COMPARATIVE EFFECTIVENESS OF ROBOTIC VS CONVENTIONAL TOTAL LAPAROSCOPIC HYSTERECTOMY FOR BENIGN INDICATIONS

By

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A THESIS

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CERTIFICATE OF APPROVAL

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ABSTRACT

OBJECTIVE: To compare surgical outcomes, hospital charges, and patient satisfaction among women undergoing total laparoscopic hysterectomy for non-malignant indications with and without robotic assistance.

METHODS: Retrospective chart review was conducted for patients who underwent total laparoscopic hysterectomy for non-malignant indications at two community hospitals and a neighboring academic medical center from 2008 - 2010. Subjects were invited to complete follow-up questionnaires.

RESULTS: Hospital records were searched using an ICD9-based search protocol, yielding 411 cases that were screened for inclusion. There were 299 cases that met study criteria, 134 (44.8%) of which involved robotic assistance. Data were extracted by manual chart review of electronic records. Patients in the robotic group had greater age, BMI, and history of cancer. Robotic assistance resulted in greater total hospital charges, although significant interaction was discovered whereby increased charges associated with robotic assistance were localized to two of the three hospitals studied. Robotic assistance was not associated with significant differences in operative time, estimated blood loss >100mL, conversion to open laparotomy, major complications, or likelihood of prolonged hospital stay, although significant interaction was found between hospital site and odds of prolonged hospital stay. Ninety-nine subjects (33%) completed questionnaires. Among respondents, robotic assistance did not demonstrate superior patient satisfaction or recovery experience.

CONCLUSION: In women undergoing total laparoscopic hysterectomy for non-malignant indications, robotic assistance was associated with greater total hospital charges. These data do not demonstrate significant benefit in operative time, estimated blood loss, length of stay, or patient satisfaction among patients whose operations involved robotic assistance. Patients with increased age, BMI, or personal history of cancer may be more likely to receive robotic-assistance when undergoing total laparoscopic hysterectomy.

INTRODUCTION

Hysterectomy is the most common non-pregnancy-related surgical procedure for women of reproductive age in the United States.(1) Approximately 600,000 procedures are performed each year, and approximately 20 million U.S. women have undergone the procedure. Nearly 90% of hysterectomies are performed for benign indications such as leiomyomas, menstrual disorders, and endometriosis.(2) Rates of competing hysterectomy techniques are shifting, with increasing rates of laparoscopic hysterectomy observed over the last two decades.(2, 3) Laparoscopic hysterectomy has demonstrated benefits over open hysterectomy including decreased blood loss, length of stay, recovery time, and rate of complication.(4-6)

In 2005, the U.S. Food and Drug Administration (FDA) approved the da Vinci robotic surgery system for gynecologic operations. Advocates of robotic-assisted surgery cite advantages including stereoscopic vision, improved range of motion, movement filtering, and ergonomics.(7) However, users of the robotic system have reported disadvantages including increased operative time, lack of direct access to patient, lack of haptic (tactile) feedback, bulkiness of equipment, and cost.(8, 9) The retail price for the da Vinci system ranges from $2 – $2.3 million in addition to annual maintenance contracts and semi-disposable equipment.(10) According to the manufacturer's annual report, hysterectomy surpassed prostatectomy in 2010 as the most commonly performed robotic operation worldwide. In 2011, the worldwide rate of robotic-assisted hysterectomy grew from 110,000 annual cases to 146,000 cases, a 33% annual increase.(11) Approximately 73% of robotic hysterectomies are performed for benign indications.

Nevertheless, published data comparing outcomes of robotic vs conventional laparoscopic hysterectomy are limited, particularly for cases limited to non-malignant indications. A 2011 review by Sarlos and colleagues found six studies comparing robotic and conventional laparoscopic hysterectomy for benign indications.(10) Five studies in their review were historical cohort studies, while one used a prospective, matched case-control design.(9) We are unaware of any published prospective randomized controlled trial.

Aside from a large, multicenter study of over 36,000 cases from 2007-2008 at 350 institutions by Pasic and colleagues (12), the other studies reviewed by Sarlos primarily included one or two surgeons at one or two hospitals with no statistical adjustment for potential confounders. These studies had sample sizes ranging from 68 to 324, with a median of 80 cases. Operative times were significantly longer for robotic cases in five out of six studies, but surgeons' experience was rarely mentioned (despite being recognized as an important confounder in such analyses).(7) Most studies found no significant differences in rates of intraoperative conversion to open hysterectomy, estimated blood loss, or length of hospital stay between the two techniques. Only two studies reported costs, both of which found the robotic technique significantly more expensive, with mean cost differences of $2667 USD and $2631 USD.(9, 12) None of these studies reported patient-derived outcomes such as resolution of symptoms, post-hospital complications, or recovery time. Thus, the existing literature comparing these techniques for benign indications is limited by few studies, often with limited sample size, limited cost data, and lack of patient-centered outcomes.

The rapid and widespread adoption of novel medical technology such as robotic surgery poses important questions to individuals, policy-makers, and society at large. The rise of national healthcare spending, currently comprising 18% of U.S. gross domestic product and projected to hit 20% by 2020, reduces resources available for other important government and private programs in fields such as education, public safety, and public health.(13) In our era of spiraling healthcare costs and challenges to the funding of safety-net programs like Medicare and Medicaid, it is imperative that healthcare interventions are carefully evaluated for the outcomes they achieve. Many health care organizations have begun adopting the "triple aim" proposed by the Institute for Healthcare Improvement: improved population health, improved patient care, and decreased cost.(14, 15)

To further inform patient, physician, and purchaser decision-making, we sought to compare surgical outcomes, hospital charges, and patient satisfaction between patients who underwent total laparoscopic hysterectomy (TLH) with or without robotic assistance. We conducted a retrospective observational cohort comparison of patients who underwent TLH for non-malignant indications at three local hospitals between 2008 and 2010. We further invited subjects to complete questionnaires regarding surgical satisfaction and recovery.

MATERIALS & METHODS

CASE SELECTION: Potential cases were identified by applying an ICD9-based search protocol at three local hospitals: two community hospitals and one academic medical center. The protocol first identified all cases with operative dates between 1/1/2008 and 12/31/2010 that included code 68.41 (Laparoscopic total abdominal hysterectomy). The target date range was selected based on a preliminary case count (for 1/1/2009 - 12/31/2009) and desire to have at least 80% power to detect a difference in mean operative time of 25 minutes, which would compare favorably to the mean differences reported in prior studies.(7, 8) To capture intended laparoscopic cases that subsequently converted to open abdominal procedures, the protocol also identified all cases that included code 68.49 (Other and unspecified total abdominal hysterectomy) only if these cases also included code V64.41 (Laparoscopic procedure converted to open procedure). Finally, cases with ICD9 codes indicating lymph node biopsy, vaginal suspension, or colpopexy were excluded. Such cases were excluded in order to focus analysis on cases with relatively similar complexity and operative risk.

411 cases meeting the above criteria were reviewed. Due to limitations in electronic chart availability, the operative date range for cases provided by the community hospitals was 1/1/2008 - 10/29/2010, whereas the operative date range for cases provided by the academic medical center were 6/1/2008 - 12/31/2010. Subsequent screening identified 112 cases that did not meet inclusion/exclusion criteria, yielding 299 that were included in the final study sample (Figure 1). Cases were excluded at this stage if they were started as supracervical or laparoscopic-assisted vaginal hysterectomies but later converted to total laparoscopic or open abdominal hysterectomies. Additional exclusion criteria applied at this stage were operative indication of malignancy (including endometrioid adenocarcinoma), and cases involving planned ancillary procedures thought to add substantial complexity or time (breast operations, cystocele repairs, etc). Cases involving endometrial hyperplasia or a history of cervical dysplasia (up to

CIN III) were retained, as these indications were not felt to confer substantial additional operative risk or complexity.

PREOPERATIVE, PROCEDURAL, and OUTCOME DATA: Manual chart review of all cases was conducted utilizing a standardized data collection tool. Demographic data and surgical risk factors were collected from pre-operative history and physical examination reports. These included age, height, weight, abdominal or pelvic operative history, hypertension, diabetes, current smoking status, heart disease, history of non-skin cancer, and coagulopathy. When necessary, admission nursing notes were used to collect height and weight data. BMI was calculated based on available pre-operative height and weight.

Primary surgeon identification, surgical indications, intra-operative complications, and utilization of robotic assistance were collected from operative reports. Multiple indications were noted for individual cases. Estimated blood loss (EBL) and operative time (skin-to-skin) were collected solely from anesthesia reports. EBL was not reported on anesthesia reports for 15 cases. EBL was reported as “minimal” on 30 cases, and in 46 cases the EBL included a “<” or “+” character. Operative time was missing from one case. Postoperative complications were collected from nursing reports, discharge summaries, and subsequent ED reports or hospital admissions (to the same hospital) within 6 months post-operatively.

Pre-operative hemoglobin was recorded as the most recent Hgb on record up to 30 days preoperatively. Post-operative hemoglobin was recorded as the lowest Hgb level documented postoperatively prior to discharge. Because 119 cases (40%) were missing either preoperative or postoperative hemoglobin values, estimated blood loss was used to evaluate blood loss. Uterine weight was collected from pathology reports, and length of stay was collected from discharge summaries. ICD9 procedure codes and total hospital charges were provided by hospital finance departments. We did not attempt to evaluate operative cost, but rather total hospital charges billed to patients/payers.

A 23-item questionnaire was developed based on prior validated surveys of patient satisfaction with hysterectomy.(16-18) Subjects were mailed invitations to complete the questionnaire online using a numeric code linking their responses to surgical data. Following a low response rate, a second round of printed questionnaires was mailed to all non-responders along with postage-paid return envelopes.

Preoperative comorbidities (HTN, DM, etc) were independently reviewed by two investigators (GA, JH). When disagreement arose as to whether to code risk factor as present or absent, a third investigator (RD) resolved the dispute. A similar method was applied in reviewing intraoperative and postoperative complications. All such deliberations were blind to robotic assistance. Subsequently, variables for minor and major complications were developed, which combined both intraoperative and postoperative (within 6 months) complications.

Preoperative indications for surgery were subsequently grouped for purposes of analysis. Menorrhagia, metromenorrhagia, polymenorrhea, dysfunctional uterine bleeding, postmenopausal bleeding, and anemia were grouped as “abnormal uterine bleeding.” Dysmenorrhea, pelvic pain, and dyspareunia were grouped as “pelvic pain.” Fibroid, leiomyoma, leiomyomata were grouped as “leiomyoma.” Family history of uterine cancer or increased genetic susceptibility to uterine cancer were grouped as “other increased risk of uterine cancer.” History of breast cancer, family history of ovarian cancer, BRCA+, or increased genetic susceptibility to ovarian cancer were grouped as “other increased risk of ovarian cancer.”

Associated surgical procedures were also subsequently grouped for purposes of analysis. These groupings included "any salpingectomy/oopherectomy," and "any lysis of adhesions or excision/destruction peritoneal tissue."

Due to variable reporting methods of EBL ("min," "<") and natural grouping of EBL (typically in increments of 50mL, with a median of 100mL), this variable was categorized as ≤100 mL and >100 mL (ebl100) for purposes of logistic regression. Length of stay (recorded as integers, with a median of 1 day), was categorized as 1 day vs >1 day (longstay).

Forty-seven primary surgeons were identified, with case counts ranging from 1 to 53. An operator frequency variable was generated to account for the number of cases in our dataset performed by each individual surgeon. We were unable to determine how many laparoscopic operations (robotic or conventional) had been performed by each surgeon prior to each case or with what frequency they might be performing other laparoscopic hysterectomies during our study period that did not meet criteria for inclusion in this study.

STATISTICAL ANALYSIS: Bivariate analysis comparing conventional and robotic surgery groups was performed for all predictor and outcome variables. A t-test or fisher's exact X^2 test was used to compare continuous or discrete variables between the robotic and conventional groups. In cases where continuous data were not normally distributed (BMI, operative time, uterine weight, total hospital charges), the natural log transformation was utilized. Median values are reported for continuous variables with skewed distributions (operative time, hospital charges). All tests were two-sided, using a .05 significance level.

Multivariable linear regression analyses of operative time and total hospital charges adjusted for age, BMI, hospital site, operator frequency, comorbid conditions, operative indications, and ancillary procedures. In order to account for possible variation in the success of robotic programs at individual hospitals, interactions between hospital center and robotic assistance were evaluated for all outcome variables.

For binary outcomes, small case counts limited our ability to control for confounding variables. Thus, for EBL>100, we controlled for BMI, operative indication of uterine bleeding, and ancillary lysis of adhesions or excision of peritoneal tissue. These three variables were felt to be important a-priori factors in predicting increased blood loss. We also evaluated the impact of including additional predictors, individually, in the model in order to detect and adjust for potential confounders of the robotic effect. Similarly, for length of stay, we controlled for hospital center and evaluated additional variables' impact on the robotic odds ratio.

This study and all consent documents were approved by institutional review boards at Oregon Health & Science University (OHSU) and Providence Health System. Study data were collected and managed using REDCap electronic data capture tools hosted at OHSU. Data analyses were conducted using Stata software, version 11.0, Statcorp, College Station, TX.

RESULTS

BASELINE CHARACTERISTICS: 299 cases met study criteria and were included in analysis. Of these, 99 subjects (33.1%) completed patient questionnaires. A subject attrition diagram is shown in Figure 1.

134 cases (44.8%) were intended as robotic-assisted total laparoscopic hysterectomies, while 165 (55.2%) were intended as conventional laparoscopic total hysterectomies. Subject characteristics and preoperative comorbid conditions are shown in Table 1.

Compared to the conventional group, subjects in the robotic group had significantly greater age, BMI, and personal history of cancer. Operator frequency was significantly greater in the conventional group (mean 29.4 cases) than the robotic group (mean 12.2 cases). Robotic assistance was less likely to have been utilized at hospital #2 and more likely to have been utilized at hospital #1. No significant differences were found for hypertension, diabetes, current smoking status, heart disease, coagulopathy, or uterine size.

OPERATIVE PROCEDURES: Operative indications and ancillary procedures are presented in Table 2. The most frequently cited indications for surgery included abnormal uterine bleeding (56%), pelvic pain (45%), leiomyoma (25%), and pelvic mass (19%). Cases involving robotic assistance were significantly more likely to list endometrial hyperplasia as an indication and less likely to list abnormal uterine bleeding or pelvic pain.

The most common ancillary procedures were salpingectomy/oopherectomy (67%), cystoscopy (31%), and lysis of adhesions or excision of peritoneal tissue (24%). Conventional hysterectomy was associated with significantly greater rates of cystoscopy (44% vs 16%) and lysis/excision procedures (29% vs. 19%).

OUTCOMES: Surgical outcomes and hospital charges are presented in Table 3. The median operative time was identical for conventional (136.5 mins, range 67-330) and robotic cases (136.5 mins, range 60-489). With regard to operative time, no significant interaction between robotic assistance and hospital site was detected. After adjusting for age, BMI, hospital center, operator frequency, comorbidities, operative indications, and ancillary procedures, robotic assistance remained an insignificant predictor of operative time (adjusted Ratio: 0.966, 95% CI: 0.882, 1.057).

Although overall total hospital charges were greater among the robotic group (median $20,739) than the conventional group (median $17,252), there was evidence of significant interaction between hospital center and surgery type. After incorporating this interaction and adjusting for age, BMI, operator frequency, comorbidities, operative indications, and ancillary procedures, robotic assistance was still found to predict increased total hospital charges at two hospitals (Hosp 1 Ratio: 1.12, 95% CI: 1.01, 1.25; Hosp2 Ratio: 1.125, 95% CI: 1.04, 1.22), although robotic assistance appeared less expensive at hospital 3 (Ratio: 0.889, 95% CI: 0.78, 1.02).

Robotic assistance was associated with increased odds of blood loss greater than 100mL (unadjusted OR 1.61, 95% CI: 0.98, 2.66), though the difference was marginally significant. No significant interaction between robotic assistance and hospital site was found to affect blood loss. In addition to the three a-priori covariates, hospital center, operator frequency, and operative indications of pelvic pain were found to individually confound the robotic effect as evidenced by a shift in the OR >10%. Adding these covariates to the final model, the magnitude of association between robotic assistance and increased blood loss remained similar, although the p-value increased from .06 to .248 (adjusted OR 1.56, 95% CI:

0.73 – 3.33). Statistical adjustment for additional individual covariates did not significantly change the OR for EBL>100mL (Table 5).

Mean length of stay was 1.40 days in the robotic group compared with 1.31 days in the conventional group. Because length of stay was reported as integers (a minority of which were >1 day), we dichotomized this variable and compared percentages of patients requiring longer stay (LOS >1 day). Robotic assistance was not significantly associated with greater odds of staying in the hospital >1 day (OR 1.28, 95% CI: 0.76, 2.15). However, a significant interaction existed between hospital center and type of surgery, whereby robotic cases performed at hospital #1 were significantly less likely to result in extended hospital stay, though robotic cases at hospital #2 were significantly more likely to result in an extended stay. Statistical adjustment for other individual covariates did not significantly change the OR for extended hospital stay with robotic assistance, except in the case of operator frequency. Adjusting for this variable dramatically reduced the OR for prolonged hospital stay at hospital #2 from 2.58 to 1.37 (Table 6).

Rates of conversion to open laparotomy were not significantly different between robotic and conventional groups (unadjusted OR 0.85; 95% CI: 0.32, 2.23). Neither minor nor major complications rates were significantly different, although the rate of major complication in the robotic group (11.9%) was nearly double the rate in the conventional group (6.1%; unadjusted OR 2.10, 95% CI: 0.92, 4.80). Minor and major complications are presented in Table 4. When adjusted for hospital site, the odds of major complication remained greater among robotic cases, although the effect was reduced (adjusted OR 1.67, 95% CI: 0.628 – 4.43). Similarly, adjusting for operator frequency reduced the OR for major complications (adjusted OR: 1.73, 95% CI: 0.70 – 4.27) while adjusting for operative indication of pelvic pain increased the OR for major complications (adjusted OR: 2.61, 95% CI: 1.09 – 6.25). Statistical adjustment for other individual covariates did not significantly change the OR for major complication with robotic assistance (Table 7).

Ninety-nine subjects (33%) returned completed questionnaires regarding their hysterectomy experience. Forty-three (43%) of responders fell into the robotic group. Survey results are presented in Appendix C.

No significant differences were found between groups with regard to resolution of symptoms, perceived operative results, or length of time until return to normal activity. Patients who underwent conventional hysterectomy were more likely to report post-operative emotional problems (32% vs 16%) and postoperative limitations on social activity (Table 8). Patients in the conventional arm also reported greater dissatisfaction at the prospect of living life the way they felt pre-operatively. Patients in the robotic arm were more likely to report recovering from surgery faster than anticipated, but were also more likely to report “other” types of postoperative problems (14% vs 0%). Compared with non-responders, survey respondents were less likely to be smokers and less likely to have experienced complications from their operation.

DISCUSSION

Among patients undergoing total laparoscopic hysterectomy (TLH) at one of three local hospitals, robotic-assistance did not confer superior surgical outcomes such as reduced operating time, blood loss, or length of stay. These findings were generally consistent in unadjusted and adjusted analyses, although some interactions between hospital site and robotic assistance were discovered. Further, patients who underwent robotic-assisted procedures did not report superior operative or recovery experiences. However, cases involving robotic assistance incurred greater total hospital charges in two of three hospitals.

Our study adds to the limited but growing literature evaluating robotic assistance in TLH cases performed for benign indications. Our findings are generally consistent with similar studies in a systematic review which found no significant difference in blood loss or length of stay among robotic cases, and suggested greater cost amongst robotic cases. The large American study by Pasic and colleagues reported a cost difference of $2667 USD, while a smaller European study by Sarlos and colleagues reported a similar difference of $2631 USD. We have reported a difference in *median* rather than mean total hospital charges due to skewness of our data, and the difference we report is greater ($3487) than that reported by Pasic and Sarlos, although our figures estimate hospital charges seen by the patient/payer rather than costs to the hospital (as reported by Pasic and Sarlos). Total hospital *charges* are invariably greater than *costs* and may be reimbursed at varying rates depending on patient insurance type. Moreover, the cost figures reported by Pasic and Sarlos did not account for capital expenditures (robot acquisition) and maintenance, whereas these expenditures may be reflected in hospital charges to the patient/insurer in our data.

Our finding of equivalent operative time between groups (median 136.5 mins in both groups) diverges from prior studies, many of which have found significantly greater operative times among robotic-assisted cases. Our study includes cases from 2008-2010, and may therefore reflect greater cumulative experience with robotic equipment among surgeons and hospital staff during this time frame.

The rate of major complication among robotic cases (11.9%) was nearly double that of conventional cases (6.1%) in our analysis, although the p-value for this difference became larger after adjusting for hospital site (.078 → .278). Our inability to detect statistically significant differences in complication rates is consistent with other studies, most of which have also been limited by small caseload. Furthermore, our complication rate is higher than other studies have reported, perhaps in part because our search method involved reviewing subsequent hospital admissions within a 6 month period (rather than events limited to the operative admission) which we feel better captures adverse events.

We aimed to compare TLH cases within our community for the purpose of informing patients, physicians, and payers. Our study sample involved cases performed by 47 different surgeons and although we adjusted for hospital center and operator frequency, our results are vulnerable to substantial residual confounding related to difference in surgeons' and hospitals' experience with laparoscopic techniques, as well as other covariates for which we could not account, such as different hospital fee structures and involvement of resident (trainee) surgeons. Other studies have shown that both conventional laparoscopy and robotic techniques involve a learning curve, typically 20-40 cases, before outcomes such as operative time and blood loss plateau.(19, 20) A recent study by Twijnistra and colleagues found that while surgical experience (volume) in laparoscopic hysterectomy predicted improved blood loss and adverse events, operative time is better predicted by an independent surgical skills factor (i.e. some surgeons operate faster, independent of experience).(21)

Importantly, we discovered significant interactions between hospital site and utilization of robotic assistance in determining certain outcomes such as length of stay and hospital charges. For instance, at hospital #1 the odds of prolonged hospital stay were significantly less among patients in the robotic arm than the conventional arm, although this trend was reversed at hospital #2. Concurrently, 85% of our cases from hospital #1 involved robotic assistance, whereas 76% of cases from hospital #2 were conventional. Although this correlation between increased volume of a particular technique and improved surgical outcomes was not observed for other primary endpoints, it nevertheless suggests that hospital case volume can be an important factor in surgical outcomes. Moreover, we observed that the increased odds of prolonged hospital stay among robotic cases at hospital #2 were dramatically reduced when the model adjusted for operator frequency. Similarly, the odds of major complication among robotic cases were reduced after adjusting for operator frequency. These observations suggest that the frequency with which surgeons performed hysterectomies meeting our study criteria contributed substantially to the outcomes of prolonged hospital stay and major complication, further highlighting the important role of experience and case volume among operators using new surgical techniques

We found significant propensity for use of robotic assistance among patients with increased age, BMI, and history of cancer. This finding may reflect surgeons' preference for robotic assistance among this group due to increased underlying risk of complication, or may reflect referral patterns whereby such patients are more likely to be referred to robotically-trained surgeons.

We believe our study is among the first in this field to query patient-derived outcomes. Patient-reported experiences are an important but often neglected outcome in this literature. However, despite two rounds of mailings, the response rate to our questionnaire (33%) was low. These outcomes are thus limited in both their statistical power and potential for responder bias.

CONCLUSION

Use of robotic technology is rapidly growing in cases of total laparoscopic hysterectomy for non-malignant indications, despite lack of demonstrated benefit in outcomes such as operative time, blood loss, length of stay, or patient experience. Consistent with findings in two other studies, our data suggest use of robotic technology in these cases may significantly increase hospital charges, albeit this finding was limited to only two of three hospitals studied. Patients with increased age, BMI, and cancer history are more likely to undergo hysterectomy with robotic assistance, which may reflect increased operative risk or patient referral patterns.

Given the rapid pace with which robotic technology is being adapted for performing hysterectomy and the potential financial impact on the health care system, further study evaluating the risks and costs of robotic assistance are warranted, including randomized control trials. Future studies should explore the elements that drive differential costs in these procedures, and assess patient-reported outcomes.

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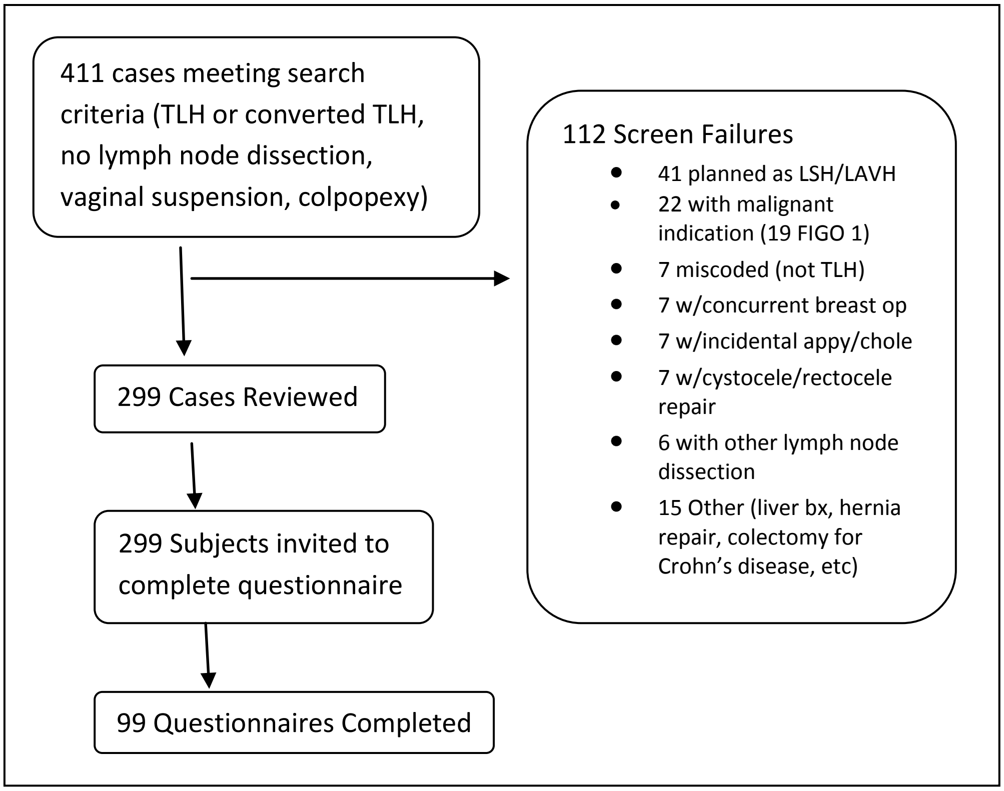
APPENDIX A: FIGURES

Figure 1: Subject Attrition Diagram



APPENDIX B: TABLES

Table 1: Patient Characteristics and Comorbidities (mean, standard deviation, range)

	Conventional (n=165)	Robotic (n=134)	Total (n=299)	P*
Age (yrs)	43.4(8.86), 20-71	46.0(10.57), 23-78	44.6(9.73), 20-78	.026
BMI	28.7(7.7), 18.2–66.2 (n=136)	32.6(9.3), 18.3-58.0 (n=120)	31.2(9.15), 18.2-66.2	<.001
Abd Op Hx	121 (73.3%)	88 (65.7%)	209(69.9%)	.164
Hypertension	26 (15.8%)	33 (24.6%)	59(19.7%)	.059
Diabetes	5 (3.0%)	9 (6.7%)	14(4.7%)	.171
Current Smoker	32 (19.4%)	33 (24.6%)	65(21.7%)	.324
Heart Disease	2 (1.2%)	0	2(0.7%)	.504
Coagulopathy	2 (1.2%)	4 (3.0%)	6 (2.0%)	.413
Cancer Hx	6 (3.6%)	22 (16.4%)	28 (9.4%)	<.001
Operator Frequency (# cases in dataset)	29.4(20.3)	12.2 (11.3)	21.7 (18.9)	<.001
Hospital ID	1: 13 (7.9%) 2: 139 (84.2%) 3: 13 (7.9%)	1: 74 (55.2%) 2: 43 (32.1%) 3: 17 (12.7%)	1: 87 (29.1%) 2: 182 (60.9%) 3: 30 (10.0%)	<.001
Uterine Weight (g)	159.8(132.6), 27.7-820 (n=160)	137.1(80.6), 22-436.7 (n=131)	149.6(112.6), 22-820	.371

* p-values based on two-sided t-tests and Fishers exact tests for continuous and binary variables, respectively

Table 2: Operative Indications & Ancillary Procedures

Operative Indication	Conventional (n=165)	Robotic (n=134)	Total (n=299)	P*
Abnormal uterine bleeding	102 (61.8%)	66 (49.3%)	168(56.2%)	.035
Pelvic Pain	95 (57.6%)	38 (28.4%)	133(44.5%)	<.001
Leiomyoma	43 (26.1%)	31 (23.1%)	74(24.8%)	.592
Pelvic mass	29 (17.6%)	29 (21.6%)	58(19.4%)	.382
Endometrial hyperplasia	7 (4.2%)	20 (14.9%)	27(9.0%)	.002
Cervical dysplasia/CIN	13 (7.9%)	12 (9.0%)	25(8.4%)	.834
Stress Incontinence	5 (3.0%)	3 (2.2%)	8(2.7%)	.735
Endometriosis	26 (15.8%)	28 (20.9%)	54 (18.1%)	.291
Other elevated risk of uterine cancer	1 (0.6%)	3 (2.2%)	4 (1.34%)	.329
Other elevated risk of ovarian cancer	9 (5.5%)	12 (9.0%)	21 (7.0%)	.262
Other	18 (10.9%)	16 (11.9%)	34 (11.4%)	.855
Ancillary Procedure				
Salpingectomy/ Oopherectomy	106 (64.24%)	95 (70.9%)	201 (67.2%)	.265
Cystoscopy	72 (43.6%)	22 (16.4%)	94 (31.4%)	<.001
Lysis of adhesions or excision/destruction peritoneal tissue	47 (28.5%)	25 (18.7%)	72 (24.1%)	.057
Repair of Urinary Stress Incontinence	5 (3.0%)	3 (2.2%)	8 (2.7%)	.735
Dilation/Curettage	5 (3.0%)	1 (0.8%)	6 (2.0%)	.229
Transfusion of Packed Cells	3 (1.8%)	4 (3.0%)	7 (2.3%)	.704
Suture of Laceration of Vagina	4 (2.4%)	2 (1.5%)	6 (2.0%)	.695
Other	15 (9.1%)	12 (9.0%)	27 (9.0%)	1.00

* p-values based on two-sided t-tests and Fishers exact tests for continuous and binary variables, respectively

Table 3: Surgical Outcomes and Hospital Charges (conventional group is reference)

	Conventional (n=165)	**Robotic (n=134)**	**Total (n=299)**	**Robotic Ratio* (95% CI)**	**Adjusted Ratio** (95% CI)**
Operative Time (min)	Median 136.5 Range: 67-330 **n=164**	Median 136.5 Range: 60-489	Median 136.5 Range: 60-489 **n=134**	0.994 (0.915, 1.08) p = .891	**0.966** **(0.882, 1.057)** **p=.450**
Total Hospital Charges (dollars)	Median: 17,252 Range: 13370-48851	Median: 20,739 Range: 10210-38490	Median 18,815 Range: 10210 – 48851	1.182 (1.126, 1.240) p <.001	**Hosp 1: 1.124** **(1.012 – 1.248)** **(p=.029)** **Hosp2: 1.125** **(1.040 – 1.217)** **(p=.003)** **Hosp3: 0.889** **(0.778 – 1.016)** **(p=.085)**
				Robotic OR (95% CI)	**Adjusted OR***** **(95% CI)**
EBL>100mL	44 (28.0%)	49 (38.6%)	93 (32.8%)	1.613 (0.980, 2.657) p = .060	**1.56** **(0.733, 3.32)** **p=.248**
Long Stay (>1 day)	39(23.6%)	38(28.4%)	77(25.8%)	1.278 (0.761, 2.150) p = .354	**Hosp1: 0.276** **(0.082 – 0.927)** **(p=.037)** **Hosp2: 2.575** **(1.215 – 5.458)** **(p=.014)** **Hosp3: 0.359** **(0.075 – 1.715)** **(p=.199)**
Conversion to Open Laparotomy	10 (6.1%)	7 (5.2%)	17 (5.7%)	0.854 (0.316, 2.231) p = .755	
Minor Complication	20 (12.1%)	22 (16.4%)	42 (14.1%)	1.424 (0.741, 2.738) p = .289	**1.218** **(0.554, 2.678)** **p=.624**
Major Complication	10 (6.1%)	16 (11.9%)	26 (8.7%)	2.102 (0.921, 4.799) p = .078	**1.668** **(0.628, 4.430)** **P=.305**

*Ratio for continuous variables reflects ratio of estimated medians
**Continuous variables adjusted for age, BMI, hospital center, operator frequency, comorbidities, operative indications, and ancillary procedures
***EBL>100 adjusted for BMI, hospital center, operator frequency, operative indications, and ancillary lysis of adhesions or excision of peritoneal tissue; Complications adjusted for hospital site.

Table 4: Complications

Minor Complications	Conventional (n=165)	Robotic (n=134)
ED visit <90 days (pain, nausea, vomiting, fever, vaginal bleeding)	13	7
Corneal Abrasion	2	4
Vaginal/perineal laceration	4	2
Urinary retention		4
Positional neuropathy		2
Diarrhea/Proctitis		1
Suture penetration of bladder		1
Postoperative Ileus	1	
Missing needle requiring x-ray		1
Total:	**20**	**22**
Major Complications	**Conventional**	**Robotic**
Abscess	3	3
Blood Transfusion**	1	3
Vaginal bleed from loosening sutures requiring return to OR	3	
Serosal tear of colon		3
Cellulitis	1	1
Cuff Dehiscence		1
Deep Vein Thrombosis		1
Recto-vaginal fistula		1
Injury to ureter, converted to open procedure w/stent placement	1	
Conversion secondary to technical problems with robot		1
Significant bleeding requiring conversion	1	
Midline cystotomy		1
Incisional hernia <6 months post-op requiring return to OR		1
Total:	**10**	**16**

*Four subjects suffered unrelated minor and major complications

**One transfusion case also involved fibular fracture from ground level fall on POD#1

Table 5: EBL>100mL: Diagnostic Evaluation for Residual Confounding

Model	Robot OR	95% Confidence Interval	p
Base Model: Constant + robot + logbmi + any_abnml_ut_bleed + any_lysis_excision + hosp_id + op_freq + indications_any_pain	1.561393	.7329493 3.326219	.248

Model	Robot OR	95% Confidence Interval	p	% change upon robot OR	Added variable's p
Base + Age	1.529581	.7173399 3.261518	.271	-2.0%	.371
Base + Op_hx	1.537366	.7163305 3.299445	.270	-1.5%	.778
Base + HTN	1.560738	.732235 3.326667	.249	--0--	.902
Base + DM	1.55429	.7278927 3.318922	.255	-0.5%	.144
Base + smoke	1.551003	.7267244 3.310209	.256	-0.7%	.618
Base + Cancer_hx	1.46325	.6782477 3.156811	.332	-6.3%	.161
Base + Uterine Weight	1.589602	.7307327 3.457947	.242	+1.8%	.262
Base + Leiomyoma	1.560768	.7323752 3.326158	.249	--0--	.249
Base + Pelvic Mass	1.615177	.7510186 3.473678	.220	+3.4%	.095
Base + Endo Hyperplasia	1.585476	.7415152 3.389995	.235	+1.5%	.607
Base + CIN	1.556848	.7307855 3.316674	.251	-0.3%	.831
Base + Endometriosis	1.586072	.7437813 3.382212	.233	+1.6%	.310
Base + Other_Ovar_CA	1.567518	.7345714 3.344963	.245	+0.4%	.562
Base + Other_Indications	1.551673	.7280373 3.307096	.255	-0.6%	.765
Base + Salpingoopherect	1.544359	.7170802 3.326052	.267	-1.1%	.067
Base + Cystoscopy	1.58822	.7425944 3.396798	.233	+1.7%	.673
Base + Other_Proc	1.541259	.7213817 3.292955	.264	-1.3%	.275

Table 6: LOS >1 DAY: Diagnostic Evaluation for Residual Confounding

Model	Robot OR	95% Confidence Interval	p
Base Model: Constant + robot + hosp2 + hosp3 + rob*hosp2 + rob*hosp3	Hosp1: .2755102 Hosp2: 2.575499 Hosp3: .3589744	.0819216 .9265675 1.215274 5.458185 .0751614 1.714477	.037 .014 .199

Model	Robot OR	95% Confidence Interval	p	% change upon robot OR	Added variable's p
Base + Age	Hosp1: .2793734 Hosp2: 2.337708 Hosp3: .3371192	.082764 .9430371 1.080125 5.059488 .0700265 1.622948	.040 .031 .175	+1.4% -9.2% -6.1%	.266
Base + BMI	Hosp1: .2394251 Hosp2: 2.789259 Hosp3: .3302697	.0697878 .8214103 1.160115 6.706201 .0683444 1.596007	.023 .022 .168	-13.1% +8.3% -8.0%	.058
Base + Op_freq	Hosp1: .3305119 Hosp2: 1.366857 Hosp3: .3709141	.0975383 1.119951 .5970276 3.129335 .0775684 1.773625	.075 .460 .214	+20.0% -46.9% +3.3%	<.001
Base + Op_hx	Hosp1: .2638155 Hosp2: 2.511105 Hosp3: .3388426	.0779164 .8932472 1.181015 5.339177 .0703824 1.631294	.032 .017 .177	-4.2% -2.5% -5.6%	.432
Base + HTN	Hosp1: .2997998 Hosp2: 2.41847 Hosp3: .3530243	.0881354 1.019793 1.13211 5.166455 .0735432 1.694599	.054 .023 .193	+8.8% -6.1% -1.7%	.181
Base + DM	Hosp1: .2623913 Hosp2: 2.554704 Hosp3: .2704648	.0759578 .9064135 1.190758 5.480973 .0536988 1.36225	.034 .016 .113	-4.8% -0.8% -24.7%	.002
Base + smoke	Hosp1: .2908319 Hosp2: 2.610901 Hosp3: .3427483	.0860464 .9829948 1.229324 5.545166 .0711674 1.650706	.047 .013 .182	+5.6% +1.4% -4.5%	.300
Base + Cancer_hx	Hosp1: .2882464 Hosp2: 2.814852 Hosp3: .3830117	.0854293 .9725698 1.297603 6.106178 .0795315 1.844527	.045 .009 .231	+4.6% +9.3% +6.7%	.354
Base + Uterine Weight	Hosp1: .2322736 Hosp2: 2.409923 Hosp3: .4132317	.0671366 .8036015 1.116098 5.203598 .0808879 2.111075	.021 .025 .288	-15.7% -6.4% +15.1%	.046
Base + Abn_Uter_Bleed	Hosp1: .2863572 Hosp2: 2.130395 Hosp3: .3589572	.0843354 .972314 .9770314 4.64528 .0743888 1.73212	.045 .057 .202	+3.9% -17.3% --0--	.071
Base + Any_pain	Hosp1: .274069 Hosp2: 2.410166 Hosp3: .3331491	.0813954 .9228267 1.10124 5.274872 .0682384 1.62648	.037 .028 .174	-0.5% -6.4% -7.2%	.565
Base + Leiomyoma	Hosp1: .2782853 Hosp2: 2.669089 Hosp3: .3818743	.0820083 .9443282 1.251621 5.691849 .0791017 1.843551	.040 .011 .231	+1.0% +3.6% +6.4%	.070

Base + Pelvic Mass	**Hosp1: .289078 Hosp2: 2.531589 Hosp3: .3589414**	**.0853832 .9787186 1.192336 5.375115 .0749279 1.719506**	**.046 .016 .200**	**+4.9% -1.7% --0--**	**.385**
Base + Endo Hyperplasia	**Hosp1: .2833609 Hosp2: 2.264773 Hosp3: .2696072**	**.0832536 .9644435 1.048909 4.89003 .0538788 1.349102**	**.044 .037 .111**	**+2.8% -12.1% -24.9%**	**.055**
Base + CIN	**Hosp1: .2684198 Hosp2: 2.692486 Hosp3: .3666104**	**.0789273 .9128547 1.260735 5.750203 .0758596 1.771737**	**.035 .011 .212**	**-2.6% +4.5% +2.1%**	**.091**
Base + Endometriosis	**Hosp1: .264615 Hosp2: 2.621684 Hosp3: .3810085**	**.0781257 .896262 1.234072 5.569552 .079348 1.829504**	**.033 .012 .228**	**-4.0% +1.8% +6.1%**	**.267**
Base + Other_Ovar_CA	**Hosp1: .2829699 Hosp2: 3.153017 Hosp3: .3448081**	**.084086 .9522627 1.441493 6.896684 .0710531 1.673293**	**.041 .004 .186**	**+2.7% +22.4% -3.9%**	**.047**
Base + Other_Indication	**Hosp1: .2752049 Hosp2: 2.603746 Hosp3: .3547947**	**.0817325 .926654 1.226804 5.526143 .0741722 1.697121**	**.037 .013 .194**	**-0.1% +1.1% -1.2%**	**.549**
Base + Salpingoopherect	**Hosp1: .2429323 Hosp2: 2.193986 Hosp3: .3108434**	**.0690314 .8549169 1.021719 4.71125 .0616791 1.566555**	**.028 .044 .157**	**-11.8% -14.8% -13.4%**	**.002**
Base + AnyLysisAdhesi	**Hosp1: .2689967 Hosp2: 2.57033 Hosp3: .3898402**	**.0795787 .9092788 1.202617 5.493515 .0801408 1.896354**	**.035 .015 .243**	**-2.4% -0.2% +8.6%**	**.031**
Base + Cystoscopy	**Hosp1: .34565 Hosp2: 3.129007 Hosp3: .2988035**	**.0997093 1.198222 1.426438 6.863732 .0614385 1.453218**	**.094 .004 .134**	**+25.5% +21.5% -16.8%**	**.030**
Base + Other_Proceudre	**Hosp1: .3035483 Hosp2: 2.468291 Hosp3: .323046**	**.0890139 1.035138 1.15551 5.272528 .065821 1.585493**	**.057 .020 .164**	**+10.2% -4.2% -10.0%**	**.047**

Table 7: Statistical Adjustment for Major Complications

Model	**Robot OR**	**95% Confidence Interval**	**p**
Base Model: Constant + robot	**2.101695**	**.9205063 4.798578**	**.078**

Model	**Robot OR**	**95% Confidence Interval**	**p**	**% change upon robot OR**	**Added variable's p**
Base + Age	**2.27102**	**.9861825 5.229794**	**.054**	**+8.1%**	**.137**
Base + BMI	**2.02576**	**.8120176 5.053714**	**.130**	**-3.6%**	**.047**
Base + hosp_id	**1.667665**	**.6278151 4.429816**	**.305**	**-20.7%**	**.278**
Base + op_freq	**1.726545**	**.6973698 4.274572**	**.238**	**-17.8%**	**.358**
Base + Op_hx	**2.177075**	**.9495383 4.991539**	**.066**	**+3.6%**	**.338**
Base + HTN	**2.127052**	**.9272146 4.879508**	**.075**	**+1.2%**	**.793**
Base + DM	**2.003616**	**.8718464 4.604568**	**.102**	**-4.7%**	**.146**
Base + smoke	**2.030292**	**.8854626 4.655288**	**.094**	**-3.4%**	**.128**
Base + Cancer_hx	**2.349599**	**1.020153 5.411555**	**.045**	**+11.8%**	**.214**
Base + Uterine Weight	**1.984802**	**.8352918 4.716242**	**.121**	**-5.6%**	**.024**
Base + any_abnml_ut_bleed	**2.367561**	**1.023326 5.477575**	**.044**	**+12.7%**	**.045**
Base + Any_pain	**2.611636**	**1.090929 6.252144**	**.031**	**+24.3%**	**.107**
Base + Leiomyoma	**2.097433**	**.9182439 4.79091**	**.079**	**-0.2%**	**.882**
Base + Pelvic Mass	**2.106785**	**.9217537 4.815324**	**.077**	**+0.2%**	**.909**
Base + Endo Hyperplasia	**2.187606**	**.9488255 5.043732**	**.066**	**+4.1%**	**.584**
Base + CIN	**2.121039**	**.9278077 4.848857**	**.075**	**+0.9%**	**.383**
Base + Endometriosis	**2.09926**	**.917867 4.801234**	**.079**	**-0.1%**	**.966**
Base + Other_Ovar_CA	**No major comps observed among pts with indication of elev risk ovarian CA so unable to fit adjusted logistic regression model.**				
Base + Other_Indications	**No major comps observed among pts with other operative indications so unable to fit adjusted logistic regression model.**				
Base + Salpingoopherect	**2.095343**	**.9159386 4.793403**	**.080**	**-0.3%**	**.918**
Base + any_lysis_excision	**2.355486**	**1.013975 5.471846**	**.046**	**+12.1%**	**.043**
Base + Cystoscopy	**2.244387**	**.9399106 5.359313**	**.069**	**+6.8%**	**.625**
Base + Other_Proc	**2.145832**	**.9299395 4.9515**	**.074**	**+2.1%**	**.013**

APPENDIX C – Table 8: Survey Results

	Non-Robotic (n=56)	Robotic (n=43)	p*
Resolved Symptoms			.540
1. Completely	85.7%	79.1%	
2. Mostly	10.7%	18.6%	
3. Somewhat	3.6%	2.3%	
4. Not at all	0%	0%	
Results Compared to Expectation			1.00
1. Better	60.7%	60.5%	
2. About as Expected	37.5%	37.2%	
3. Worse	1.8%	2.3%	
Health now vs before operation			.233
1. Much better	76.8%	59.5%	
2. A little better	12.5%	16.7%	
3. About the same	8.9%	16.7%	
4. A little worse	1.8%	7.1%	
5. Much worse	0%	0%	
Rest of your life feeling as before op			.044
1. Very satisfied	3.6%	14.0%	
2. Mostly satisfied	3.6%	11.6%	
3. Mixed	7.1%	16.3%	
4. Mostly dissatisfied	17.9%	11.6%	
5. Very dissatisfied	67.9%	46.5%	
Rest of your life feeling as now			.112
1. Very satisfied	58.9%	38.1%	
2. Mostly satisfied	30.4%	47.6%	
3. Mixed	10.7%	11.9%	
4. Mostly dissatisfied	0%	2.4%	
5. Very dissatisfied	0%	0%	
Recovered from operation now?			.429
1. Totally recovered	100%	97.6%	
2. Partially recovered	0%	2.4%	
3. Not at all recovered	0%	0%	
Recovery speed vs expectation			.056
1. Faster	33.9%	58.1%	
2. About as fast	46.4%	27.9%	
3. Slower	19.6%	14.0%	
Post-Operative Problems			
Re-admission to hospital for problems related to your surgery	3.6%	4.7%	1.00
Incision became infected	5.4%	4.7%	1.00
Required antibiotics for infection at the site of surgery	3.6%	2.3%	1.00

Post-Operative Problems	Non-Robotic (n=56)	Robotic (n=43)	p*
Incision opened	1.8%	2.3%	1.00
Depression or anxiety	19.6%	11.6%	.410
Other emotional problems (unusually emotional, mood swings, insomnia)	32.1%	16.3%	.102
Urinary tract problems (difficulty controlling your urine, frequent urination, urinary infections)	17.9%	18.6%	1.00
Vaginal problems (vaginal dryness, yeast infections, vaginal discharge)	26.8%	18.6%	.472
Pelvic pain (pelvic pain or discomfort)	14.3%	4.7%	.179
Nonpelvic pain (bowel problems or pain, back pain, leg pain)	17.9%	20.9%	.799
Hot flashes	37.5%	39.5%	.838
Sexual problems (sexual desire problems, painful intercourse)	28.6%	18.6%	.345
Fatigue	28.6%	18.6%	.345
Weight gain	35.7%	30.2%	.668
Problem with lost income after surgery	3.6%	4.7%	1.00
Problems performing housework after surgery	3.6%	7.0%	.650
Other(s)	0	14.0% (count: 6)	.005
		1. Intraoperative shoulder injury → pain, loss of motion 2. Vaginal bleeding after sex 3. DVT, coumadin 8-9 months, weekly INR checks 4. Severe rectocele, chronic constipation, f/u surgery 6months post-op 5. Abnormal cells hoped to have removed still present, requiring pap tests q6 months 6. Need hormones, dose varies since I still have one ovary	

	Non-Robotic (n=56)	Robotic (n=43)	P*
Days of assistance needed at home			.936
1. 1-3 days	44.6%	40.5%	
2. 4-7 days	26.8%	31.0%	
3. More than a week	16.1%	14.3%	
4. More than two weeks	12.5%	14.3%	
Days until normal activity			.831
1. 1-3 days	8.9%	7.0%	
2. 4-7 days	14.3%	20.9%	
3. More than a week	19.6%	20.9%	
4. More than two weeks	57.1%	51.2%	
Your health is:			.867
1. Excellent	14.6%	14.0%	
2. Very Good	47.3%	51.2%	
3. Good	27.3%	25.6%	
4. Fair	10.9%	7.0%	
5. Poor	0%	2.3%	
Health limits moderate activities			.505
1. Not limited at all	87.3%	79.1%	
2. Limited a little	7.3%	14.0%	
3. Limited a lot	5.5%	7.0%	
Health limits climbing several flights			.812
1. Not limited at all	80.0%	76.7%	
2. Limited a little	14.6%	14.0%	
3. Limited a lot	5.5%	9.3%	
6 mo post-op: <u>physical</u> health → accomplished less than would like			.440
1. None of the time	41.8%	55.8%	
2. Little of the time	29.1%	27.9%	
3. Some of the time	17.9%	9.3%	
4. Most of the time	10.7%	7.0%	
5. All of the time	0%	0%	
6 mo post-op: <u>physical</u> health → limited kind of work & activities			.407
1. None of the time	48.2%	58.1%	
2. Little of the time	23.2%	27.9%	
3. Some of the time	17.9%	7.0%	
4. Most of the time	8.9%	7.0%	
5. All of the time	0%	0%	
6 mo post-op: <u>emotional</u> health → accomplished less than would like			.255
1. None of the time	52.7%	65.1%	
2. Little of the time	20.0%	23.3%	
3. Some of the time	18.2%	9.3%	
4. Most of the time	7.3%	0%	
5. All of the time	1.8%	2.3%	

	Non-Robotic (n=56)	Robotic (n=43)	p*
6 mo post-op: <u>emotional</u> health → limited kind of work & activities			.130
1. None of the time	63.6%	65.1%	
2. Little of the time	14.6%	25.6%	
3. Some of the time	16.4%	7.0%	
4. Most of the time	5.5%	0%	
5. All of the time	0%	2.3%	
6 mo post-op, how much did pain interfere w/normal work			.831
1. Not at all	55.6%	59.5%	
2. A little bit	31.5%	23.8%	
3. Moderately	7.4%	9.5%	
4. Quite a bit	5.6%	7.1%	
5. Extremely	0%	0%	
6 mo post-op, how often calm & peaceful			.552
1. None of the time	0%	0%	
2. Little of the time	7.1%	2.3%	
3. Some of the time	30.4%	27.9%	
4. Most of the time	48.2%	60.5%	
5. All of the time	14.3%	9.3%	
6 mo post-op, how often have lots of energy			.146
1. None of the time	8.9%	4.7%	
2. Little of the time	17.9%	4.7%	
3. Some of the time	37.5%	46.5%	
4. Most of the time	28.6%	41.9%	
5. All of the time	7.1%	2.3%	
6 mo post-op, how often felt downhearted & depressed			.291
1. None of the time	33.9%	39.5%	
2. Little of the time	23.2%	37.2%	
3. Some of the time	30.4%	18.6%	
4. Most of the time	8.9%	2.3%	
5. All of the time	3.6%	2.3%	
6 mo post-op, how often did phycial health or emotional problems intefere with social activities			.060
1. None of the time	42.9%	65.1%	
2. Little of the time	26.8%	20.9%	
3. Some of the time	19.6%	4.7%	
4. Most of the time	10.7%	7.0%	
5. All of the time	0%	2.3%	

	Non-Robotic (n=56)	Robotic (n=43)	p*
Post-operatively, how satisfied w/ability to have & enjoy sex by self or with partner			.281
1. Very dissatisfied	9.1%	2.4%	
2. Somewhat dissatisfied	10.9%	23.8%	
3. Neither satisfied/dissatisfied	21.8%	28.6%	
4. Somewhat satisfied	18.2%	14.3%	
5. Very satisfied	40.0%	31.0%	

***** p values represent Fishers exact tests

Table 9: Survey Responder Analysis

	Non-Responder (n=200)	Responder (n=99)	P*
Age (yrs)	43.8	46.0	.065
BMI	30.6	30.4	.877
Operative History	69.0%	71.7%	.689
Hypertension	20.5%	18.2%	.758
Diabetes	5.5%	3.0%	.401
Smoker	28.0%	9.1%	<.001
Heart Disease	0.5%	1.0%	.553
Coagulopathy	2.0%	2.0%	1.00
Cancer Hx	10.0%	8.1%	.677
Hospital Center	Hosp1: 27.0% Hosp2: 61.0% Hosp3: 12.0%	Hosp1: 33.3% Hosp2: 60.6% Hosp3: 6.1%	.198
Operator Frequency	Median: 12	Median: 13 Ratio: 1.003	.986
Indication: Abnl Ut Bleeding	53.5%	61.6%	.216
Indication: Pain	46.5%	40.4%	.326
Indication: Leiomyoma	22.5%	29.3%	.204
Indication: Pelvic mass	18.5%	21.2%	.641
Indication: Endometrial Hyperplasia	8.5%	10.1%	.671
Indication: CIN	8.0%	9.1%	.825
Indications: Endometriosis	17.5%	19.2%	.750
Operative Time (mins)	Median: 139	Median: 135 Ratio: 0.930	.103
Hospital Charges ($USD)	Median: 18,833	Median: 18,493 Ratio: 0.989	.698
EBL>100mL	35.8%	26.6%	.140
Length of Stay >1day	28.5%	20.2%	.160
Conversion	6.5%	4.0%	.441
Minor Complication	17.0%	6.1%	.051
Major Complication	11.5%	3.0%	.015

***** p values represent two-sided t-tests and Fishers exact tests for continuous and binary variables, respectively