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Role of minimally invasive surgery in gynecologic oncology: An updated survey of members of the Society of Gynecologic Oncology

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Abstract

Objectives—To evaluate the current patterns of use of minimally invasive surgical procedures, including traditional, robotic-assisted, and single-port laparoscopy, by Society of Gynecologic Oncology (SGO) members and to compare the results to those of our 2004 and 2007 surveys.

Methods—SGO members were surveyed through an online or mailed-paper survey. Data were analyzed and compared with results of our prior surveys.

Results—Four hundred six (32%) of 1279 SGO members responded. Eighty-three percent of respondents (n = 337) performed traditional laparoscopic surgery (compared to 84% in 2004 and 91% in 2007). Ninety-seven percent of respondents performed robotic surgery (compared to 27% in 2007). When respondents were asked to indicate procedures that they performed with the robot but not with traditional laparoscopy, 75% indicated radical hysterectomy and pelvic lymphadenectomy for cervical cancer. Overall, 70% of respondents indicated that hysterectomy and staging for uterine cancer was the procedure they most commonly performed with a minimally invasive approach. Only 17% of respondents who performed minimally invasive surgery performed single-port laparoscopy, and only 5% of respondents indicated that single-port laparoscopy has an *important* or *very important* role in the field.

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Conclusions—Since our prior surveys, we found a significant increase in the overall use and indications for robotic surgery. Radical hysterectomy or trachelectomy and pelvic lymphadenectomy for cervical cancer and total hysterectomy and staging for endometrial cancer were procedures found to be significantly more appropriate for the robotic platform in comparison to traditional laparoscopy. The indications for laparoscopy have expanded beyond endometrial cancer staging to include surgical management of early-stage cervical and ovarian cancers, but the use of single-port laparoscopy remains limited. We also found that, since our 2007 survey, robotic surgical training significantly increased with a greater percentage of fellows completing more than 50% of the surgical cases.

Introduction

Minimally invasive surgery, including traditional laparoscopy and robotic-assisted laparoscopy, is becoming increasingly common in the surgical management of gynecologic malignancies. Numerous studies have shown that laparoscopic surgery is safe and feasible in most patients with endometrial, cervical, or early-stage ovarian cancer [1, 2]. A large randomized trial, Gynecologic Oncology Group LAP-2, showed that for endometrial cancer stages IA to IIA, laparoscopic surgical staging is associated with fewer postoperative complications and shorter hospital stay than the standard laparotomy approach, and the 5-year survival rate is almost identical between the 2 groups [3]. A prospective randomized trial is currently under way to further address the role of minimally invasive approaches in the management of early-stage cervical cancer [4].

In an effort to determine the impact of minimally invasive surgery in gynecologic malignancies, we surveyed Society of Gynecologic Oncology (SGO) members in 2004 and 2007. In our 2004 survey, we found that members were utilizing laparoscopy for select procedures, but the majority of procedures were still being performed with laparotomy [5]. In 2007, we saw an overall increase in the use and indications for laparoscopy and robotic-assisted surgery [6]. In our 2012 survey, reported here, we again investigated the trends in minimally invasive surgery in academic and community practices, including the role of a new modality, single-port laparoscopy. We specifically assessed the current use and indications for traditional, robotic-assisted, and single-port laparoscopy in gynecologic oncology. We compared our results to those of our previous surveys to determine if there has been any change in the frequency and types of minimally invasive procedures performed in gynecologic oncology.

Materials and Methods

After obtaining Institutional Review Board approval and approval from the SGO, we obtained a full mailing list of all candidate members of the SGO. Surveys were mailed using US postal mail from January to April 2012. Respondents were given the option to complete either the paper version or an online survey. To encourage participation, all SGO members were sent 3 mailings of the survey and a reminder mailing. Neither the paper nor the Internet surveys had names associated with the responses. The survey was estimated to take 10 minutes to complete.

All of the data collected was stored by an institutional research department at the institution of one of the authors. Respondents were asked about demographic characteristics, including their current practice setting, role in fellow and resident education, and personal training history. Respondents were also asked about their use of minimally invasive procedures, including the type of minimally invasive technique, specific procedures performed, rates of conversion to laparotomy, and rates of referral of patients to colleagues. Respondents were asked about their opinions regarding the role of minimally invasive surgery in gynecologic oncology. Finally, respondents were asked about their experience with minimally invasive surgical training during fellowship, and their opinion of the role of minimally invasive surgery in current fellowship and residency training programs.

The collected data were analyzed using frequency distribution tests. The relationships between categorical variables of interest were assessed using Fisher's exact test. Statistical analyses were performed with SAS 9.3 for Windows (SAS Institute Inc., Cary, NC). Data from the 2007 [6] and 2012 surveys were compared with $p<0.05$ considered statistically significant (2-sided p values reported). Only questions with identical wording in the 2007 and 2012 surveys were compared. General comparisons were made to the 2004 survey, as the question format differed [5].

Results

Demographics

Of the 1279 SGO members, 406 (31.7%) responded to the survey. Most respondents were in academic practices. Most were men (69.1%) and aged 41 to 60 years (57.6%). Over half of respondents completed their fellowship training 11 or more years ago (Table 1).

Practice of Minimally Invasive Surgery

A total of 337 respondents (83.0%) indicated that they performed minimally invasive surgery. Of those (n = 61) that did not perform minimally invasive surgery potential reasons included, 16/61 (26.2%) lack of training, 10/61 (16.4%) increased operative time, 7/61 (11.5%) lack of data supporting oncologic outcomes, 6/61 (9.8%) lack of technical skills, and 3/61 (4.9%) lack of proper equipment.

When respondents were asked to specify the type(s) of minimally invasive surgery performed for 50% or more of their overall cases, 126/259 respondents (48.7%) indicated robotic-assisted surgery, 66/259 (25.5%) indicated traditional laparoscopy, 3/259 (1.2%) indicated single-port laparoscopy, and 64/259 (24.7%) indicated that laparotomy still accounted for 50% or more of cases. When respondents (n = 329) were asked to specify the number of minimally invasive procedures performed each month, 15.2% (n = 50/329) indicated over 20, 36.8% (n = 121/329) indicated 11 to 20, 34.9% (n = 115/329) indicated 6 to 10, and 13.1% (n = 43/329) indicated 5 procedures performed each month. These results are markedly different from 2007, when 6.8% (n = 22/322) of respondents indicated performing over 20 procedures per month, 16.8% (n = 54/322) indicated performing 11 to 20 procedures per month, 44.4% (n = 143/322) indicated performing 6 to 10 procedures per month, and 32.0% (n = 103/322) indicated performing less than 5 procedures per month.

When respondents were asked to indicate the minimally invasive surgical procedure they most commonly performed, 69.8% indicated staging of endometrial cancer, 17.3% indicated evaluation of adnexal masses, 4.4% indicated prophylactic bilateral salpingo-oophorectomy, and 4.4% indicated staging of incidental endometrial cancer (Table 2). The percentage of respondents for whom laparoscopic hysterectomy and staging for endometrial cancer was the most commonly performed procedure increased from 43.7% in 2004 to 69.8% in 2012 ($p<0.001$) (Table 2).

Between 2007 and 2012, there were significant increases in the proportions of respondents who thought minimally invasive surgery was appropriate for staging of endometrial cancer (from 72.2% to 85.5% [n = 254/352 to 288/337], $p<0.0001$), staging of ovarian cancer (61.9% to 72.4% [n = 218/352 to 244/337], $p=0.004$), and staging of cervical cancer (42.1% to 56.1% [n = 148/352 to 189/337], $p=0.0003$). There was also a very large increase in the proportion of respondents who thought minimally invasive surgery was appropriate for radical hysterectomy and pelvic lymphadenectomy for cervical cancer (from 36.7% (129/352) to 81.6% (275/337), $p<0.0001$). In addition to early-stage cervical cancer, the majority of respondents indicated minimally invasive surgery is *always or usually* appropriate for the initial management of early-stage ovarian and endometrial cancers. And almost a quarter (21.7%, n = 70/322) of respondents indicated these techniques were appropriate for advanced endometrial cancer (Table 3).

There were trends toward a decrease in conversions from minimally invasive surgery to laparotomy between 2004 and 2007 and an increase in conversions between 2007 and 2012 (Table 4). When respondents were asked to indicate which of a list of potential reasons contributed to at least 50% of conversions to laparotomy, the most common reasons indicated were adhesions (43.1% [n = 125/290]) and extensive disease (37.9% [n = 108/285]). This trend was similar to that observed in the 2004 and 2007 surveys. In the 2012 survey, 6.1% of respondents (n =14/228) cited inadequate staging, 4.8% (n = 11/229) cited blood loss, and 2.3% (n = 5/217) cited equipment failure as contributing to at least 50% of conversions.

In the 2012 survey, 90.2% (314/348) of respondents *rarely* or *never* referred a patient to a colleague for minimally invasive surgery, which was a significant increase from 2004 (80.6%, $p=0.0004$) but not from 2007 (89.4% (330/369), $p=0.8$) (Table 5).

Training in Minimally Invasive Surgery

The majority of respondents to the current survey (79.6%; n = 262/329) indicated that during fellowship training, *maximum emphasis* or *some emphasis* should be given to training in minimally invasive surgery. When asked what number of laparoscopic procedures per month would be appropriate for fellowship training, the majority of respondents in each survey year indicated 6 or more procedures per month—80.0% in 2004, 93.1% in 2007, and 88.7% in 2012.

Between 2007 and 2012, the proportion of respondents who reported receiving *adequate* training in laparoscopic surgery (6-20 procedures per month) increased from 19.4% (n=74/382) to 24.5% (n = 80/327), and the proportion that reported receiving *extensive*

training in laparoscopic surgery (over 20 procedures per month) increased from 4.2% (n = 16/382) to 8.9% (n = 29/8.9) (p=0.004 for both comparisons). In our current survey, even though the majority of respondents received only limited training in minimally invasive surgery during their fellowship, 87.4% (n = 291/333) rated their laparoscopic skills and 75.1% (n = 253/337) rated their robotic skills as either *very good* or *good*.

Robotic Surgery

The results on robotic surgery from the 2012 survey were compared only to the results of the 2007 survey, as we did not ask about robotics in the 2004 survey. In the 2012 survey, 97.0% of respondents (n = 257/265) performed robotic gynecologic procedures, compared to 29.0% (n = 99/342) in the 2007 survey (p<0.0001). Over half (56.1%; n=138/246) of respondents who used the robotic system stated that they used it for *50% or more* of all their gynecologic cases, compared to 42.2% (n= 27/64) in 2007 (p=0.05). When 2012 respondents who used robotics in at least 50% of cases were asked to select the single most influential reason, 65/121 (53.7%) selected improved dexterity, 16/121 (13.2%) selected better visualization, and 10/121 (8.3%) selected surgeon comfort. When respondents who did not use robotics were asked to select reasons, 26/49 (53.1%) selected ability to perform all gynecologic surgeries for which minimally invasive surgery is appropriate by traditional laparoscopy; 23/49 (46.9%) selected cost; 9/18.4 (18.4%) selected no robotic system at hospital/practice; 8/49 (16.3%) indicated using the robot limits training of fellows or residents; and 3/49 (6.1%) indicated that current literature does not support oncologic safety.

Since our 2007 survey, respondents reported a significant increase in the appropriateness of the robot for several gynecologic oncology procedures, radical hysterectomy and pelvic lymphadenectomy for cervical cancer (89.1% compared to 60.2% in 2007); trachelectomy and staging for cervical caner (56.4% compared to 24.3% in 2007); and total hysterectomy and staging for endometrial cancer (93.8% compared to 65.1% in 2007) (Table 6). When respondents were asked to indicate procedures that they performed with the robot but not with traditional laparoscopy, 105/140 (75%) indicated radical hysterectomy and pelvic lymphadenectomy for early-stage cervical cancer, and 67/140 (47.9%) indicated hysterectomy and staging for uterine cancer.

Training in Robotic Surgery

Of respondents to the 2007 and 2012 surveys, 56.7% and 56.6%, respectively, indicated that they did not train fellows. From 2007 to 2012, the proportion of respondents who allowed fellows to sit at the console during robotic surgery for gynecologic procedures did not increase significantly (34.3% in 2007 compared to 40.6% in 2012; p=0.4). The proportion of respondents indicating over 50% of gynecologic cases were completed by fellows sitting at the console was 20.8% in 2007 compared to 50.5% in 2012 (p=0.01).

Among respondents to the 2007 and 2012 surveys, 20.6% (n = 14/68) and 19.1% (n=47/246), respectively, indicated that they did not train residents. From 2007 to 2012, the proportion of respondents allowing residents to sit at the console during robotic surgery increased significantly, from 27.9% (n = 19/68) to 58.9% (n=145/246) (p<0.0001). No

respondents in 2007 and only 13.0% (n=19/146) of respondents in 2012 indicated that over 50% of cases were completed by residents sitting at the console (p=0.08).

When respondents were asked to state the number of procedures necessary to achieve proficiency or *an 'experienced' status* in robotic surgery, 37.0% (n=94/254) specified 26 to 50 cases, 31% (n=79/254) specified 11 to 25 cases, and 23.6% (n=60/254) specified over 50 cases. Asked to predict their future use of robotic surgery, 53.0% (n=134/253) of respondents predicted that their use of the robot would *increase* over the next year, 45.4% (n=115/253) predicted that it would *remain the same*, and 1.6% (n=4/253) predicted that it would *decrease*.

Single-Port Surgery

Respondents who performed minimally invasive surgery were asked about the role of single-port laparoscopy in gynecologic oncology. Only 5.2% (n=15/290) of respondents indicated that single-port laparoscopy has an *important* or *very important* role in the field; 51.4% (n=149/290) indicated that single-port surgery was either *very unimportant* (32.4%) or *unimportant* (19.0%), and 24.1% (n=70/290) were unsure whether it has a role. When asked if they performed single-port laparoscopy, 83.0% (n=239/288) of respondents stated that they *did not*. Among the 17.0% (n=49/288) who did perform single-port laparoscopy, the most commonly performed procedures were evaluation of adnexal masses (85.7% of respondents; n=42/49), prophylactic bilateral salpingo-oophorectomy (75.5%; n=37/49), and staging and treatment of uterine cancer (24.5%; n=12/49). Only 4.1% (2/49) of respondents utilized single-port laparoscopy for radical hysterectomy and pelvic lymphadenectomy in cervical cancer.

Discussion

The role of minimally invasive surgery in gynecologic oncology is expanding. Since 2004, there has been a statistically significant increase in the use of minimally invasive techniques. This increase has been most notable in robotics, where between 2007 and 2012, the use of robotic surgery among survey respondents increased by 68 percentage points, and indications for robotic surgery expanded. From 2004 through 2012, hysterectomy and staging for uterine cancer remained the most common procedure performed with minimally invasive techniques. Over the same period, use of minimally invasive techniques expanded in patients with early-stage cervical and ovarian cancers. In the 2012 survey, some use of minimally invasive techniques was also observed in advanced-stage cervical, uterine, and ovarian cancers (Table 3). While the role of single-port laparoscopy increased slightly from 2007 to 2012, its role in the field has remained more limited; fewer than 20% of respondents to the 2012 survey indicated that they performed this technique, and approximately 95% indicated that it does not have an *important* role in the field.

Since the approval of the robotic platform by the US Food and Drug Administration in 2005, use of the robotic system has steadily increased. Since our last (2007) survey, the proportion of respondents indicating that they used this technology increased dramatically, from 29% to 97%. Still, 18% of respondents to our current survey stated that they did not currently have a robotic system at their own institution.

Studies evaluating the safety, efficacy, and feasibility of minimally invasive surgery in comparison to standard laparotomy in gynecologic oncology have demonstrated benefits for minimally invasive techniques and support the use of these techniques in gynecologic oncology [7-11]. For example, Soliman et al [7] compared traditional and robotic-assisted laparoscopy to laparotomy in a retrospective study including all patients at a single institution who underwent radical hysterectomy with pelvic lymphadenectomy for cervical cancer. A total of 95 radical hysterectomies were performed during the 3-year study period, and the 3 approaches were compared with respect to intra-operative, post-operative, and pathologic outcomes. The authors found that operative time was significantly shorter for open radical hysterectomy compared to both robotic-assisted and laparoscopic radical hysterectomy. Estimated blood loss and subsequent transfusion rates were significantly lower for the minimally invasive approaches compared with the open procedure. In addition, the median length of hospital stay was significantly shorter for robotic-assisted radical hysterectomy (1 day) than for laparoscopic (2 days) or open radical hysterectomy (4 days). Pathological outcomes were similar for the 3 approaches.[7]. A phase III trial is currently underway comparing the long-term outcomes (quality of life, disease-free and overall survival, quality of life, and delayed post-operative complications such as lymphedema or incisional hernia formation) of robotic and traditional laparoscopy to standard abdominal radical hysterectomy for the management of early-stage cervical cancer [4].

Since our prior surveys, we found a general trend that six or more minimally invasive procedures per month would be appropriate for fellowship training. At this time, data are insufficient to demonstrate the number of procedures necessary to achieve proficiency in each minimally invasive approach. Studies comparing the learning curves for robotic surgery and other types of minimally invasive surgery are limited. Woelk et al demonstrated through cumulative summation analysis that operative time and length of hospital stay decrease after 36 months of experience performing robotic hysterectomy, and surgical proficiency is obtained after approximately 91 procedures. This study was performed at a large, high-volume institution, and the results may not be applicable to gynecologic surgeons in different settings [13]. In addition, Persson et al found a steep learning curve for robotic-assisted radical hysterectomy and an inverse relationship between complication rates and the number of procedures performed [14]. As robotic and other minimally invasive techniques are becoming more prevalent and advanced, more prospective studies are needed to determine goals and guidelines for adequate fellowship training in these techniques.

Despite the significant increase in use and indications for robotic surgery found in our survey analysis, it is imperative to discuss the expense of minimally invasive approaches. Although a few publications support no increase in cost for robotics over traditional laparoscopy, the vast majority of studies support significantly higher cost when utilizing the robotic platform. For example, Bell et al [15] investigated the total costs (direct and indirect) of a single surgeon performing hysterectomies with lymph node dissection for endometrial cancer, and found laparoscopy (LH) to be the least expensive approach in comparison to robotics (RAH) and laparotomy (OH) (LH $7570 v RAH $8212 v OH $12944). Wright and colleagues [16] showed similar surgical outcomes for women with endometrial cancer who underwent laparoscopic or robotic hysterectomy with staging however the robotic approach added an additional $1291 to patient cost. It is important to acknowledge that in the U.S.A.

initial acquisition fees range from $1.5-$1.7 million with annual maintenance fees ranging from $100,000 to $170,000. These costs are higher in Europe and reimbursements rates are variable between the continents [17].

Given the added costs of robotics as mentioned above, it is pertinent to identify to patient groups that would benefit most from robotic assistance. Studies have demonstrated the advantages of the robotic platform in obese patients or in complex procedures such as para-aortic lymphadenectomy or trachelectomy, which may not be feasible with a laparoscopic approach [18-19]. Despite the advantages the robotic-platform provides, there are settings for which the role of robotic surgery has not been well-defined, such as cytoreductive surgery for ovarian cancer and recurrent disease with multiple sites and carcinomatosis.

Our study has several limitations. The primary limitation is sampling bias: the response rate was only 32%. Thus, the results may not represent the views of the entire community of gynecologic oncologists. In addition, there may have been selection bias, in which members who performed minimally invasive procedures were more likely to complete this survey. Again, this would mean that the results may not represent the views of the entire SGO community. Recall bias may also have been present. Members were prompted to participate through the issuance of the survey on 3 separate occasions as well as a reminder, but respondents may not have accurately recalled the number and type of procedures performed.

In summary, the findings from our survey indicate that minimally invasive surgical techniques, particularly robotic surgery, have gained significant acceptance among SGO members and have also become widely available. No data currently exist with which to assess whether minimally invasive techniques are equivalent or superior to laparotomy for the treatment of cervical and ovarian cancers. Hopefully, data from a randomized prospective trial (perhaps modeled after the now completed LAP-2 study for endometrial cancer) will demonstrate the advantages of minimally invasive surgery in these diseases, and these techniques will gain widespread acceptance for the management of all gynecologic malignancies. As data on the learning curve for minimally invasive surgery become available and practitioners become more competent, we will likely see further expansion in minimally invasive techniques for gynecologic malignancies.

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Table 1

Demographic characteristics

	2007		2012		
Characteristic	**N**	**%**	**N**	**%**	**p value**
Age, years	**(N = 378)**		**(N=387)**		
30-40	93	24.6	76	19.6	<0.0001
41-50	141	37.3	118	30.5	
51-60	102	27.0	105	27.1	
61-70	37	9.8	56	14.5	
>70	5	1.3	32	8.3	
Sex	**(N = 382)**		**(N = 375)**		
Male	272	71.2	259	69.1	0.53
Female	110	28.8	116	30.9	
Years since completing fellowship					
	(N= 380)		**(N=374)**		
<1	12	3.2	16	4.3	0.057
1-5	64	16.8	49	13.1	
6-10	86	22.6	61	16.3	
11-15	54	14.2	55	14.7	
>15	164	43.2	193	51.6	
Practice type	**(N = 372)**		**(N=383)**		
Academic	172	46.2	175	45.7	0.015
Community	92	24.7	94	24.5	
Both	104	28.0	95	24.8	
Other	4	1.1	19	5.0	
Number of gynecologic oncologists in practice					
	(N = 379)		**(N = 376)**		
None	74	19.5	67	17.8	0.156
1-5	267	70.4	254	67.5	
6-10	29	7.7	47	12.5	
11-20	9	2.4	7	1.9	

	2007		2012		
Characteristic	**N**	**%**	**N**	**%**	**p value**
>20	0	0.0	1	0.3	
Involvement in fellowship training					
			(N = 375)		
Yes	-	-	148	39.5	
No	-	-	227	60.5	

Table 2

Most commonly performed laparoscopic procedure

	Respondents indicating that procedure was the one they most often performed laparoscopically					
	2004 (N = 280)		2007 (N = 252)		2012 (N = 225)	
Procedure	**N**	**%**	**N**	**%**	**N**	**%**
Adnexal mass, diagnostic	194	69.3	96	38.1	39	17.3*
Cervical cancer, laparoscopically assisted or total laparoscopic radical hysterectomy and pelvic lymphadenectomy	1	0.4	2	0.8	0	0.0
Cervical cancer, staging	2	0.7	0	0.0	3	1.3
Cervical cancer, trachelectomy and staging	0	0.0	0	0.0	1	0.4
High-risk woman, prophylactic bilateral oophorectomy	32	11.4	27	10.7	10	4.4*
Ovarian cancer, placement of intraperitoneal catheters	0	0.0	2	0.8	0	0.0
Ovarian cancer, second look	7	2.5	4	1.6	0	0.0
Ovarian cancer, staging of incidental finding of ovarian cancer	0	0.0	0	0.0	2	0.9
Ovarian cancer, tumor debulking	0	0.0	0	0.0	0	0.0
Endometrial cancer, laparoscopically assisted or total laparoscopic hysterectomy and staging	29	10.4	110	43.7	157	69.8*
Endometrial cancer, staging of incidental finding of endometrial cancer	7	2.5	4	1.6	10	4.4
Other	8	2.9	7	2.8	3	1.3

*$p<0.0001$.

Table 3

Respondents agreeing that minimally invasive surgeries almost always or usually have a role in the initial management of gynecologic oncology cases*

Type of cancer	No. indicating always or usually/ No. of respondents to question	%
Cervical cancer		
Early-stage	263/323	81.4
Advanced-stage	39/318	12.3
Endometrial cancer		
Early-stage	315/326	96.6
Advanced-stage	70/322	21.7
Ovarian cancer		
Early-stage	165/326	50.6
Advanced-stage	7/321	2.2

* 2012 results only. Questions in the 2004 and 2007 surveys did not differentiate between the early and late stages of cervical, uterine, and ovarian cancer.

Table 4

Rates of conversion to laparotomy during a minimally invasive procedure

	% of Respondents		
Conversion rate	**2004 (N = 277)**	**2007 (N = 321)**	**2012 (N = 326)**
0%	15.5	8.4	9.8
1%-4%	66.5	86.9	66.6
5%-10%	15.5	2.8	19.9
11%-20%	0.0	0.0	3.7
>20%	0.0	0.0%	0.0
Don't know/not applicable	2.5	1.9	0.0

Table 5

Frequency of referral of patients to a colleague for minimally invasive surgery

	2004 (N = 319)		2007 (N = 369)		2012 (N = 348)	
Frequency	**N**	**%**	**N**	**%**	**N**	**%**
Almost always	3	0.9	9	2.4	9	2.6
Usually	10	3.1	8	2.2	9	2.6
Sometimes	49	15.4	22	6.0	16	4.6
Rarely	104	32.6	116	31.4	79	22.7
Never	153	48.0	214	58.0	235	67.5

Table 6

Procedures that respondents who used the robot thought were appropriate for the robot

	2007 (N =103)		2012 (N = 257)		
	N	%	N	%	p value
Adnexal mass, diagnostic	25	24.3	98	38.1	0.0138
Cervical cancer, radical hysterectomy and pelvic lymphadenectomy	62	60.2	229	89.1	<0.0001
Cervical cancer, staging	30	29.1	109	42.4	0.0227
Cervical cancer, trachelectomy and staging	25	24.3	145	56.4	<0.0001
High-risk woman, prophylactic bilateral oophorectomy	26	25.2	89	34.6	0.1037
Ovarian cancer, tumor debulking	4	3.9	15	5.8	0.6049
Endometrial cancer, total laparoscopic hysterectomy and staging	67	65.1	241	93.8	<0.0001
Other	17	16.5	21	8.2	0.0237