Review

Meta-analysis of changes in epithelial ovarian cancer incidence rates associated with salpingectomy: A comparison of 2022–2023 and earlier periods

Greg Marchand[1], Daniela Gonzalez Herrera[1], Brooke Hamilton[1], McKenna Robinson[1], Emily Kline[1], Sarah Mera[1], Michelle Koshaba[1], Greenley Jephson[1], Nidhi Pulicherla[1], Ali Azadi[2]

[1]Marchand Institute for Minimally Invasive Surgery, Arizona, United States of America

[2]Department of Obstetrics and Gynecology, University of Arizona Faculty of Medicine, Arizona, United States of America

Abstract

This systematic review and meta-analysis evaluated epithelial ovarian cancer (EOC) incidence rates associated with salpingectomy, with an exploratory assessment of temporal trends following guideline-driven increases in opportunistic salpingectomy. A literature search was conducted across PubMed, Web of Science, Cochrane, and Scopus, targeting cohort studies published between January 2015 and September 2023. Eligible studies were cohort studies reporting EOC incidence in women undergoing salpingectomy (opportunistic or risk-reducing) compared to controls without salpingectomy, with sufficient sample sizes (>100 salpingectomy cases) and homogeneous populations. The Newcastle-Ottawa Scale (NOS) was used to assess methodological quality. A meta-analysis calculated the risk ratio (RR) of EOC incidence, with subgroup analysis exploring temporal trends, using a random-effects model. Five cohort studies, involving 5,819,102 women with 31,586 EOC cases, were included, all with low risk-of-bias (NOS scores ≥6). Salpingectomy was associated with a 77.7% reduction in EOC incidence compared to control patients [RR =0.223, 95% confidence interval: (0.182, 0.274), p<0.001; I^2=0]%. The 2022-2023 period should be interpreted as a recent evidence window rather than a formally powered comparative period owing to the small number of studies available. These findings confirm that salpingectomy, particularly opportunistic procedures, substantially reduces EOC incidence. Clinicians should consider offering salpingectomy to average-risk women during gynecologic surgeries, with informed consent. Further research with longer follow-up of contemporary cohorts is needed. [J Turk Ger Gynecol Assoc.]

Keywords: EOC, epithelial cell ovarian cancer, meta-analysis, RRSO, salpingectomy

Received: July 26, 2025 **Accepted:** December 22, 2025 **Epub:** February 04, 2026

Introduction

Epithelial ovarian cancer (EOC) remains a significant public health concern, ranking as the sixth leading cause of cancer-related mortality among women worldwide and causing more deaths than any other gynecologic malignancy. High-grade serous carcinoma, the most common EOC subtype, accounts for approximately 85% to 90% of cases and is frequently diagnosed at an advanced stage, which complicates treatment efforts and contributes to elevated mortality rates (1-3). The limited effectiveness of current screening strategies has shifted the focus toward primary prevention strategies, particularly for women at average risk of developing EOC.

Recent research has identified the fallopian tubes as the primary site of origin for many high-grade serous EOC cases, with serous tubal intraepithelial carcinoma (STIC) recognized as a critical precursor lesion (4,5). This discovery has led to increased use of salpingectomy as a preventive strategy, particularly through opportunistic salpingectomy performed during benign

Address for Correspondence: *Greg Marchand*
e-mail: *gm@marchandinstitute.org* ***ORCID:*** *orcid.org/0000-0003-4724-9148*

DOI: *10.4274/jtgga.galenos.2025.2025-5-7*

Cite this article as: *Marchand G, Gonzalez Herrera D, Hamilton B, Robinson M, Kline E, Mera S, et al. Meta-analysis of changes in epithelial ovarian cancer incidence rates associated with salpingectomy: a comparison of 2022–2023 and earlier periods. J Turk Ger Gynecol Assoc. [Epub Ahead of Print]*

gynecologic surgeries or as permanent sterilization (6). Since 2015, the American College of Obstetricians and Gynecologists (ACOG) and other organizations have recommended opportunistic salpingectomy, with reinforcement in 2019, resulting in rising adoption (7). Observational studies have suggested risk reductions of 49-65% with minimal impact on ovarian function (8).

This systematic review and meta-analysis evaluated EOC incidence rates associated with salpingectomy, with an exploratory assessment of temporal trends following the increased adoption of opportunistic salpingectomy after the 2015 and 2019 ACOG Guideline updates. We hypothesized that the protective effect would be consistent across the period, while acknowledging that the limited number of very recent large-scale studies precludes definitive conclusions about further strengthening of the effect in 2022-2023.

Methodology

This review followed PRISMA guidelines (9).

Inclusion and exclusion criteria

To maintain a focused scope on the changes in EOC incidence rates over time, the inclusion criteria were carefully tailored to select high-quality cohort studies that directly address the study's objective. Eligible studies were required to be either retrospective or prospective cohort studies that reported EOC incidence rates in women who underwent salpingectomy, whether performed as an opportunistic procedure (for example, during hysterectomy or sterilization) or as a risk-reducing intervention (such as in women with *BRCA* mutations). To reflect contemporary salpingectomy practices influenced by the 2015 and 2019 guideline updates from the ACOG, studies were required to have been published between January 2015 and September 2023. An exception was made for pivotal studies published before 2015 that included large sample sizes (greater than 10,000 women) and provided essential historical context for understanding earlier EOC incidence trends. In addition, studies were required to have sufficient salpingectomy sample sizes, defined as greater than 100 cases, to ensure adequate statistical power for estimating changes in EOC incidence rates. Studies also needed to focus on homogeneous populations, such as average risk women undergoing opportunistic salpingectomy or clearly defined high-risk groups (for example, *BRCA* mutation carriers), with control groups that were free of confounding surgical interventions, such as hysterectomy, which could obscure the specific effect of salpingectomy on EOC incidence.

Studies were excluded from the analysis if they did not report overall EOC incidence rates, focusing instead on related outcomes, such as the prevalence of STIC or specific histological subtypes of ovarian cancer without providing aggregate EOC incidence data. Randomized controlled trials were excluded, as they were deemed less relevant for capturing observational data on EOC incidence rates in real-world clinical settings. Molecular studies, *in vitro* studies, *in vivo* studies, narrative reviews, and case reports were also excluded due to their inability to provide comparative incidence rate data suitable for meta-analysis. Studies that lacked a control group were not considered, as they could not provide a relative measure of the effect of salpingectomy on EOC incidence. Furthermore, studies with small salpingectomy sample sizes (fewer than 100 cases) or heterogeneous populations, such as those with control groups that included women who had undergone hysterectomy or tubal ligation, were excluded to maintain consistency in population characteristics and reduce potential confounding factors. Studies published before 2015 were generally excluded unless they met the criteria for pivotal studies (n>10,000), ensuring that the included studies were aligned with current clinical practices and guideline-driven salpingectomy adoption.

These inclusion and exclusion criteria were specifically designed to prioritize studies that provide relevant data on the changes in EOC incidence rates over time, ensuring statistical robustness, population homogeneity, and alignment with contemporary salpingectomy practices, thereby facilitating a reliable meta-analysis of temporal trends in EOC incidence.

Information sources and search strategy

A comprehensive literature search was conducted across four major academic databases, which were PubMed, Web of Science, Cochrane, and Scopus, to identify relevant studies published between January 2015 and September 2023. The search strategy was carefully developed to capture studies that address EOC incidence rates in the context of salpingectomy, incorporating a broad range of search terms to maximize the sensitivity of the search. The key search terms included "Epithelial ovarian cancer," "serous tubal intraepithelial carcinoma," "isolated serous intraepithelial carcinoma," "incidental serous tubal intraepithelial carcinoma," "TIC," "Tubal intraepithelial carcinoma," "salpingectom*," "opportunistic salpingectomy," and "risk-reducing salpingectomy." The complete search strategy, including the specific combinations and Boolean operators used, is provided in Supplementary File to ensure reproducibility. To enhance the comprehensiveness of the search, the reference lists of included studies and relevant review articles were manually searched to identify any additional studies that might have been missed by the database searches. Given that this study only used publicly available, previously published data, no institutional review board approval was required for the conduct of this research.

Study selection

The study selection process was conducted in a rigorous, two-stage approach to ensure accuracy and consistency in identifying studies that meet the inclusion criteria. In the first stage, two independent reviewers screened the titles and abstracts of all identified records to eliminate studies that were clearly irrelevant to the research question, using a standardized eligibility form based on the predefined inclusion and exclusion criteria. In the second stage, the full-text articles of potentially relevant studies were retrieved and independently reviewed by the same two reviewers to confirm their eligibility for inclusion in the meta-analysis. Any discrepancies or disagreements between the reviewers during either stage of the screening process were resolved through discussion, and, when necessary, a third reviewer was consulted to achieve consensus. Data management was facilitated using Microsoft Excel, and duplicate records were removed using EndNote software to streamline the screening process and ensure efficiency.

Data extraction

Data extraction was performed independently by two reviewers using a pre-designed data extraction form to ensure consistency and accuracy in capturing the relevant information from each included study. The extracted data included study identification details (such as author names and publication year), country of origin, study design (retrospective or prospective cohort), population characteristics (including whether the population consisted of average risk women or high-risk *BRCA* mutation carriers), exposure details (type of salpingectomy, such as opportunistic or risk-reducing), inclusion and exclusion criteria, the number of EOC cases reported, the total sample size, and risk estimates [such as risk ratios (RRs) or odds ratios]. Any discrepancies identified during the data extraction process were resolved through consensus between the reviewers, ensuring the reliability of the extracted information. This process was designed to capture all data necessary for both the qualitative and quantitative synthesis of the study findings.

Risk-of-bias assessment

The methodological quality of the included studies was assessed using the Newcastle-Ottawa Scale (NOS) for cohort studies, which is a widely recognized tool for evaluating the quality of non-randomized studies (10). The NOS assesses three key domains: selection (including representativeness of the exposed cohort, selection of the non-exposed cohort, ascertainment of exposure, and demonstration that the outcome of interest was not present at the start of the study), comparability (based on the design or analysis to control for confounders), and outcome (including assessment of the outcome, duration of follow-up, and adequacy of follow-up). Each study was scored out of a maximum of nine points, with scores of six or higher indicating a low risk-of-bias. The assessment was conducted independently by two investigators, and any disagreements were resolved through discussion or by consulting a third investigator to ensure consistency and objectivity in the evaluation process.

Data synthesis

Both qualitative and quantitative syntheses were performed. For the quantitative analysis, a meta-analysis calculated the RR of EOC incidence in women undergoing salpingectomy versus controls using a random-effects model. A subgroup analysis was performed to explore temporal trends by separating studies predominantly reflecting pre-2022 practice from the limited number of studies published in 2022-2023. This temporal subgrouping is exploratory in nature due to the small number of studies in the most recent evidence window. Heterogeneity was assessed using I^2; sensitivity analyses explored sources of heterogeneity.

Statistical analysis

All statistical analyses were conducted using Open-Meta Analyst software, which is a robust and widely used tool for performing meta-analytic calculations. A p-value of less than 0.05 was considered statistically significant for all statistical tests. The RR and its corresponding 95% confidence interval (CI) were calculated for each included study and then pooled to estimate the overall effect of salpingectomy on EOC incidence rates across the study periods. The subgroup analysis and sensitivity analyses were designed to enhance the robustness of the findings and to address any potential sources of variability among the included studies.

Results

Study selection

The study selection process is comprehensively illustrated in the PRISMA flowchart (Figure 1), which outlines the steps taken to identify and include relevant studies. A total of 2018 records were initially identified across the four databases searched: PubMed contributed 977 records, Web of Science provided 975 records, Cochrane contributed 58 records, and Scopus yielded 8 records. After removing 201 duplicate records, 1817 unique titles and abstracts were screened for relevance to the study's objective of evaluating changes in EOC incidence rates associated with salpingectomy. During this screening phase, 1801 records were excluded, primarily because they did not address EOC incidence rates, focused on unrelated interventions, or did not involve salpingectomy as the primary exposure. The remaining 16 full-text articles were thoroughly

assessed for eligibility against the predefined inclusion and exclusion criteria.

Ultimately, five cohort studies were included in the final analysis, as they met all criteria, including cohort study design, reporting of EOC incidence rates, sufficient sample size, and population homogeneity. The 11 studies that were excluded were deemed ineligible for these specific reasons: three studies involved mixed populations with confounding surgical interventions, such as hysterectomy or tubal ligation included in the control group, which could obscure the effect of salpingectomy; two studies were excluded due to small salpingectomy sample sizes (fewer than 100 cases) or because they were published before 2015, reflecting outdated clinical practices not aligned with current guideline-driven salpingectomy adoption; one study focused on an irrelevant population that did not meet the study's criteria; and five studies addressed irrelevant interventions or outcomes, such as the prevalence of STIC rather than overall EOC incidence rates. This rigorous selection process ensured that only high-quality studies reporting EOC incidence after salpingectomy were included, allowing an overall meta-analysis and an exploratory examination of temporal trends.

Risk-of-bias

The risk-of-bias assessment for the five included cohort studies was conducted using the NOS, and the results are presented in Table 1, demonstrating that all studies achieved a low risk-of-bias, with NOS scores of 6 or higher. In the selection domain, most studies performed strongly, with clear representativeness of the exposed cohort (women undergoing salpingectomy) and appropriate selection of the non-exposed cohort (controls without salpingectomy). However, the studies by Hanley et al. (11) and Falconer et al. (12) exhibited a higher risk of selection bias due to insufficient detail in describing the participant selection processes, which could potentially introduce bias into the study findings. In the comparability domain, the majority of the studies adequately controlled for key confounders, such as age, genetic risk factors, or other relevant clinical variables, ensuring that the salpingectomy and control groups were comparable at baseline. Nevertheless, Hanley et al. (11) and Falconer et al. (12) demonstrated a higher risk of comparability bias due to limited or inadequate adjustment for confounders, which could affect the reliability of the comparisons between the study groups. The outcome domain was consistently robust across all five studies, with accurate and standardized methods

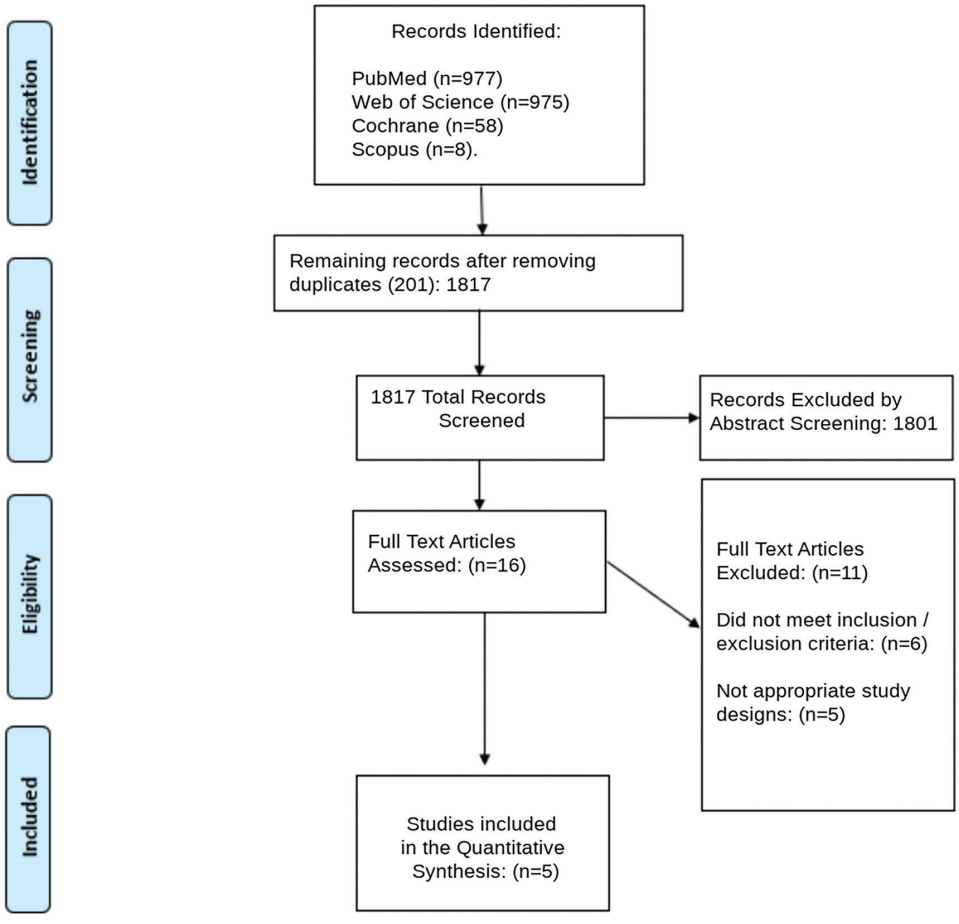

Figure 1. PRISMA flowchart

for assessing EOC incidence, sufficiently long follow-up periods to capture incident cases, and minimal loss to follow-up, ensuring that the outcome data were reliable. The overall low risk-of-bias across the included studies supports the reliability and validity of their findings for inclusion in the meta-analysis, although the noted selection and comparability biases in the studies by Hanley et al. (11) and Falconer et al. (12) suggest that their results should be interpreted with a degree of caution to account for potential methodological limitations.

Study characteristics

The characteristics of the five included cohort studies are summarized in Table 2, providing a detailed overview of the studies that contributed to the meta-analysis. Collectively, these studies involved a total of 5,819,102 women, with 31,586 EOC cases identified across the cohorts, offering a substantial sample size for evaluating changes in EOC incidence rates over time. The studies were conducted in diverse geographical regions, with two studies from Canada, one from the Netherlands, one from England, and one from Sweden, reflecting a predominantly Western population but providing a broad perspective on salpingectomy practices. The included studies encompassed two distinct population types: average risk women undergoing opportunistic salpingectomy, typically performed during benign gynecologic surgeries or as a method of sterilization, and high-risk women, specifically *BRCA1* or *BRCA2* mutation carriers, undergoing risk-reducing salpingo-oophorectomy (RRSO). Giannakeas et al. (13) conducted a retrospective cohort study in Ontario, Canada, involving 32,879 women who underwent salpingectomy, with 31 EOC cases identified during the follow-up period, providing recent data relevant to the 2022-2023 period. Hanley et al. (11) evaluated 25,889 women who underwent opportunistic salpingectomy, reporting only 5 EOC cases, which was significantly fewer than the expected number based on the incidence rates observed in the control group. Blok et al. (14) conducted a prospective cohort study in the Netherlands, focusing on 527 *BRCA1* or *BRCA2* mutation carriers who underwent RRSO, with 12 cases of high-grade serous ovarian cancer identified, often of tubal origin, reflecting the high-risk nature of this population. Stanciu et al. (15) examined a smaller cohort of 287 women in England, primarily *BRCA* mutation carriers or those with a strong family history of breast or ovarian cancer, who underwent RRSO, identifying 1 case of EOC, which developed after 92 months. Falconer et al. (12), a pivotal retrospective cohort study from Sweden, analyzed a large cohort of 5,819,102 women, of which 71,781 underwent salpingectomy, reporting a total of 31,399 EOC cases, with the majority (31,311 cases) occurring in the control group, indicating a reduced incidence rate in the salpingectomy group. These five studies collectively provide a robust dataset for estimating the overall protective effect of salpingectomy and for an exploratory examination of temporal trends.

Synthesis of results

A double-arm random-effects meta-analysis of the three studies in average risk women undergoing opportunistic salpingectomy [Falconer et al. (12), Hanley et al. (11), Giannakeas et al. (13)] yielded a pooled RR of 0.223 (95% CI: 0.182-0.274, $p<0.001$;

Table 1. Newcastle-Ottawa Scale risk-of-bias assessment for included cohort studies

Study	Selection (max 4)	Comparability (max 2)	Outcome (max 3)	Total score (max 9)
Giannakeas et al. (13)	★★★★	★★	★★★	9
Hanley et al. (11)	★★	★	★★★	6
Blok et al. (14)	★★★★	★★	★★★	9
Stanciu et al. (15)	★★★★	★★	★★★	9
Falconer et al. (12)	★★	★	★★★	6

Stars (★) indicate points awarded in each domain. Hanley et al. (11) and Falconer et al. (12) received fewer stars in selection and comparability due to higher risk-of-bias, as described. Total scores ≥6 indicate low risk-of-bias

Table 2. Characteristics of included studies

Study	Country	Design	Population	Salpingectomy type	EOC cases	Sample size
Giannakeas et al. (13)	Canada	Retrospective cohort	Average risk women	Opportunistic	148	131,516
Hanley et al. (11)	Canada	Retrospective cohort	Average risk women	Opportunistic	26	57,969
Blok et al. (14)	Netherlands	Prospective cohort	BRCA1/2 mutation carriers	Risk-reducing (RRSO)	12	527
Stanciu et al. (15)	England	Retrospective cohort	BRCA carriers/high-risk	Risk-reducing (RRSO)	1	287
Falconer et al. (12)	Sweden	Retrospective cohort	Average risk women	Opportunistic	31,399	5,628,803
EOC: Epithelial ovarian cancer, RRSO: Risk-reducing salpingo-oophorectomy						

I^2=0%) after exclusion of Giannakeas et al. (13) in sensitivity analysis to resolve initial heterogeneity (Figure 2).

The 2022-2023 subgroup is presented as an exploratory recent evidence window; it is not a formally powered temporal comparison due to the limited number of studies and shorter follow-up durations in this period. Exploratory temporal subgroup analysis showed a consistent protective effect in the pre-2022 period (RR: 0.220, 95% CI: 0.179-0.272) and a non-significant point estimate in the limited 2022-2023 evidence window (RR: 0.538, 95% CI: 0.208-1.389; I^2=70.7%) (Figure 3). Single-arm incidence in the opportunistic salpingectomy subgroup was 0.001 (95% CI: 0.001-0.001) after sensitivity analysis (Figure 4).

Discussion

The exploratory temporal subgroup analysis does not provide evidence of a statistically stronger protective effect in the most recent 2022-2023 evidence window compared with earlier years, which is expected, given the still-limited number of large contemporary cohorts with sufficient follow-up (Figure 5). To the best of our knowledge, this remains one of the few meta-analyses to quantitatively synthesize the rapidly accumulating observational evidence on opportunistic salpingectomy in average risk women.

The protective effect of salpingectomy on EOC incidence is biologically plausible and well-supported by the understanding that the fallopian tubes serve as the primary site of origin for many high-grade serous EOC cases, with STIC identified as a key precursor lesion (5,6). By removing the fallopian tubes, salpingectomy effectively eliminates the anatomical site where STIC develops, thereby interrupting the oncogenic pathway that leads to EOC. This mechanism is reflected in the findings of the included studies, particularly Falconer et al. (12), which reported a 65 percent reduction in ovarian cancer risk primarily occurring in the control group, indicating a significant protective effect of salpingectomy (10). Similarly, Hanley et al. (11) observed only 5 EOC cases among 25,889 women in the salpingectomy group, a number far below the expected incidence based on control group rates, further supporting the preventive impact of opportunistic salpingectomy (11). In contrast, Giannakeas et al. (13) reported no significant association between salpingectomy and EOC incidence among 32,879 women, with only 31 EOC cases identified, which may be attributed to a short follow-up period and low event rates that limited the study's statistical power to detect a significant

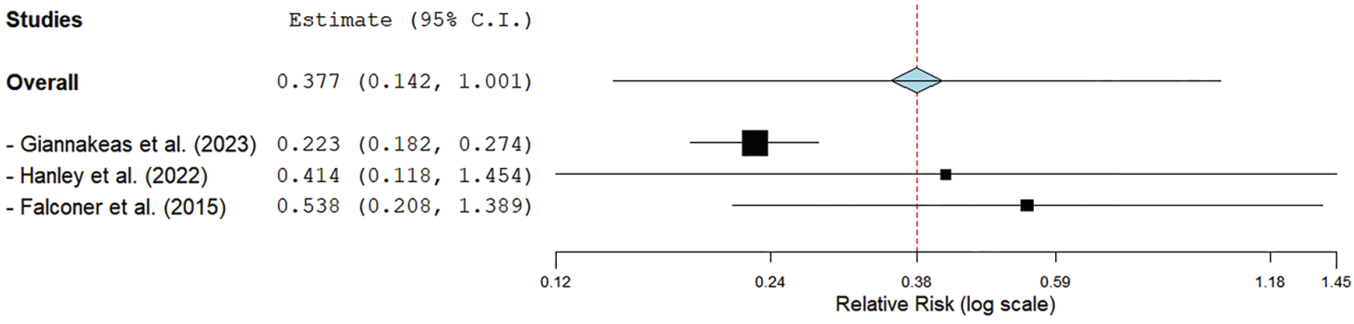

Figure 2. Leave-one-out test of the double-arm meta-analysis model of EOC incidence
EOC: Epithelial ovarian cancer, C.I.: Confidence interval

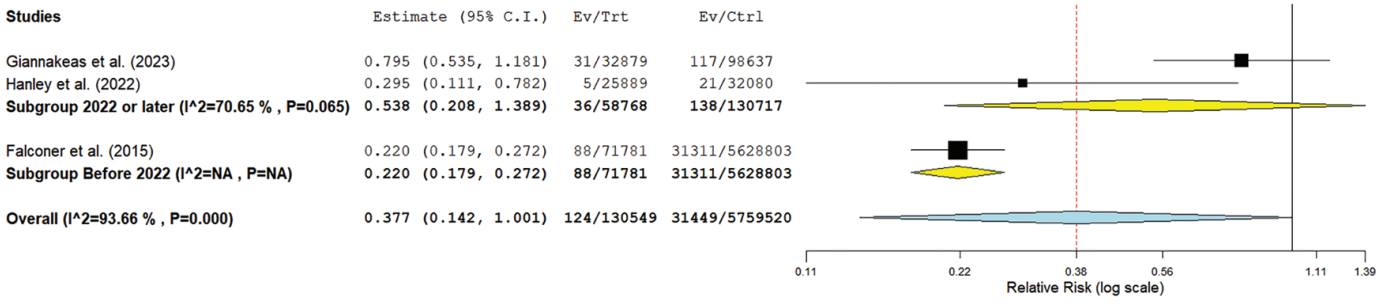

Figure 3. Subgroup analysis based on year for the double-arm meta-analysis model of EOC incidence
EOC: Epithelial ovarian cancer, C.I.: Confidence interval

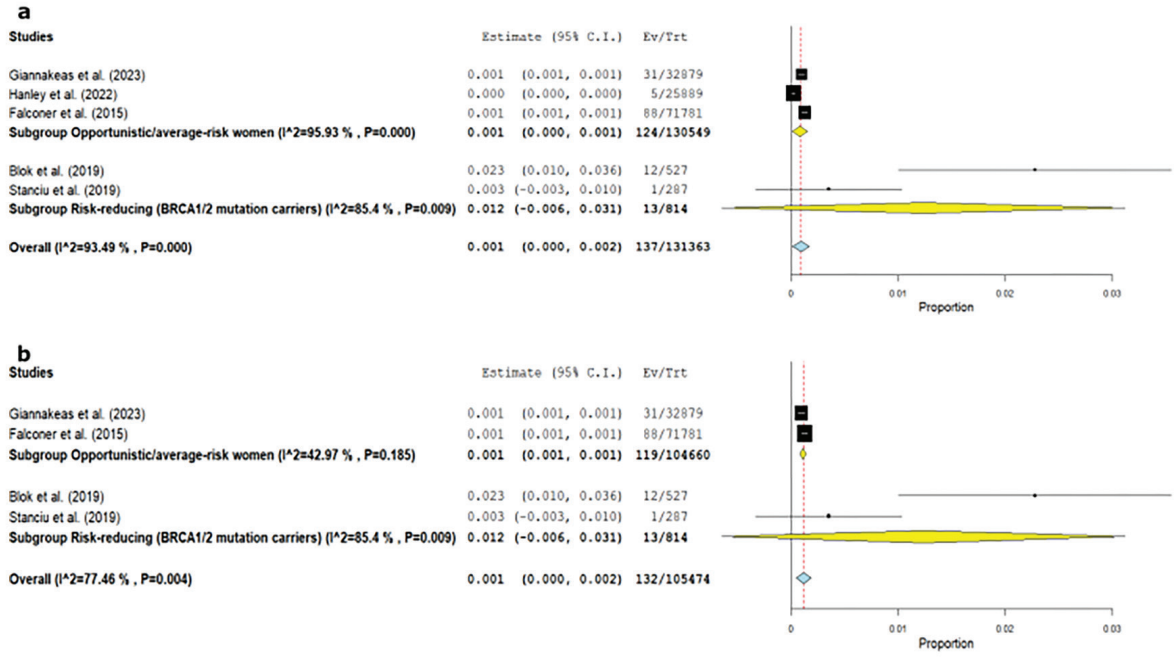

Figure 4. (a) Single-arm meta-analysis of EOC incidence with a subgroup analysis based on approach to salpingectomy and BRCA1/2 mutation status and (b) single-arm meta-analysis of EOC incidence with sensitivity analysis of the opportunistic approach subgroup

EOC: Epithelial ovarian cancer, C.I.: Confidence interval

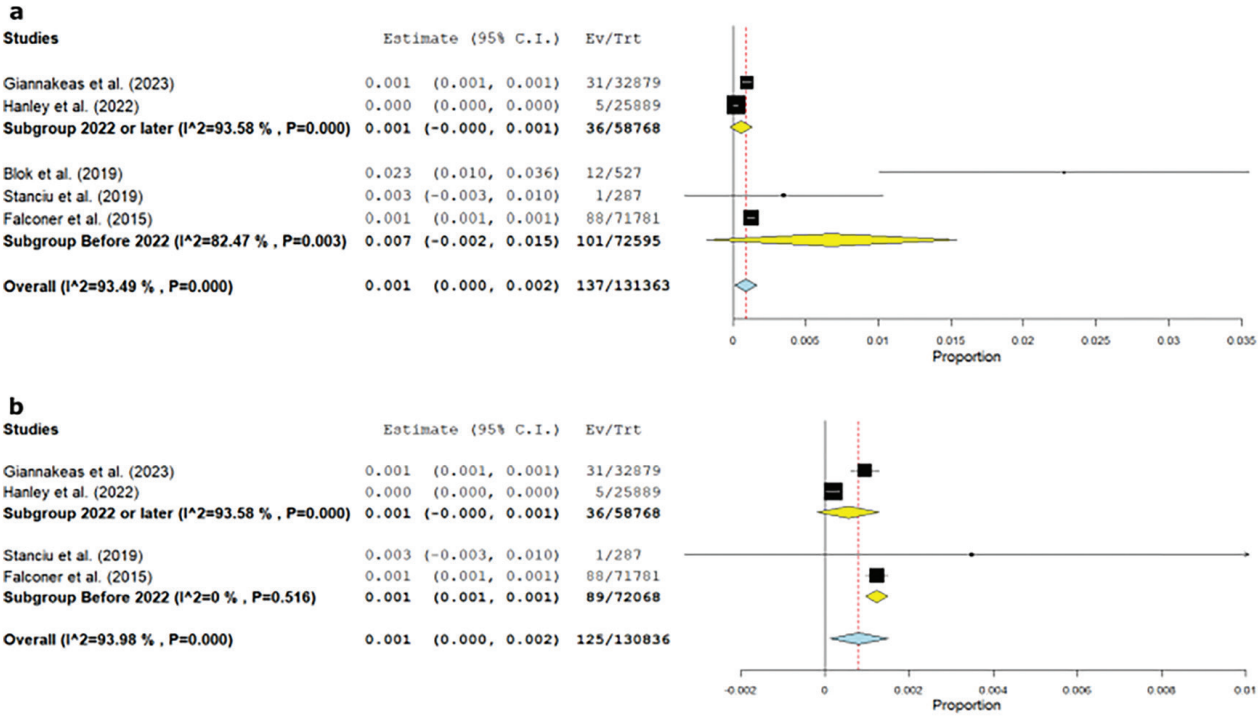

Figure 5. (a) Single-arm meta-analysis of EOC incidence with a subgroup analysis based on year and (b) single-arm meta-analysis of EOC incidence with sensitivity analysis of the subgroup of pre-2022

EOC: Epithelial ovarian cancer, C.I.: Confidence interval

effect (12). The studies by Blok et al. (14), which included 527 *BRCA* mutation carriers with 12 EOC cases, and Stanciu et al. (15), which included 287 *BRCA* mutation carriers with one EOC case developed during follow-up, provide evidence of salpingectomy's protective effect in high-risk populations, although their smaller sample sizes contributed less to the overall pooled effect compared to the larger studies focused on average risk women (13,14).

Study Limitations

This study possesses several notable strengths that enhance its scientific rigor and reliability, making it, we believe, a valuable contribution to the field of gynecologic oncology. The comprehensive literature search conducted across four major academic databases ensured a thorough and systematic identification of relevant studies, minimizing the risk of missing key publications that address EOC incidence rates in the context of salpingectomy. The inclusion of only high-quality cohort studies, all of which demonstrated a low risk-of-bias as confirmed by NOS scores of 6 or higher, bolsters the credibility and validity of the findings, ensuring that the meta-analysis is based on robust and reliable data. The large total sample size of 5,819,102 women, with 31,586 EOC cases identified across the five studies, provides substantial statistical power for the overall meta-analysis of the protective effect of salpingectomy, enhancing confidence in the study's results. The specific focus on comparing EOC incidence rates in 2022-2023 to earlier periods aligns closely with the recent guideline-driven changes in clinical practice, particularly the increased adoption of opportunistic salpingectomy, making the findings highly relevant to current clinical contexts and public health strategies. In addition, the use of a random-effects model in the meta-analysis, combined with sensitivity analyses to explore sources of heterogeneity, ensured a comprehensive and robust assessment of the effect of salpingectomy on EOC incidence rates, accounting for variability across studies and populations. Despite its strengths, this study is subject to several limitations that warrant careful consideration when interpreting the findings. The high level of heterogeneity observed in the meta-analysis, as indicated by I^2 values, suggests significant variability in the effect sizes reported across the included studies, which may impact the precision of the pooled RR estimate. This heterogeneity is likely attributable to differences in the study populations, with three studies focusing on average risk women undergoing opportunistic salpingectomy and two studies focusing on high-risk *BRCA* mutation carriers undergoing RRSO, as well as variations in the indications for salpingectomy, such as opportunistic versus risk-reducing procedures. Sensitivity analyses and subgrouping analyses helped to resolve heterogeneity in some, but not all subgroups, which suggests that population differences are a significant contributor to the heterogeneity. The remaining residual variability indicates the need for cautious interpretation of the results. The reliance on observational cohort studies, rather than randomized controlled trials, limits the ability to establish a causal relationship between salpingectomy and reduced EOC incidence rates, as unmeasured confounders, such as differences in healthcare access or underlying risk factors, may have influenced the observed associations. The predominance of studies conducted in Western countries, specifically Canada, the Netherlands, England, and Sweden, may restrict the generalizability of the findings to other populations, particularly those in low-resource settings or regions with different healthcare practices and salpingectomy adoption rates. By prioritizing studies published after 2015 with sufficient sample sizes and homogeneous populations, the study may have excluded earlier studies or those with smaller sample sizes, potentially limiting the historical context for understanding long-term trends in EOC incidence rates, although the inclusion of the pivotal study by Falconer et al. (12) mitigates this to some extent. The low number of EOC cases reported in some studies, such as Hanley et al. (11) with only 5 cases among 25,889 women and Stanciu et al. (15) with one case among 287 women, may have reduced the precision of the effect estimates for these studies, although the large sample sizes of other studies, such as Falconer et al. (12) with 5,628,803 women and Giannakeas et al. (13) with 131,516 women, compensated for this limitation by providing substantial statistical power. Finally, the short follow-up periods in some studies, particularly Giannakeas et al. (13), may have underestimated the true effect of salpingectomy on EOC incidence rates, as EOC may develop years after the procedure, potentially attenuating the observed associations in studies with limited follow-up duration. The 2022-2023 evidence window remains limited in both number of studies and duration of follow-up and therefore does not yet allow definitive conclusions about further strengthening of the protective effect over time.

Clinical implications

The findings of this meta-analysis, which demonstrate a 77.7% reduction in EOC incidence rates associated with salpingectomy compared to control patients, have significant implications for clinical practice, particularly in the field of gynecologic surgery. The substantial reduction in EOC incidence rates, supported by a large sample, provides strong evidence to support the use of opportunistic salpingectomy as a primary prevention strategy for average risk women undergoing benign gynecologic surgeries, such as hysterectomy or sterilization. Clinicians should engage in shared decision-making with their patients, discussing the significant protective benefits of salpingectomy in reducing EOC incidence rates, which is particularly relevant

given the high mortality associated with this malignancy, alongside the potential risks of the procedure, such as surgical complications or permanent infertility, which may be a concern for women who have not completed childbearing. The continued endorsement of opportunistic salpingectomy in professional guidelines, such as those issued by ACOG, is warranted based on these findings, and healthcare providers should advocate for the integration of salpingectomy into routine clinical practice where appropriate, particularly as a replacement for tubal ligation in women seeking permanent sterilization (7). For high-risk populations, such as women with *BRCA1* or *BRCA2* mutations, RRSO remains the standard of care (4), but the findings from studies such as Blok et al. (14) and Stanciu et al. (15), which reported reduced EOC incidence in *BRCA* carriers undergoing salpingectomy, suggest that salpingectomy alone may offer a significant protective effect, potentially serving as a less invasive option for some high-risk women, although further research is needed to confirm this approach. It is important to support the ongoing education and training for gynecoloy surgeons to ensure that salpingectomy is performed safely and effectively, maximizing its preventive potential while minimizing associated risks.

Research implications

The results of this meta-analysis highlight several critical avenues for future research to build upon the current evidence base and further elucidate the impact of salpingectomy on EOC incidence rates over time. Randomized controlled trials are urgently needed to establish a causal relationship between salpingectomy and reduced EOC incidence rates, addressing the inherent limitations of observational cohort studies, which are susceptible to confounding and selection biases. Such trials could provide definitive evidence to guide clinical recommendations and strengthen the case for widespread adoption of salpingectomy as a preventive strategy. Long-term cohort studies with extended follow-up periods are essential to assess the durability of the protective effect of salpingectomy on EOC incidence rates, particularly given that some studies, such as Giannakeas et al. (13), may have underestimated the effect due to short follow-up durations that did not allow sufficient time for EOC cases to manifest. These long-term studies should also evaluate the impact of salpingectomy on other health outcomes, such as overall mortality and quality of life, to provide a comprehensive understanding of its benefits and potential risks. Cost-effectiveness analyses are another critical area for future research, as they would help to evaluate the economic feasibility of implementing widespread salpingectomy programs, particularly in healthcare systems with limited resources, where the costs of surgical interventions must be balanced against their preventive benefits. Moreover, studies conducted in diverse populations, including those from non-Western countries and underrepresented regions, are necessary to enhance the generalizability of the findings, as the current meta-analysis is limited by the predominance of studies from Western countries, which may not fully reflect global variations in healthcare practices and salpingectomy adoption rates. Further research should also explore the optimal timing and indications for salpingectomy, particularly in younger women or those with specific genetic risk profiles, to refine clinical recommendations and maximize the preventive benefits of the procedure while minimizing potential adverse effects. By addressing these research priorities, the medical and scientific community can further solidify the role of salpingectomy in reducing EOC incidence rates and contribute to the development of targeted prevention strategies that have the potential to significantly alleviate the global burden of this deadly malignancy.

Conclusion

Salpingectomy is associated with a substantial and consistent reduction in EOC incidence across the studied period. The currently available data from 2022-2023 do not yet demonstrate a further strengthening of this protective effect, but continued surveillance and longer follow-up of contemporary cohorts are warranted. Clinicians are strongly encouraged to offer opportunistic salpingectomy to average risk women during benign gynecologic surgeries, ensuring informed consent discussions clearly outline the substantial benefits of EOC risk reduction alongside potential risks.

Footnotes

Author Contributions: Surgical and Medical Practices: G.M., A.A., N.P., S.M., M.K., Concept: G.M., A.A., Design: G.M., A.A., D.G.H., B.H., Data Collection or Processing: D.G.H., B.H., M.R., N.P., E.K., M.K., G.J., Analysis or Interpretation: G.M., A.A., D.G.H., Literature Search: D.G.H., B.H., M.R., E.K., Writing: G.M., S.M., M.K., G.J.

Conflict of Interest: No conflict of interest is declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Weiderpass E, Labrèche F. Malignant tumors of the female reproductive system. Saf Health Work. 2012; 3: 166-80.
2. Kim J, Park EY, Kim O, Schilder JM, Coffey DM, Cho CH, et al. Cell origins of high-grade serous ovarian cancer. Cancers (Basel). 2018; 10: 433.
3. O'Shea AS. Clinical staging of ovarian cancer. Methods Mol Biol. 2022; 2424: 3-10.
4. Manchanda R, Menon U. Setting the threshold for surgical prevention in women at increased risk of ovarian cancer. Int J Gynecol Cancer. 2018; 28: 34-42.

5. Gupta KK, Gupta VK, Naumann RW. Ovarian cancer: screening and future directions. Int J Gynecol Cancer. 2019; 29: 195-200.
6. Mills K, Marchand G, Sainz K, Azadi A, Ware K, Vallejo J, et al. Salpingectomy vs tubal ligation for sterilization: a systematic review and meta-analysis. Am J Obstet Gynecol. 2021; 224: 258-65.
7. ACOG Committee Opinion No. 774 summary: opportunistic salpingectomy as a strategy for epithelial ovarian cancer prevention. Obstet Gynecol. 2019; 133: 842-3.
8. Yoon SH, Kim SN, Shim SH, Kang SB, Lee SJ. Bilateral salpingectomy can reduce the risk of ovarian cancer in the general population: a meta-analysis. Eur J Cancer. 2016; 55: 38-46.
9. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Int J Surg. 2021; 88: 105906.
10. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses. Ottawa Hospital Research Institute. 2011. Available from: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp.
11. Hanley GE, Pearce CL, Talhouk A, Kwon JS, Finlayson SJ, McAlpine JN, et al. Outcomes from opportunistic salpingectomy for ovarian cancer prevention. JAMA Netw Open. 2022; 5: e2147343.
12. Falconer H, Yin L, Grönberg H, Altman D. Ovarian cancer risk after salpingectomy: a nationwide population-based study. J Natl Cancer Inst. 2015; 107: dju410.
13. Giannakeas V, Murji A, Lipscombe LL, Narod SA, Kotsopoulos J. Salpingectomy and the Risk of ovarian cancer in ontario. JAMA Netw Open. 2023; 6: e2327198.
14. Blok F, Dasgupta S, Dinjens WNM, Roes EM, van Beekhuizen HJ, Ewing-Graham PC. Retrospective study of a 16 year cohort of BRCA1 and BRCA2 carriers presenting for RRSO: Prevalence of invasive and in-situ carcinoma, with follow-up. Gynecol Oncol. 2019; 153: 326-34.
15. Stanciu PI, Ind TEJ, Barton DPJ, Butler JB, Vroobel KM, Attygalle AD, et al. Development of peritoneal carcinoma in women diagnosed with serous tubal ıntraepithelial carcinoma (STIC) following risk-reducing salpingo-oophorectomy (RRSO). J Ovarian Res. 2019; 12: 50.

Supplementary File Link: https://d2v96fxpocvxx.cloudfront.net/a5223c9c-50f0-490d-b293-6a74c2af8d3b/content-images/9ea065b7-9af5-4410-bf6e-0fc79c165e62.pdf