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Quality indicators for the management of endometrial, cervical and ovarian cancer

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Running title: Quality indicators for endometrial, cervical and ovarian cancer

Authorship: AB, AL, LW performed the data acquisition and analysis**.** Interpretation of the data and drafting and revision of the manuscript was performed by all authors.

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Abstract

Objective: Measuring quality indicators improves the quality of care. The aim of this review is to identify a set of quality indicators (QIs) that can be used to measure the standard of treatment for patients with endometrial, cervical and ovarian cancer.
Methods: A systematic literature search was performed in the Pubmed and Google Scholar database. Articles related to the field of interest, which covered QIs for the management of endometrial, cervical and ovarian cancer, were included if they were written in English and available in full text. Articles related to prevention, screening, diagnosis, quality of life and patient satisfaction were excluded.
Results: A total of 57 suitable articles was found: 13 for endometrial cancer, 17 for cervical cancer and 27 for ovarian cancer. An overview of the selected QIs was made and classified by type of indicator. Relevant QIs related to the structural organisation of health care are: referral to high volume specialists in high volume hospitals, treatment by specialized gynecological oncologists and discussion of treatment plan by a multidisciplinary team according to current guideliness. Important process measures are: a patient report of high quality, an adequate pretreatment staging and an adherence to treatment guidelines. The ultimate goal is to reduce treatment related morbidity and increase the survival rate, which can be measured as outcome indicators.
Conclusion: The proposed set of QIs should be validated and can be implemented into quality assurance programmes to improve the quality of care and the outcome of patients with a gynecological cancer.

Keywords: Quality Indicators, Guidelines, Endometrial cancer, Cervical Cancer, Ovarian cancer

Highlights

- Appropriate QIs can be used to measure the quality of care of gynecological cancers
- QIs have the potential to improve the quality of care of gynecological cancers

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1. Introduction

The treatment of gynaecological cancers can be challenging and complex. Nowadays there is a growing interest in measuring the quality of care for many tumor types (1-3). In 1990, the Institute of Medicine defined the quality of care as 'the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge' (4). To achieve this, it is important to understand the factors in the clinical pathway of a patient that influence the quality of diagnoses and treatment. These can be identified by measuring quality indicators (QIs). Quality indicators enable health care professionals to compare their clinical management with the ideal standards according to the guidelines in order to detect aspects of suboptimal care (5-7). There is a high need to implement audit and quality control into daily clinical practice as a large proportion of patients do not receive the best evidence based treatment. For example, it has been shown that less than 50% of patients suffering from ovarian cancer in Europe are treated according to the guidelines (8). Unfortunately, there are many physicians that consider initiatives for improvement as an obstacle of their practice, limiting their therapeutic freedom and increasing the administrative burden (6, 9). Aletti et al. identified four factors that may be involved in this variability in the deliverance of care: "lack of resources resulting in suboptimal structures and hospitals; lack of certified referral centers for specific cancers; lack of clinical guidelines that may be used across different institutions and physicians and lack of training programs, resulting in a wide variability in individual physician's performance"(9). With the enforcement of quality assurance programmes, quality of care and adherence to guidelines can be improved which has a positive impact on both the survival of the patient and the cost-efficiency of the health care system (8, 10). Measurement of QIs allows units to develop a framework of continuous quality improvement, whereby real time data is audited regularly in order to take action to deliver better health care (11).

The aim of this review is to select and define QIs that can be used to measure the quality of the treatment of endometrial, cervical and ovarian cancer. Although cancer survival is the ultimate indicator of the effectiveness of the health care system, it is complex and expensive to measure. Therefore, we focused on structural, process and outcome measures of health care.

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2. Methods

2.1 Search and data collection

A literature search was performed by searching the PUBMED database from August 2017 until November 2017. A predetermined search plan was followed for the three cancers of interest: endometrial, cervical and ovarian cancer. There was no restriction on publication date. First, a general search was carried out using the main search term '*quality indicators*' followed by the specific cancer, e.g. *quality indicators endometrial cancer*. After that, a second search term was added: e.g. *endometrial cancer "quality of care*". Since this search generated many articles focused on cancer screening and quality of life, which is not the aim of this review, a search based on words in title was applied. In this more specific search, the following equation was used for endometrial cancer: *(((quality[Title]) AND endometrial cancer[Title]) NOT quality of life[Title]) NOT screening[Title].* As QIs intend to measure the adherence to guidelines and the quality of care, a last search term was added: *(endometrial cancer[Title]) AND implement* guidelines[Title]*. An additional search on Google Scholar was performed to ensure no relevant articles were missed. In an identical manner, the search for cervical and ovarian cancer was carried out. Duplicates were removed. The remaining articles are displayed in *Figure 1*.

2.2 Study selection

Articles were excluded based on title by three independent reviewers (AB, AL, LW). The abstracts of the remaining articles were read and the papers were retained, provided they met the following inclusion criteria: written in English, a full text version is available, the field of interest is the quality of care of the management of endometrial, cervical and ovarian cancer. Articles on the following topics were excluded: prevention, screening, diagnosis, quality of life and patient satisfaction. Figure 1 gives an overview of the data collection and the number of articles retrieved or excluded from the search. Details on the remaining articles are given in *The Appendix*.

2.3 Study quality

Remaining full text articles were evaluated on their level of evidence by three independent reviewers (AB, AL, LW) using the Oxford (UK) CEBM Levels of Evidence (12). After consensus was achieved, it was concluded not to exclude any articles regarding study quality. Based on the collected literature, all QIs were listed for endometrial, cervical and ovarian cancer. Relevant QIs were selected independently by two gynecologic oncologists (PVD, XBT). An attempt was made to limit the number of QIs in order to make future registration less cumbersome.

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3. Results

3.1 Structural measures

Structural measures refer to health care facility resources, e.g. the number and qualification of staff, case volume of the hospital and specialist, supplies, access to specific technologies etc (3, 13). After analyzing all selected literature, five common structural indicators came forward for endometrial, cervical and ovarian cancer: (1) high volume surgeons in high volume hospitals, (2) level of adherence to the guidelines, (3) centralisation: referral to tertiary centers, (4) education and specialisation of the treating physician: preference for a gynecological oncologist and (5) a multidisciplinary team meeting discussing diagnosis and treatment plan. The present search supports a positive correlation between case volume of the treating physician in the treating institution and the outcome of the patient (13). For cervical cancer treatment, one recommends a number of 10 or more radical hysterectomies performed by surgeon per year and 20 or more performed by institution per year (13). For ovarian cancer a cut-off of 20 to 24 patients per departement was determined, as this resulted in a significantly higher survival ($p = 0.001$) (14, 15). According to a study of Mercado et al. the risk of in-hospital death after ovarian cancer surgery decreased with 69% when performed by a high volume surgeon (15). To reach the highest quality of care, it is essential that low volume centers refer their patients to the high volume hospitals. It is proven that even when low volume hospitals provide high quality care, they still have lower survival rates than high volume centers (14, 15). Centralisation of care can increase the relative three-year survival rate up to 20% (16-18). Therefore, the combination of a high volume hospital and a high volume surgeon can be considered as a positive prognostic factor (19). For the treament of patients with endometrial cancer, no data could be found for the minimal case load per surgeon and unit. Endometrial cancer continues to be managed by general gynaecologists rather than specialist gynaecological oncologists, making it difficult to study the impact of staging and treatment by a dedicated team on the outcome of these patients. However it would be logic that the requirements for surgeons and hospitals treating endometrial cancer by hysterectomy and pelvic/paraaortic lymphdenectomy would be similar to those of cervical cancer surgery.

Treatment in hospitals with greater case volume is associated with a decreased likelihood to be treated by a non-specialist or general surgeon (15). Women undergoing surgery for ovarian cancer performed by general gynecologists or surgeons have a lower survival rate than women treated by a gynecological oncologist. According to the American Board of Obstetrics and Gynecologists, a Gynecologic Oncologist is “a specialist in obstetrics and gynecology who is prepared to provide consultation on comprehensive management of patients with gynecologic cancer and who works in an institutional setting wherein all the elective forms of cancer therapy are available” (20). The European Society of Gynaecologic Oncology (ESGO) stated that surgery should be performed by a certified gynecologic oncologist or by a trained surgeon, who is specialized in the management of gynecologic cancer or has completed an ESGO accredited fellowship. This should ensure that the surgeon has acquired the skills to perform abdominal and pelvic operations and thus ensure a complete cytoreduction (15, 21). Gynecological Oncologists are more likely to achieve an

adequate surgical staging and obtain a complete cytoreduction. Several authors have shown that gynecological oncologists were about two times more likely to achieve optimal cytoreduction in patients with ovarian cancer (15, 21). This is important because patients receiving a suboptimal cytoreduction have a five-year survival rate of 0% to 15% compared to 30% to 40% for patients receiving an optimal cytoreduction (15). It is clear that surgery performed by gynecological oncologists is a prognostic factor and relevant QI.

Beside the case load of the surgeon and the institution, another important indicator of improved quality of care and therefore improved survival, is the guideline-based care and a multidisciplinary approach (21-23). It is recommended to work in a team involving anesthesiologists, infectologists, general surgeons and many other specialists. Physicians who work in multidisciplinary teams (MDT) obtain the best clinical and oncological outcomes by having a holistic concept of patient treatment and therefore a better overall quality of care (21). High volume hospitals are more likely to treat women according to the guidelines. Wright et al. revealed a compliance of 82% at high volume hospitals compared with only 64% at low volume hospitals. This may be a potential explanation of the correlation between caseload of surgeon and hospitals and patient outcomes (18). Moreover, when patients were treated in teaching hospitals their survival was better (14). According to the French Society of Gynecologic Oncology, the participation of the treating physician in clinical trials is a prognostic factor and therefore must be formally encouraged (8, 9, 19). They claim that an institution should be involved in at least one clinical trial programme to reach better outcomes (8).

In conclusion, women with gynecological cancers must ideally be referred to high volume gynecologic oncologists in high volume hospitals, where they should be discussed by a MDT and be treated according to the guidelines, to increase their life expectancy and quality of life (3, 10, 15, 19, 24).

3.2 Process and outcome measures

Process measures refer to specific actions in the management of the patients implemented to achieve an optimal result, where outcome measures are the ultimate indicators of the total health of treated patients and the quality of given care. Therefore, treatment related morbidity and survival are considered as outcome measures (3, 13). These indicators vary per cancer type and are therefore discussed separately. The proposed set of QIs is presented in *Table 1-3.*

3.3 Endometrial cancer *(table 1)*

The Scottisch Cancer Taskforce (SCT) states that before treating a patient with endometrial cancer, the extent of disease should be assessed by magnetic resonance imaging (MRI) and/or computed tomography (CT) of the abdomen and pelvis (11). Investigation of the para-aortic lymph nodes should be included in the MRI. The SCT proposes a target of 90% of all patients with endometrial cancer, to tolerate situations where an urgent treatment is

required before performing any imaging or situations where endometrial cancer is an incidential finding at hysterectomy (11). According to the International Federation of Gynecology and Obstetrics (FIGO), staging must contain the exclusion of lung metastases with a chest X-ray (CXR) (25). Accurate staging is crucial to determine a prognosis and to offer the most suitable treatment. Centralisation of surgery leads to more accurate and uniform staging (25). Chenoz et al. evaluated 36 QIs for endometrial cancer in a multicenter study and showed that five of them are measurable (at least 80% of the patients are affected by the indicator) and improvable (the difference between the theoretical target and the observed rate is below 5%) (5). One of their QIs is "the proportion of patients undergoing surgery, for whom tumor grade is available/reported for treatment decisions", which was also described as relevant by Werbrouck et al. (5, 26). Taking into account that tumor grading on curettage or endometrial aspirate samples is not very reliable and that using the tumor grade to plan further surgery has limited relevance (with or without lymphadenectomy), we did not retain this QI (27).

The SCT indicates that after a thorough staging, all patients who do not have metastatic disease should undergo total hysterectomy (TH) and bilateral salpingo-oophorectomy (BSO). This treatment is associated with the best long term survival (11). In reality, a target of 80% of all patients can be pursued, since some patients are not fit enough to undergo the surgical intervention or other patients prefer a fertility conserving treatment (11). Werbrouck et al. also determined that patients with clinical stage I should undergo a TH/BSO and they proposed a theoretical target of 100%, but this seems unrealistic (26). Patients undergoing definitive surgery should undergo laparoscopic surgery if possible, which is associated with reduced post-operative complications and length of stay. However, the procedure must be clinically suitable for the patient and therefore a tolerance of 50% minimal invasive surgery of all patients has been proposed (11).

Beside the surgical management, the SCT states that adjuvant vaginal brachytherapy should be considered for patients with intermediate risk: stage IB, grade 1 or 2, or stage IA, grade 3 endometrioid or mucinous endometrial cancer (11). The SCT uses a target of 90%, since some patients can not tolerate vaginal brachytherapy or some have a complicated post-operative recovery (11). For patients with high-intermediate or high risk, vaginal brachytherapy should not be used as sole adjuvant modality, and pelvic radiotherapy and systemic treatment should be considered. Patients with stage III and IV endometrial cancer should have platinum-based chemotherapy, which can improve progression free survival in these patients (26). Werbrouck et al. stated that every patient with advanced endometrial cancer (stage III and IV) should receive chemotherapy (26). As a considerable proportion of patients with endometrial cancer has important comorbidity, according to the SCT not every patient can or wants to undergo chemotherapy. Therefore a target of 75% of all patients with stage IV is used (11).

Chenoz et al. indicated "American Society of Anesthesiologists (ASA) and/or World Health Organization (WHO) score reporting" as a measurable and improvable QI. (5) Werbrouck et al. also determined this as an indicator and proposed a target of 100%, so every patient should have his ASA and/or WHO score reported (26).

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3.4 Cervical cancer *(table 2)*

It is essential to stage cervical cancer prior to first treatment, in order to assess the extent of the cancer and to avoid unnecessary or inappropriate treatment. According to the SCT, the local staging should be done by MRI of the pelvis and abdomen, with a target rate of 95%. The tolerance of 5% within this target accounts for situations where patients require urgent treatment before MRI is performed. Patients who are unable to undergo MRI due to contraindications, who are treated by LLETZ (Large Loop Excision of the Transformation Zone) only or patients with histopathological FIGO-stage IA1 disease, are excluded for this target rate (28). Croke et al. mentioned that the pretreatment staging should be done by CT instead of MRI. The target rate in this article was set at 97% (23).

When primary surgery is not feasible, radical radiotherapy is often recommended. These patients who are not suitable for surgery have a greater risk for nodal or metastatic disease. Therefore, they should undergo PET-CT assessment if available, because the detection of an extra pelvic disease will change the overall management. A target rate of 95% was set by the SCT, so patients who can not endure PET-CT procedures or who have poorly controlled diabetes can be tolerated (28). However, as PET-CT is not generally available in all hospitals and in all parts of the world this can not be considered to be a mandatory QI.

Patients diagnosed with a IA2-IB1 disease according to the FIGO stages or a tumor <4cm should preferentially undergo radical hysterectomy, because they are less likely to have a metastatic spread. It is also proven that young women undergoing a radical hysterectomy have a better long-term quality of life than young women undergoing chemo-radiation therapy (28). Patients who decline surgery, who undergo fertility conserving treatment, who have neo-adjuvant chemotherapy or patients enrolled into surgical trials are not included in the target rate of 70%-74% (13, 29, 30). A radical hysterectomy is considered of high quality if it provides a wide excision of the tumor, removes areas of possible micrometastases, results in good local control and a favorable morbidity outcome. The quality of hysterectomy depends on many different aspects, but one of the most important QIs is “clear resection margins after undergoing hysterectomy”. Positive surgical margins have an increased risk of recurrence. Ninety five percent of the patients who undergo radical hysterectomy should have clear resection margins. There is a 5% tolerance for situations where it is not possible to achieve clear surgical margins despite radiological staging. Patients undergoing neo-adjuvant chemotherapy are not included in this target rate (13, 28). Another indicator to evaluate the quality of the radical hysterectomy is pelvic recurrence after surgery. To obtain high quality, the proportion of patients suffering from pelvic recurrence should be less than 15% (13).

Pelvic lymphadenectomy is considered as one of the most essential steps in performing a radical hysterectomy and is therefore seen as a QI for cervical cancer treatment. The benefit of lymphadenectomy is widely studied and most studies mention a better local control but not overall survival when lymphadenectomy is performed (13, 30). A unit must try to

perform a lymphadenectomy in at least 95% of their cervical cancer patients which are operated for FIGO IA2 to IIB disease (13). However, the minimum number of resected lymph nodes is still an unresolved issue. Some authors claim a lymphadenectomy is adequate when the specimens contain at least one examined lymph node in each common iliac, external and internal iliac and obturator area. The EORTC-GCG (European Organisation for Research and Treatment of Cancer-Gynecological Cancer Group) suggests that there should be a minimum of 12 lymph nodes removed (13). Pieterse et al. assessed the relation between the number of removed pelvic lymph nodes after a radical hysterectomy with pelvic lymphadenectomy and the outcome. These authors reported that in most cases a resection of 10-20 lymph nodes was performed both in patients with negative lymph nodes (median: 19 removed lymph nodes) and in patients with positive lymph nodes (median: 18 removed lymph nodes). However, they could not find a positive correlation between cancer specific survival (CSS) or the disease free survival (DFS) and the number of removed lymph nodes in patients with negative nodes. For patients diagnosed with positive lymph nodes, there was a positive correlation with the DFS but not with the CSS (31). Recently, a sentinel node biopsy procedure became an acceptable alternative for performing a pelvic lymphadenectomy. For quality assurance bilateral sentinel nodes should be removed (32).

The duration of primary (chemo)radiotherapy (external beam radiotherapy or brachytherapy) should not be more than 56 days. A longer period of treatment has shown to deteriorate the control of the cancer. A hospital should pursue a target rate of 90% of patients undergoing radiotherapy in less than 56 days. Ten percent can be tolerated for situations where patients default on their treatment (23, 28, 29, 33, 34). Chiew et al. reported an adherence of 73% to this guideline (29). Concurrent chemotherapy combined with radiotherapy is the first treatment of choice in stages IB2 to IVA cervical cancer, because it improves the overall survival with 10% in comparison with radiotherapy alone(23, 28, 33-36). The SCT sets a target rate of 70% so that patients can be tolerated for whom chemotherapy is contraindicated (28). Eifel. et al. showed that patients treated in facilities taking care of three or fewer eligible patients per year, are less likely to receive concurrent chemotherapy than patients treated in high volume facilities (37).

One of the main treatment options for locally advanced cervical cancer is intracavitary brachytherapy. Croke et al. mentioned that intracavitary brachytherapy should be incorporated in the treatment of cervical cancer. This was the most endorsed QI by experts (23, 33), emphasizing that treatment of locally advanced cervical cancer is evolving into a more technological and individual tailored treatment and that brachytherapy has a better outcome than other radiotherapy-techniques (23).

3.5 Ovarian cancer *(table 3)*

In order to treat a patient with ovarian cancer properly, a thorough preoperative assessment must precede any treatment. Both ESGO and Aletti et al. present “the required preoperative workup” as a QI (9, 19). This indicator is related to the overall management of the patient, as well as the participation to clinical research and the decision-making process in a MDT (19). To achieve this indicator, more than 95% of the patients with advanced ovarian cancer should receive an adequate preoperative assessment. It includes preoperative abdominal

and thoracic imaging to exclude unresectable distant parenchymal metastases, the determination of the ratio of plasma CA 125 and carcinoembryonic antigen markers (CEA) levels and/or a biopsy to exclude secondary ovarian neoplasms (19). This was also mentioned in the European Society of Medical Oncology (ESMO) guidelines. Moreover, ESMO proposes additional endoscopic tests and biopsies (e.g. laparoscopy, gastroscopy, colonoscopy, etc) to obtain a tissue diagnosis, particularly when CA 125/CEA ratio is ≤25 (38). Confirmation must be histologic, or cytologic if histology is not appropriate (39).

Aletti et al. also emphasize the importance of a thorough staging, including a (retro)peritoneal assessment for early disease stages (9). Although this has a major impact on the outcome of patients with apparent early stage disease, it is often ignored as data of the EORTC-ACTION (European Organisation for Research and Treatment of Cancer-Adjuvant ChemoTherapy In Ovarian Neoplasm) trials have shown. Only 34% of the 448 patients enrolled in the trial were correctly staged (9, 24). The most common omissions were sampling of para-aortic lymph nodes (78%), biopsy of the diaphragm (55%) and sampling of pelvic lymph nodes (52%) (9, 24, 40). The authors mentioned a few reasons for these staging failures, e.g a lack of surgical expertise, which occurred more frequently in low volume centers (less than five patients) (see structural measures). In such centers, patients were only completely staged in 20.5% of cases. Unfortunately, even patients treated in high volume hospitals were only completely staged in 37% of cases (9, 24). To improve the practice of surgeons, the EORTC-GCG conducted a literature search to identify five indicators for staging laparotomy. One of these five indicators was “the percentage of staging operations having total abdominal hysterectomy, bilateral salpingo-oophorectomy, peritoneal cytology, infracolic omentectomy, random peritoneal biopsies, and systematic pelvic and para-aortic lymphadenectomy” (24, 39). In a further study, it was proven that the overall survival improved after optimal surgical staging due to upstaging and adding systemic treatment in patients with occult metastatic disease. These findings support the performance of a systematic pelvic and para-aortic lymph node sampling or lymphadenectomy, preferably by a gynecological oncologist, in the management and staging of patients in early disease stages of ovarian cancer (3, 8, 9).

In many papers “the rate of complete surgical resection” emerged as an important QI. In the paper of the ESGO, it is even stated that the “complete cytoreduction” is the most important QI for the surgical procedure (9, 19). As mentioned earlier, the overall survival is difficult to measure as it requires long-term follow-up. Therefore, complete cytoreduction was presented as the best surrogate marker. “Complete abdominal surgical resection is defined by the absence of remaining macroscopic lesions after careful exploration of the abdomen”(19). In the past optimal debulking has also been defined as “the proportion of patients with nodules less <1cm residual disase after cytoreductive surgery” (41). A meta-analysis by the Cochrane group revealed that the risk of death is two times higher if there is residual disease of <1cm and even three times higher if there is residual disease of >1cm (8). To improve the surgical care of patients with ovarian cancer, the Society of Gynecologic Oncologists (SGO) developed two measures: “the description of residual disease following cytoreduction and the performance of adequate surgical staging as defined by the Gynecologic Oncology Group (GOG)”(36, 38). The possibility of obtaining a complete resection also depends on other QIs, such as case volume of the center/surgeon and the training, skills, and experience of the surgeon/the surgical team. In order to optimize the

staging of epithelial ovarian cancer, the EORTC-GCG identified six process QIs for cytoreductive surgery. An important QI was "the percentage of patients having hysterectomy, bilateral salpingo-oophorectomy and infracolic omentectomy when optimal debulking was considered feasible" (24).

In the article of Liang et al., the compliance with eight QIs, proposed by the SGO was evaluated (40). The importance of the complete staging and the operative report was mentioned in this article, but also the administration of platin/taxane therapy within 42 days and venous thromboembolism prophylaxis within 24 hours were included as QIs. According to Querleu et al. thromboprophylaxis with low molecular weight heparin is required for at least four weeks in the context of the peri- operative anaesthetic management. The compliance for this indicator was much higher than for the chemotherapy, likely because perioperative QIs are incorporated routinely into hospital systems (40, 41). When the therapy is delayed, the reason for this delay should be documented. In a study at a single NCI-designated Comprehensive Cancer Center, it was concluded that the incorporation of platin/taxane based chemotherapy was the most common area of non-compliance to Nation Comprehensive Cancer Network (NCCN) guidelines for ovarian cancer. Nearly half of the patients with a delay in receiving chemotherapy had a documented reason. The postponement was mainly due to medical co-morbidities or disease progression.

Gagliardi et al. has set up a multidisciplinary panel to review potential indicators, extracted from a literature search, with the purpose to prioritize QIs. The 28 days morbidity, the average length of stay and the perioperative mortality are common measures of complications associated with surgery. The 28 days morbidity was even incorporated into the ovarian cancer standards recommended by other countries. Another important indicator, "the proportion of eligible ovarian cancer patients receiving postoperative platinum-based chemotherapy", was extracted from the evidence, but was not prioritized by the panel of Gagliardi et al. This emphasized the importance of practical experience in addition to what is evidence based (41).

To guarantee an adequate postoperative care, good communication between colleagues and consequent improvement of quality, there must be a structured prospective reporting of complications within 30 days postoperatively. Data to be recorded are reoperations, interventional radiology, readmissions, secondary transfers to intensive care units, prolonged hospitalization and deaths. The optimal target is 100%, so 100% of the complications should be recorded, where as the minimal target is that patients with serious complications and mortality are at least discussed(8, 9, 19). Barber et al. even proposed the readmission within 30 days of a surgical procedure as a quality metric (42).

3.6 Patient report

During treatment and follow-up of a patient with cancer it is important to document every finding and every decision in the patient report. To preserve the quality of this report, all the minimum required elements of a pathology and operative report and all the postoperative complications should be mentioned (19). Because of its importance and general applicability, the quality of the patient report is explained for the three cancer types together.

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An optimal operative and pathology report requires at least a description of the following aspects in a structured way (43-45):

- Surgical handling: operative procedure, metastatic disease, postoperative residual tumour
- Macroscopic description: invasion of surrounding structures, including omental/parametrial involvement, tumour site and size
- Microscopic description: histological tumour type and differentiation, lymph node involvement (region, total number of nodes resected, number of nodes involved by tumour), tumour grade (TNM and FIGO stage), status of resection margins, relevant molecular assessments (eg somatic BRCA status)

As already mentioned in the section on endometrial cancer, the ASA and/or WHO score needs to be reported for every patient, so the physician knows whether to perform additional preoperative examinations (5, 26). This is not only applicable to endometrial cancer, but also to cervical and ovarian cancer.

The purpose of measuring all previous QIs is to improve the quality of care of patients with gynecological cancer, with the intention to reduce treatment related morbidity and to increase the overall survival of these patients. The ultimate outcome measure of the quality of care is the survival. The one, three and five year overall survival can be used as a relevant QIs (5, 26, 41).

4. Discussion

The treatment of gynecological cancers is still accompanied with considerable morbidity and mortality (46). Measuring quality indicators can improve quality of care and eliminate variation between physicians in order to guarantee more adherence to guidelines and an evidence based treatment. The objective of this study was to present an overview of the most important structural, process and outcome QIs in the gynecological cancer care. Measuring the quality of care should become an integral part of health care, leading to improved quality of care and better patient outcomes. The purpose of auditing care is not “finger-pointing”, but establishing a culture and framework which is using QIs on a continuous and routine basis to monitoring quality of health care (47). Bakkum-Gamez et al. showed for example that, after the incorporation of surgical guidelines and periodic quality assessment, the performance of pelvic and para-aortic lymph node dissection in surgical endometrial cancer management increased from 77.9% and 48.8% of cases to 89.3% and 83.4% (48). A recent paper which was published after the search was ended, showed similar findings for cervical cancer: in high volume hospitals a higher number of lymph nodes was retrieved by laparoscopic radical hysterectomy (49). The offered set of relevant QIs can easily be used in daily practice and applied to the majority of patients treated for endometrial, cervical of ovarian cancer. Hopefully, in the near future, such set of indicators will be used in all hospitals to monitor their given care and remove barriers to follow the guidelines (5).

It is impossible to set fixed minimum and ideal targets on the several QIs. Some of the QIs are objective (eg percentage of patients having a histological diagnosis befrore having

chemotherapy) and others are subjective (eg quality of the pathology report). Rather than focusing on a fixed target one should assess evolutions and improvements over time. For some indicators target rates were suggested, sometimes even a theoretical target of 100%. It is clear that for most QIs this cannot be achieved, due to comorbidities and patient preferences. However, an ambitious theoretical target can function as an incentive for high quality care (5). Because of this, only the fundamental aspects QI assessment were discussed in this paper. When more detailed information is needed, one can look into the articles used in this study. An overview of these articles can be found in the reference list and *Appendix I*.

This literature study includes the description of QIs of three gynecological cancers which could be extracted from the literature. The strength of this study is that it provides an overview of relevant QIs for three important gynecological cancers. This allows physicians to check the indicators easily and use them quickly in practice. The limitation of this paper is that the amount of research in this field is limited and the QIs suggested have not been studied in a consistent prospective way. Normally QIs originate from an accredited Guidelines Institute or from formally organized expert consensus conferences. When selecting the relevant QIs, the authors (three independent reviewers AB, AL, LW and the two gynecological oncologists (PVD, XBT) served as experts themselves. In addition, accredited guidelines such as NICE and NCCN were not taken into account as we wanted to focus on the evidence based literature on the subject. It is clear the retrieved QIs need validation in the future. In the context of a study, a survey can be found via the following link and we invite the reader to give his/her opnion on the relevance of the QIs suggested in this paper: https://www.survio.com/survey/d/T7X3H4Y9K5N2D2Q4U

In conclusion, the aim of measuring QIs is to improve the quality of care and the adherence to the guidelines in order to guarantee a patient report of high quality, an adequate staging and an optimal treatment. Women with gynecological cancers must ideally be referred to high volume gynecologic oncologists in high volume hospitals, where they should be discussed by a MDT. The ultimate goal is to increase their survival by continuously improving the quality of cancer care.

Conflict of interest statement

The authors do not have any conflicts of interest.

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Table 1: Selected Quality Indicators for Endometrial Cancer

	ENDOMETRIAL CANCER - Quality indicators
Pre-operative	QI 1: Proportion of patients who have an MRI and/or CT scan performed to have their stage of disease assessed prior to first treatment.
Peri-operative	QI 2: Proportion of patients who undergo total hysterectomy (TH) and bilateral salpingo-oophorectomy (BSO).
	QI 3: Proportion of patients undergoing definitive surgery who undergo laparoscopic surgery.
Non-operative	QI 4: Proportion of patients with stage IB (grade 1 or 2) or stage IA (grade 3 endometrioid or mucinous) endometrial cancer having adjuvant vaginal brachytherapy.
	QI 5: Proportion of patients with stage IV endometrial cancer receiving chemotherapy.
Patient report	QI 6: Proportion of patients whose ASA and/or WHO score is reported.
	QI 7: Proportion of patients who have an operative report that contains all minimum required elements.
	QI 8: Proportion of patients who have a pathology report that contains all minimum required elements.
	QI 9: Proportion of recorded serious postoperative complications or deaths.
Survival	QI 10: Proportion of patients who are alive 1/3/5 y after their diagnosis.

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Table 2: Selected Quality Indicators for Cervical Cancer

	CERVICAL CANCER - Quality indicators
Pre-operative	QI 1: Proportion of patients who have their stage of disease assessed by magnetic resonance imaging (MRI) prior to first treatment.
	QI 2: Proportion of patients for whom primary definitive surgery is not appropriate, who undergo positron emission tomography - computed tomography imaging.
Peri-operative	QI 3: Proportion of patients with stage IB1 cervical cancer, who undergo radical hysterectomy.
	QI 4: Proportions of patients with surgically treated cervical cancer who have clear resection margins.
	QI 5: Proportion of patients who have pelvic lymphadenectomy specimens that contain at least one examined lymph node in each common iliac, external and internal iliac and obturator area or proportion of patients who have successful bilateral identifications of sentinel nodes after a sentinel node procedure.
	QI 6: Proportion of patients suffering pelvic recurrence after radical hysterectomy for cervical cancer.
Non-operative	QI 7: Proportion of patients undergoing radical radiotherapy for whom treatment time is no longer than 56 days.
	QI 8: Proportion of patients undergoing radical radiotherapy, who receive concurrent platinum-based chemotherapy.
	QI 9: Proportion of patients with locally advanced cervical cancer where intracavitary brachytherapy is incorporated into treatment.
Patient report	QI 10: Proportion of patients whose ASA and/or WHO score is reported.
	QI 11: Proportion of patients who have an operative report that contains all minimum required elements.
	QI 12: Proportion of patients who have a pathology report that contains all minimum required elements.
	QI 13: Proportion of recorded serious postoperative complications or deaths.
Survival	QI 14: Proportion of patients who are alive 1/3/5 y after their diagnosis.

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Table 3: Selected Quality Indicators for Ovarian Cancer

	OVARIAN CANCER - Quality indicators
Pre-operative	QI 1: Proportion of patients who received a required preoperative workup.
	QI 2: Proportion of patients who had a thorough staging with peritoneal and retroperitoneal assessment for arly disease stages.
	QI 3: Proportion of patients who got histo/cytological diagnosis prior to starting neo-adjuvant hemotherapy.
Peri-operative	QI 4: Proportion of patients who underwent an adequate surgical staging.
	QI 5: Proportion of patients who had a complete surgical resection.
	QI 6: Proportion of performed staging laparotomies in which all of the following procedures are included: otal hysterectomy, bilateral salpingo-oophorectomy, cytology of the peritoneal cavity, infracolic mentectomy, random peritoneal biopsies and systematic pelvic and para-aortic lymphadenectomy if medium r high risk features.
	QI 7: Proportion of patients having hysterectomy, bilateral salpingo-oophorectomy and infracolic mentectomy when optimal debulking was considered feasible.
Post-operative	QI 8: Proportion of patients with ovarian cancer experiencing significant morbidity during the first 28 days ollowing surgery.
	QI 9: Proportion of patients who had a readmission within 30 days of a surgical procedure.
Non-operative	QI 10: Proportion of patients with ovarian cancer who received postoperative platinum-based hemotherapy (3 to 6 cycles of platinum/carboplatin and paclitaxel).
	QI 11: Proportion of patients with invasive stages I (grade 3), IC-IV ovarian, fallopian tube, or peritoneal ancer to whom platin or taxane is administered within 42 days following cytoreduction.
	QI 12: Proportion of patients with invasive ovarian, fallopian tube or peritoneal cancer who received venous hromboembolism prophylaxis within 24 h of cytoreduction.
Patient report	QI 13: Proportion of patients whose ASA and/or WHO score is reported.
	QI 14: Proportion of patients who have an operative report that contains all minimum required elements.
	QI 15: Proportion of patients who have a pathology report that contains all minimum required elements.
	QI 16: Proportion of recorded serious postoperative complications or deaths.
Survival	QI 17: Proportion of patients who are alive 1/3/5 y after their diagnosis.

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APPENDIX I

Title of article	Author	Year
ENDOMETRIAL CANCER		
Endometrial Cancer Clinical Quality Performance Indicators*	Scottish Cancer Taskforce	2014
Evaluation and Selection of Quality Indicators for the Management of Endometrial Cancer	Chenoz et al.	2017
Evaluation of the quality of the management of cancer of the corpus uteri — Selection of relevant quality indicators and implementation in Belgium	Werbrouck et al.	2013
Impact of Treatment Guidelines and Implementation of a Quality Assurance Program on Quality of Care in Endometrial Cancer	Du Bois et al.	2009
Reducing readmissions after robotic surgical management of endometrial cancer: A potential for improved quality care	Liang et al.	2013
Compliance with adjuvant treatment guidelines in endometrial cancer: room for improvement in high risk patients	Eggink et al.	2017
Province Wide Clinical Governance Network for Clinical Audit for Quality Improvement in Endometrial Cancer Management	Mandato et al.	2012
The Relevance of Gynecologic Oncologists to Provide High-Quality of Care to women with Gynecological Cancer	Minig et al.	2016
Adjuvant Therapy in Early-Stage Endometrial Cancer: A Systematic Review of the Evidence, Guidelines, and Clinical Practice in the U.S.	Latif et al.	2014
The impact of surgical guidelines and periodic quality assessment on the staging of endometrial cancer	Bakkum-Gamez et al.	2011
A Quality Process Study of Lymph Node Evaluation in Endometrial Cancer	Forde et al.	2011
An Audit of the Quality of Endometrial Cancer Care in a Specialised Unit	Parkin et al.	2015
Adherence to national guidelines for treatment and outcome of endometrial cancer stage I in relation to co-morbidity in southern Netherlands 1995–2008	Boll et al.	2011
CERVICAL CANCER		
Cervical cancer clinical quality performance indicators*	Scottish Cancer	2014

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	Taskforce	
Radiation therapy quality-of-care indicators for locally advanced cervical cancer: A consensus guideline	Croke et al.	2016
Determinants of Quality Care and Mortality for Patients With Locally Advanced Cervical Cancer in Virginia	Showalter et al.	2016
Assessing guideline adherence and patient outcomes in cervical cancer	Chiew et al.	2017
Quality of care in women with stage I cervical cancer	Chu et al.	1982
Failing to deliver established quality treatment for cervical cancer: what is going on and how can we improve it?	Hill et al.	2016
Patterns of care study of brachytherapy in New South Wales: cervical cancer treatment quality depends on caseload.	Thompson et al.	2014
Quality assurance for radical hysterectomy for cervical cancer: the view of the European Organization for Research and Treatment of Cancer--Gynecological Cancer Group (EORTC-GCG)	Verleye et al.	2009
Quality control in sentinel lymph node biopsy in cervical cancer	Gien et al.	2008
The number of pelvic lymph nodes in the quality control and prognosis of radical hysterectomy for the treatment of cervical cancer	Pieterse et al.	2006
Pelvic and parametrial lymph nodes in the quality control of the surgical treatment of cervical cancer	Girardi et al	1993
The Quality of Cervical Cancer Brachytherapy Implantation and the Impact on Local Recurrence and Disease-Free Survival in RTOG Prospective Trials 0116 and 0128	Viswanathan et al.	2012
Evaluation of quality indices during multifractionated pelvic interstitial brachytherapy for cervical cancer	Chopra et al.	2013
Role of Surgical Versus Clinical Staging in Chemoradiated FIGO Stage IIB-IVA Cervical Cancer Patients-Acute Toxicity and Treatment Quality of the Uterus-11 Multicenter Phase III Intergroup Trial of the German Radiation Oncology Group and the Gynecologic Cancer Group	Marnitz et al.	2015
Quality assurance in MR image guided adaptive brachytherapy for cervical cancer: Final results of the EMBRACE study dummy run	Kirisits et al.	2015
Patterns of radiation therapy practice for patients treated for intact cervical cancer in 2005 to 2007: a quality research in radiation oncology study	Eifel et al.	2013

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Intensity-modulated arc therapy with simultaneous integrated boost in the treatment of primary irresectable cervical cancer. Treatment planning, quality control, and clinical implementation	Vandecasteele et al.	2009
OVARIAN CANCER		
Development of ovarian cancer surgery quality indicators using a modified Delphi approach	Gagliardi et al.	2005
EORTC–GCG process quality indicators for ovarian cancer surgery	Verleye et al.	2008
Advanced (stage iii-iv) ovarian cancer surgery quality indicators*	ESGO	
Quality Improvement in the Surgical Approach to Advanced Ovarian Cancer: The Mayo Clinic Experience	Aletti et al.	2009
Setting the bar: compliance with ovarian cancer quality indicators at a National Cancer Institute-designated Comprehensive Cancer Center	Liang et al.	2015
Evaluation of Society of Gynecologic Oncologists (SGO) ovarian cancer quality surgical measures	Gogoi et al.	2012
Observed-to-expected ratio for adherence to treatment guidelines as a quality of care indicator for ovarian cancer	Galvan-Turner et al.	2015
European Society of Gynaecologic Oncology Quality Indicators for Advanced Ovarian Cancer Surgery	Querleu et al.	2016
Reporting 'Denominator' data is essential for benchmarking and quality standards in ovarian cancer	Philips et al.	2017
Quality control in ovarian cancer surgery	Aletti et al.	2016
Adherence to Treatment Guidelines for Ovarian Cancer as a Measure of Quality Care	Bristow et al.	2013
Association of Hospital Volume and Quality of Care With Survival for Ovarian Cancer	Wright et al.	2017
Quality indicators in ovarian cancer surgery: Report from the French Society of Gynecologic Oncology	Querleu et al.	2013
A new frontier for quality of care in gynecologic oncology surgery: Multi-institutional assessment of short-term outcomes for ovarian cancer using a risk-adjusted model	Aletti et al.	2007
Hospital readmission after ovarian cancer surgery: Are we measuring surgical quality?	Barber et al.	2017
Impact of a structured quality management program on surgical outcome in primary advanced ovarian cancer	Harter et al.	2011

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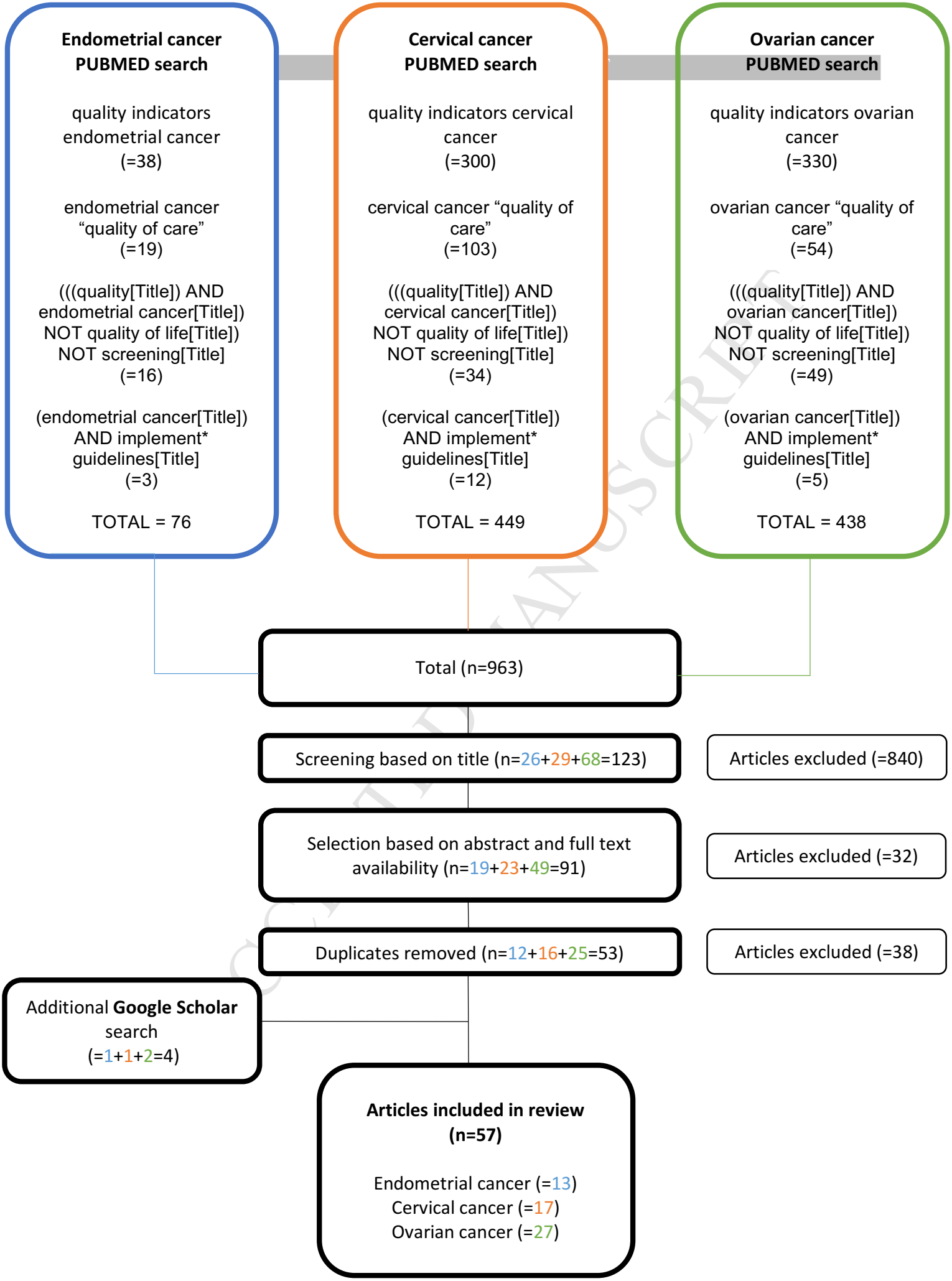
Ovarian Cancer Clinical Quality Performance Indicators*	Scottish Cancer Taskforce	2016
Quality control in ovarian cancer surgery	Hacker et al.	2011
Quality of pathology reports for advanced ovarian cancer: Are we missing essential information?	Verleye et al.	2010
Better resource utilisation and quality of care for ovarian cancer patients using internet-based pathology review	Kommoss et al.	2016
Quality of care in advanced ovarian cancer: The importance of provider specialty	Mercado et al.	2010
Surgical readmission and survival in women with ovarian cancer: Are short-term quality metrics incentivizing decreased long-term survival?	Barber et al.	2017
Integrated care in ovarian cancer "IgV Ovar": results of a German pilot for higher quality in treatment of ovarian cancer	Keyver-Paik et al.	2016
Does a Standardized Preoperative Algorithm of Clinical Data Improve Outcomes in Patients With Ovarian Cancer? A Quality Improvement Project	Shah et al.	2015
Clinical governance network for clinical audit to improve quality in epithelial ovarian cancer management	Mandato et al.	2013
Influence of Department Volume on Survival for Ovarian Cancer: Results From a Prospective Quality Assurance Program of the Austrian Association for Gynecologic Oncology	Marth et al.	2009
Quality control in the surgical management of ovarian cancer patients	Barton et al.	2009

* *Articles retrieved from Google Scholar*


Endometrial cancer
PUBMED search
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(=38)
endometrial cancer "quality of care"
(=19)
(((quality[Title]) AND endometrial cancer[Title]) NOT quality of life[Title]) NOT screening[Title]
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(=3)
TOTAL = 76
Cervical cancer
PUBMED search
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(=300)
cervical cancer "quality of care"
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(=12)
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Ovarian cancer
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(=5)
TOTAL = 438
Total (n=963)
Screening based on title (n=26+29+68=123)
Articles excluded (=840)
Selection based on abstract and full text availability (n=19+23+49=91)
Articles excluded (=32)
Duplicates removed (n=12+16+25=53)
Articles excluded (=38)
Additional Google Scholar search
(=1+1+2=4)
Articles included in review
(n=57)
Endometrial cancer (=13)
Cervical cancer (=17)
Ovarian cancer (=27)