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Research

Opportunistic salpingectomy between 2011 and 2016: a descriptive analysis

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Abstract

Background: Opportunistic salpingectomy (OS) is the removal of fallopian tubes during hysterectomy for benign indications or instead of tubal ligation, for the purpose of preventing ovarian cancer. We determined rates of OS at the time of hysterectomy and tubal sterilization and examined how they changed over the study period.

Methods: Using data from the Canadian Institute for Health Information's Discharge Abstract Database and National Ambulatory Care Reporting System for all Canadian provinces and territories (except Quebec) between the fiscal years 2011 and 2016, we conducted a descriptive analysis of all patients aged 15 years or older who underwent hysterectomy or tubal sterilization. We excluded those with diagnostic codes for any gynecologic cancer and those who underwent unilateral salpingectomy. We examined the proportion who had OS during their hysterectomy and compared the proportion of tubal sterilizations that were OS with the proportion that were tubal ligations.

Results: A total of 318 528 participants were included in the study (mean age 42.5 yr). The proportion of hysterectomies that included OS increased from 15.4% in 2011 to 35.5% by 2016. With respect to tubal sterilization, the rate of OS increased from 6.5% of all tubal sterilizations in 2011 to 22.0% in 2016. There was considerable variation across jurisdictions in 2016, with British Columbia having the highest rates (53.2% of all hysterectomies and 74.0% of tubal sterilizations involved OS).

Interpretation: The rates of OS increased between 2011 and 2016, but there was considerable variation across the included jurisdictions. Our study indicates room for rates of OS to increase across many of the included jurisdictions.

In 2020, about 3100 people in Canada received a diagnosis of ovarian cancer.[1] If they go on to have the same experience as past patients, fewer than 50% of them will be alive in 2025.[2] Ovarian cancer is the most lethal of the gynecologic cancers, and it is the fifth leading cause of cancer deaths in females.[1] There remains no effective screening method for ovarian cancer. The most recent evidence from the UK Collaborative Trial of Ovarian Cancer Screening showed that after a median of 16.3 years of follow-up among 202 562 randomized participants, there was no statistically significant reduction in deaths from ovarian cancer or tubal cancer in the screening groups.[3]

Whereas the general population lifetime risk of ovarian cancer is 1.4%,[4] people with an inherited germline *BRCA1* or *BRCA2* mutation have an average cumulative risk of 40% to 75% and of 8% to 34%, respectively.[5] In *BRCA1* and *BRCA2* mutation carriers, bilateral salpingo-oophorectomy is recommended, which reduces the risk of ovarian or fallopian cancers by 80%.[6,7] Removal of the ovaries is not recommended for the general population, as it is associated with increased total mortality, coronary heart disease and osteoporosis.[7,8] Thus, a different preventive strategy is needed for people at average risk, who make up 80% of cases of high-grade serous carcinoma. The recent understanding that this histotype, the most common and lethal form of ovarian cancer, often originates in the fallopian tube has introduced a prevention opportunity.[9–13]

In September 2010, British Columbia's Ovarian Cancer Research team (known as OVCARE) suggested that all BC gynecologic surgeons discuss bilateral salpingectomy for primary prevention of ovarian cancer with all patients who were to undergo hysterectomy.[14] They also suggested that bilateral salpingectomy replace tubal ligation for people seeking tubal sterilization. Opportunistic salpingectomy (OS) collectively refers to the removal of the fallopian tubes at the time of hysterectomy or instead of tubal ligation, while leaving the ovaries intact.[15] The OVCARE advice was followed by similar recommendations from the Society of Gynecologic Oncology of Canada in 2011[16] and by the Society of Obstetricians and Gynaecologists of Canada in 2015.[17]

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Although Canada was the first country to recommend consideration of salpingectomy during benign gynecologic surgery, by 2018 a total of 9 countries had statements supporting consideration of OS.[18]

Multiple studies have shown that OS does not increase the risk of perioperative adverse outcomes,[19,20] nor does it increase the risk for minor complications.[21] Furthermore, there seem to be no indicators of an earlier age of onset of menopause after OS, although some uncertainty remains regarding ovarian function after OS.[22–26] Uptake of OS has been high in BC, where it was first advised,[27] but no national data have been published since the Society of Obstetricians and Gynaecologists of Canada recommended OS in 2015.[17] The last national data that were published examined uptake of OS at the time of hysterectomy across Canada until the end of 2011; uptake was less than 15% in all provinces except BC.[28]

It is important to understand how commonly OS is performed, as it is an important method of primary prevention for ovarian cancer.[29] We hypothesized that rates increased after 2011 across Canada. We aimed to describe the rates of OS at the time of hysterectomy and tubal sterilization and to examine how these rates changed in the years after 2011.

Methods

Study design and setting

This large retrospective descriptive analysis of rates of OS from fiscal year 2011 to 2016 included all Canadian jurisdictions except Quebec; we excluded that province because its data are not recorded in the databases that we used for this study. We have reported the study using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for reporting observational studies.[30]

Data sources

We used data from the Discharge Abstract Database and National Ambulatory Care Reporting System of the Canadian Institute for Health Information (CIHI). These databases include all surgeries performed both as inpatient care and as day surgeries across all Canadian provinces and territories (except Quebec). Previous studies validating the Discharge Abstract Database have reported a high degree of accuracy in the procedure and primary diagnosis codes.[31] We combined data from Prince Edward Island into 2-year periods to protect patient privacy.

We requested data for all patients who had undergone any of (or any combination of) hysterectomy, salpingectomy, oophorectomy and tubal ligation between Apr. 1, 2011, and Mar. 31, 2017 (referred to hereafter as 2011 to 2016, the relevant fiscal years). These were the most recent data available at the time of the data request. Appendix 1, Appendix Table 1 (available at www.cmajopen.ca/content/10/2/E466/suppl/DC1) lists all relevant diagnostic codes used in this analysis.

We identified patients undergoing each of the relevant procedures using Canadian Classification of Health Interventions codes.[32] We grouped patients according to their procedures, with stratification into groups. For hysterectomies, we considered those who had undergone a hysterectomy with no concomitant oophorectomy or salpingectomy (referred to as hysterectomy alone), those who underwent a hysterectomy and bilateral salpingectomy (hysterectomy with OS), and those who underwent a hysterectomy with bilateral salpingo-oophorectomy. To understand uptake of OS at the time of tubal sterilization, we grouped people according to whether they underwent tubal ligation or bilateral salpingectomy alone.

Participants

We included all patients who had undergone any, or any combination, of hysterectomy, salpingectomy, oophorectomy and tubal ligation, as outlined above. We excluded those who were less than 15 years old at the time of surgery, as these gynecologic surgeries are rare among people in this age group and more likely to represent data errors. We excluded anyone whose records included a diagnostic code for ovarian, uterine, cervical or fallopian tube cancer, and anyone who underwent a unilateral salpingectomy, as OS refers to the removal of both fallopian tubes for primary prevention of ovarian cancer.

Statistical analysis

We examined the rates of OS between 2011 and 2016, which include the numbers of hysterectomies that were performed with and without bilateral salpingectomy or salpingo-oophorectomy as well as the number of sterilizations that were performed by bilateral salpingectomy or tubal ligation, in each year of our study period across all included Canadian provinces and territories. We combined data from the Northwest Territories, Nunavut and Yukon to meet privacy requirements, and we refer to these jurisdictions collectively as "the territories." We also examined whether rates of OS differed according to patient age group at the time of surgery, neighbourhood income quintile and rurality of residence (classified as rural, rural-remote, rural-very remote or urban), using data on age, income quintile and rurality from the CIHI databases.

Ethics approval

We obtained ethics approval from the University of British Columbia's Clinical Research Ethics Board. Approval by the ethics board for use of deidentified administrative data files includes a waiver of informed consent from participants.

Results

A total of 413 889 participants had 1 of the relevant surgeries in Canadian jurisdictions (other than Quebec) at age 15 years or older during our study period. After eliminating those with a record of invasive cervical, uterine, ovarian or fallopian tube cancer (n = 34 171) and a further 61 190 records that did not represent a surgery of interest (i.e., cases in which the patient underwent bilateral salpingo-oophorectomy without corresponding hysterectomy, hysterectomy with unilateral salpingectomy or

Table 1 (part 1 of 2): Demographic characteristics and diseases associated with surgery between fiscal years 2011 and 2016 in Canada (except Quebec), according to concomitant procedures

Characteristic	Procedure; no. (%) of patients*				
	Hysterectomy *n* = 178 128			Tubal sterilization *n* = 140 400	
	Alone *n* = 76 848	With OS *n* = 47 672	With BSO *n* = 53 608	Tubal ligation *n* = 121 583	OS *n* = 18 817
Fiscal year					
2011	16 953 (22.1)	4769 (10.0)	9192 (17.1)	22 948 (18.9)	1602 (8.5)
2012	14 433 (18.8)	6429 (13.5)	8785 (16.4)	21 957 (18.1)	2210 (11.7)
2013	13 268 (17.3)	7578 (15.9)	8728 (16.3)	21 270 (17.5)	2788 (14.8)
2014	11 954 (15.6)	9073 (19.0)	8891 (16.6)	19 791 (16.3)	3324 (17.7)
2015	10 420 (13.6)	9428 (19.8)	8951 (16.7)	18 438 (15.2)	4061 (21.6)
2016	9820 (12.8)	10 395 (21.8)	9061 (16.9)	17 179 (14.1)	4832 (25.7)
Age, yr, mean ± SD	49.1 ± 12.8	43.3 ± 7.1	52.8 ± 10.6	34.4 ± 5.6	36.8 ± 6.6
Age group, yr					
15–24	196 (0.3)	109 (0.2)	271 (0.5)	4681 (3.9)	305 (1.6)
25–34	6457 (8.4)	4602 (9.7)	1469 (2.7)	56 346 (46.3)	6795 (36.1)
35–44	26 923 (35.0)	22 722 (47.7)	8385 (15.6)	56 514 (46.5)	9670 (51.4)
45–54	22 051 (28.7)	18 256 (38.3)	23 720 (44.2)	4031 (3.3)	1824 (9.7)
55–64	8968 (11.7)	1367 (2.9)	11 976 (22.3)	‡	‡
≥ 65	12 253 (15.9)	616 (1.3)	7787 (14.5)	‡	‡
Region of residence					
Urban	57 613 (75.0)	38 113 (79.9)	42 860 (80.0)	91 035 (74.9)	15 604 (82.9)
Rural	4372 (5.7)	2071 (4.3)	2647 (4.9)	5676 (4.7)	550 (2.9)
Rural-remote	7062 (9.2)	3393 (7.1)	4016 (7.5)	10 444 (8.6)	1078 (5.7)
Rural-very remote	7414 (9.6)	3811 (8.0)	3821 (7.1)	13 740 (11.3)	1469 (7.8)
Unknown	387 (0.5)	284 (0.6)	264 (0.5)	688 (0.6)	116 (0.6)
Income quintile					
Q1 (lowest)	13 582 (17.7)	8233 (17.3)	9271 (17.3)	28 362 (23.3)	3997 (21.2)
Q2	15 320 (19.9)	9072 (19.0)	10 163 (19.0)	25 393 (20.9)	3822 (20.3)
Q3	16 016 (20.8)	10 035 (21.1)	10 974 (20.5)	24 891 (20.5)	3957 (21.0)
Q4	16 722 (21.8)	10 581 (22.2)	11 486 (21.4)	23 601 (19.4)	3858 (20.5)
Q5 (highest)	14 446 (18.8)	9166 (19.2)	11 195 (20.9)	17 935 (14.8)	2955 (15.7)
Unknown	762 (1.0)	585 (1.2)	519 (1.0)	1401 (1.2)	228 (1.2)
Province or territory					
British Columbia	6793 (8.8)	13 305 (27.9)	6444 (12.0)	9021 (7.4)	10 819 (57.5)
Alberta	11 673 (15.2)	8640 (18.1)	8306 (15.5)	23 387 (19.2)	2032 (10.8)
Saskatchewan	4856 (6.3)	2581 (5.4)	2221 (4.1)	9179 (7.5)	548 (2.9)
Manitoba	4571 (5.9)	1460 (3.1)	2875 (5.4)	6869 (5.6)	187 (1.0)
Ontario	39 775 (51.8)	16 673 (35.0)	27 980 (52.2)	57 638 (47.4)	4279 (22.7)
New Brunswick	2737 (3.6)	1728 (3.6)	1881 (3.5)	5207 (4.3)	181 (1.0)
Nova Scotia	3421 (4.5)	2074 (4.4)	2178 (4.1)	4861 (4.0)	271 (1.4)
Prince Edward Island	642 (0.8)	225 (0.5)	352 (0.7)	897 (0.7)	27 (0.1)
Newfoundland	2180 (2.8)	790 (1.7)	1232 (2.3)	3896 (3.2)	138 (0.7)
Territories (Yukon, Northwest Territories, Nunavut)	200 (0.3)	196 (0.4)	139 (0.3)	628 (0.5)	335 (1.8)

Table 1 (part 2 of 2): Demographic characteristics and diseases associated with surgery between fiscal years 2011 and 2016 in Canada (except Quebec), according to concomitant procedures

Characteristic	Procedure; no. (%) of patients*				
	Hysterectomy *n* = 178 128			Tubal sterilization *n* = 140 400	
	Alone *n* = 76 848	With OS *n* = 47 672	With BSO *n* = 53 608	Tubal ligation *n* = 121 583	OS *n* = 18 817
Disease (and ICD-10 diagnostic code) associated with surgery†					
Endometriosis (N80.X)	15 772 (20.5)	12 220 (25.6)	13 204 (24.6)	2156 (1.8)	1129 (6.0)
Uterine leiomyoma (D25.X)	26 001 (33.8)	22 619 (47.4)	22 855 (42.6)	1276 (1.0)	499 (2.7)
Benign uterine or ovarian neoplasm (D26.X, D27.X, D28.7)	1950 (2.5)	1466 (3.1)	6935 (12.9)	452 (0.4)	377 (2.0)
Abnormal bleeding (N92.X, N93.X)	32 515 (42.3)	28 368 (59.5)	14 169 (26.4)	8671 (7.1)	2149 (11.4)
Pelvic organ prolapse (N81.X)	28 648 (37.3)	4317 (9.1)	7368 (13.7)	554 (0.5)	183 (1.0)
Pelvic inflammatory disease (N73.X, N74.X)	3614 (4.7)	2991 (6.3)	4248 (7.9)	2410 (2.0)	1157 (6.1)
Salpingitis and oophoritis (N70.X)	721 (0.9)	850 (1.8)	1144 (2.1)	240 (0.2)	982 (5.2)
Ovarian dysfunction (E28.X)	151 (0.2)	129 (0.3)	216 (0.4)	107 (0.1)	29 (0.2)
Sterilization (Z30.2)	507 (0.7)	446 (0.9)	56 (0.1)	115 854 (95.3)	15 014 (79.8)
Pelvic, perineal and lower abdominal pain (R10.2, R10.3)	3656 (4.8)	3637 (7.6)	2493 (4.7)	786 (0.6)	801 (4.3)

Note: BSO = bilateral salpingo-oophorectomy, ICD-10 = *International Statistical Classification of Diseases and Related Health Problems* (10th revision), OS = opportunistic salpingectomy, SD = standard deviation.
*Except where indicated otherwise.
†Each patient could have more than 1 diagnostic code.
‡Suppressed owing to small numbers (< 5) and residual disclosure.

unilateral salpingo-oophorectomy), we had a final cohort of 318 528 participants.

In our study population, 76 848 patients underwent hysterectomy alone, 47 672 underwent hysterectomy with OS, and 53 608 underwent hysterectomy with bilateral salpingo-oophorectomy. Among those who underwent tubal sterilization, 121 583 had tubal ligation and 18 817 had OS (Table 1). Table 1 shows that more OS occurred toward the end of the study period, that rates of OS were higher in urban areas and that the diagnostic codes associated with the surgery were similar across the groups.

Uptake of OS over time

Figure 1A shows that the uptake of OS at the time of hysterectomy increased between fiscal years 2011 and 2016. More specifically, whereas only 15.4% of hysterectomies included salpingectomy in 2011, this proportion had increased to 35.5% by 2016, which represents a 130% increase in the proportion of people having OS at hysterectomy. Conversely, the rate of hysterectomy alone (without removal of ovaries or fallopian tubes) decreased from 54.8% to 33.5% between 2011 and 2016. Rates for hysterectomy with bilateral salpingo-oophorectomy were relatively stable across the study period, ranging from an annual low of 29.5% in 2013 to an annual high of 31.1% in 2015.

Figure 1B shows that the proportion of people who underwent OS for sterilization also increased, from 6.5% of all tubal sterilizations in 2011 to 22.0% in 2016, which represents a 238% increase in the proportion of people having OS at tubal sterilization. However, 78.0% of tubal sterilizations were by tubal ligation in 2016.

Variation in uptake of OS across jurisdictions

Figure 2 shows that uptake of OS increased in all included Canadian jurisdictions across the study period, but the proportions were highly variable across the country. In BC, where OS has been recommended practice since 2010, over half of hysterectomies included OS (reaching 53.2% in 2016; Figure 2A) with concomitant declines in the proportion of people undergoing hysterectomy alone. The proportion of people undergoing hysterectomy with bilateral salpingo-oophorectomy changed very little across the study period (Appendix 1, Appendix Figure 1).

The territories had the next largest uptake of OS at the time of hysterectomy, with 44.6% of hysterectomies including OS by 2016. Also by 2016, Alberta, Saskatchewan and New Brunswick each had OS performed for more than 40% of those who underwent hysterectomy. Other provinces fell between 23.5% (PEI) and 33.9% (Nova Scotia).

Figure 2B shows that BC was the only Canadian province where more than half (74.0%) of tubal sterilizations were accomplished by OS by 2016. In the territories,

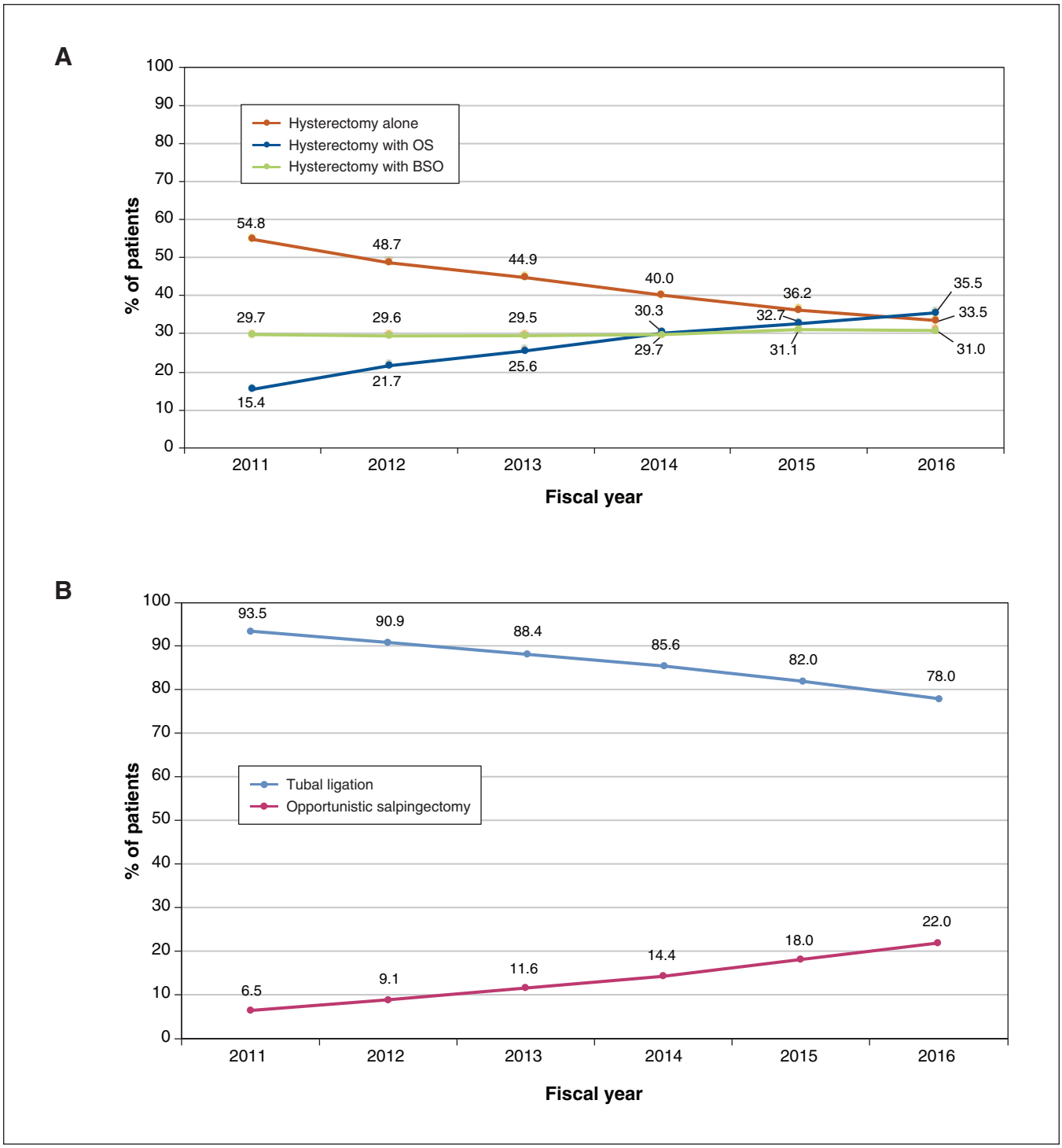

Figure 1: (A) Proportion of hysterectomies according to concomitant procedures across all Canadian provinces and territories (except Quebec) between fiscal years 2011 and 2016. (B) Proportion of tubal sterilizations through opportunistic salpingectomy or tubal ligation across all Canadian provinces and territories (except Quebec) between fiscal years 2011 and 2016. Note: BSO = bilateral salpingo-oophorectomy, OS = opportunistic salpingectomy.

48.6% of tubal sterilizations were done by OS, with the next highest rates of uptake being 16.1% in Saskatchewan and 16.0% in Alberta. The lowest rate of uptake was in PEI (5.6% in the 2-year period 2015–2016), followed closely by New Brunswick (5.8%).

Uptake of OS by age and geographic region of residence

When distribution was examined by age categories (Figure 3), the age group 35 to 44 years had the highest rate of hysterectomy with OS, followed by the age groups 25 to

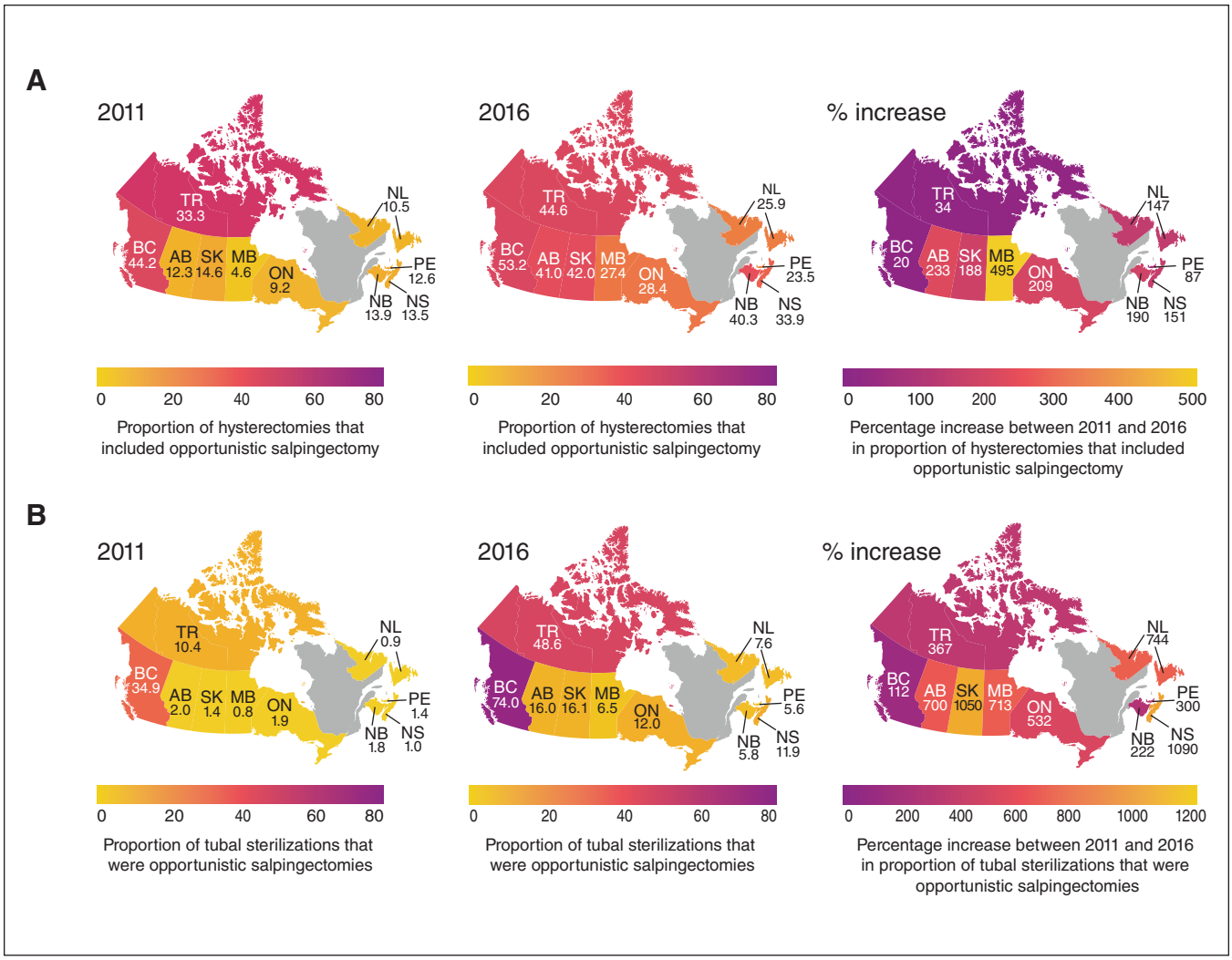

Figure 2: (A) Proportion of all hysterectomies that included an opportunistic salpingectomy in Canadian provinces and territories (except Quebec) in fiscal years 2011 and 2016 and the percentage increase over this period. (B) Proportion of all tubal sterilizations that were done by opportunistic salpingectomy in Canadian provinces and territories (except Quebec) in fiscal years 2011 and 2016 and the percentage increase over this period. Note: AB = Alberta, BC = British Columbia, MB = Manitoba, NB = New Brunswick, NL = Newfoundland and Labrador, NS = Nova Scotia, ON = Ontario, PE = Prince Edward Island, SK = Saskatchewan, TR = the territories (Yukon, Northwest Territories, Nunavut).

34 years and 45 to 54 years. Very few people over 55 years of age underwent hysterectomy with OS, and many had hysterectomy alone (Figure 3A). The opposite was true for tubal sterilization, for which rates of OS were higher among those in the oldest age group (45–54 yr). In 2016, only 11.9% of people aged 15 to 24 years seeking tubal sterilization received OS (Figure 3B). Appendix 1, Appendix Table 2 shows that the high share of 15- to 24-year-olds who had hysterectomy with bilateral salpingo-oophorectomy represented mostly gender affirmation surgery.

Figure 4 shows minimal variation by geographic region of residence and increasing uptake across all geographic regions. Figure 4A shows similar rates of OS at the time of hysterectomy by 2016 across urban, rural, rural-remote and rural-very remote residence. By 2016, the lowest proportion of hysterectomy with OS occurred in rural areas (31.6%), whereas the highest occurred in rural-very remote areas (36.5%). Figure 4B also shows increased uptake of OS for sterilization across all regions during our study period, with the highest rates of sterilization by OS by 2016 in urban areas (23.9%) and the lowest in rural areas (14.9%).

Interpretation

Over the study period, an increasing proportion of hysterectomies in the studied Canadian jurisdictions included OS for the prevention of high-grade serous ovarian cancer. By 2016, more hysterectomies included OS (35.5%) than did not (33.5%). As expected, rates of hysterectomy with bilateral salpingo-oophorectomy did not change over the study period, given that these surgeries were not targeted by any of the OS practice recommendations and tended to be performed for other indications. This surgery

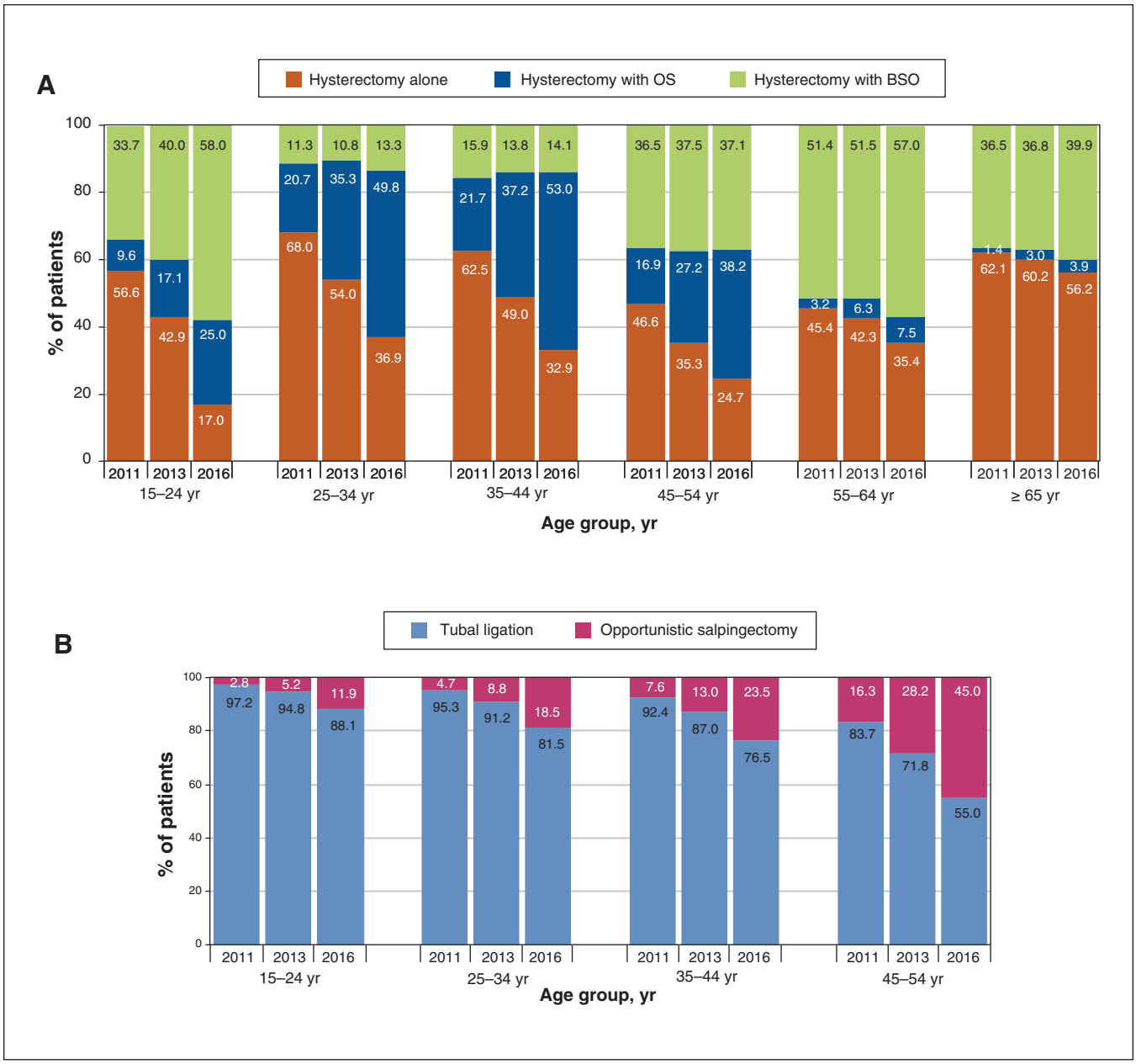

Figure 3: (A) Proportion of hysterectomies according to concomitant procedures in fiscal years 2011, 2013 and 2016 in Canadian provinces and territories (except Quebec), by age group. (B) Proportion of tubal sterilizations that were done by opportunistic salpingectomy and by tubal ligation in fiscal years 2011, 2013 and 2016 in Canadian provinces and territories (except Quebec), by age group. Data for age groups 55–64 years and 65 years or older are not presented because of small numbers (< 5) and residual disclosure. Note: BSO = bilateral salpingo-oophorectomy, OS = opportunistic salpingectomy.

is often provided, with ovarian cancer prevention in mind, to older women who are already menopausal, and it was consistently the most common form of hysterectomy among those 65 years of age or older across our study period. There was also an increase in tubal sterilizations done by OS over the study period.

Nonetheless, there were many missed opportunities for ovarian cancer prevention across our study period, and considerable variation in the proportion of people having OS across included jurisdictions in Canada. Using our own assumptions that all tubal ligations could have been OS and that 75% of hysterectomies could have included OS, we determined (from these data) that 179 219 potential opportunities for ovarian cancer prevention were not taken.

Although rates of OS in BC were very high, many patients in PEI were still undergoing hysterectomy alone by the end of our study period. We postulate that people may not be uniformly aware of the option, and surgeons may not be discussing OS with their patients before hysterectomy or tubal sterilization. Jurisdictional variation also points to physicians' residency training as an important factor in uptake of OS.

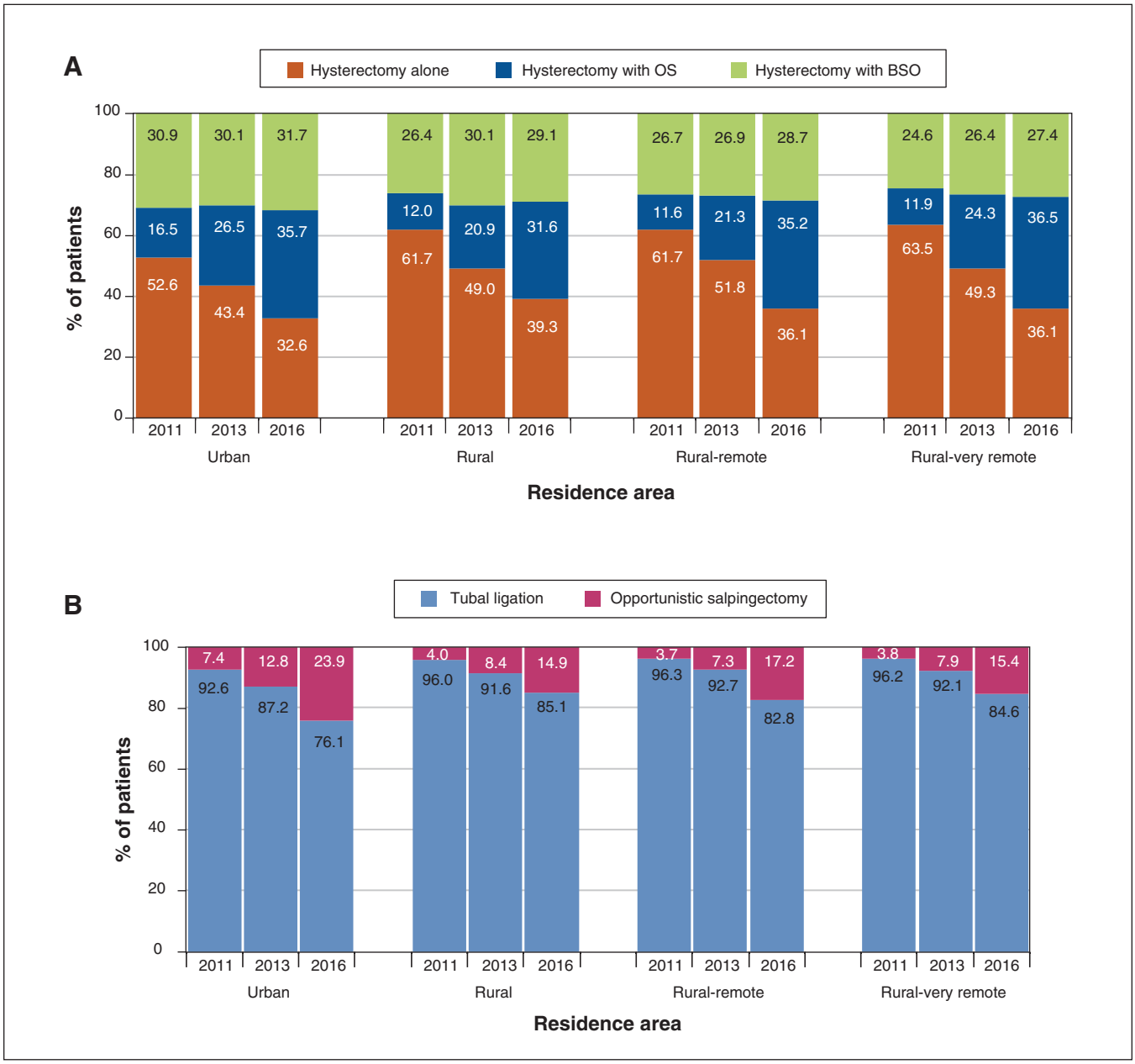

Figure 4: (A) Proportion of hysterectomies according to concomitant procedures in fiscal years 2011, 2013 and 2016 in Canadian provinces and territories (except Quebec), by geographic region of residence. (B) Proportion of tubal sterilizations that were done by opportunistic salpingectomy and tubal ligation in fiscal years 2011, 2013 and 2016 in Canadian provinces and territories (except Quebec), by geographic region of residence. Note: BSO = bilateral salpingo-oophorectomy, OS = opportunistic salpingectomy.

The territories had the second-highest rate of uptake of OS, which may reflect the fact that many physicians in the territories complete their residency training in BC. Research examining why the 2010 educational campaign succeeded in BC, by comparison with the situation in Ontario, showed that support from thought leaders and exposure to OS from many different information sources were important in explaining differences in adoption.[33] For example, the OVCARE knowledge translation campaign exposed gynecologic surgeons to recommendations through a popular conference, the media and local rounds.[33]

The jurisdiction with the lowest rate of uptake of OS at the time of hysterectomy (PEI) was performing nearly a quarter of all hysterectomies with OS by the end of our study period, but uptake at the time of tubal sterilization was considerably lower in this jurisdiction. We expect this reflects concern about higher rates of complications in the typically younger patients undergoing tubal sterilization. Previous research has shown that nearly half of those undergoing tubal sterilization do so during the same hospital stay as a live birth, often after cesarean delivery.[19] As noted earlier, published research has shown no increase in

perioperative or postoperative complications with OS for sterilization relative to tubal ligation,[19,21] including when OS is done at the time of cesarean delivery.[34–36] Salpingectomy has also long been considered the preferred method to ensure definitive sterilization when tubal ligation fails.[37]

We also postulate that lower rates of OS at the time of sterilization may reflect physicians' concerns about reducing the age of onset of menopause.[38] Given that earlier age at menopause has been associated with increased mortality,[39–41] this is an important concern. In this regard, the results of many studies to date, including those examining ovarian sonographic parameters and hormonal assays, have been reassuring.[23,24,42–44] Recent work in BC has also indicated no difference in time to initiation of hormone replacement therapy or in time to first physician visit for a menopausal concern among any OS groups (including among those undergoing OS for sterilization, relative to those undergoing tubal ligation),[22] but this finding conflicted with a Swedish registry study reporting more menopausal symptoms 1 year after surgery among women who underwent hysterectomy with OS.[45] Thus, there is still some uncertainty about ovarian function after OS. A recent Cochrane systematic review found no evidence of any difference in onset of menopause after hysterectomy with salpingectomy; however, when the ranges of antimullerian hormone concentrations reported across studies were used to define menopause, onset of menopause occurred between 0 and 20 months earlier in the group that underwent hysterectomy with salpingectomy.[26]

Despite this uncertainty, OS has a good safety profile overall, with no differences in major surgical outcomes, including overall rates of hospital readmission, blood transfusion and postoperative complications,[19,20] as well as no difference in minor complications, except for a small increased likelihood of filling a prescription analgesic medication in the immediate 2 weeks after discharge, which disappeared by 1 month after discharge.[21] Although a large prospective observational study of the effectiveness of OS for cancer prevention is urgently needed, historical studies lead us to hypothesize that OS will be effective in preventing high-grade serous ovarian cancer.[46–50]

Limitations

Our analysis was limited by the fact that our data extended only to fiscal year 2016. Given a trend of increasing uptake across many jurisdictions, it is likely that rates of OS are currently higher in many, and possibly all, of the jurisdictions that we studied. However, given the change between 2011 and 2016, and the fact that these data include 2 full calendar years following the Society of Obstetricians and Gynaecologists of Canada recommendation for OS,[17] we expect that the trends reported remain relevant.

Like all studies relying on administrative data, there is a risk of imprecision given our dependence on accuracy of coding in the database. We cannot be certain that all bilateral salpingectomies performed at the time of hysterectomy or for tubal sterilization were done for the purpose of primary prevention of ovarian cancer (i.e., they may not all have been OS). However, bilateral salpingectomy was rare before recommendations were made beginning in 2010,[19] and there is no reason to believe that other indications for bilateral salpingectomy are increasing over time; as such, we are confident that most practice change has been driven by uptake of OS.

We were only able to analyze uptake of OS on the basis of surgeries performed and were unable to determine instances when OS was discussed with a patient and the patient declined, which research has suggested could be a source of differences in uptake.[51] Future research should investigate barriers to uptake of OS in provinces where rates are very low, in particular with respect to tubal sterilization.

We were unable to study uptake of OS according to surgical approach and thus cannot present data on how variation in use of alternative surgical approaches (i.e., robotic, open, laparoscopic or vaginal) might have influenced the uptake of OS.

Conclusion

In some Canadian jurisdictions, high rates of hysterectomy alone and of tubal ligation represent missed opportunities to potentially prevent a deadly, high-grade serous ovarian cancer. The high rates of OS in BC following the province's OVCARE initiative suggest that knowledge translation can be successful in this area. Cancer funders and organizations in every jurisdiction and nationwide should make efforts to improve uptake of OS both at the time of hysterectomy and during tubal sterilization.

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