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Research Report

The potential for opportunistic salpingectomy to reduce ovarian cancer in women undergoing non-gynecologic surgery

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ABSTRACT

Background: We sought to estimate the impact, acceptance, and additional cost of opportunistic bilateral salpingectomy (OBS) or bilateral salpingo-oophorectomy (BSO) during certain non-gynecologic procedures on the incidence of high grade serous ovarian cancer (HGSOC).

STUDY DESIGN: US population and institutional data were reviewed for three common laparoscopic non-gynecologic surgeries: Cholecystectomy (CCY), Ventral Hernia Repair (VHR), and Bariatric Surgical Procedures (BSP). Additionally, institutional review was performed on all patients, aged 35–75, undergoing these procedures from July 2016 to June 2019 to determine candidacy for OBS or BSO. Patients with history of hysterectomy or tubal sterilization were excluded. Baseline population risk (1.4%) and estimated risk reduction associated with OBS (65%) and BSO (98%) were applied to determine the impact OBS or BSO would have on incidence if applied as standard of care. Separately, patients were surveyed regarding acceptance of concurrent risk reducing procedure. Cost effective analysis (CEA) was performed using multiple models which evaluated participation of Surgery, OB/GYN, and both.

Results: For the institutional review, 765 cases were identified, with 417 eligible. Extrapolating the percentage of eligible female patients from our institution undergoing CCY (63 %), VHR (57 %), and BSP (81 %) to reported annual US cases, resulted in eligible cases as follows: CCY (472,500), VHR (199,500–285,000), and BSP (184,680). Therefore, we estimate 466,891—–513,488 eligible patients per year. Assuming 20,400 new ovarian cancer (OC) cases annually, between 4,248 and 4,839 cases would be eliminated (20.8–23.7 % reduced incidence). Fifty-nine patients were surveyed (13 AA, 2H) with acceptance rate of 81 %. CEA revealed that multiple models for institution of this practice would favor implementing risk reducing surgery, with OBS performing better than BSO.

Conclusion: Over half of female patients undergoing three common non-gynecologic abdominal surgeries could benefit from OBS or BSO. If logistics can be arranged between surgeons and their patients, incidence of OC could be reduced by at least 20–25%.

1. Introduction

With an incidence of 20,400 new cases per year in the US and baseline population risk (BPR) of 1/70 (1.4 %), high grade serous cancer of the ovary, peritoneum and fallopian tube (HGSOC) has the highest mortality rate of all gynecologic cancers and is the fifth leading cause of cancer death in women (http://www.herc.research.va.gov, xxxx). Current understanding is that most HGSOCs arise in the distal end of the fallopian tube and recent data suggest a 65 % lifetime risk reduction (RR) following salpingectomy, which can be performed with minimal additional operating room time, blood loss, and morbidity, via either laparotomy or minimally invasive surgery (ACOG Committee, 2019; Bercow et al., 2017; Chan et al., 2014; Childers and Maggard-Gibbons, 2018; Crum, 2009; Csikesz et al., 2010; Dilley et al., 2017; Erickson et al., 2013; Estimate of Bariatric Surgery Numbers, 2018). Risk reduction following bilateral salpingo-oophorectomy (BSO) is > 98 % (Falconer et al., 2015). For this reason, the American College of Obstetrics and Gynecology (ACOG) Committee Opinion 774 recommends discussion of opportunistic bilateral salpingectomy (OBS) with any woman who has completed childbearing and is undergoing gynecologic

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pelvic surgery (Garcia et al., 2016). In these cases it is assumed that the gynecologist or pelvic surgeon who is performing the pelvic surgery will be comfortable adding a minimally invasive OBS or BSO to the planned procedure, and likely the patient will be in lithotomy position and Trendelenburg during the case.

In contrast to the recommendation for risk reducing surgery for the pelvic surgeon, there are no such recommendations or guidelines regarding women undergoing other abdominal procedures during which risk reducing surgery might be performed. Cholecystectomy is one of the most commonly performed abdominal surgical procedures, and in developed countries the majority are performed laparoscopically. In the US every year, approximately 700,000 cholecystectomies are performed and 90 % of these are performed laparoscopically (Garcia et al., 2018). Similarly, bariatric surgery for weight loss and ventral hernia repair are common surgeries in the US (228,000 and 400,000 per year, respectively), with the majority performed via minimally invasive methods. Over 80 percent of bariatric surgical procedures are performed in women, and approximately half of these are performed in reproductive aged women (Hanley et al., 2017; Nagle et al., 2015; Neumann et al., 2014). Thus, minimally invasive non-gynecologic surgeries offer an opportunity to perform risk reducing surgery, either as OBS or BSO, for women who are having the more common minimally invasive surgical procedures.

Unlike the case with pelvic surgery, abdominal surgical procedures often do not include a pelvic surgeon who are trained or credentialed for pelvic and/or risk reducing surgery. Given this, a second surgeon may be required to perform the pelvic portion of the case once the primary procedure is completed. Additionally, there may be the need to put the patient in Trendelenburg position, which is a critical detail in obese women. The overall case time will be extended, particularly if the patient is morbidly obese. While these are all potential limitations to performing risk reducing surgery in these cases, Tomasch et al have shown that implementation of risk reducing procedures in the non-gynecologic population is feasible (http://www.bls.gove/data/inflation_calculator.htm, 2022). Yet there have been no models addressing potential impact this surgery could have on HGSOC incidence in the US. Because there are many more non-gynecologic surgeries performed annually than gynecologic, if the logistics regarding performing an OBS or BSO at the time of non-gynecologic surgeries could be overcome, it would potentially result in a dramatic reduction in the incidence of ovarian cancer.

Our objectives in the current study were twofold. First, we aimed to provide a model for patient eligibility, risk reduction impact, and cost effectiveness of OBS/BSO at the time of non-gynecologic minimally invasive procedures. Second, we aimed to evaluate patient perspectives and acceptability of OBS/BSO at the time of non-gynecologic procedures. Given that there is a high rate of obesity in the mid-Atlantic, that obesity is a risk factor for the abdominal surgeries we are considering, and that obesity is associated with a worse overall survival from ovarian cancer, (Kindelberger et al., 2007) we also explored the impact of obesity on our population of patients. Finally, we explored race as an exploratory endpoint with respect to acceptance of RR surgery.

2. Methods

The University of Virginia (UVA) Institutional Review Board (IRB) approved the retrospective needs assessment as well as the patient survey, including patient data for those participating in the survey. Patient consent was waived for the retrospective portion. Patients provided verbal consent for the survey.

2.1. Retrospective needs assessment

We performed a retrospective review of institutional records from July 1, 2016 through June 30, 2019 for patients ages 35–75 years with a CPT billing code for laparoscopic CCY, VHR, and/or BSP. Male patients were excluded and patients who had multiple eligible procedures over the time period were only considered once. Electronic medical records of eligible female patients were reviewed for date of procedure and surgical history. In order to be most conservative with estimates of benefit, and because operative and pathology reports were usually not available for remote surgeries, it was conservatively assumed that patients who previously underwent a hysterectomy were not eligible for risk reducing surgery because fallopian tube status was unknown. Patients with a history of tubal ligation were also excluded, as they may have had a salpingectomy, or would garner a reduced rate of ovarian cancer from BTL alone. Demographic data including age, race, and BMI were collected.

The national annual rates of CCY, VHR, and BSP in female patients were determined by reports from the Society of Gastrointestinal and Endoscopic Surgeons (SAGES) and American Society for Metabolic and Bariatric Surgery (ASMBS) [20.21]. A population-based model using our institution for comparison was created. Total case numbers were reviewed to determine what percentage of CCY, VHR and BSP are being performed on females. Institutional percentages were applied to case numbers reported by SAGES and ASMBS to extrapolate annual case volume and eligibility totals for the US population.

Baseline population risk for developing ovarian cancer of 1/70 (1.4 %) and a risk reduction of 65 % following OBS, or 98 % following BSO in women 60 years of age or older, were applied to the eligible cases to determine the impact OBS and BSO would have on incidence of disease if implemented in the selected patient population (http://www.herc.research.va.gov, xxxx; Csikesz et al., 2010; Falconer et al., 2015).

2.2. Assessment of patient acceptability and interest

A patient acceptability survey was modified from previously validated institutional surveys to assess interest in risk-reducing surgery. Non-guiding questions were constructed pertaining to patient history. For appropriate questions a validated Likert rating scale was implemented. The complete survey as well as presentation technique and consent were reviewed and approved by both a behavioral sciences department liaison and the IRB prior to its use [Supplemental Fig. 1]. Inclusion criteria were females ages 18–75 years.

Eligible patients seen and scheduled for non-gynecologic surgery were provided a handout with information regarding HGSOC and OBS/BSO as part of their pre-operative information packet [Supplemental Fig. 2]. Attempt to reach the patients within one week of their clinic visit was made and survey performed via phone if the patient was agreeable and provided verbal consent. The survey was implemented and completed by phone with women scheduled to undergo CCY, VHR, or BSP through a single provider's clinic from January 2020 through January 2021. Survey data were reviewed and analyzed to determine interest for a program that offers OBS/BSO in this patient population. Demographic data including age, race, BMI, and indication for surgery were collected.

2.3. Cost effective analysis

The cost effectiveness of opportunistic salpingectomy at the time of hysterectomy or during laparoscopic sterilization was studied previously by Dilley et al. (Kurman and Shih Ie, 2016) They found that salpingectomy was cost effective and provided potential ovarian cancer risk reduction. This model was extrapolated to include BS for women under age 60 or BSO for women over 60 years of age who were undergoing general surgery procedures. This model only considers the cost of up-front carboplatin and paclitaxel, without use of maintenance therapy or recurrent therapy, to allow the most conservative cost estimate. We hypothesized that while OBS and BSO have increased upfront costs, there is long term savings to the health care system through ovarian cancer reduction. The cost effectiveness was evaluated using Incremental Cost- Effectiveness Ratio (ICER) by assigning effectiveness and

Table 1
Case Totals.

	Total	Cholecystectomy	Ventral Hernia Repair	Bariatric Surgical Procedures
Cases	1206	750	322	134
Female	765	473	183	109
Female with Tubes	417			
Female > 60	244	146	83	15
Female > 60 with Tubes	120			

utilities to cancer and non-cancer health states to find the Quality Adjusted Life Year (QALY) (Kurman and Shih Ie, 2010). The standard willingness to pay per QALY has historically been $50,000, and given that this is a conservative estimate, it has been used in the evaluation (McAlpin et al., 2014). Integration schemas were created for different operating room scenarios including OB/GYN consultation for all, primary surgeon performed for all, and an integrated analysis for OBS performed by the primary surgeon and BSO performed by OB/GYN in the previously delineated age groups.

TreeAge Pro 2021 was used to perform all analyses.

3. Results

3.1. Retrospective needs assessment

A total of 1206 of the outlined surgical cases were performed during the study period: CCY (750), VHR (322), and BSP (134). CCY accounted for the majority of cases consistent with annual reported numbers of 750,000 (SAGES), 350,000–500,000 (SAGES), and 228,000 (ASMBS) (Nagle et al., 2015; Neumann et al., 2014). Of these cases, 765 were female; 244 women were 60 years of age or older at the time of surgery. The number of CCY, VHR, and BSP performed on females were 473, 183, and 109 respectively. Of the cases performed on female patients, 348 were excluded due to their surgical history, leaving 417 eligible cases (54.5 %) (Table 1).

We then applied these percentages obtained from our retrospective institutional review and described above to the US annual case totals for CCY, VHR, and BSP respectively: annual reported numbers of 750,000 (SAGES), 350,000–500,000 (SAGES), and 228,000 (ASMBS). Using the 54.5 % eligibility seen in our population, we estimate a total of 466,891–513,488 eligible cases that could benefit from OBS or BSO each year.

We used assumptions of 20,400 new HGSOC cases per year, baseline incidence rate of 1.4 %, and risk reduction after OBS of 65 % (Csikesz et al., 2010). Applying the estimated eligible case totals, the number of HGSOC cases eliminated annually would be between 4,248 and 4,673 cases (20.8–22.9 % reduced incidence). (Fig. 1a). Furthermore, separating cases by age < 60 and ≥ 60 to account for the possibility of BSO in appropriate patients and using the same incidence, BPR, and RR after OBS in addition to a RR of 98 % following BSO for women 60 and older, cases eliminated annually would be between 4,335 and 4,839 cases (21.3–23.7 % reduced incidence). (Fig. 1b).

3.2. Assessment of acceptability

Sixty-four women met inclusion criteria for the survey, and 59 completed surveys (92.2 % completion rate). Of these 59 women, 15 (25 %) identified as black or Hispanic. All (59/59) of participants felt that the information offered to them in the one-page handout provided at the time of their pre-operative counseling was sufficient to explain the process and reasoning behind OBS/BSO for risk reduction in HGSOC, and all (59/59) felt it should be offered as standard to all women undergoing elective abdominal surgery.

When asked about their feelings regarding the procedure itself 66.1

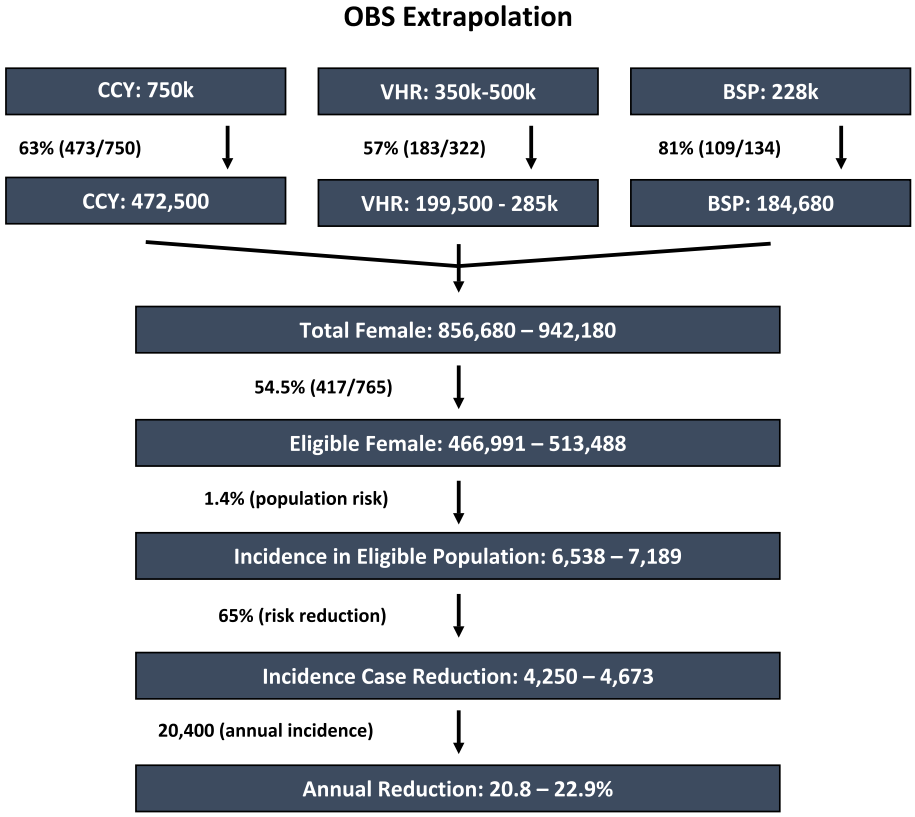

Fig. 1a. Incidence reduction with salpingectomy alone.

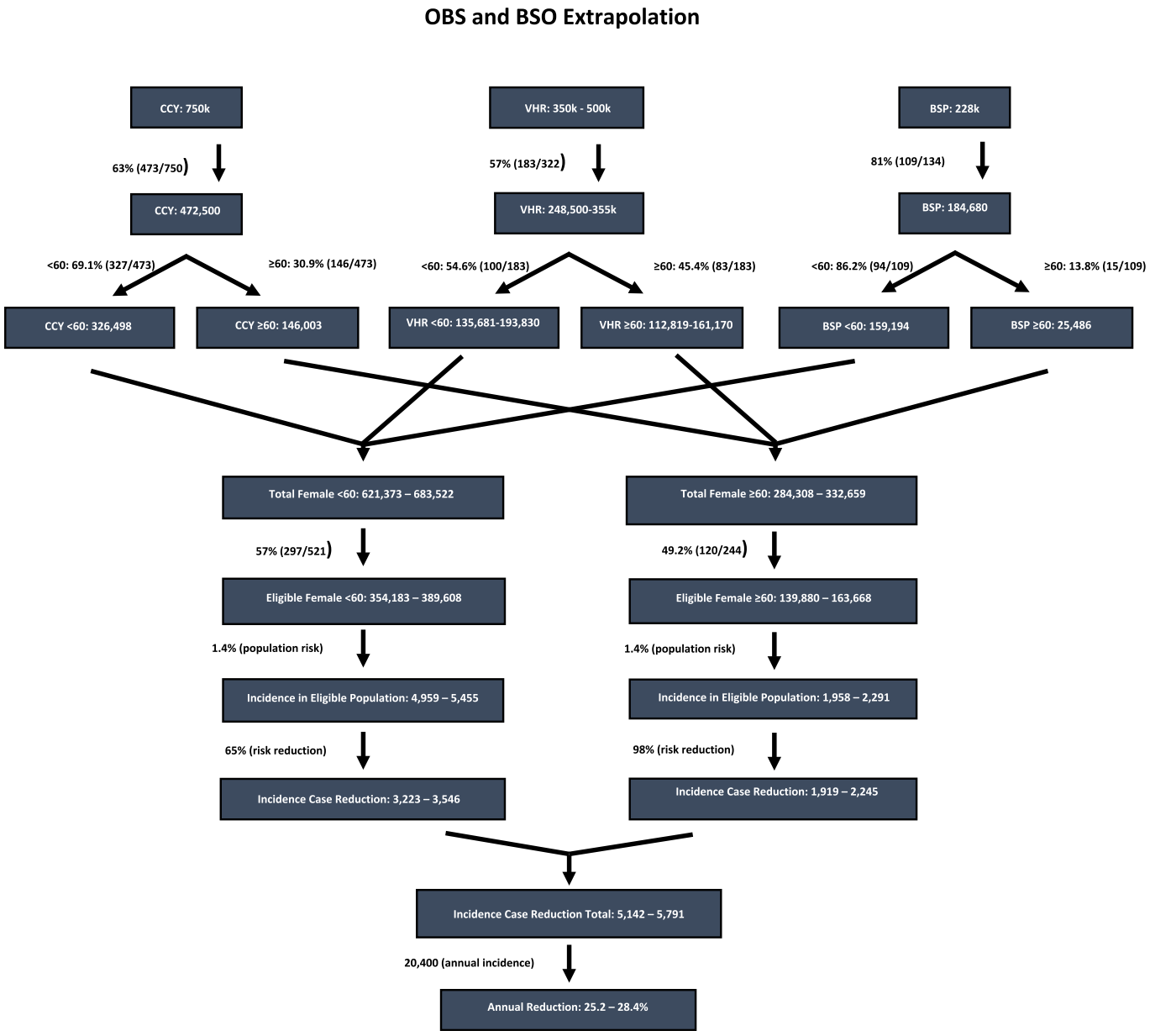

Fig. 1b. Incidence reduction with salpingectomy in women under the age of 60 and bilateral salpingo-oophorectomy in women over the age of 60.

% (39/59), 73 % (11/15) of minority patients, expressed that they would absolutely want the procedure performed if possible, at their upcoming surgery, with an additional 15.3 % (9/59) expressing strong interest. Only 6.8 % (4/59) reported low interest in the procedure if offered and all cited interest in future childbearing as their reason. Only 1 patient expressed complete disinterest in the intervention and was also the youngest patient interviewed (age 23).

With regard to counseling and scheduling constraints, 79.7 % (47/59) of participants reported they were comfortable with being contacted outside of clinic for counseling if necessary and wouldn't need an additional appointment to discuss the procedure even if it were going to be performed by a separate provider. Additionally, standard procedure scheduling provided a sufficient time between counseling and the scheduled procedure to meet Medicaid sterilization requirements with an average of 40.5 days between pre-op and surgery [Table 2].

3.3. Cost effective analysis

Cost-effective analyses for OBS and BSO were performed. Each was evaluated with the risk reduction surgery performed by either the general surgeon or with the addition of a gynecologist [Fig. 2]. Estimated baseline probabilities were adapted for application in our population [Table 3] (http://www.herc.research.va.gov, xxxx; Falconer et al., 2015; McAlpin et al., 2014; Neumann et al., 2014) [27]. Costs and utilities were estimated based on Bercow et al in the calculation of ovarian cancer costs for carboplatin/paclitaxel without maintenance in the first year, and the additional ovarian cancer treatment costs and surgical complication rates/costs were based off of Dilley et al [Table 4] (Kurman and Shih le, 2016; Santry et al., 2005). As in Dilley et al, for the purposes of this CEA, women who died of cancer were expected to die after 5 years, with costs calculated by the initial year of treatment, 3 additional years, and the costs in the final year of life. Women who were alive with ovarian cancer were assumed to have the first year of treatment costs only. However, given advances in treatment, especially increased use of maintenance bevacizumab and PARP inhibitors, we believe the costs reported in these papers were conservative. All costs were updated to 2021 dollars using the Consumer Price Index (Tomasch et al., 2020).

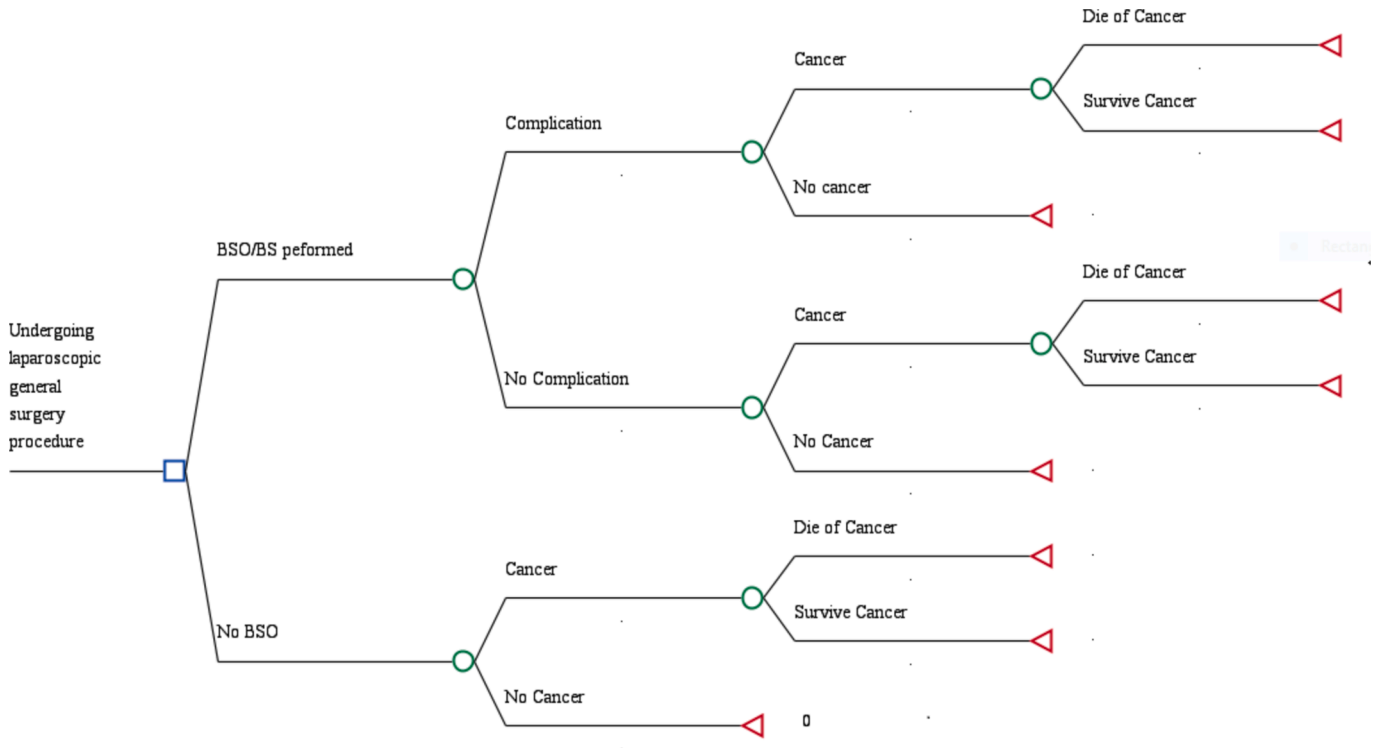

Fig. 2. Cost-effective analysis schema.

The additional cost of the surgery was based on the CPT code 58,661 (Laparoscopic Removal of Adnexal Structures) at the rate billed by our institution billing department and in correlation with Medicare reimbursement. After evaluating the instruments used in hernia repair, bariatric surgical procedures, and cholecystectomy the only additional equipment needed would possibly be a foam pad under the patient to aid in patient stabilization during Trendelenburg position. The price for this was also provided by institutional billing. The majority of the cases in Tomasch et al did not use additional trocars, 79 % of the surgeries, and conceivably trochars in unused locations could be relocated as necessary (thus these costs were not included) (http://www.bls.gove/data/inflation_calculator.htm, 2022). Additionally in Tomasch et all the majority (75.2 %) of the surgeries were performed exclusively by general surgeons and the average time for the surgery was 13 min (range 4–45 min) (http://www.bls.gove/data/inflation_calculator.htm, 2022). Given the possible need to reposition the patient, an additional 5 min was added. Thus, the additional cost for the surgery included the extra operating time, estimated to be 18 min. Childers et al calculated the average cost of OR time to be $44 per minute (in 2021 dollars), which was added to the additional surgical cost (Tomasch et al., 2020; U.S. Cancer Statistics Data Visualizations Tool, 2018).

The CEA was run under multiple scenarios. Stratifying OBS for women under the age of 60 and BSO for women over the age of 60, if performed by the general surgeon (extra cost of surgery $2,045), the surgery is deemed cost-effective with an ICER of $10,557. This is well below traditional ICER thresholds of $50,000. However, if BSO is not performed after the age of 60 and all eligible women were to undergo OBS performed by a general surgeon at the time of other surgery, it is not cost effective based on traditional thresholds, with an ICER of $308,265. This was primarily due to the reduced rate of prevention of 65 % for OBS versus 98 % for BSO.

Multiple sensitivity analyses were also run looking at the cost of surviving/dying of cancer (surviving $100,000-$400,000 and dying $200,000-$600,000). This found that for a general surgeon to perform OBS it becomes cost effective when cancer treatment is $220,000 and $280,000 respectively, with an ICER of $4,550. The lifetime treatment cost needed to justify OBS performed by OBGYN was $310,000 and $440,000 respectively, with ICER of $8,244.

Finally, a collaborative model analysis was performed using a weighted cost for the general surgeon to perform OBS and OBGYN to perform BSO in appropriately eligible women. Accounting for the frequency with which OBS and BSO would be performed in the overall population, the relative risk reduction in ovarian cancer becomes 78.7 %. This model was not cost effective initially, ICER $247,701, however, after performing a sensitivity analysis, the cost of ovarian cancer needed to be $175,000 and $290,000, which then minimized the ICER to $1,594. Given new lines of treatment and routine use of maintenance therapy it is very reasonable to believe this threshold is currently met.

4. Discussion

Ovarian cancer is the most lethal of all the gynecologic malignancies. The majority of women will present with advanced stage disease and succumb to their disease; for these patients the 5-year survival is only 30 %, despite FDA approvals of novel therapies over the past 5 years in the US. Additionally, multiple large prospective screening trials using several modalities, including ultrasound, serum biomarkers, and algorithms have failed the promise of diagnosing early disease, when it still might be curable. Prevention remains one of the only established methods for decreasing the number of women who will develop advanced disease, with a prevention rate of close to 100 % for BSO and potentially 65 % or higher for OBS (Garcia et al., 2016). Despite the demonstrated success of prevention, the hundreds of thousands of abdominal surgeries performed on US women each year represent a lost opportunity for risk reducing surgery and the subsequent decrease in incidence of HGSOC.

Through the use of national estimates and a brief time period institutional chart review of eligibility, we conservatively estimate that the incidence of fallopian tube/ovarian cancer would be reduced by at least 20 % if opportunistic OBS and BSO procedures were performed on a routine basis at the time of surgery for three of the most common non-gynecologic minimally invasive procedures. This estimate is likely

Table 2
Survey Results.

Patients	64
Completed survey	59
Age	44 (23 – 66)
Race	
White	44
Black	13
Hispanic	2
BMI	40.1 (25.7 – 69.4)
Insurance	
Medicare	13
Medicaid	32
PPO	14
Days Before Surgery	40.5 (29 – 68)
Information Sufficient	
Yes	59
No	0
Information Important	
Yes	59
No	0
Interest in Procedure	
1	1
2	3
3	7
4	9
5	39
Comfort with Phone Consultation	
1	0
2	6
3	6
4	24
5	23
Preferred Consultation Type	
Face-to-Face	14
Phone	45

Table 3
Baseline Probabilities.

Variable	Probability	Reference
Surgical complication – BS/BO	0.016	21
Lifetime Ovarian CA Risk		
Baseline	0.014	1
After Salpingectomy	0.005	21
After BSO	0.0003	11
Death from Ovarian CA	0.52	27
Weighted Ovarian CA Risk After BS/BSO	0.213	a
Surgical Success Rate	0.933	19

a – risk calculated based on weighted expected surgical cases.

low, as in our analysis we almost certainly excluded some patients that had tubes and/or ovaries left *in situ* after a hysterectomy or tubal ligation, and there are additional non-gynecologic procedures during which a OBS or BSO could be performed.

Additionally, we have shown that there is significant interest in this patient population when presented with information and opportunity. Our data are further substantiated by the similarities seen in the work done by Tomasch et al who also noted similar and significant interest in women undergoing non-emergent CCY (http://www.bls.gove/data/inflation_calculator.htm, 2022). It should also be noted that in the analysis of minority populations which composed 25 % of those

Table 4

Variable	Cost[a]	Utility	Reference
Laparoscopic BS or BSO- CPT - 58,661	$ 2,320	–	c
Modifier 51 – multiple procedures	$ (1,160)	–	c
Cost of OBS/BSO pad	$ 93	–	c
Cost per extra OR time[b]	$ 792	–	19, 24
Total Cost BS-BSO – General Surgeon, including modifier 51	$2,045	–	
Total Cost BS-BSO Gynecologist, excluding modifier 51	$3,205	–	d
Total Cost Weighted	$2,525		
Surgical Complication	$15,809	0.77	22
Ovarian Cancer		0.64	22
Initial year of diagnosis	$114,816	–	21
Subsequent year	$5,823	–	22
Final year of life	$75,203	–	22
Total Cost Ovarian Cancer Treatment	$207,488		
Death		0	22

a – All costs in 2021 dollars (Tomasch et al., 2020).
b – Extra 13 min of operating time plus 5 min patient positioning (McAlpin et al., 2014) multiplied by average cost of OR per minute ($44) (U.S. Cancer Statistics Data Visualizations Tool, 2018).
c- Costs obtained from institutional billing department.
d – Weighted cost assuming general surgeon performs BS and OBGYN performs BSO.

surveyed, there was not a difference with regard to overall attitudes toward receiving information and opportunity.

We acknowledge that the addition of any pelvic surgery to these procedures will require a significant change in standard practice including (possibly) a second attending surgeon, possible change in patient position, and change in bed position, among other factors. However, based on our data, the change in standard practice would result in a significant risk reduction for US women for a potentially lethal disease. In order to implement change, we will need to institute an educational initiative for the non-gynecologic surgeons who perform these procedures, as well as education modules for the patients and their communities. In the case of acceptance by pelvic surgeons operating for benign gynecologic conditions, we have already seen a significant change in standard practice. After an educational initiative supporting salpingectomy was launched among gynecologists, the OVCARE group demonstrated a rate of salpingectomy for sterilization increase from 0.4 % to 33.3 %, and the rate of OBS increase from 5 % to 35 % over a 3-year period. Importantly, there was no increase in complications or readmissions with the additional procedure (Dilley et al., 2017). Similarly, a large community-based health care system demonstrated an increase in salpingectomy at the time of hysterectomy from 14.7 % to 72.7 % over a 3 year period (Ventral Hernia Repair Surgery Patient Information from SAGES, 2015).

We also recognize that the majority of women in our study are obese. Given that obesity is a risk factor for gallbladder disease and ventral hernia (as well as obviously the need for bariatric surgery), obesity is likely a generalizable condition, at least in the US and other developed countries. Obesity has also been associated with a worse overall survival from all types of ovarian cancer, and as such obese women would significantly benefit from risk reducing surgery; however, obesity creates difficulties particularly when performing pelvic surgery. Steep Trendelenburg may present problems with ventilating obese women, and careful positioning on the surgical bed with a non-slip pad is critical to patient safety. Nevertheless, obese women successfully have pelvic surgery in the US every year, and these procedures can be performed successfully and safely (http://www.bls.gove/data/inflation_calculator.htm, 2022). Again, an educational program for the general surgeons is likely to be necessary to gain acceptance and allow pelvic surgery in this population.

Our analysis has a number of important limitations. Notably, the model assumed all eligible patients would elect to and successfully undergo salpingectomy or salpingo-oophorectomy; this is unlikely,

although Tomasch et al demonstrated a 93.3 % success rate in their population (http://www.bls.gove/data/inflation_calculator.htm, 2022). Additionally, the model does not account for service-line or provider limitations which could further limit the ability to provide salpingectomy. Together these limitations might lead to the belief that the stated decrease in ovarian cancer incidence is overestimated, however we believe the conservative nature of the approach counters these shortcomings. By excluding any patient who had a previous hysterectomy or sterilization it is assumed that all these procedures removed the fallopian tubes which has only recently become the recommendation and is not universally practiced, thus underestimating the eligible population. It also does not account for women who had their gynecologic procedures at an age less than 60 who may benefit from oophorectomy if they undergo surgery later in life. Another argument might be that childbearing is not complete in many cases until after the age of 35; assumed in this model, however, some women will have completed childbearing at ages younger than this cutoff as well and should not preclude offering the procedure to all potentially interested patients which would further expand the eligible population. Similarly, BSO can be offered to women over the age of 75. Finally, most laparoscopic abdominal surgery, and some open procedures, allow for access to the pelvis. Our model chose 3 common abdominal procedures but it should be noted that there are many others, including colorectal and urologic procedures, during which salpingectomy could be performed. Additionally annual numbers for these cases are on the rise. Had all potential cases been included in the analysis the eligible patient population would likely have been much larger and the potential impact estimated higher.

It should also be noted that the CEA used conservative numbers for the cost of an ovarian cancer diagnosis as reported values were for the primary chemotherapy line, surgery, and one year of surveillance. Many additional treatment options including chemotherapies and targeted agents are regularly used in the recurrent setting with patients being exposed to at least 2–3 lines of treatment, the costs of which cannot be overlooked. The additional cost of these treatments would certainly improve the ICER when considering risk reducing surgery in all scenarios.

While the impact of offering OBS or BSO during non-gynecologic surgeries has great potential to reduce OC, we understand that there may be some challenges to overcome if this is to take place. Surgeon availability and procedure comfort, operating room logistics, appropriate patient counseling and consent, and appropriate billing must all be considered. Further direction for this study will include evaluation of these potential challenges, and strategies like training and credentialing surgical colleagues to perform salpingectomy may be necessary to overcome some of these hurdles. Educational programs for surgeons, such as those required for gynecologic pelvic surgeons, will likely be required. We also will need to empower women and their communities with data regarding the role of prevention and encourage them to speak with their surgeons regarding the feasibility of combined procedures.

5. Conclusions

The potential to decrease incidence of HGSOC, an often fatal diagnosis, by $>$ 20 % is significant and a worthy goal. We have made significant strides in this with gynecologic surgery, and are moving toward the same success in obstetric tubal ligations. It is now time for discussion regarding how to include the non-gynecologic surgical population, and furthermore we should strive to overcome any obstacles for the benefit of our patients.

CRediT authorship contribution statement

Ian C. Cook: Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Sarah E. Podwika:** Writing – review & editing, Methodology. **Peter T. Hallowell:** Writing – review & editing, Methodology. **Mark R. Conaway:** Writing – review & editing, Formal analysis. **Charles N. Landen:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.gore.2025.101685.

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