0)	
Concomitant procedures					
Anterior repair	13	(0.7)	145	(1.1)	.11
Posterior repair	2	(0.1)	47	(0.4)	.08
Incontinence repair	4	(0.2)	61	(0.5)	.12
Oophorectomy	23	(1.3)	145	(1.1)	.62
Colpopexy	2	(0.1)	32	(0.2)	.25
Lymphadenectomy	764	(41.8)	5188	(40.2)	.21

POD 0, postoperative day 0; *POD 1*, postoperative day 1.
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TABLE 2
Multivariable model for predictors for same-day discharge

	aRR
Age, y	
<50	Referent
50–59	0.97 (0.84–1.13)
60–69	0.92 (0.79–1.08)
70–79	0.75 (0.62–0.90)[a]
≥80	0.57 (0.43–0.77)[a]
Race/ethnicity	
White	Referent
Black	0.90 (0.70–1.15)
Hispanic	1.61 (1.35–1.92)[a]
Other	2.71 (2.35–3.13)[a]
Unknown	1.82 (1.58–2.09)[a]
Year of operation	
2011	Referent
2012	1.62 (1.17–2.24)[a]
2013	1.71 (1.25–2.34)[a]
2014	1.79 (1.33–2.43)[a]
2015	1.88 (1.40–2.53)[a]
2016	2.38 (1.78–3.18)[a]
Body mass index	
Normal	Referent
Overweight	0.91 (0.79–1.04)
Obese	0.85 (0.75–0.97)[a]
Unknown	1.27 (0.65–2.46)
Diabetes	
No	Referent
Insulin	0.89 (0.69–1.13)
Non-insulin	0.92 (0.79–1.06)
Cigarette smoking	0.99 (0.83–1.18)
Functional status	
Independent	Referent
Partially dependent	0.39 (0.14–1.03)
Totally dependent	—[b]
Unknown	0.66 (0.21–2.04)
Chronic obstructive pulmonary disease	0.53 (0.30–0.92)[a]
Congestive heart failure	0.52 (0.07–3.68)
Hypertension on medication	0.85 (0.77–0.95)[a]
Steroid use	1.16 (0.79–1.68)

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(continued)

Similarly, obese women were 15% less likely to have a same-day discharge than normal-weight women (RR, 0.85; 95% CI, 0.75–0.97). In contrast, compared with white women, Hispanic women (RR, 1.61; 95% CI, 1.35–1.92) and those who underwent lymphadenectomy (RR, 1.17; 95% CI, 1.07–1.29) were more likely to have a same-day discharge. The chance of same-day discharge decreased with increasing operative time.

The overall complication rate was 2.1% in women discharged on the day of surgery vs 2.6% in those discharged on postoperative day 1 (P=.19) (Table 3). The overall rate of severe complications was 0.7% in both groups, as was the rate of intermediate complications in women discharged on the same day (1.5%) and on those discharged on postoperative day 1 (2.1%; P=.11). The rate of wound complications was lower in those discharged on the day of surgery (0.9% vs 1.8%; P=.01), but the remainder of the specific complications were similar between the groups (P>.05 for all).

The readmission rate was 2.3% among women discharged on the day of surgery vs 3.1% in those discharged on postoperative day 1 (P=.051). In a multivariable model, there was no association between same-day discharge and readmission (RR, 0.99; 95% CI, 0.71–1.38; Table 4). More recent year of surgery was associated with a lower readmission rate, whereas underlying medical comorbidities and the occurrence of postoperative complications were associated with a greater readmission rate. Similar trends were noted when analyses stratified by day of discharge were examined.

Comment

Principal findings

This study suggests that use of same-day discharge is increasing among women with endometrial cancer who undergo minimally invasive hysterectomy. Importantly, same-day discharge appears to be safe. Compared with women hospitalized overnight, there was no increase in the risk of perioperative complications or readmission in women discharged on the day of surgery.

TABLE 2
Multivariable model for predictors for same-day discharge *(continued)*

	aRR
American Society of Anesthesiologists classification score	
≤1	Referent
2	1.16 (0.89–1.51)
3	1.09 (0.83–1.43)
4–5	0.55 (0.31–1.001)
Operative time, quartiles	
Low	Referent
Medium low	0.72 (0.65–0.81)[a]
Medium high	0.55 (0.49–0.63)[a]
High	0.38 (0.33–0.44)[a]
Lymphadenectomy	1.17 (1.07–1.29)[a]
Any wound infection	0.63 (0.39–1.03)
Severe complications	1.34 (0.75–2.36)
Intermediate complications	0.87 (0.60–1.28)

Log-Poisson model for predictors of same-day discharge included age, race/ethnicity, year, body mass index, lymphadenectomy, diabetes, cigarette smoking, functional status, chronic obstructive pulmonary disease, congestive heart failure, hypertension on medication, steroid use, American Society of Anesthesiologists classification score, operative time, any wound infection (superficial, deep, and organ/space surgical site infection), severe (sepsis, shock, arrest, myocardial infarction, pulmonary embolism, ventilation >48 hours, and unplanned intubation), and intermediate (pneumonia, acute renal failure, urinary tract infection, cerebrovascular accident/stroke with deficit, coma, and deep-vein thrombosis/thrombophlebitis) complications.

aRR, adjusted risk ratio.

[a] *P* value <.05; [b] Nonestimable.

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Results

A growing body of literature suggests that same-day discharge is safe for minimally invasive hysterectomy for benign indications.[2–16] The earliest of these studies, in 1994, included 7 patients undergoing laparoscopic hysterectomy and found that with a stringent postoperative care model, patients could be safely discharged home within 4–6 hours of surgery.[15] Larger studies have been able to elucidate factors associated with greater rates of readmission, including diabetes mellitus, chronic obstructive pulmonary disease, chronic steroid use, daily alcohol use, bleeding disorders, and longer operative times (>2 hours).[6] More recently, a systematic review including nearly 12,000 patients from 15 observational studies reported that same-day discharge is feasible.[7]

Previous studies also have shown that same-day discharge after minimally invasive hysterectomy for endometrial cancer is feasible.[18–23] In 1 study, a routine same-day discharge protocol was adopted for minimally invasive hysterectomy for endometrial cancer and showed no change in postoperative readmission, unscheduled surgery, infection, and composite complications in 30 days of surgery.[20] In a more recent systematic literature review, Nahas et al,[21] showed that although all of the current studies are retrospective, non-randomized, collectively they suggest that in select patients and with careful planning, same-day discharge is safe and feasible in gynecologic oncologic cases. In line with this growing body of literature, in a large cohort of patients, we found no increased risk of hospital readmission for patients with endometrial cancer discharged on the day of surgery.

Clinical implications

Despite the growing body of literature supporting the safety of same-day discharge after minimally invasive hysterectomy, only a small percentage of patients with endometrial cancer were discharged on the day of surgery. Even by 2016, only 16% of patients in our cohort were discharged on the day of surgery. There are a number of barriers to same-day discharge. Physicians may be reluctant to discharge patients for fear of missed complications. The development of detailed selection criteria may help to reduce physician anxiety and facilitate same-day discharge. Likewise, patients may be hesitant to leave on the day of surgery. In one report, 20% of overnight admissions after minimally invasive hysterectomy were due to social reasons, including placement, arranging home health services, or transportation issues.[22] Setting expectations for patients and a detailed process for same-day discharge will likely help reduce patient barriers for same-day discharge.

Research implications

A priori, we hoped to develop a preoperative risk calculator for the safety of same-day discharge. Preoperative risk calculators have become helpful for personalized perioperative planning based on a patient's individual risk factors and characteristics. Previous studies have found that older age, late procedure start times and completion times, longer-duration operations, and greater blood loss were associated with a decreased likelihood of same day discharge.[7] There is limited quantitative evidence to define specific criteria for same-day discharge for hysterectomy for endometrial cancer. However, due to the low rate of readmission overall and particularly among patients discharged the same day following surgery, we were unable to create a risk prediction model.

Strengths and limitations

Although the study benefits from the inclusion of a large number of women, we recognize a number of important limitations. First, although we were able to define discharge day, NSQIP lacks data on the specific time of day of discharge. Previous work has demonstrated increased feasibility for same-day discharge for patients operated on early

TABLE 3
Outcomes of patients discharged on the same day compared with POD 1

	POD 0		POD 1		
	n	(%)	n	(%)	*P* value
Any wound infection	17	(0.9)	226	(1.8)	.01
Superficial surgical-site infection	4	(0.2)	92	(0.7)	.01
Deep surgical site-infection	1	(0.1)	22	(0.2)	.24
Organ/space surgical-site infection	12	(0.7)	114	(0.9)	.32
Any complication	38	(2.1)	334	(2.6)	.19
Severe complications	13	(0.7)	95	(0.7)	.90
Sepsis	3	(0.2)	43	(0.3)	.22
Shock	2	(0.1)	16	(0.1)	.87
Cardiac arrest	0	(0.0)	4	(0.03)	.45
Myocardial infarction	2	(0.1)	3	(0.02)	.06
Pulmonary embolism	5	(0.3)	28	(0.2)	.63
Ventilation >48 h	3	(0.2)	10	(0.1)	.24
Unplanned intubation	3	(0.2)	12	(0.1)	.37
Intermediate complications	28	(1.5)	269	(2.1)	.11
Pneumonia	3	(0.2)	19	(0.1)	.86
Acute renal failure	0	(0.0)	7	(0.1)	.32
Urinary tract infection	22	(1.2)	217	(1.7)	.13
Cerebrovascular accident/stroke with deficit	1	(0.1)	7	(0.1)	.99
Coma	0	(0.0)	1	(0.01)	.71
Deep vein-thrombosis/thrombophlebitis	2	(0.1)	33	(0.3)	.23
Readmission	42	(2.3)	404	(3.1)	.051
Adjusted %, 95% confidence interval	—	(1.7, 1.3–2.4)	—	(2.1, 1.8–2.3)	

Any wound infection included superficial, deep, and organ/space surgical site infection. Any complication included severe (sepsis, shock, arrest, myocardial infarction, pulmonary embolism, ventilation>48 hours, and unplanned intubation) and intermediate (pneumonia, acute renal failure, urinary tract infection, cerebrovascular accident/stroke with deficit, coma, and deep-vein thrombosis/thrombophlebitis) complications.

Log-Poisson model was fitted to estimate the adjusted risks of readmission, including day of discharge, age, race/ethnicity, year, body mass index, lymphadenectomy, diabetes, cigarette smoking, functional status, chronic obstructive pulmonary disease, congestive heart failure, hypertension on medication, steroid use, American Society of Anesthesiologists classification score, operative time, any wound infection, severe, and intermediate complications.

POD 0, postoperative day 0; *POD 1*, postoperative day 1.

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in the day.[7] Timing of the procedure is likely to have influenced the likelihood of same-day discharge and possibly outcomes and would be of great interest for future study. Second, as with any observational study, we are unable to control for day of discharge, and there was undoubtedly selection bias in the allocation of discharge day. Although other smaller studies have shown the safety of same-day discharge in single-center cohorts, a priori the goal of our analysis was to examine same-day discharge in a larger cohort.[5,18,21] Further work is clearly needed to examine how the performance and extent of lymph node removal influence the safety of same-day discharge.

Third, NSQIP also lacks specific patient demographic characteristics and surgical variables that could be of interest in distinguishing possible risks of readmission including comorbidities such as obstructive sleep apnea (with or without use of continuous positive airway pressure), and surgical techniques such as performance of robot-assisted vs laparoscopic mode of hysterectomy. Fourth, despite the large study size, the outcomes of readmission and complications were relatively rare. The analysis may have been underpowered to detect small differences in outcomes for women discharged on the day of surgery. Finally, we lacked data on patient's social support network and postoperative care needs. A substantial number of postoperative hospitalizations are for social indications and further analyzing these factors would be of great utility for policy planning.[22]

TABLE 4
Multivariable models of factors associated with readmission among patients discharged on the same day of surgery or on POD 1

	aRR, overall	aRR, POD 0	aRR, POD 1
Day of discharge			
Same day	0.99 (0.71–1.38)	—	—
POD 1	Referent	—	—
Age, y			
<50	Referent	Referent	Referent
50–59	1.02 (0.72–1.45)	0.47 (0.17–1.28)	1.12 (0.77–1.64)
60–69	0.93 (0.66–1.31)	0.36 (0.13–1.03)	1.06 (0.73–1.55)
70–79	1.32 (0.91–1.92)	0.74 (0.25–2.21)	1.47 (0.98–2.20)
≥80	1.55 (0.94–2.53)	0.39 (0.04–3.39)	1.75 (1.04–2.95)[a]
Race			
White	Referent	Referent	Referent
Black	1.35 (0.96–1.91)	1.11 (0.22–5.52)	1.37 (0.96–1.96)
Hispanic	0.74 (0.46–1.19)	1.03 (0.29–3.60)	0.72 (0.43–1.20)
Other	0.84 (0.53–1.35)	0.51 (0.14–1.80)	0.93 (0.56–1.55)
Unknown	0.95 (0.65–1.40)	0.97 (0.36–2.58)	0.86 (0.55–1.34)
Year			
2011	Referent	Referent	Referent
2012	0.76 (0.50–1.15)	0.62 (0.14–2.64)	0.75 (0.49–1.17)
2013	0.56 (0.37–0.85)[a]	0.28 (0.06–1.31)	0.58 (0.38–0.89)[a]
2014	0.55 (0.37–0.82)[a]	0.19 (0.04–0.84)[a]	0.58 (0.38–0.87)[a]
2015	0.67 (0.47–0.97)[a]	0.28 (0.07–1.12)	0.70 (0.48–1.03)
2016	0.52 (0.36–0.76)[a]	0.28 (0.07–1.04)	0.54 (0.36–0.80)[a]
Body mass index			
Normal	Referent	Referent	Referent
Overweight	0.89 (0.64–1.24)	0.94 (0.34–2.56)	0.91 (0.64–1.29)
Obese	0.80 (0.59–1.08)	0.74 (0.30–1.84)	0.82 (0.59–1.12)
Unknown	0.88 (0.12–6.36)	—[b]	1.11 (0.15–8.04)
Diabetes			
No	Referent	Referent	Referent
Insulin	0.79 (0.51–1.24)	0.51 (0.06–4.36)	0.81 (0.51–1.28)
Non-insulin	0.92 (0.69–1.21)	0.59 (0.17–2.07)	0.94 (0.70–1.26)
Cigarette smoking	1.01 (0.73–1.40)	0.27 (0.06–1.26)	1.11 (0.79–1.57)
Functional status			
Independent	Referent	—	Referent
Partially dependent	1.81 (0.67–4.89)	—	1.82 (0.67–4.94)
Totally dependent	3.99 (1.34–11.91)[a]	—	4.46 (1.49–13.32)[a]
Unknown	1.27 (0.18–9.15)	—	1.33 (0.19–9.58)

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TABLE 4
Multivariable models of factors associated with readmission among patients discharged on the same day of surgery or on POD 1 *(continued)*

	aRR, overall	aRR, POD 0	aRR, POD 1
Chronic obstructive pulmonary disease	1.12 (0.59–2.11)	–	0.94 (0.48–1.85)
Congestive heart failure	4.86 (1.77–13.35)[a]	–	5.01 (1.82–13.80)[a]
Hypertension on medication	1.13 (0.91–1.40)	1.42 (0.68–2.98)	1.12 (0.89–1.40)
Steroid use	1.34 (0.73–2.47)	3.03 (0.78–11.74)	1.06 (0.52–2.15)
American Society of Anesthesiologists classification score			
≤1	Referent	–	Referent
2	1.10 (0.51–2.38)	–	0.91 (0.42–1.98)
3	1.42 (0.65–3.11)	–	1.17 (0.53–2.58)
4–5	1.53 (0.54–4.36)	–	1.35 (0.47–3.85)
Operative time, quartiles			
Low	Referent	Referent	Referent
Medium low	0.94 (0.69–1.27)	2.51 (0.67–9.47)	0.96 (0.70–1.31)
Medium high	1.26 (0.94–1.68)	3.43 (0.94–12.44)	1.12 (0.83–1.51)
High	1.09 (0.82–1.47)	4.01 (1.14–14.14)[a]	1.02 (0.76–1.38)
Lymphadenectomy	1.18 (0.97–1.43)	1.33 (0.65–2.72)	1.16 (0.95–1.42)
Any wound infection	11.34 (8.72–14.76)[a]	22.53 (8.16–62.20)[a]	11.41 (8.68–15.00)[a]
Severe complications	4.97 (3.63–6.82)[a]	10.22 (3.24–32.21)[a]	4.55 (3.26–6.33)[a]
Intermediate complications	3.48 (2.60–4.64)[a]	5.57 (1.64–18.91)[a]	3.64 (2.69–4.92)[a]

Log-Poisson models were fitted for predictors of readmission. The overall model included day of discharge, age, race/ethnicity, year, body mass index, lymphadenectomy, diabetes, cigarette smoking, functional status, chronic obstructive pulmonary disease, congestive heart failure, hypertension on medication, steroid use, Society of Anesthesiology classification score, operative time, any wound infection, severe, and intermediate complications. Similar models were fitted for stratified analysis by day of discharge. Functional status, chronic obstructive pulmonary disease, congestive heart failure, and American Society of Anesthesiologists classification score were not included in the model restricting to same day discharge patients because of model convergence.

aRR, adjusted risk ratio.

[a] *P* value <.05; [b] Nonestimable.

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Conclusion

These findings have important implications for reducing costs and improving efficiency for surgery for endometrial cancer. Given that hospital charges are one of the major drivers of cost for surgery for endometrial cancer, same-day discharge can be an important lever to lower the cost of hysterectomy. A previous modeling study noted that reducing length of stay after hysterectomy could result in significant cost savings.[24] Given the growing body of literature for the safety of same-day discharge, implementing tools to promote day of surgery discharge to providers and patients would be of great value. Interventions as simple as developing protocols for providers and setting expectations for patients could be of value. Finally, given the benefits of same-day discharge after hysterectomy, day of surgery discharge might be a quality metric for hysterectomy for endometrial cancer.[25–32]

References

1. Scalici J, Laughlin BB, Finan MA, Wang B, Rocconi RP. The trend towards minimally invasive surgery (MIS) for endometrial cancer: an ACS-NSQIP evaluation of surgical outcomes. Gynecol Oncol 2015;136:512–5.
2. Bruneau L, Randet M, Evrard S, Damon A, Laurent FX. Total laparoscopic hysterectomy and same-day discharge: Satisfaction evaluation and feasibility study. J Gynecol Obstet Biol Reprod (Paris) 2015;44:870–6 [in French].
3. Dedden SJ, Geomini P, Huirne JAF, Bongers MY. Vaginal and laparoscopic hysterectomy as an outpatient procedure: a systematic review. Eur J Obstet Gynecol Reprod Biol 2017;216:212–23.
4. Donnez O, Donnez J, Dolmans MM, Dethy A, Baeyens M, Mitchell J. Low pain score after total laparoscopic hysterectomy and same-day discharge within less than 5 hours: results of a prospective observational study. J Minim Invasive Gynecol 2015;22:1293–9.
5. Gien LT, Kupets R, Covens A. Feasibility of same-day discharge after laparoscopic surgery in gynecologic oncology. Gynecol Oncol 2011;121:339–43.
6. Jennings AJ, Spencer RJ, Medlin E, Rice LW, Uppal S. Predictors of 30-day readmission and impact of same-day discharge in laparoscopic hysterectomy. Am J Obstet Gynecol 2015;213:344 e1–7.
7. Korsholm M, Mogensen O, Jeppesen MM, Lysdal VK, Traen K, Jensen PT. Systematic review of same-day discharge after minimally invasive hysterectomy. Int J Gynaecol Obstet 2017;136:128–37.
8. Lassen PD, Moeller-Larsen H, DE Nully P. Same-day discharge after laparoscopic hysterectomy. Acta Obstet Gynecol Scand 2012;91:1339–41.
9. Maheux-Lacroix S, Lemyre M, Couture V, Bernier G, Laberge PY. Feasibility and safety of

outpatient total laparoscopic hysterectomy. JSLS 2015;19. e2014 00251.
10. Minig L, Chuang L, Patrono MG, Fernandez-Chereguini M, Cardenas-Rebollo JM, Biffi R. Clinical outcomes after fast-track care in women undergoing laparoscopic hysterectomy. Int J Gynaecol Obstet 2015;131:301–4.
11. Nensi A, Coll-Black M, Leyland N, Sobel ML. Implementation of a same-day discharge protocol following total laparoscopic hysterectomy. J Obstet Gynaecol Can 2018;40:29–35.
12. Perron-Burdick M, Yamamoto M, Zaritsky E. Same-day discharge after laparoscopic hysterectomy. Obstet Gynecol 2011;117:1136–41.
13. Schiavone MB, Herzog TJ, Ananth CV, et al. Feasibility and economic impact of same-day discharge for women who undergo laparoscopic hysterectomy. Am J Obstet Gynecol 2012;207:382 e1–9.
14. Sheyn D, El-Nashar S, Billow M, Mahajan S, Duarte M, Pollard R. Readmission rates after same-day discharge compared with postoperative day 1 discharge after benign laparoscopic hysterectomy. J Minim Invasive Gynecol 2018;25:484–90.
15. Taylor RH. Outpatient laparoscopic hysterectomy with discharge in 4 to 6 hours. J Am Assoc Gynecol Laparosc 1994;1:S35.
16. Walker JL, Piedmonte MR, Spirtos NM, et al. Laparoscopy compared with laparotomy for comprehensive surgical staging of uterine cancer: Gynecologic Oncology Group Study LAP2. J Clin Oncol 2009;27:5331–6.
17. Fountain CR, Havrilesky LJ. Promoting same-day discharge for gynecologic oncology patients in minimally invasive hysterectomy. J Minim Invasive Gynecol 2017;24:932–9.
18. Lee J, Aphinyanaphongs Y, Curtin JP, Chern JY, Frey MK, Boyd LR. The safety of same-day discharge after laparoscopic hysterectomy for endometrial cancer. Gynecol Oncol 2016;142:508–13.
19. Lee SJ, Calderon B, Gardner GJ, et al. The feasibility and safety of same-day discharge after robotic-assisted hysterectomy alone or with other procedures for benign and malignant indications. Gynecol Oncol 2014;133:552–5.
20. Melamed A, Katz Eriksen JL, Hinchcliff EM, et al. Same-day discharge after laparoscopic hysterectomy for endometrial cancer. Ann Surg Oncol 2016;23:178–85.
21. Nahas S, Feigenberg T, Park S. Feasibility and safety of same-day discharge after minimally invasive hysterectomy in gynecologic oncology: a systematic review of the literature. Gynecol Oncol 2016;143:439–42.
22. Rivard C, Casserly K, Anderson M, Isaksson Vogel R, Teoh D. Factors influencing same-day hospital discharge and risk factors for readmission after robotic surgery in the gynecologic oncology patient population. J Minim Invasive Gynecol 2015;22:219–26.
23. ACS NSQIP Participant Use Data File. Available at: https://www.facs.org/quality-programs/acs-nsqip. Accessed January 21, 2017.
24. Wright JD, Havrilesky LJ, Cohn DE, et al. Estimating potential for savings for low risk endometrial cancer using the Endometrial Cancer Alternative Payment Model (ECAP): a companion paper to the Society of Gynecologic Oncology Report on the Endometrial Cancer Alternative Payment Model. Gynecol Oncol 2018;149:241–7.
25. Gandaglia G, Ghani KR, Sood A, et al. Effect of minimally invasive surgery on the risk for surgical site infections: results from the National Surgical Quality Improvement Program (NSQIP) Database. JAMA Surg 2014;149:1039–44.
26. George EM, Burke WM, Hou JY, et al. Measurement and validation of frailty as a predictor of outcomes in women undergoing major gynaecological surgery. BJOG 2016;123:455–61.
27. Mahdi H, Lockhart D, Maurer KA. Impact of age on 30-day mortality and morbidity in patients undergoing surgery for endometrial cancer. Gynecol Oncol 2015;137:106–11.
28. Nelson G, Altman AD, Nick A, et al. Guidelines for pre- and intra-operative care in gynecologic/oncology surgery: Enhanced Recovery After Surgery (ERAS(R)) Society recommendations—Part I. Gynecol Oncol 2016;140:313–22.
29. Rivard C, Nahum R, Slagle E, et al. Evaluation of the performance of the ACS NSQIP surgical risk calculator in gynecologic oncology patients undergoing laparotomy. Gynecol Oncol 2016;141:281–6.
30. Szender JB, Frederick PJ, Eng KH, Akers SN, Lele SB, Odunsi K. Evaluation of the National Surgical Quality Improvement Program Universal Surgical Risk Calculator for a gynecologic oncology service. Int J Gynecol Cancer 2015;25:512–20.
31. Teoh D, Halloway RN, Heim J, Vogel RI, Rivard C. Evaluation of the American College of Surgeons National Surgical Quality Improvement Program Surgical Risk Calculator in Gynecologic Oncology Patients Undergoing Minimally Invasive Surgery. J Minim Invasive Gynecol 2017;24:48–54.
32. Wright JD, Ananth CV, Lewin SN, et al. Robotically assisted vs laparoscopic hysterectomy among women with benign gynecologic disease. JAMA 2013;309:689–98.

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