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Identifying modifiable and non-modifiable risk factors associated with prolonged length of stay after hysterectomy for uterine cancer☆

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HIGHLIGHTS

- Perioperative risk factors account for approximately 25% of the variation in prolonged LOS.
- A substantial proportion of the variation in LOS remains unexplained by measurable factors.
- There are similar predictors of prolonged LOS for abdominal and minimally invasive hysterectomy.

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ABSTRACT

Objective. We examined the influence of modifiable (intraoperative factors and complications) and non-modifiable (clinical and demographic characteristics) factors on length of stay (LOS) for women who underwent hysterectomy for uterine cancer.

Methods. The National Surgical Quality Improvement Program database was used to identify women who underwent hysterectomy for uterine cancer from 2006 to 2015. The association between demographic, preoperative, intraoperative, and postoperative factors and LOS was examined. The primary outcome was prolonged LOS (>75th an3 > 90th percentiles). Model fit statistics were used to assess the importance of each group of characteristics.

Results. Of 19,084 women identified, 6082 (31.9%) underwent abdominal and 13,002 (68.1%) underwent minimally invasive hysterectomy. In the abdominal hysterectomy group, the 75th and 90th percentiles for LOS were 5 and 8 days, respectively. All risk factors combined accounted for 23.6% of the variation in LOS >75th percentile. Demographic characteristics explained 4.0%, preoperative factors 7.0%, intraoperative factors 7.9%, and postoperative characteristics 9.7% of variation in prolonged LOS. In the minimally invasive group, the 75th and 90th percentiles for LOS were 1 and 2 days, respectively. The combined risk factors explained 16.2% of the variation in prolonged LOS. Demographic characteristics accounted for 6.2%, preoperative factors 4.1%, intraoperative factors 6.9%, and postoperative characteristics 1.3% of variation in prolonged LOS. Similar patterns were seen when prolonged LOS was defined as >90th percentile.

Conclusion. Perioperative risk factors account for approximately one quarter of the variation in prolonged LOS. Overall, a substantial proportion of the variation in LOS remains unexplained by measurable patient and hospital factors which may limit the utility of LOS as a quality metric for endometrial cancer.

1. Introduction

Hospital length of stay (LOS) has been proposed as a quality metric and influences reimbursement for a variety of surgical procedures. In the context of growing healthcare costs, the Centers for Medicare and

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Table 1
Demographic, preoperative, intraoperative and postoperative conditions of patients who underwent abdominal hysterectomy by prolonged length of stay.

	LOS ≤ 75th %		LOS > 75th %			LOS ≤ 90th %		LOS > 90th %		
	N	(%)	N	(%)	*P*-value	N	(%)	N	(%)	*P*-value
All	4834	(79.5)	1248	(20.5)		5545	(91.2)	537	(8.8)	
Demographics										
Year of operation					0.050					0.17
2006	a	a	a	a		a	a	a	a	
2007	a	a	a	a		a	a	a	a	
2008	177	(3.7)	45	(3.6)		201	(3.6)	21	(3.9)	
2009	324	(6.7)	62	(5.0)		366	(6.6)	20	(3.7)	
2010	355	(7.3)	72	(5.8)		392	(7.1)	35	(6.5)	
2011	537	(11.1)	160	(12.8)		623	(11.2)	74	(13.8)	
2012	613	(12.7)	187	(15.0)		717	(12.9)	83	(15.5)	
2013	838	(17.3)	228	(18.3)		973	(17.5)	93	(17.3)	
2014	928	(19.2)	235	(18.8)		1063	(19.2)	100	(18.6)	
2015	1004	(20.8)	242	(19.4)		1141	(20.6)	105	(19.6)	
Age					<0.001					<0.001
<50	607	(12.6)	97	(7.8)		666	(12.0)	38	(7.1)	
50–59	1280	(26.5)	264	(21.2)		1431	(25.8)	113	(21.0)	
60–69	1742	(36.0)	412	(33.0)		1985	(35.8)	169	(31.5)	
≥70	1205	(24.9)	475	(38.1)		1463	(26.4)	217	(40.4)	
Race					<0.001					0.002
White	3417	(70.7)	843	(67.5)		3905	(70.4)	355	(66.1)	
Black	604	(12.5)	240	(19.2)		741	(13.4)	103	(19.2)	
Other	236	(4.9)	59	(4.7)		267	(4.8)	28	(5.2)	
Unknown	577	(11.9)	106	(8.5)		632	(11.4)	51	(9.5)	
Elective surgery					<0.001					<0.001
No	134	(2.8)	221	(17.7)		211	(3.8)	144	(26.8)	
Yes	3776	(78.1)	824	(66.0)		4294	(77.4)	306	(57.0)	
Unknown	924	(19.1)	203	(16.3)		1040	(18.8)	87	(16.2)	
Preoperative conditions										
BMI					<0.001					<0.001
Normal	755	(15.6)	215	(17.2)		870	(15.7)	100	(18.6)	
Overweight	966	(20.0)	256	(20.5)		1113	(20.1)	109	(20.3)	
Obese	3098	(64.1)	763	(61.1)		3544	(63.9)	317	(59.0)	
Unknown	15	(0.3)	14	(1.1)		18	(0.3)	11	(2.0)	
Diabetes					<0.001					0.01
No	3733	(77.2)	886	(71.0)		4234	(76.4)	385	(71.7)	
Insulin dependent	280	(5.8)	114	(9.1)		344	(6.2)	50	(9.3)	
Type 2	821	(17.0)	248	(19.9)		967	(17.4)	102	(19.0)	
Smoking					0.50					0.66
No	4373	(90.5)	1121	(89.8)		5006	(90.3)	488	(90.9)	
Yes	461	(9.5)	127	(10.2)		539	(9.7)	49	(9.1)	
Functional status					<0.001					<0.001
Independent	4728	(97.8)	1166	(93.4)		5399	(97.4)	495	(92.2)	
Partially dependent	70	(1.4)	70	(5.6)		102	(1.8)	38	(7.1)	
Totally dependent	17	(0.4)	a	a		23	(0.4)	a	a	
Unknown	19	(0.4)	a	a		21	(0.4)	a	a	
COPD					<0.001					0.001
No	4713	(97.5)	1189	(95.3)		5393	(97.3)	509	(94.8)	
Yes	121	(2.5)	59	(4.7)		152	(2.7)	28	(5.2)	
CHF					<0.001					<0.001
No	4821	(99.7)	1228	(98.4)		5524	(99.6)	525	(97.8)	
Yes	13	(0.3)	20	(1.6)		21	(0.4)	12	(2.2)	
Bleeding disorder					<0.001					<0.001
No	4739	(98.0)	1182	(94.7)		5420	(97.7)	501	(93.3)	
Yes	95	(2.0)	66	(5.3)		125	(2.3)	36	(6.7)	
Open wound					<0.001					<0.001
No	4810	(99.5)	1227	(98.3)		5512	(99.4)	525	(97.8)	
Yes	24	(0.5)	21	(1.7)		33	(0.6)	12	(2.2)	
ASA class					<0.001					<0.001
None	a	a	a	a		a	a	a	a	
1	a	a	a	a		a	a	a	a	
2	1963	(40.6)	336	(26.9)		2185	(39.4)	114	(21.2)	
3	2606	(53.9)	781	(62.6)		3032	(54.7)	355	(66.1)	
4–5	139	(2.9)	125	(10.0)		198	(3.6)	66	(12.3)	
Intraoperative conditions										
Total operation time in minutes										
Median (IQR)	138	(101–189)	185	(128–242)	<0.001	143	(103–196)	186	(129–250)	<0.001
Postoperative conditions										
Any wound infection					<0.001					<0.001
No	4531	(93.7)	1056	(84.6)		5159	(93.0)	428	(79.7)	
Yes	303	(6.3)	192	(15.4)		386	(7.0)	109	(20.3)	
Pneumonia					<0.001					<0.001
No	4807	(99.4)	1177	(94.3)		5490	(99.0)	494	(92.0)	
Yes	27	(0.6)	71	(5.7)		55	(1.0)	43	(8.0)	
PE					<0.001					<0.001

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