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Clinical implementation of routine diagnostic laparoscopy to guide initial treatment in patients with advanced-stage epithelial ovarian cancer in Dutch clinical practice: Evaluation of support and a budget impact analysis

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HIGHLIGHTS

- Laparoscopy use to guide treatment regime in patients with ovarian carcinoma increased from 16% to 20% in the Netherlands.
- Routine implementation of the laparoscopy to guide treatment regime was not supported by the majority of the hospitals.
- Reasons for limited support were logistic barriers, its invasive nature and the availability of non-invasive diagnostics.
- The slight increase in laparoscopy use did not have a large impact on Dutch national health care budget.
- It is advised that the laparoscopy is useful in case it is uncertain whether a successful primary cytoreduction is feasible.

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ABSTRACT

Objective. In patients with advanced-stage epithelial ovarian cancer (EOC), a diagnostic laparoscopy (DLS) to determine treatment regime prevents futile laparotomies and seems cost-neutral. The uptake of DLS in current practice is unknown. We evaluated the clinical application of routine DLS in treatment planning in patients with advanced-stage EOC in the Netherlands.

Methods. The implementation was evaluated over the period 2017–2019, using a health technology assessment including clinical, organizational, and economic factors. Barriers for implementation were identified and DLS use was assessed using semi-structured surveys with healthcare professionals. Data from the Dutch Gynecological Oncology Audit were used to determine (un)successful CRS rates. To assess the economic impact, we performed a budget impact analysis (BIA) of the combined interventions of DLS and primary CRS.

Results. The DLS use to guide treatment planning increased from 16% to 20%. The majority of the centers did not support routine DLS implementation, mainly because of logistic barriers and its invasive nature. The primary CRS rate of all CRS decreased from 44% to 36%, in favor of interval CRS. The unsuccessful primary CRS rate decreased from 15% to 9% resulting in fewer patients needed a second interval CRS. Consequently, total health care costs decreased from €4.457.496 to €4.274.751.

Abbreviations: BIA, Budgetimpact analysis; CEA, Cost-effectiveness analysis; DGOA, Dutch Gynecological Oncology Audit; CRS, Cytoreductive surgery; CT-scan, Computed Tomography scan; DLS, Diagnostic laparoscopy; EOC, Epithelial ovarian cancer; FIGO, Fédération Internationale de Gynécologie et d'Obstétrique; HTA, Health technology assessment; NACT, Neo-adjuvant chemotherapy; MRI, Magnetic resonance imaging; PET, Positron emission tomography; DSA, Deterministic sensitivity analyses; NZa, Dutch Health Care Authority.

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Conclusions. The implementation of routine DLS for guiding treatment planning in patients with advanced-stage EOC has limited support in the Netherlands. Over the years, total health care costs decreased. For current practice, it is advised that a DLS is useful in case it is uncertain whether a successful primary CRS is feasible based on conventional work-up.

1. Background

Several studies showed the non-inferiority of neo-adjuvant chemotherapy (NACT) followed by interval cytoreductive surgery (CRS) compared to primary CRS followed by adjuvant chemotherapy with regards to overall survival and progression-free survival of advanced-stage epithelial ovarian cancer (EOC) (1,2). However, a post-hoc analysis showed that primary CRS results in the best survival in a subgroup of patients with stage IIIC disease with metastatic tumor up to 45 mm (3,4). Therefore, it is important to identify patients with extensive disease in whom it is unlikely to achieve a successful (<1 cm residual disease) primary CRS or preferably, to achieve no macroscopic residual disease. A systematic review showed a negative predictive value of the diagnostic laparoscopy (DLS) in predicting a successful primary CRS of 69–100% (5). The negative predictive value is defined as patients in whom a successful primary CRS was achieved, divided by all patients in whom a successful primary CRS was predicted based on findings of a DLS. This review included only one randomized controlled trial (6). In this multicenter, Dutch trial, called the Lapovca-trial (trial number: NTR2644), patients with suspected advanced-stage ovarian cancer in whom a successful primary CRS was considered feasible according to conventional workup, were randomized to undergo either directly a primary CRS or a DLS to assess the abdomen. The findings at DLS were used in the decision to start with either primary CRS or NACT followed by interval CRS. This study showed the benefits of routine DLS before planned primary CRS, since the number of futile laparotomies (>1 cm residual disease) was significantly lower in the DLS group (10 out of 102 patients, 10%) compared to the primary surgery group (39 out of 99 patients, 39%). Based on this clinical trial, a cost-effectiveness analysis (CEA) was performed to support coverage decisions (7). The CEA showed that the use of the DLS did not result in extra costs, as the laparoscopy costs were compensated by the decrease in number of futile laparotomies. In addition, the difference in observed effectiveness, described as Quality Adjusted Life Years, between the DLS group and the primary CRS group was almost similar (difference of 0.01). Based on the results of the Lapovca-trial and the CEA, it was concluded that performing a DLS to guide treatment decisions prevents futile laparotomies and is cost-neutral. Following the publication of this trial, an implementation study was initiated and the evidence-based Dutch guidelines were adjusted using the AGREE (Appraisal of Guidelines Research and Evaluation) method (8). Health Technology Assessment (HTA) plays an important role in the support for and evaluation of the implementation of a new healthcare intervention and takes into account the clinical, organizational, and economical aspects for coverage decision. Therefore, this study aimed to evaluate the implementation of a routine DLS in the diagnostic work-up of patients with suspicion of advanced-stage EOC, using an HTA framework.

2. Methods

For the HTA, clinical, organizational, and economic domains were included to evaluate the routine DLS in the diagnostic work-up of patients with suspected advanced-stage EOC.

2.1. Clinical domain

We evaluated the use of a DLS to guide initial treatment and the number of (unsuccessful) primary and interval CRS procedures in patients with suspected advanced-stage EOC in the Netherlands between 2017 and 2019. The results of the Lapovca-trial were published in 2017. The majority of the hospitals in the Netherlands that perform cytoreductive surgery for advanced-stage EOC participated in this trial. The DLS was already used in clinical practice and the results of the trial were discussed at (inter)national meetings shortly after publication. Therefore, we expect that in 2019, data on the use of the DLS would accurately reflect the uptake of the Lapovca-trial results in clinical practice. To put this in perspective, we additionally collected data on the conventional diagnostic work-up of patients with advanced-stage EOC for baseline characteristics.

For these evaluations, we created a semi-structured survey (Supplementary File 3) which was sent to 23 gynecologic-oncology teams that represent the surgical EOC care in the Netherlands and we used data from the Dutch Gynecological Oncology Audit (DGOA) (9). The DGOA is a population-based and prospectively maintained quality registry, facilitated by the Dutch Institute for Clinical Auditing, that contains reliable, detailed clinical data of all patients with any form of therapy for gynecological malignancies in the Netherlands (10). In addition to this survey and data from the DGOA, we asked the centers to provide data concerning the numbers of primary CRS and on the use of the DLS in 2017 and 2019.

2.2. Organizational domain

Potential barriers for the implementation of a routine DLS were evaluated by using the same semi-structured surveys as mentioned in the Clinical domain section. Health care professionals were asked about their view on a routine DLS implementation and which procedure-specific and logistic barriers they expect to occur when the DLS would be routinely implemented.

2.3. Economic domain

We conducted a budget impact analysis (BIA) according to the ISPOR guidelines (The Professional Society for Health Economics and Outcomes Research), to determine the impact of routine DLS implementation on the Dutch national budget (11). We did not include implementation costs itself, because the DLS was already used in clinical practice and therefore, we did not expect substantial extra costs for routine implementation of the procedure itself.

2.3.1. Description of budget impact model

The BIA model is presented in Fig. 1. In this model, we present the situations of 2017, 2019, and 2022. The target population consisted of patients with advanced-stage EOC (FIGO stage IIB-IV) who were eligible for primary CRS based on conventional work-up (thus, without the laparoscopy). The model is based on the combined interventions DLS followed by either primary CRS or NACT, versus no laparoscopy and only primary CRS. In the model, the number of computed tomography (CT) scans and consultations with a gynecologic-oncologist as part of the diagnostic work-up were included. In addition, we included the number of patients who underwent NACT and interval CRS after DLS and the number of second interval CRS after an unsuccessful primary CRS. We assumed that all patients with an unsuccessful primary CRS had the intention of being treated with NACT followed by interval CRS. Therefore, these patients had one extra CT scan and one extra

Fig. 1. Budget Impact Model including the components of the ISPOR (The Professional Society for Health Economics and Outcomes Research) framework. [a]Patients planned for primary CRS was calculated using the number of performed primary CRS (Source: DGOA), the percentage of patients who had a DLS before planned PCS (Source: survey), and the percentage of patients who continued with primary CRS based on DLS findings (Source: Lapovca-trial). [b]Other CRS and DLS specifics (not included in this figure): the percentage of patients who underwent an interval CRS after was decided to start with NACT based on DLS findings was 85% (assumption) and the percentage of a second interval CRS after an unsuccessful primary CRS was 70% (assumption), and was for all scenario's the same. The percentage of DLS performed in a separate session was 67% in 2017 and 81% in 2019 and 2022 (source: survey). [c]The percentage of patients who underwent directly primary CRS (thus without a DLS) of all patients who were planned for primary CRS ("Target population"). [d]The percentage of patients who underwent first a DLS to guide treatment decision relative to all patients who were planned for primary CRS ("Target population"). [e]Patients who had >1 cm residual disease after primary CRS. This reflects the rate of all patients who underwent a primary CRS, because the unsuccessful primary CRS rate was not separately available for patients with or without a DLS before primary CRS. Inflation details are not included in this figure, but more details about the input parameters are presented in Table 1. CRS: cytoreductive surgery; FIGO: Fédération Internationale de Gynécologie et d'Obstétrique; OC: ovarian carcinoma; DLS: diagnostic laparoscopy.

consultation by a gynecologic-oncologist for chemotherapy response assessment compared to patients who had a successful primary CRS. Data on length of hospital admission for a CRS procedure and a DLS were also included. We did not include the number of patients who started with NACT based on conventional work-up, because this number is not affected by the use of the DLS in this setting.

Data input was based on the results of the semi-structured survey (see Clinical domain), data from the DGOA registry, data from the Lapovca-trial, and the Dutch ovarian cancer incidence data (12).

The cost prices and sources used for the included costs units are presented in Table 1. Medical costs were presented in Euros (€). The reference prices (average unit costs) from "the Dutch manual for cost analyses, methods and standard prices for economic evaluation in health care" were used as source (13). When a reference price was not available for a specific subject, the maximum tariffs set by the Dutch Health Care Authority (NZa) were used or an internal cost-price investigation at the Netherlands Cancer Institute was conducted (14).

2.3.2. Sensitivity analyses

The model structure and input parameters were based on several assumptions and are, as a consequence, associated with a level of uncertainty. For this reason and to evaluate the impact of each variable on the total health care costs, a deterministic sensitivity analysis (DSA) was performed for 2022. The parameters included in this DSA are presented in Table 2.

3. Results

3.1. Semi-structured survey response

Thirteen of the 23 centers (57%) completed the semi-structured survey, three centers (13%) partly completed the survey and seven centers (30%) did not respond to the survey. Complete data on the number of primary CRS and on the use of DLS were provided by 15 centers.

The complete semi-structured survey results are presented in Supplementary File 4.

3.2. Clinical domain

3.2.1. Conventional diagnostic work-up

Besides medical history, physical examination, and ultrasound, 100% (14 out of 14) of the centers used Cancer Antigen 125, Carcinoembryonic Antigen, and CT-scan of the chest and abdomen in the conventional work-up of patients with EOC. Chest X-ray and Cancer Antigen 19.9 were used by 21% (3 out of 14) of the centers. Pre-treatment cytology and histology were applied in 36% (5 out of 14) of the centers in the work-up of suspected stage II EOC and in 71% (10 out of 14) of the centers in the work-up of suspected stage III-IV EOC. Magnetic resonance imaging (MRI) and Positron Emission Tomography (PET)/CT were not routinely used in the diagnostic work-up of EOC. The following factors were considered as decisive factors for the start of NACT instead of primary CRS: poor clinical condition (85%, 11 out of 13 centers), suspicion

Table 1
Overview of costs and input parameters for the Budget Impact Analysis.

Costs, for all scenario's	Unitcosts			Source
Laparotomy (primary or interval CRS), per surgery	€10.000[a]			Internal cost-price investigation
Laparoscopy in the same session as primary CRS, per surgery	€1.245[b]			Internal cost-price investigation
Laparoscopy in separate session than planned primary CRS, per surgery	€2.075			Internal cost-price investigation
CT-scan chest/abdomen, per investigation	€162			NZa (13)
Hospital admission, per day (no ICU admission)	€642			Hakkaart et al. (13)
Consultation by a gynecologic-oncologist	€162			Hakkaart et al. (13)
Input parameters separated for each scenario	**2017**	**2019**	**2022**	**Source**
Number of performed (primary and interval) CRS	625	709	709	DGOA (10)
% primary CRS of all performed CRS	44%	36%	36%	DGOA (10)
% unsuccessful[c] primary CRS of all performed primary CRS	15%	9%	9%	DGOA (10)
% DLS before planned primary CRS	16%	20%	20%	Survey
% DLS planned in separate session than planned primary CRS	67%	81%	81%	Survey
% patients who continued with primary CRS after DLS	62%	62%	62%	Lapovca-trial (6)
% patients who had an interval CRS after starting with NACT[d]	85%	85%	85%	Assumption
% patients who had interval CRS after an unsuccessful primary CRS[e]	70%	70%	70%	Assumption
Median days of hospital admission for CRS	6	6	6	DGOA (10)
Median days of hospital admission for a DLS[f]	1	1	1	Assumption
Price index	95.7	100.0	103.2[g]	(19)

CRS: cytoreductive surgery; CT: computed tomography; DLS: diagnostic laparoscopy; ICU: Intensive Care Unit; NACT: neo-adjuvant chemotherapy.
[a] Including cytoreductive surgery, abdominal uterus extirpation, bilateral salpingo-oophorectomy, and omentectomy.
[b] Discount of 40% compared to a laparoscopy planned in a separate session, because of reduced overhead costs. Discount only applicable when based on DLS findings it is decided to continue with primary CRS.
[c] >1 cm residual disease.
[d] These patients started with NACT based on findings during DLS.
[e] These patients started with NACT after an unsuccessful primary CRS.
[f] Only applicable for DLS performed in a separate session than the planned primary CRS or when the DLS was planned in the same session and the primary CRS was abandoned based on DLS findings.
[g] Inflation rate based on average inflation index in the period of 2015–2019.

of extended disease involving intra-abdominal organs like liver, spleen, and intestines on CT-scan (85%, 11 out of 13 centers), the presence of pathological lymph nodes above the renal veins on CT-scan (85%, 11 out of 13 centers) and suspicion of extended disease involving the mesentery of the small intestines (100%, 13 out of 13 centers). In contrast to the above-mentioned factors, increased age (ranging from 70 to 80 years), the presence of an immobile intra-abdominal mass, presence of ascites (with or without paracentesis for symptom relief), and theatre capacity were no decisive factors to abandon primary CRS.

3.2.2. Numbers of performed CRS procedures and the use of DLS

Numbers on CRS and the use of DLS are presented in Table 3. The numbers on primary CRS and the use of DLS per center that participated in this implementation project, are presented in Supplementary File 1, Figs. S1 – S3.

Of all executed (primary or interval) CRS, the percentage of primary CRS decreased from 44% (275 out of 625) in 2017 to 36% (257 out of 709) in 2019 in favor of interval CRS's. The unsuccessful primary CRS rate dropped from 15% (40 out of 275) in 2017 to 9% (22 out of 257) in 2019. For the interval CRS, the unsuccessful CRS rates remained stable with rates of 10% (36 out of 350) and 11% (52 out of 452) in 2017 and 2019 respectively.

The use of the DLS to guide initial treatment planning increased from 16% in 2017 to 20% in 2019. There were no new hospitals that started with using the DLS after 2017. In 2017, 67% of the centers indicated that the DLS was mainly performed in a separate theatre session than the primary CRS. In 2019, this percentage increased to 81% of the centers. All centers indicated that the DLS and the CRS procedures were performed in the same hospital.

Table 2
Deterministic sensitivity analyses of the budget impact analysis for 2022. The percentages reflect the increase or decrease compared to the values used for the base case analysis.

	Min	Max
Planning of DLS in separate session than planned primary CRS[a]	−20%	+19%[b]
Costs of a CRS	−20%	+20%
Median hospitalization days for CRS	Lower quartile, 5	Upper quartile, 8
Unsuccessful primary CRS[c] rate	−5%[b]	+20%

CRS: cytoreductive surgery; DLS: diagnostic laparoscopy; NACT: neoadjuvant chemotherapy.
[a] Performing the DLS in the same session leads to reduction of overheadcosts.
[b] For these variables, it was not possible reduce or increase by 20% compared to the base case value, as this would lead to respectively a negative value or a value of more than 100%.
[c] >1 cm residual disease.

3.3. Organizational domain

In this study, we found that the implementation of routine DLS was limited, and therefore, we found a need to evaluate potential barriers for the implementation.

Eleven out of thirteen hospitals (85%) had a (partly) negative view on the routine implementation of the DLS. These hospitals indicated that DLS is an invasive procedure and does not always predict correctly surgical outcome. In addition, centers also indicated that other (non-invasive) diagnostics provide sufficient information for clinical decision-making. Therefore, routine implementation of the DLS was considered of limited additional value. Instead, 31% of the centers (4 out of 13) indicated that the DLS was rarely used in the work-up and 62% (8 out of 13) indicated that the DLS was saved for patients in whom it was uncertain whether a successful primary CRS is feasible based on conventional workup.

Besides procedure-specific barriers, 69% (9 out of 13) of the centers also expect to face logistic barriers in case of routine implementation. The centers indicated that more operation time is needed while the operation theatre capacity is limited. In addition, they also indicated that when a primary CRS is feasible based on DLS findings, it is preferable that the primary CRS is scheduled on short notice which could also be a logistic challenge.

Table 3
Numbers of performed cytoreductive surgeries and laparoscopies before planned primary cytoreductive surgery in 2017 and 2019 in Dutch centers that provide surgical treatment for patients with ovarian cancer.

	2017		2019		Source
Timing of CRS					
Primary CRS	275	44%	257	36%	DGOA (10)
Interval CRS	350	56%	452	64%	DGOA (10)
Surgical outcome					
Successful primary CRS	234	85%	225	87%	DGOA (10)
Complete primary CRS[a]	186	68%	201	78%	DGOA (10)
Optimal primary CRS[b]	48	17%	24	9%	DGOA (10)
Unsuccessful primary CRS	40	15%	22	9%	DGOA (10)
Missing	1	0%	10	4%	DGOA (10)
Successful interval CRS	313	89%	396	88%	DGOA (10)
Complete interval CRS	221	63%	306	68%	DGOA (10)
Optimal interval CRS	92	26%	90	20%	DGOA (10)
Unsuccessful interval CRS	36	10%	52	11%	DGOA (10)
Missing	1	0%	4	1%	DGOA (10)
Use of diagnostic laparoscopy[c]					
DLS used before planned primary CRS	16%		20%		Survey
Laparoscopy planned in separate session than primary CRS	67%		81%		Survey
Laparoscopy planned in the same session as primary CRS	33%		19%		Survey

CRS: cytoreductive surgery; DLS: diagnostic laparoscopy.
[a] No macroscopic residual disease.
[b] <1 cm residual disease.
[c] Based on data provided by 15 Dutch centers that provide surgical treatment for patients with ovarian cancer (see also Supplementary File 1, Figs. S1–S3).

3.4. Economic domain

3.4.1. Resource utilization

The input parameters with the corresponding sources are presented in Table 2 and the CRS data from the DGOA registry for the period 2017–2020 are presented in Supplementary File 2, Table S1.

As we do not expect a significant change in incidence of number of both primary and interval CRS-procedures, we assumed the same number in 2022 as in 2019 ($n = 709$). Decreasing trends in percentage of primary CRS, in favor of interval CRS, and in percentage of unsuccessful primary CRS were observed. However, due to the COVID pandemic, initial treatment with NACT may have been chosen more frequently in 2020 compared to 2019. Therefore, these numbers may not reflect clinical practice under normal circumstances. For this reason, we assumed the same percentages primary CRS and unsuccessful primary CRS rate for 2022 as in 2019 (respectively 36% and 9%).

Based on the survey, the percentage of DLS to decide on primary CRS increased from 16% in 2017 to 20% in 2019. However, based on the results of the survey, we do not expect this rate to increase further in 2022 since the observed lack of support to implement the DLS routinely (see also Clinical and Organizational Domain of the Results).

The following variables were also not expected to change in 2022 compared to 2019: the rate of DLS performed in a separate session as the planned primary CRS, the rate of patients who continued with primary CRS after DLS, the rate of patients who had an interval CRS after unsuccessful primary CRS or following NACT and the incidence of EOC in the Netherlands.

Based on data from the DGOA registry, the median length of hospital stay for CRS was six days (interquartile range Q1 - Q3: 5–8 days). Subsequently, we calculated a length of hospital stay of six days for all scenarios of CRS regardless of surgical outcome plus one day when the DLS was conducted in a separate session.

3.4.2. Total health care costs

The results of the base case analysis are shown in the BIA model presented in Fig. 1.

Total costs were €4.457.496 in 2017, €4.274.751 in 2019, and estimated to be €4.411.543 in 2022. The differences in total costs were €-182.745 between 2017 and 2019, and €136.792 between 2019 and 2022. The decrease in total costs between 2017 and 2019 was primarily caused by the decrease in number of primary CRS, in favor of interval CRS. Secondly, the number of unsuccessful primary CRS decreased, leading to fewer patients needing a second interval CRS. As almost all variables were assumed the same in 2022 as they were in 2019, the estimated increase in total costs between 2019 and 2022 was caused by the assumed national economic inflation.

3.4.3. Deterministic sensitivity analyses (DSA) for the scenario of 2022

The DSA for the scenario of 2022 resulted in assumed total health care costs ranging from €3.812.224 (minus €599.000 compared to base case value) to €5.010.862 (plus €599.000 compared to base case value). The variability in costs for cytoreductive surgery had the largest impact on the total health care costs. The 20% increase in unsuccessful primary CRS rate had the second-largest impact leading to an increase in total health care costs to €4.963.541 (plus €552.000). The variability in the number of DLS performed in a separate session than the primary CRS had the lowest impact on the total health care costs. The results of the DSA are shown in the tornado diagrams in Figs. 2 and 3.

4. Discussion

We evaluated the clinical implementation of a routine DLS to guide initial treatment in patients with advanced-stage EOC in the Netherlands. The rate of DLS to guide treatment planning increased minimally from 16% in 2017 to 20% in 2019. The support for routine implementation of the DLS is limited, despite the positive and promising results of the Lapovca-trial. Despite the limited use of the DLS, the unsuccessful primary CRS rates were low and decreased from 15% in 2017 to 9% in 2019.

This could be explained by the centralization of care for patients with EOC in the Netherlands (15). As a consequence, multidisciplinary teams of the dedicated ovarian cancer hospitals gained more experience in selecting patients with advanced-stage EOC for initial treatment. This presumably led to a better selection of patients suitable for primary CRS and subsequently, resulted in a reduced number of unsuccessful primary CRS. Another effect of centralizing this care is that more patients underwent surgery by experienced teams, which also resulted in a lower number of unsuccessful CRS rates. In addition, our results showed

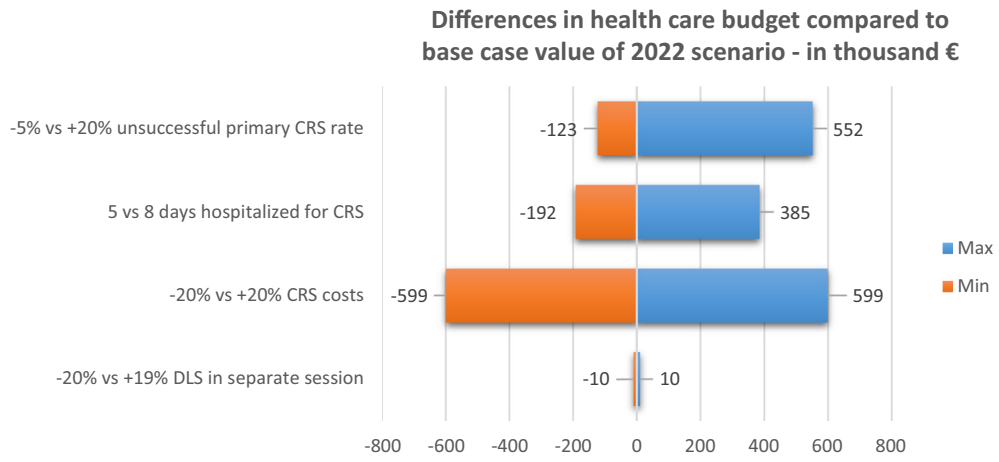

Fig. 2. Tornado diagram showing deterministic sensitivity analyses results of the 2022 scenario. Base case values were €4.411.543 for total health care costs. CRS: cytoreductive surgery; DLS: diagnostic laparoscopy

that the number of primary CRS decreased, in favor of interval CRS. This shift could possibly be explained by results from randomized controlled trials that failed to show a difference in survival between patients who underwent a primary CRS and patients who started with NACT (16). Therefore, it can be assumed that in 2019, this influenced the treatment strategy for patients with advanced-stage EOC in favor of neo-adjuvant chemotherapy instead of primary CRS.

Centers indicated multiple reasons for the limited support of the routine DLS implementation, despite the negative predictive value of 69–100% to predict surgical outcome (5). One reason is that DLS, which is an invasive procedure, is not regarded as a golden standard to predict surgical outcomes. Non-invasive diagnostics like CT-scan or the potential future diagnostic diffusion-weighted MRI (DW-MRI) are indicated as good alternatives (17). Another reason which hampers the routine implementation of DLS are logistic challenges, in relation to the limited theatre capacity. When DLS is performed in a separate session, more theatre time and hospital admission time are needed. When DLS and primary CRS are planned in one session, the primary CRS might be abandoned based on findings discovered during the DLS. Both situations lead to less efficient use of theatre and admission capacity.

From an economic perspective, total health care costs decreased between 2017 and 2019, primarily caused by a reduced number of primary CRS, in favor of interval CRS. However, we did not include the costs of patients who underwent interval CRS based on conventional work-up. Therefore, it is expected that the decrease in costs between 2017 and 2019 will be mainly compensated by the increased costs for interval CRS. We expected that a substantial increase in DLS would result in only a small decrease in unsuccessful primary CRS, as this rate is already low with the current limited use of the DLS. Therefore, in contrast to what was observed in the CEA of van de Vrie et al., the laparoscopy costs of routine DLS will not be fully compensated by the decrease in the number of laparotomies per patient (7). As a consequence, routine DLS seems not economically beneficial and therefore, implementation of routine DLS will most likely not result in lower health care costs.

Lastly, another limiting factor of gaining trust in the use of a DLS during diagnostic work-up for patients with a suspected advanced-stage EOC is the lack of a standardized assessment during DLS such as advocated by Fagotti et al. (18,19). This could make the assessment less subjective and more reliable. In addition, the majority of the hospitals indicated that DLS is mainly used in patients in whom it is uncertain whether a primary CRS is feasible based on conventional work-up. However, selection criteria to assess surgical resectability are not standardized and differ among hospitals. A standardized protocol to identify patients in whom the use of DLS would be beneficial to guide initial treatment in patients with advanced-stage EOC would be helpful.

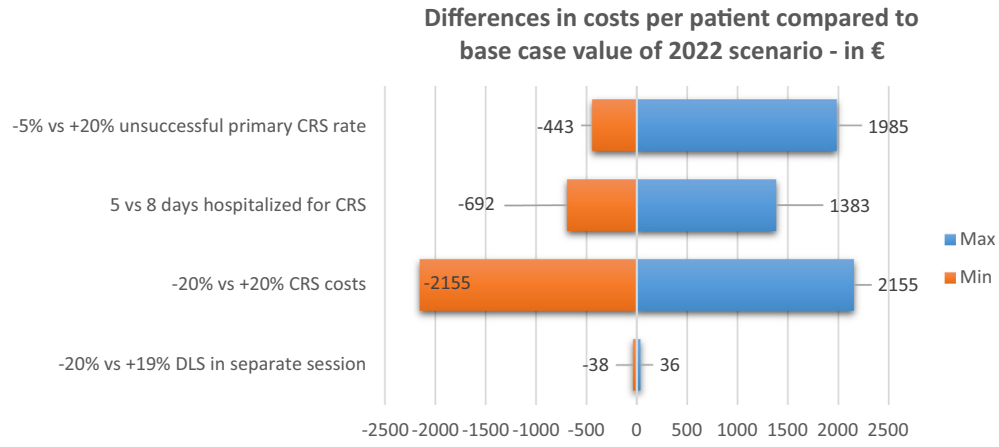

Fig. 3. Tornado diagram showing deterministic sensitivity analyses results of the 2022scenario. Base case values were €15.861 for health care costs per patient. CRS: cytoreductive surgery; DLS: diagnostic laparoscopy.

A limitation of the evaluation of the implementation of routine DLS is a complete response rate to the survey of only 57% of the centers and information on the use of the DLS was available from only 65% of the centers that provide surgical care for EOC. However, despite these relative low response rate, we expect our results to be representative of the entire surgical EOC care organization in the Netherlands.

In conclusion, we found that, despite the favorable results from literature, the support to implement routine DLS to guide initial treatment in patients with advanced-stage EOC is limited in the Netherlands. One reason is the centralization of surgical care for EOC which already resulted in a more appropriate selection of patients suitable for primary CRS based on conventional workup. Other reasons are the expected logistic barriers in the planning of surgery, the availability of other well-performing non-invasive diagnostics, and the experience that predicting surgical outcomes based on findings during DLS is not foolproof. Possibly because there is no standardized protocol used to assess the abdomen. The slight increase in DLS use from 2017 to 2019 did not have a large impact on the Dutch national health care budget. Currently, the DLS is mainly used in patients in whom it is uncertain whether a successful primary CRS is feasible based on conventional workup. Based on our findings, we consider this strategy to be the proper application of the DLS in guiding initial treatment in patients with advanced-stage EOC for the Dutch situation.

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Author contributions statement

PL, KG and WvD designed the project and created the semi-structured survey. MA and MvG collected the data. PL and VR performed the budget impact analysis. PL wrote the manuscript in consultation with VR, KG and WvD. All authors provided critical feedback, helped shape the analysis and the manuscript.

Declaration of Competing Interest

All authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ygyno.2022.03.028.

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