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Original Article

Hysteroscopic Endometrial Polypectomy: Clinical and Economic Data in Decision Making

Mario Franchini, MD, Giuseppe Lippi, MD, Stefano Calzolari, MD, Giovanna Giarrè, MD, Giampietro Gubbini, MD, Ursula Catena, MD, Attilio Di Spiezio Sardo, PhD, MD, and Pasquale Florio, PhD, MD

From the The Hospital Center Florence Pietro Palagi, Florence, Italy (Drs. Franchini, Lippi, Calzolari, and Giarrè), Madre Fortunata Toniolo Clinic, Bologna, Italy (Dr. Gubbini), Department of Public Health, School of Medicine, University of Naples Federico II, Naples, Italy (Drs. Catena and Sardo), and UOC Obstetrics and Gynecology, San Iacopo Hospital, Pistoia, Italy (Dr. Florio).

ABSTRACT **Study Objective:** To compare the costs of hysteroscopic polypectomy using mechanical and electrosurgical systems in the hospital operating room and an office-based setting.

Design: Retrospective cohort study (Canadian Task Force classification II-2).

Setting: Tertiary referral hospital and center for gynecologic care.

Patients: Seven hundred and fifty-four women who underwent endometrial polypectomy between January 20, 2015, and April 27, 2016.

Interventions: Hysteroscopic endometrial polypectomy performed in the same-day hospital setting or office setting using one of the following: bipolar electrode, loop electrode, mechanical device, or hysteroscopic tissue removal system.

Measurements and Main Results: The various costs associated with the 2 clinical settings at Palagi Hospital, Florence, Italy were compiled, and a direct cost comparison was made using an activity-based cost-management system. The costs for using reusable loop electrode resection-16 or loop electrode resection-26 were significantly less expensive than using disposable loop electrode resection-27, the tissue removal system, or bipolar electrode resection ($p = .0002$). Total hospital costs for polypectomy with all systems were significantly less expensive in an office setting compared with same-day surgery in the hospital setting ($p = .0001$). Office-based hysteroscopic tissue removal was associated with shorter operative time compared with the other procedures ($p = .0002$)

Conclusion: The total cost of hysteroscopic polypectomy is markedly higher when using disposable equipment compared with reusable equipment, both in the hospital operating room and the office setting. Same-day hospital or office-based surgery with reusable loop electrode resection is the most cost-effective approach in each settings, but requires experienced surgeons. Finally, the shorter surgical time should be taken into consideration for patients undergoing vaginal polypectomy in the office setting, owing more to patient comfort than to cost savings. Journal of Minimally Invasive Gynecology (2018) 25, 418–425 © 2017 AAGL. All rights reserved.

Keywords: Cost analysis; Hysteroscopy; Office setting; Operating room; Polyps

Endometrial polyps are common, diagnosed in 10% to 40% of women with abnormal uterine bleeding, as well as in 1% to 12% of asymptomatic patients during gynecologic examinations [1]. Moreover, hysteroscopic resection has been adopted as the standard treatment for endometrial polyps, because it is easy to perform under general anesthesia and carries a low risk of complications [2].

Advances in instrumentation with small-diameter scopes and mechanical and bipolar instruments have led to the ability to perform polypectomy in the office setting [3,4]. Disadvantages of this approach include a greater learning curve, higher costs of disposable and specialized equipment [5], and longer procedure time to cut tissue and remove fragments from the uterine cavity [6]. A recently introduced technique aimed at overcoming these challenges is the use of a hysteroscopic tissue removal system, which has been shown to be effective, fast, and easily learned and can be applied in an

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Corresponding author: Pasquale Florio, PhD, MD, UOC Obstetrics and Gynecology, San Iacopo Hospital, via Ciliegiole, 51100 Pistoia, Italy.
E-mail: floriop@hotmail.com

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operating room or office setting with or without cervical dilation, depending on scope diameter [7].

Several available mechanical or electrosurgical systems allow the removal of polyps in both the operating room and office settings. However, no study to date has compared these systems to determine the most effective and cost-saving equipment for hysteroscopic polypectomy [8].

Medical institutions need to determine the actual costs associated with specific activities based on the resources they consume. Activity-based cost management determines usefulness and timeliness and thereby allows organizations to use the information as a basis for cost management [9].

In the present study, we compared current costs for hysteroscopic polypectomy using mechanical or electrosurgical systems in different clinical settings and evaluated how activity-based cost management can support decision making.

Materials and Methods

Retrospective health and nonhealth service costs, as well as clinical details and types of surgical procedures, were obtained from patient electronic medical records for January 20, 2015, to April 27, 2016. A total of 773 consecutive procedures (in 754 women, 19 with repeat procedures) for endometrial polypectomy were performed and classified according to the type of technology used and the model of care in the tertiary center for gynecologic care.

All women underwent clinical evaluation (gynecologic consultation, ultrasound, and hysteroscopy) in an office setting. Patients diagnosed with 1 or more polyps were given the option of undergoing treatment during the same prescreening consultation via office-based surgery (OBS; n = 210) or treatment several weeks later in the hospital operating room for same-day surgery (SDS; n = 544). The choice of hysteroscopic polypectomy system was made by skilled surgeons according to instrument availability and/or surgeon preference based on experience [6,10–13].

A total of 210 polypectomies were performed using the different OBS setting instruments listed in Table 1, and 563 polypectomies (in 544 women, 19 with repeat procedures) were performed using the various SDS setting instruments listed in Table 2. All hysteroscopic procedures requiring ≤5-mm-diameter scopes were performed vaginoscopically. All OBS procedures were performed without sedation or local anesthesia. For SDS procedures, general or spinal anesthesia with low-dose hyperbaric bupivacaine and intrathecal fentanyl was used in the hospital operating room [14].

A suction-irrigating unit (Endomat; Karl Storz, Tüttlingen, Germany) was used to provide a continuous flow of 250 to 350 mL, a positive pressure of 60 to 70 mm Hg (150 mm Hg

Table 1

Office-based surgery procedures and instruments*

Type of procedure	n	Instruments
OBS-HTR	35	A 5.6-mm, 0-degree field of view*, rigid continuous-flow hysteroscopic morcellator incorporating a 9 Fr operative channel was used with a 2.9-mm disposable blade for mechanical polyp removal. Because the outflow sheath increases the overall diameter to 5.6 mm, before beginning the procedure, the scope diameter was reduced to 5 mm, removing the outer sheath. The 2.9-mm disposable blade was secured to a reusable hand piece, and fluid evacuation was accomplished while the inner tube was working with a clear vision and good distention of the uterine cavity.
OBS-MechP-5	39	A 5-mm, 30-degree field of view, rigid continuous- flow hysteroscope with a 5 Fr working channel† was used with 5 Fr reusable scissors and graspers for mechanical polypectomy.
OBS-MechP-3.5	37	A 3.5-mm, 90-degree field of view, semirigid 1.8-mm continuous-flow hysteroscope‡ with a single-use 3.5-mm sheath incorporating expandable working channel§ was used with reusable 5 Fr scissors and graspers for mechanical polypectomy.
OBS-BEP-5	31	A 5-mm, 30-degree field of view, rigid continuous-flow hysteroscope with a 5 Fr working channel† was used for electrosurgical polypectomy with a 5 Fr coaxial bipolar disposable twizzle electrode¶ and a 5 Fr reusable grasping forceps for extraction.
OBS-BEP-3.5	30	A 3.5-mm, 90-degree field of view, semirigid 1.8-mm continuous-flow hysteroscope‡ with a single-use 3.5-mm sheath incorporating an expandable working channel§ was used for electrosurgical polypectomy with a 5 Fr coaxial bipolar disposable twizzle electrode¶ and a 5 Fr semirigid reusable grasping forceps for extraction.
OBS-LEP-16	38	A 16 Fr, 0-degree field of view, rigid continuous-flow mini-resectoscope** with a reusable bipolar 13 Fr angled loop-electrode was used for polyp resection.

OBS = office-based surgery; HTR = hysteroscopic tissue removal; Mech = mechanical; BEP = bipolar electrosurgical probe; LEP = loop electrosurgical probe.
* Truclear 5.0 system; Medtronic, Dublin, Ireland.
† Karl Storz, Tüttlingen, Germany.
‡ Alphascope hysteroscope; Ethicon, Menlo Park, CA.
§ Gynecare Versascope; Ethicon, Menlo Park, CA.
¶ Versapoint Bipolar Electrosurgical System; Gynecare, Ethicon, Menlo Park, CA.
** Gubbini system; Tontarra, Medizintechnik, Tüttlingen, Germany.

Table 2

Hospital same-day surgery procedures and instruments

Type of procedure	Number	Instruments
SDS-LEP-27	66	A 27 Fr, 12-degree field of view, rigid continuous-flow resectoscope* with a disposable bipolar 4-mm angled loop electrode
SDS-LEP-26	85	A 26 Fr, 0-degree field of view, rigid continuous-flow resectoscope† with a reusable bipolar angled loop-electrode
SDS-LEP-16	70	A 16 Fr, 0-degree field of view, rigid continuous-flow mini-resectoscope‡ with a reusable bipolar 13 Fr angled loopelectrode was used for polyp resection.
SDS-HTR	67	A 5.6-mm, 0-degree field of view, rigid continuous-flow hysteroscope§ incorporating a 9 Fr operative channel was used with a 2.9-mm disposable blade for mechanical polyp removal. Because the outflow sheath increases the overall diameter to 5.6 mm, before beginning the procedure, the scope diameter was reduced to 5 mm removing the outer sheath. The 2.9-mm disposable blade was secured to a reusable hand piece, and fluid evacuation was accomplished while the inner tube was working with a clear vision and good distention of the uterine cavity.
SDS-MechP-5	69	A 5-mm, 30-degree field of view, rigid continuous-flow hysteroscope with a 5 Fr working channel† was used with 5 Fr reusable scissors and graspers for mechanical polypectomy.
SDS-MechP-3.5	66	A 3.5-mm, 90° field of view, semirigid 1.8-mm continuous-flow hysteroscope¶ with a single-use 3.5-mm sheath incorporating an expandable working channel** was used with reusable 5 Fr scissors and graspers for mechanical polypectomy.
SDS-BEP-5	72	A 5-mm, 30-degree field of view, rigid continuous-flow hysteroscope with a 5 Fr working channel† was used for electrosurgical polypectomy with a 5 Fr coaxial bipolar disposable twizzle electrode* and a 5 Fr reusable grasping forceps for extraction.
SDS-BEP-3.5	68	A 3.5-mm, 90-degree field of view, semirigid 1.8-mm continuous-flow hysteroscope¶ with a single-use 3.5-mm sheath incorporating an expandable working channel** was used for electrosurgical polypectomy with 5Fr coaxial bipolar disposable twizzle electrode* and with a 5 Fr semirigid reusable grasping forceps for extraction.

SDS = hospital same day surgery; LEP = loop electrode resection; HTR = hysteroscopic tissue removal; Mech = mechanical; BEP = bipolar electrode resection.
* Versapoint Bipolar Electrosurgical System; Gynecare, Ethicon, Menlo Park, CA.
† Karl Storz, Tüttlingen, Germany.
‡ Gubbini system, Tontarra; Medizintechnik, Tüttlingen, Germany.
§ Truclear 5.0 system; Medtronic, Dublin, Ireland.
¶ Alphascope hysteroscope; Ethicon, Menlo Park, CA.
** Gynecare Versascope; Ethicon, Menlo Park, CA.

for hysteroscopic tissue removal), and a suction pressure of 0.3 to 0.4 bar applied to the inner tube for hysteroscopic tissue removal. The fluid balance was promptly recorded in all procedures. All tissue specimens were sent for histopathological assessment.

Economic Data Computation

Before computing costs, we completed a process and activity analysis of hysteroscopic polypectomy. Table 3 lists the activities performed at each step for polypectomy in the SDS and OBS groups. The resources needed for each activity were evaluated, including work force effort, such as physician and nursing personnel; disposable supplies; equipment; and instruments. Because resources have monetary value, costs were assigned to activities based on the amount of resources consumed [15]. The average health cost for each activity was calculated by an activity-based costing system considering the specific components listed in Table 4.

Nonhealth costs were computed according to the human capital method on the basis of average days missed from work or activities of daily living hours for each procedure resulting from the consultation visit, length of stay, and convalescent period at home. The cost of each day missed from work was determined based on the mean wage of working women in Italy [16]. For the calculations using the human capital method, both market and nonmarket economic activities (i.e., household tasks) were included [17].

Table 3

Same-day operating room surgery vs office-based surgery activities for hysteroscopic polypectomy

Activity	Day surgery	Office setting
Before recovery	Consultation; preoperative assessment	Consultation
Procedure	Operating room	Office operating room
Hospital stay	Day-surgery ward	Waiting room
After discharge	Follow-up visit	Follow-up visit

Table 4

Activities used to determine costs

Charge category	Activities
Equipment and instruments	Surgical room cost per hour Cost per day in hospital setting
Traceable direct costs of materials for polypectomy	Blade, electrode, and loop Standard cost per unit of product
Other costs	Use of operating room Use of recovery unit Disposable items, instruments and medical equipment, anesthetic supplies, and dressings
Hysteroscope	Fixed costs were determined subcontracting to third parties A price-per-procedure includes instruments, repairs, and sterilization process
Wages	Mean annual Tuscany (Italy) compensation Time-driven ABC was used for assigning personnel costs based on time required for each unit activity
Indirect cost	Preadmission laboratory testing X-ray and physicians on duty Additional costs for failed procedures and readmission were also estimated
Cost of ancillary services	Dietary, laundry, housekeeping (not allocated) Histological analysis and ultrasound were reimbursed from prospective payment system (ambulatory patient) of regional health system (Tuscany, Italy)

ABC = activity-based costing.
All costs were estimated in 2015 prices and include value added tax.

Statistical Analysis

The Kolmogorov–Smirnov test was used to evaluate data distributions and a determination of Gaussian. Comparisons among groups were performed by one-way analysis of variance, followed by the Newman–Keuls post hoc test or the Kruskal–Wallis test for nonparametric values, followed by Dunn's post hoc test. A comparison between proportions was performed using Fisher's exact test. Data are expressed as mean ± standard deviation.

Statistical analyses were performed using GraphPad Prism version 3.00 for Windows (GraphPad Software, La Jolla, CA). A p value < .05 was considered to indicate significance.

Results

Clinical Findings

Table 5 lists the patients' clinical and demographic data. A total of 773 consecutive procedures for endometrial polyp removal were evaluated, including 210 done in an office-based setting (OBS group) and 563 done in the hospital operating room (SDS group). There were no significant between-group differences in mean age, body mass index, parity, or hormonal replacement therapy. Hysteroscopic polypectomy was successful for 100% of the SDS group and 91% of the OBS group. In the OBS group, 19 procedures were repeated in the hospital (bipolar electrode -5, n = 6; bipolar electrode-3.5, n = 8; mechanical-5, n = 2; mechanical -3.5, n = 2; loop resection-16, n = 1; p = .006). The most common reason for incomplete removal in the OBS group was patient discomfort (11 of 19; 57.8%).

Office-based hysteroscopic tissue removal was associated with the shortest operative time of all procedures (p = .0002) (Table 6). The procedures performed in the hospital operating room did not differ significantly in terms of duration of surgery.

Table 5

Clinical and demographic data

Variable	OBS procedures	SDS procedures	p value
Patients, n (%)	210 (27.8)	544 (72.2)	—
Mean age, yr, mean ± SD	51 ± 12	53 ± 16	.7
Mean body mass index, kg/m^2, mean ± SD	22.4 ± 5.4	24.5 ± 6.2	.8
Parity, n, mean ± SD	1.98 ± 1.19	1.81 ± 1.11	1.00
Premenopausal, n (%)	142 (32.4)	191 (35.1)	.36
Postmenopausal, n (%)	142 (67.6)	353 (64.9)	.53
Hormone replacement therapy, n/N (%)	35/210 (16.7)	81/544 (14.9)	.34
Procedures for cost computation, n/N (%)	210/773 (27.1)	563/773 (72.9)	—
Polyps <1.5 cm, n/N (%)	210/210 (100)	19/563 (3.4)	.002
Polyps >1.5 cm, n/N (%)	0/210 (0)	563/773 (96.4)	.002

OBS = office-based surgery; SDS = hospital same-day surgery.

Table 6

Surgical and postoperative data for office-based surgery patients and same-day surgery patients

Parameter	OBS-HTR	OBS-BEP-5	OBS-BEP-3.5	OBS-MechP-5	OBS-MechP-3.5	OBS-LEP-16
Operating time, min, mean ± SD	5.1 ± 1.1	10.6 ± 2.9	11.1 ± 4.3	7.24 ± 3.2	8.5 ± 3.4	8.6 ± 2.8
Successful removal, n (%)*	35 (100)	25/31 (80.6)	22/30 (73.3)	37/39 (94.9)	35/37 (94.6)	37/38 (97.4)
Failed removal, n/N (%)	0/35 (0)	6/31 (19.4)	8/30 (26.7)	2/39 (5.1)	2/37 (5.4)	1/38 (2.6)

	SDS-BEP-3.5	SDS-MechP-3.5	SDS-LEP-26	SDS-LEP-27
Operating time, min, mean ± SD	16.5 ± 6.4	14.5 ± 5.2	12.2 ± 2.7	12.4 ± 2.8
Successful removal, n/M (%)*	66/66 (100)	66/66 (100)	85/85 (100)	66/66 (100)

OBS = office-based surgery; SDS = hospital same-day surgery; HTR = hysteroscopic tissue removal; BEP = bipolar electrode resection; Mech = mechanical; LEP = loop electrode resection.
* 100% successful removal; no failures.

The number of days missed from work was significantly higher in the SDS group compared with the OBS group (mean, 4.24 ± 0.29 days vs 2.04 ± 0.13 days; p = .0001), resulting mainly from days used for presurgical visits, hospital stay, and convalescence. The time spent for preoperative consultation did not differ significantly between the groups.

Economic Findings

The costs of activities involved in hysteroscopic polypectomy using mechanical and electrosurgical systems were compared in the hospital SDS and OBS settings. The mean time for enrollment consultation was 31.7 ± 6.70 minutes for nurses and surgeons, costing €16.82 and €37.18, respectively. During the study period, the total nurse working time for preoperative SDS assessment was 3456 hours to enroll 6792 patients, the mean time for each assessment was 30.5 ± 7.4 minutes per patient, and the cost was €12.65 per patient. Between April 20, 2014, and March 27, 2015, 6414 patients were admitted with 23.184 hours of nurse working time. Each patient hospital SDS stay used 263 minutes of nurse working time, at a cost of €104.12. The scheduled time for each anesthesiologist consultation was 30 minutes, at a cost of €35.29. An additional 15 minutes of surgeon working time in the ward at €16.88 was estimated for each SDS patient during the hospital stay. Finally, total indirect costs related to hysteroscopic activities were €170.14 in the OBS group and €369.25 in the SDS group.

Office-based procedure costs were computed for the entire polypectomy process, even those costs related to transferring patients to the hospital setting for loop electrode resection-26. The lowest costs were associated with OBS loop electrode resection-16 (€269.49 ± €44.05; p = .0001), and the most expensive procedures were bipolar electrode-3.5 in the office (€716.76 ± €92.05; p = .0001). Table 7 compares direct costs related to endometrial polypectomies performed in the office. Traceable costs were lowest in loop electrode resection-16 in the office (€40.31) and highest in bipolar resection-3.5 in

Table 7

Direct and indirect costs related to endometrial polypectomies performed in the office

Category	OBS-HTR	OBS-BEP-5	OBS-BEP-3.5	OBS-MechP-5	OBS-MechP-3.5	OBS-LEP-16
Nurse	7.24	7.24	7.24	7.24	7.24	7.24
Anesthesiologist	NC	NC	NC	NC	NC	NC
Surgeon	18.61	18.61	18.61	18.61	18.61	18.61
Materials	22.10	22.10	22.10	22.10	22.10	22.10
Equipment	10.04	10.04	10.04	10.04	10.04	10.04
Hysteroscopes						
Subcontract	117.37	117.37	117.37	117.37	117.37	117.37
Traceable items	311.71	422.52	538.42	113.67	229.57	40.31
Histopathological assessment	46.48	46.48	46.48	46.48	46.48	46.48
Total	533.55	644.36	760.26	335.51	451.41	262.15

OBS = office-based surgery; SDS = hospital same-day surgery; HTR = hysteroscopic tissue removal; BEP = bipolar electrode resection; Mech = mechanical; LEP = loop electrode resection; NC = not computable.
Values are expressed in euros (€).

Table 8

Direct and indirect costs related to endometrial polypectomies performed in the hospital

Category	SDS-HTR	SDS-BEP-5	SDS-BEP-3.5	SDS-MechP-5	SDS-MechP-3.5	SDS-LEP-16	SDS-LEP-26	SDS-LEP-27
Nurse	79.67	79.67	79.67	79.67	79.67	79.67	79.67	79.67
Anesthesiologist	87.55	87.55	87.55	87.55	87.55	87.55	87.55	87.55
Surgeon	65.35	65.35	65.35	65.35	65.35	65.35	65.35	65.35
Materials	72.69	72.69	72.69	72.69	72.69	72.69	72.69	72.69
Equipment	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71
Hysteroscopes								
Subcontract	117.37	117.37	117.37	117.37	117.37	117.37	117.37	117.37
Traceable items	311.71	422.52	538.42	113.67	229.57	40.31	20.64	449.27
Histopathological analysis	46.48	46.48	46.48	46.48	46.48	46.48	46.48	46.48
Total	817.54	928.34	1044.24	619.50	735.40	546.14	526.46	955.10

SDS = hospital same-day surgery; HTR = hysteroscopic tissue removal; BEP = bipolar electrode resection; Mech = mechanical; LEP = loop electrode resection.
Values are expressed in euros (€).

the office (€538.42). Scopes and reusable and disposable supplies made up 76.1% and 47.2% of the cost of polypectomy in the OBS setting, respectively.

Direct and indirect costs in the hospital SDS setting are reported in Table 8. The lowest costs were associated with polypectomies performed with loop electrode resection-26 (€526.45 ± €0.01), significantly lower than polypectomies performed using all other scopes ($p = .0001$). The most expensive procedures were those performed with bipolar resection-3.5 (€1044.24 ± €0.01; $p = .0001$).

Hysteroscopic polypectomy was significantly less expensive in the OBS group compared with the SDS group ($p = .0001$ for all) (Table 9). The difference may be explained by the fact that hospital SDS involves a hospital stay and operating room facilities that are not applicable in the OBS setting. Moreover, owing to subcontracts with third parties, all technologies cost the same (€117.37); the higher costs of some technologies used in both the OBS and SDS groups were imputable mainly to the traceable disposable items.

Table 9

Total costs related to hysteroscopic polypectomy performed in the office and hospital

Hysteroscope	OBS	SDS	p value
HTR	533.54 ± 0.001	817.53 ± 0.001	.0006
BEP-5	627.1 ± 42.18	928.30 ± 0.001	.0009
BEP-3.5	716.76 ± 92.05	1,044.24 ± 0.001	.0006
MechP-5	345.83 ± 43.77	619.40 ± 0.001	.0001
MechP-3.5	455.46 ± 17.20	735.40 ± 0.001	.0004
LEP-16	269.49 ± 44.05	546.14 ± 0.001	.0002
LEP-26	—	526.46 ± 0.001	—
LEP-27	—	955.10 ± 0.001	—

OBS = office-based surgery; SDS = hospital same-day surgery; HTR = hysteroscopic tissue removal; BEP = bipolar electrode resection; Mech = mechanical; LEP = loop electrode resection.
Values are expressed in euros (€), mean ± SD.

Discussion

Traceable items were the first factors identified to increase the cost of procedures in both the SDS and OBS settings. Higher total costs of bipolar electrodes or removal system blades were offset by disposable items. Owing to the contractual stipulation of hysteroscopic equipment on a price-per-procedure basis, devices are becoming an overriding expense in such surgical procedures. Polypectomy performed with reusable loops was more cost-effective in the SDS group using a loop electrode 26 resectoscope and in the OBS group with a loop electrode 16 resectoscope.

The second factor in increased costs was readmission for failed procedures associated with office-based bipolar electrode resection-5 and bipolar electrode resection-3.5. This observation merits discussion, because ongoing technological advances in endoscopic instrumentation are likely to further increase the feasibility and acceptability of polypectomy in the office setting. Although there will also be a learning curve for modifications and variations of a technique, the use of novel instruments can influence surgical outcomes and costs [18].

Office-based hysteroscopic tissue removal was the most effective procedure, with 100% successful resection. The additional costs of this more expensive treatment strategy are countered by the advantages of not having to use the hospital operating room and providing more time for staff to complete other procedures.

Owing to insufficient data on long-term outcomes of polypectomy in the current study, the potential additional cost of polyp recurrence was not evaluated. A technology that minimizes readmission for failed procedures would seem more cost- effective than an instrument that reduces surgical time [19].

In the present study, operative time was shorter for hysteroscopic tissue removal compared with loop or bipolar electrode polypectomy, with a mean <5 minutes reduction in the total time to remove endometrial lesions. Cost savings and efficiency in SDS and OBS procedures can be better achieved by decreasing turnaround time between surgical cases (i.e., time from when one patient exits the operating room until the next patient enters and time for setting up and cleaning the operating room) [20,21].

In the office setting, patient acceptability and procedural pain are linked to the duration of hysteroscopic surgery [4,10,11], as well as to the use of mechanical or electrical instruments that necessitate additional maneuvers to retrieve resected tissue [22]. Additional maneuvers contribute to prolongation of the procedure compared with hysteroscopic tissue removal using a rotating blade, which allows simultaneous cutting and removal of tissue fragments [23]. Therefore, hysteroscopic tissue removal is the treatment of choice in OBS for being generally faster than cold forceps or bipolar electrodes [24].

The third result of the present study shows that total hospital costs with all systems were less expensive in the OBS vs the SDS ($p = .0001$), owing to reduced staff, recovery resources, no need for hospital stay, and operating room facilities, as noted in other studies [25,26].

The fourth consideration of the present study involves nonhealth costs, referring to missed work. Patients who underwent in-office procedures returned to normal function earlier than those who underwent hospital procedures. This faster return to normal activity benefits society in terms of increased production through earlier return to work and to the welfare system in terms of reduction of replacement income (i.e., incapacity benefit). This was based on the Italian way of life, although these costs are unlikely to be different in other European countries.

Healthcare expenditures have increased in developing countries, making economic assessment of interventions an integral part of decision making. However, the decision making process is impacted by patient pain and discomfort and increasing polyp size, owing to the limitations of undergoing polypectomy in the OBS. The selection of hysteroscopic equipment for polypectomy must be tailored to the patient and operative setting, and the surgeon must have the necessary experience, training, and confidence to avoid additional procedures.

In conclusion, the costlier office-based hysteroscopic tissue removal should be adopted, given its association with minimal readmission for failed procedures and a shorter operative time [27]. The use of loop resection 16 and loop resection 26 resectoscopes with reusable loops results in better cost efficiency in the SDS as well in the OBS, but requires a skilled surgeon [28]. The reduced operative time in the OBS should be taken into consideration for patient acceptability rather than for cost savings.

References

1. Salim S, Won H, Nesbitt-Hawes E, Campbell N, Abbott J. Diagnosis and management of endometrial polyps: a critical review of the literature. *J Minim Invasive Gynecol*. 2011;18:569–581.
2. Lieng M, Istre O, Qvigstad E. Treatment of endometrial polyps: a systematic review. *Acta Obstet Gynecol Scand*. 2010;89:992–1002.
3. Di Spiezio Sardo A, Calagna G, Guida M, Perino A, Nappi C. Hysteroscopy and treatment of uterine polyps. *Best Pract Res Clin Obstet Gynaecol*. 2015;29:908–919.
4. Litta P, Cosmi E, Saccardi C, Esposito C, Rui R, Ambrosini G. Outpatient operative polypectomy using a 5-mm hysteroscope without anaesthesia and/or analgesia: advantages and limits. *Eur J Obstet Gynecol Reprod Biol*. 2008;139:210–214.
5. Cooper NA, Clark TJ, Middleton L, et al. Outpatient versus inpatient uterine polyp treatment for abnormal uterine bleeding: randomised controlled non-inferiority study. *BMJ*. 2015;350:h1398.
6. Emanuel MH, Wamsteker K. The Intra Uterine Morcellator: a new hysteroscopic operating technique to remove intrauterine polyps and myomas. *J Minim Invasive Gynecol*. 2005;12:62–66.
7. Shazly SA, Laughlin-Tommaso SK, Breitkopf DM, et al. Hysteroscopic morcellation versus resection for the treatment of uterine cavitary lesions: a systematic review and meta-analysis. *J Minim Invasive Gynecol*. 2016;23:867–877.
8. American Association of Gynecologic Laparoscopists. AAGL practice report: practice guidelines for the diagnosis and management of endometrial polyps. *J Minim Invasive Gynecol*. 2012;19:3–10.
9. Devine K, Ealey T, O'Clock P. A framework for cost management and decision support across health care organizations of varying size and scope. *J Health Care Finance*. 2008;35:63–75.
10. Bettocchi S, Ceci O, Nappi L, et al. Operative office hysteroscopy without anesthesia: analysis of 4863 cases performed with mechanical instruments. *J Am Assoc Gynecol Laparosc*. 2004;11:59–61.
11. Garuti G, Centinaio G, Luerti M. Outpatient hysteroscopic polypectomy in postmenopausal women: a comparison between mechanical and electrosurgical resection. *J Minim Invasive Gynecol*. 2008;15:595–600.
12. Dealberti D, Riboni F, Cosma S, et al. Feasibility and acceptability of office-based polypectomy with a 16F mini-resectoscope: a multicenter clinical study. *J Minim Invasive Gynecol*. 2016;23:418–424.
13. Lethaby A, Hickey M, Garry R, Penninx J. Endometrial resection / ablation techniques for heavy menstrual bleeding. *Cochrane Database Syst Rev*. 2009;(4):CD001501.
14. Florio P, Puzzutiello R, Filippeschi M, et al. Low-dose spinal anesthesia with hyperbaric bupivacaine with intrathecal fentanyl for operative hysteroscopy: a case series study. *J Minim Invasive Gynecol*. 2012;19:107–112.
15. Franchini M, Cianferoni L, Lippi G, et al. Tubal sterilization by laparoscopy or hysteroscopy: which is the most cost-effective procedure? *Fertil Steril*. 2009;91(4 Suppl):1499–1502.
16. Italian Institute of Statistic (ISTAT). Wages of Woking Women. 2015. Available at: http://dati.istat.it/Index.aspx?DataSetCode=DCSC_RETRCONTR1. Accessed January 11, 2018.
17. European Commission Eurostat. Labour Market Indicators. 2015. Available at: https://www.ecb.europa.eu/stats/macroeconomic_and_sectoral/labour_markets/html/index.en.html. Accessed January 11, 2018.
18. van Dongen H, Emanuel MH, Wolterbeek R, Trimbos JB, Jansen FW. Hysteroscopic morcellator for removal of intrauterine polyps and myomas: a randomized controlled pilot study among residents in training. *J Minim Invasive Gynecol*. 2008;15:466–471.
19. AlHilli MM, Nixon KE, Hopkins MR, Weaver AL, Laughlin-Tommaso SK, Famuyide AO. Long-term outcomes after intrauterine morcellation vs hysteroscopic resection of endometrial polyps. *J Minim Invasive Gynecol*. 2013;20:215–221.

20. Li C, Dai Z, Gong Y, Xie B, Wang B. A systematic review and meta-analysis of randomized controlled trials comparing hysteroscopic morcellation with resectoscopy for patients with endometrial lesions. *Int J Gynaecol Obstet*. 2017;136:6–12.
21. Soliman BA, Stanton R, Sowter S, Rozen WM, Shahbaz S. Improving operating theatre efficiency: an intervention to significantly reduce change-over time. *ANZ J Surg*. 2013;83:545–548.
22. Pampalona JR, Bastos MD, Moreno GM, et al. A comparison of hysteroscopic mechanical tissue removal with bipolar electrical resection for the management of endometrial polyps in an ambulatory care setting: preliminary results. *J Minim Invasive Gynecol*. 2015;22:439–445.
23. Smith PP, Middleton LJ, Connor M, Clark TJ. Hysteroscopic morcellation compared with electrical resection of endometrial polyps: a randomized controlled trial. *Obstet Gynecol*. 2014;123:745–751.
24. Clark TJ, Middleton LJ, Cooper NA, et al. A randomised controlled trial of outpatient versus inpatient polyp treatment (OPT) for abnormal uterine bleeding. *Health Technol Assess*. 2015;19:1–194.
25. Saridogan E, Tilden D, Sykes D, et al. Cost-analysis comparison of outpatient see-and-treat hysteroscopy service with other hysteroscopy service models. *J Minim Invasive Gynecol*. 2010;17:518–525.
26. Penketh RJ, Bruen EM, White J, et al. Feasibility of resectoscopic operative hysteroscopy in a UK outpatient clinic using local anesthetic and traditional reusable equipment, with patient experiences and comparative cost analysis. *J Minim Invasive Gynecol*. 2014;21:830–836.
27. Noventa M, Ancona E, Quaranta M, et al. Intrauterine morcellator devices: the icon of hysteroscopic future or merely a marketing image? A systematic review regarding safety, efficacy, advantages, and contraindications. *Reprod Sci*. 2015;22:1289–1296.
28. Hamerlynck TW, Schoot BC, van Vliet HA, Weyers S. Removal of endometrial polyps: hysteroscopic morcellation versus bipolar resectoscopy, a randomized trial. *J Minim Invasive Gynecol*. 2015;22:1237–1243.