Preoperative and Intraoperative Interventions for Enhanced Recovery after Gynecological Surgery

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A DNP Project Manuscript
Submitted in Partial Fulfillment of the Requirements for the
Doctor of Nursing Practice Degree

University of Maryland School of Nursing
May 2020

Abstract

Problem and Purpose: Surgery causes a neuroendocrine and inflammatory stress response on the body that impairs hemostasis (Carli, 2015). Often, many of the interventions implemented during the perioperative care of patients are not evidence-based but rather due to dogmatic traditions. Enhanced recovery after surgery (ERAS) programs consist of evidence-based interventions implemented during the preoperative, intraoperative, and postoperative phases of surgery. Researchers have found that ERAS programs lead to a reduction in hospital length of stay, cost, and complications (Nelson et. al., 2016). At a community hospital in the mid-Atlantic region, anesthesia providers sought ways in which hospital length of stay and complications can be reduced in patients undergoing GYN surgery. In addition, GYN surgery is one of the most frequent types of surgical procedures performed at this institution. The purpose of this quality improvement project was to develop a clinical practice guideline (CPG) regarding ERAS for GYN surgery in order to optimize the perioperative care of patients.

Methods: An expert panel was formed consisting of the chief nurse anesthetist and anesthesiologist of the institution. A need for an ERAS CPG was established based on several meetings with key stakeholders. A literature review was conducted to develop the CPG and a draft was presented to the expert panel. Next, a Non-Human Subjects Research (NHSR) review was sought from the Institutional Review Board at the University of Maryland. The Agree II Tool was utilized by the expert panel to evaluate the quality of the CPG. Feedback from the expert panel was then incorporated into the final draft. The CPG was presented to the anesthesia providers of the institution. Practitioner Feedback Questionnaires (PFQs) were distributed and anonymously collected at the end of the presentation. A descriptive statistical analysis was performed utilizing Microsoft Excel with the data obtained from the AGREE II Tool and PFQ surveys.

Results: The results of the AGREE II tool were favorable with an overall calculated total domain score of 92%. The individual total domain scores are as follows: scope and purpose 97.2%, stakeholder involvement 100%, rigour of development 87.5%, clarity of presentation 94%, applicability 92.9%, and editorial independence 89.6%. The return rate for the PFQ surveys was 100% (n=15). The PFQ survey results revealed that 100% of providers believed that there is a need for an ERAS CPG for GYN surgery, that its utilization will benefit patients, and that the draft guideline recommendations will be supported by other anesthesia providers of the institution. This is indicative of the usability and wide acceptance of the CPG by the facility.

Conclusion: Due to the favorable results of the AGREE II Tool and PFQ survey evaluations, it is evident that the developed ERAS CPG is of high quality and its use will be accepted at this institution.

Introduction

Some of the most common procedures performed in the United States (US) are a type of gynecological (GYN) surgery. According to McDermott, Freeman & Elixhauser (2017), approximately 237,500 hysterectomies, 254,500 tubal ligations and 182,400 oophorectomies were performed in 2014 which made up 13.5% of all operating room procedures. Furthermore, these surgical procedures ranked in the top 20 most frequent and costly operating room procedures performed in the US (McDermott et al., 2017). The mean healthcare costs for a hysterectomy ranges between $31,934 to $49,526 depending on the invasiveness of the surgery and the approach with which it is performed (Wright, Jonsdottir, Jorgensen, Shah & Einarsson, 2012). Hospital length of stay has been determined to have the greatest impact on healthcare costs (Harrison, Li, Guzman, Pitcher & Rodriguez-Restrepo et al., 2020). This illustrates the necessity for interventions that can help mitigate complications, expedite recovery, and improve patient outcomes.

Surgery induces major trauma to the body triggering a neuroendocrine and inflammatory stress response that leads to pain, ileus formation, hyperglycemia, muscle protein breakdown and ultimately impaired hemostasis (Carli, 2015). Often, many of the interventions implemented during the perioperative care of patients are not evidence-based but rather due to tradition. Enhanced recovery after surgery (ERAS) programs help hasten recovery by minimizing the surgical stress response through various evidenced based interventions implemented during the preoperative, intraoperative, and postoperative phases of surgery (Nelson et al., 2016). At a rural community hospital in the mid-Atlantic region, anesthesia providers sought ways in which hospital length of stay and complications could be reduced in patients undergoing GYN surgery. Inadequate pain control, delayed mobility, and post-operative nausea and vomiting (PONV) were

reported which impeded recovery. It was evident that this institution could benefit from an ERAS clinical practice guideline (CPG) to standardize and improve the quality of perioperative care provided to GYN surgical patients. Thus, the focus of this Quality Improvement (QI) project was on the development and approval of an ERAS CPG for GYN surgery at this hospital.

Literature Review

Insulin resistance has been identified as the main pathogenic culprit in the development of post-operative complications, and the perioperative elements that contribute to increased insulin resistance include fasting, pain, bedrest and fatigue (Carli, 2015). ERAS interventions have helped to reduce insulin resistance by promoting less dietary restrictions, improving postoperative pain control, and promoting early mobilization. The focus of this literature review was on the synthesis of ERAS components and its impact on patient outcomes. A total of six studies consisting of retrospective cohort studies, systematic reviews and meta-analyses, and a non-randomized controlled trial were included. The ERAS protocols examined in each study differed greatly in the number and types of interventions implemented. The review began with a synthesis of various preoperative and intraoperative ERAS interventions, and concluded with the overall impact that ERAS protocols have had on patient outcomes.

Preoperative interventions in the six studies reviewed included preoperative counseling, cessation of alcohol and smoking approximately 4 weeks prior to surgery, elimination of the routine use of bowel preps, less restrictive fasting guidelines, and the administration of non-opioid analgesics (Mendivil et al., 2018; Myriokefalitaki et al., 2015; Modesitt et al., 2017). Preoperative counseling helped to reduced fear and anxiety, and improved pain control (Modesitt et al., 2017; Kalogera et al., 2013). It involved the education of patients regarding ERAS interventions during every phase of surgery (Mendivil et al., 2018; Myriokefalitaki et al., 2015).

Differences existed in the formality of the education and whether or not the information was given verbally or in written form.

Many randomized clinical trials showed no benefit in the routine use of mechanical bowel prep as it often led to dehydration and it was not effective in reducing rates of infection and anastomotic leaks (Nelson et al., 2016). Allowing the consumption of clear liquids and a carbohydrate drink up to 2 hours and solids up to 6 hours before surgery helped reduce insulin resistance, nausea and vomiting, and improved well-being by minimizing feelings of hunger (Nelson et al., 2016; Myriokefalitaki et al., 2015). Included in two of the six studies were non opioid analgesics given preoperatively to help minimize the inflammatory stress response and reduce opioid consumption. Retrospective cohort studies by Kalogera et al. (2013) and Modesitt et al. (2017) administered Celecoxib, Gabapentin, and Acetaminophen to patients during the preoperative phase. Both of these studies reported a significant decrease in opioid consumption suggesting improved pain control (Kalogera et al., 2013; Modesitt et al., 2017).

Intraoperative interventions included in the studies were opioid sparing analgesic plans, antibiotic prophylaxis, the avoidance of nasogastric tubes, multimodal post-operative nausea and vomiting (PONV) prophylaxis, thromboprophylaxis, the maintenance of euvolemia, and normothermia (Mendivil et al., 2018; Myriokefalitaki et al., 2015; Modesitt et al., 2017; Groot et al., 2015; & Nelson et al., 2016). The differences in the studies were based on the implementation of the interventions. For instance, Modesitt et al. (2017) implemented the use of Lidocaine infusions, Ketamine, and Magnesium intraoperatively to help reduce opioid consumption, whereas, Kalogera et al. (2013) allowed the use of Hydromorphone IV at the discretion of the anesthesia provider who supplemented with Ketamine, Ketorolac, or both. Only two of the six studies, Myriokefalitaki et al. (2016) and Mendevil et al. (2018) implemented

transversus abdominis plane blocks in open abdominal procedures which were effective in reducing opioid consumption during the postoperative period. In regards to PONV prophylaxis, a multimodal approach utilizing 2 or more antiemetics were implemented as undergoing a GYN procedure was in itself a risk factor for PONV (Mendivil et al., 2018; Myriokefalitaki et al., 2015). Thromboprophylaxis was implemented by utilizing sequential compression devices and TED stockings, and euvolemia was maintained utilizing goal-directed fluid therapy (Mendivil et al., 2018; Myriokefalitaki et al., 2015).

Increased patient satisfaction, reduced hospital length of stay, and reduced hospitalization costs were all associated with the implementation of ERAS protocols for patients undergoing GYN surgery (Kalogera, Bakkum-Gamez, Jankowski, Trabuco, & Lovely et al., 2013). In regard to hospital length of stay and cost, all of the studies reported a reduction in mean length of stay of approximately 1-4 days and cost savings that ranged between $1000-$7600 per patient (Mendevil et al., 2018; Myriokefalitaki et al., 2015; Modesitt et al., 2017). Hospital length of stay was determined to have the greatest impact on cost of care (Harrison, Li, Guzman, Pitcher & Rodriguez-Restrepo (2020). Other positive patient outcomes identified were reductions in PONV and the earlier return of bowel motility (Nelson et al., 2016). These outcomes can be attributed to improved pain control as increased opioid consumption can lead to constipation, PONV, delayed mobility which ultimately impedes recovery (Nelson et al., 2016; Modesitt et al., 2017). Overall, this literature review supported the implementation of a CPG regarding ERAS for GYN surgery as it greatly improved patient care and reduced morbidities.

Theoretical Framework

The Change Theory developed by Kurt Lewin in the 1940s is a theoretical framework that was utilized for the implementation of this QI project (Burnes, 2004). This theory postulates

that there are three steps an organization must undertake in order for successful change to occur (Burnes, 2004). These steps are unfreezing, moving, and refreezing (Burnes, 2004). During the unfreezing phase, the stability of an organization or its common practice must be "disturbed" in order to change old practices and to adopt new practices (Burnes, 2004). Furthermore, for disequilibrium to take place, the driving forces that facilitate the change must overcome resisting forces (Burnes, 2004).

In applying this theory to the scholarly project, 'unfreezing' common practice was initiated by first obtaining support from key stake holders such as the GYN surgeons, anesthesia providers, and the nursing staff of the institution. The key stakeholders served as the driving forces of change that helped with the successful implementation of the CPG. An extensive literature review was conducted during the creation of a draft CPG that consisted of the latest evidence-based interventions regarding the perioperative care of patients undergoing gynecological surgery. It was presented to the anesthesia providers of the institution.

The 'moving phase' of Lewin's change theory involves the actual implementation of the CPG in the practice setting. To ease the transition, physician and nurse champions will be utilized to ensure providers and staff had adequate support with the new practice change. According to Lewin, the 'moving' phase involves allowing trial and error during the implementation process to help stakeholders transition from a place of resistance to acceptance of the change in practice (Burnes, 2004). The 'refreezing' phase of Lewin's change theory involves efforts to re-stabilize the organization in which the implementation of the ERAS CPG now becomes common practice in the institution. The change in practice and continued adherence to the CPG will be sustained via chart audits that will be conducted on a regular basis (Carmichael et al., 2017).

Methods

The ERAS CPG was developed for a 192-bed acute care facility in the mid-Atlantic region. This facility had 8 GYN surgeons that performed a multitude of surgeries such as hysterectomies, oophorectomies, and tubal ligations. The anesthesia team consisted of 22 CRNAs and anesthesiologists. The anesthesia providers served as the target population for the utilization of the CPG. The patient population of the ERAS CPG are women undergoing GYN surgery that are admitted to inpatient care. The development of this CPG occurred in four phases. In February 2019, staff buy-in was obtained from key stakeholders of the hospital including the chief anesthesiologist and the chief nurse anesthetist. These providers formed the expert panel. A meeting was held on July 25, 2019 with the chief nurse anesthetist to discuss the latest evidence regarding ERAS for GYN surgery and to present the first draft of the CPG. Phase two and three of this QI project consisted of ensuring the ERAS interventions included in the CPG fulfilled the specific needs of the hospital. The submission of the QI project proposal to the chief certified registered nurse anesthetist (CRNA) and the chair of the department of anesthesiology occurred on September 19, 2019. Further revisions were made after this meeting and the final draft was approved and presented on October 3, 2019. The final approval of the CPG was obtained on November 7, 2019.

Data was collected at two different time periods during this QI project. First, the revised version of the Appraisal of Guidelines for Research and Evaluation (AGREE II) tool was presented to the expert panel during phase two. The quality of the CPG was evaluated using this tool which was sent electronically via email. The Agree II tool is a quantitative measure of the quality of the development of clinical practice guidelines (Brouwers, Kho, Browman et al., 2010). It has undergone both validity and reliability testing and has sufficient inter-rater

reliability (Brouwers et al., 2010). It consists of 23 items categorized in 6 different domains including Scope and Purpose, Stakeholder Involvement, and Rigour of Development. These domains are scored based on a 7 point Likert scale ranging from "strongly agree" to "strongly disagree" (Brouwers et al., 2010). The Practitioner Feedback Questionnaire (PFQ) was utilized to evaluate the CPG in relation to its scientific quality, rigor of methodology, implementability, applicability, and acceptability of the CPG by the anesthesia providers (Brouwers, Graham, Hanna, Cameron & Browman, 2004). It was distributed and collected during phase 3. This questionnaire consists of 23 items and is scored based on a 3- point Likert scale.

Descriptive statistics were performed utilizing Microsoft Excel to analyze the results of the Agree II Tool, and PFQ surveys. Within each domain of the Agree II tool, a total domain score was calculated. For each domain, this value was then used to calculate a scaled total domain score utilizing the formula: (obtained score-minimum possible score)/(maximum possible score – minimum possible score)(Brouwers, Kho, Browman et al., 2010). These results were then discussed with the expert panel during phase two of the CPG development, and adjustments were made accordingly. The response rate of the returned PFQ surveys were calculated. The results of each returned PFQ were analyzed by adding the total number of "strongly agree" responses and dividing this by the total number of items to determine the percentage of agreement. The total percentage of agreement was then determined by calculating an average of each individual percentage of agreement. This DNP project received a Non-Human Subjects Research determination from the Institutional Review Board of the University of Maryland. Confidentiality was maintained by storing the results of the AGREE II Tool in a password protected computer and was only accessed by individuals involved in the project. The results of the PFQ surveys were stored in a locked file cabinet. All documents containing

information that threatened the confidentiality of participants was discarded at the conclusion of this project.

Results

A total of four AGREE II Tool evaluations were completed by the 4 members of the expert panel. The overall calculated domain score was favorable at 92%. The scores for the six domains of the AGREE II Tool were also favorable with the scope and purpose calculated to be 97.2%, stakeholder involvement 100%, rigor of development 87.5%, clarity of presentation 94%, applicability 92.9%, and editorial independence 89.6%. The expert panel recommended the utilization of the CPG by the institution after several modifications. This recommendation was obtained from the AGREE II tool evaluations.

A total of fifteen Practitioner Feedback Questionnaires were distributed and anonymously collected after the CPG presentation. The return rate for the PFQ surveys was 100%. The calculated percentage of agreement was 81% which is indicative of strong agreement. All of the anesthesia providers believed that there was a need for an ERAS CPG for GYN surgery at this facility and that recommendations would benefit patients. Approximately 66.7% of providers (10/15) felt that the draft recommendations were not too rigid to apply to patient care, and 33.3% (5/15) remained neutral. All of the anesthesia providers believed that the CPG would be accepted by their peers and should be approved as a practice guideline.

Discussion

Clinical practice guidelines are defined as, “systematically developed statements that intend to assist clinicians and patients in making decisions about appropriate health care in specific circumstances”(Murad, 2017, p 423). CPGs improve patient care by standardizing and encouraging the implementation of interventions that are based on evidence rather than dogmatic

traditions (Murad, 2017). The AGREE II Tool survey results suggest that the clinical practice guideline for GYN surgery is of high quality and the PFQ survey results reflect its usefulness and acceptability at this institution. In regards to the AGREE II survey results, the calculated domain score of the first domain, *Scope and Purpose*, was 97.2%. In working closely with the expert panel, the CPG was rigorously developed and the interventions were tailored specifically to this facility. This domain evaluates the specificity of the objectives and purpose of practice guidelines. *Stakeholder involvement* evaluates the degree with which the views and preferences of stakeholders are sought and the calculated domain score was 100%. Several discussions and meetings were conducted with the expert panel so as to ensure that the necessary revisions to the protocol were made based on their needs. In assessing the *Clarity* and *Applicability* of the CPG, the calculated domain scores were 94% and 92.9%, respectively. These scores reflect the appropriateness of the guideline recommendations for the target population.

The Practitioner Feedback Questionnaire evaluated the perceptions and attitudes of the anesthesia providers towards the CPG in regards to its scientific quality, rigor of methodological strategies, and ease of implementation. Further, it evaluated the applicability and acceptability of the recommendations by the anesthesia providers of the institution. The PFQ survey results revealed that 100% of providers believed that there is a need for an ERAS CPG for GYN surgery, that its utilization will benefit patients, and that the draft guideline recommendations will be supported by other anesthesia providers of the institution. This is indicative of the usability and acceptance of the CPG by the facility. Though the PFQ survey results were mostly favorable, only 66.7% of providers felt that the guideline recommendations were not too rigid to apply to practice, and 33.3% were neutral regarding the complexity of the intervention. This

result is not surprising as ERAS protocols are complex consisting of multiple interventions throughout the different phases of surgery.

Facilitators of the ERAS CPG included the expert panel and change champions. The expert panel provided the majority of the feedback regarding the ERAS components and the needs of the hospital. Change champions were recruited to help with the education and reinforcement of guideline recommendations to the anesthesia team. An unintended benefit of this QI project was the garnered interest from GYN surgeons to implement ERAS guided interventions. This QI project was initially intended for the anesthesia team. Barriers encountered include time restraints caused by other hospital initiatives that were being implemented simultaneously during the creation of the CPG.

Implications for practice includes the standard use of the CPG as a valuable resource for anesthesia providers when caring for GYN patients. This will standardize care and lead to several practice changes that are evidence based and have been shown to expedite recovery and improve patient outcomes. Suggestions for future practice include the development of an implementation program that unites the multiple disciplines involved in the perioperative care of these patients. Due to the multifaceted nature of ERAS guidelines, non-adherence to guidelines was found to be a frequent issue (Murad, 2017). Strategies such as periodic continued education programs, and the conducting chart audits have been shown to improve adherence (Murad, 2017).

One strength of this QI project was the inclusion of the expert panel during the creation of the CPG and assessing the attitudes and beliefs of the anesthesia providers towards the intervention via the PFQ survey. Believing that an intervention is beneficial for patients and having trust in the intervention helps ensure successful implementation (Ament, Gillissen,

Moser, Maessen & Dirkshen, 2016). Limitations of this project are inherent in its limited generalizability to other institutions. Because this CPG was developed in close conjunction with stakeholders, the interventions included in the guidelines are tailored specifically to this community hospital.

Conclusion

In conclusion, due to the favorable results of the AGREE II Tool and PFQ surveys, it is evident that the ERAS CPG is of high quality and its use is accepted within this GYN surgical unit. Enhanced recovery after surgery clinical practice guidelines improve and standardize the perioperative care of patients undergoing GYN surgery by minimizing the surgical stress response. When implemented together, these multimodal evidence-based interventions help expedite recovery leading to a reduction in hospital length of stay, cost, and complications without increasing readmission rates (Kalogera et. al., 2013). They improve the well-being of patients and increase patient satisfaction (Kalogera et. al, 2013). Due to the large volume of gynecological surgeries performed at this hospital, many patients will benefit from this intervention. Implications for future practice include measures to help ensure sustainability and compliance. Interventions such as chart audits, regular reporting of outcome measures, and extensive training and education will need to be provided to all health care team members involved to ensure consistency and sustainability.

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Appendix A Evidence Review Table

Author, year	Study objective/intervention or exposures compared	Design	Sample (N)	Outcomes studied (how measured)	Results	*Level and Quality Rating
Nelson, Altman, Nick, Meyer, & Ramirez (2016)	The aim of this clinical practice guideline was to review existing evidence and provide recommendations for enhanced recovery pathways for the preoperative and intraoperative care in gynecologic/oncology surgery.	Systematic review and meta-analysis of literature regarding enhanced recovery after gynecological/ oncological surgery.	The number of studies included in this review was not explicitly stated in the article. Meta analyses, systematic reviews, randomized controlled trials, non-randomized controlled studies, reviews, and case series were included.	The outcomes in this clinical practice guideline were to determine the quality of evidence of interventions in the preoperative and intraoperative phase of gynecological surgery and whether to recommend their implementation in the clinical setting. The quality of the evidence and recommendation were evaluated utilizing the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system. Interventions in the preoperative phase includes: preoperative education and counseling, preoperative optimization (the cessation of alcohol and smoking 4 weeks prior to surgery), preoperative fasting and carbohydrate treatment, the avoidance of preanesthetic anxiolytics, thromboembolism prophylaxis, antimicrobial prophylaxis and skin preparation. Intraoperative interventions include: standard anesthetic protocol	The implementation of enhanced recovery after surgery protocols have led to a reduction of length of stay of 2.5 days and a decrease in complications as much as 50% for patients undergoing colorectal surgery. Authors of this CPG aimed to develop guidelines specific for gynecological/oncology patients. After reviewing the evidence, the following interventions were strongly recommended in this CPG: 1) Preadmission information, education, and counseling, preoperative optimization with the promotion of smoking and alcohol cessation four weeks before surgery. 2) The correction of anemia preoperatively. 3) Routine oral mechanical bowel prep should not be used in gynecological/oncology surgery. 4) Patients should be permitted to drink clear liquids until 2h before anesthesia and surgery. Patients should abstain from solids 6h prior to induction of anesthesia. 5) Oral carbohydrate loading reduces postoperative insulin resistance, improves preoperative	IB

				with short acting anesthetic agents, postoperative nausea and vomiting, minimally invasive surgery, the early removal of nasogastric tubes, preventing intraoperative hypothermia, and intraoperative fluid management.	wellbeing, and should be used routinely. 6) Routine administration of anxiolytics preoperatively should be avoided in order to speed postoperative recovery. 7) Due to increased risk of thromboembolism in gynecologic oncologic patients, this patient population undergoing major surgery >30 min should receive VTE prophylaxis with LMWH or heparin perioperatively (from preop to postop) along with mechanical methods (TEDS & SCDs). 8) For patients on hormonal contraception are advised to change to another form of contraception prior to surgery due to the increased risk of thromboembolism. 9) IV antibiotics should be administered routinely within 60 min of skin incision. The dose should be repeated in case of prolonged operations or severe blood loss and increased in obese patients. 10) Short acting anesthetic agents should be used to allow for rapid awakening. The addition of regional anesthesia to general anesthesia is opioid sparing, help reduce PONV, and allows more rapid awakening. Ventilation strategy using tidal volumes of 5-7 mL/kg with a PEEP of 4-6 cm	

					H2O reduces postoperative pulmonary complications. 11) Patients undergoing gynecologic procedures should receive prophylaxis using a multimodal approach to PONV using more than two antiemetic agents. The risk of PONV is reduced with increased utilization of regional anesthesia, decreasing or eliminating opioids, neostigmine, volatile anesthetics, and increasing propofol use. 12) Minimally invasive surgery including vaginal surgery is preferred for appropriate patients when feasible. 13) Routine use of a nasogastric tube should be avoided. If it is used, it should be removed before the emergence phase of general anesthesia. 14) Maintain normothermia intraoperatively with forced air warming devices. 15) Maintain euvolemia intraoperatively. Avoid very restrictive or liberal fluid regimens. 16) Goal directed fluid therapy is recommended in surgical procedures that are at high risk for blood loss >7 mL/kg.	
Groot, Ament, Maessen, Dejong,	To provide an overview and evaluate current evidence regarding enhanced recovery pathways and their	Systematic Review and Meta-analysis	31 records were included in the review involving 16	Outcomes were length of hospital stay, complication rates, readmissions, and mortality. Length of hospital	1) Preoperative education, early oral intake, and early mobilization were included in all the pathways. The number of	IC

Kleijnen, & Slangen, (2016)	effect on postoperative outcomes in women undergoing open gynecologic surgery.		observational studies. 15 records were used for data extraction. 3 of the studies were randomized controlled trials. n=1530 women were included in the intervention group.	stay was measured in days and defined as "the primary postoperative hospital stay plus the number of days of readmission within 30 days after surgery" (Groot et al, 2015, p. 384). Complication rates were measured by the number of complications developed postoperatively. Readmissions were measured by the number of incidence patients had to be re-admitted after discharge from the primary hospital admission. Mortality is counted by the number of deaths that occur postoperatively.	interventions reported ranged between four and 21 items. All outcomes are derived from nonrandomized studies that are at high risk of bias. 2) Implementation of ERAS reduced time to discharge by 1.57 days (95% CI -2.94 to -0.20, p=0.02, I2=91%). The effect on length of stay was more pronounced in the malignant group. ERAS protocols can reduce length of stay by 1 to 2 days for women undergoing abdominal hysterectomy for a benign indication. For women undergoing cytoreductive surgery, a length of stay of 5 days was reported. 3) There were no statistically significant differences in the number of complications reported between the ERAS group and the control group. 4) After a median of 35 days of follow up, the percentage ranged from 17 to 27%. Readmission rates were recorded in 11 studies, and the median reported rate was 4%. No statistically significant difference was found after 30 week of follow up with no significant heterogeneity. 5) Only a few studies reported mortality at a rate of 2%. Quantitative analysis was not performed due to low event rates.	

Kalogera, Bakkum-Gamez, Jankowski, Trabuco, & Lovely et al (2013)	To investigate the effects of enhance recovery pathways in patients undergoing gynecologic surgery.	Retrospective Cohort Study	N=241 women in the enhanced recovery group (cohorts include: 81 complex cytoreductive, 84 staging, and 76 vaginal surgery cases) compared to 235 women in the control group.	The main outcome measured was reduction in hospital length of stay. For hospital length of stay, the day of surgery was defined as postoperative day 0. Secondary outcomes include: Postoperative hypotension defined as 10% decrease from the preoperative MAP; Opioid use quantified by using oral morphine equivalents; pain control efficacy assessed using a numeric rating scale 1-10; complications in which severity was measured by the Accordion severity grading system; and cost savings.	1) Despite administering approximately 1L less in the ERAS group vs. control group, there was no increase in frequency or duration of hypotension intraoperatively (p=0.025). 2) Women in the ERAS group required 80% less opioids in the first 48 hours post op with an increase in the use of NSAIDs, acetaminophen, and tramadol. Further, PCA was required less by the women in the ERAS group (33%) vs control group (98.7%). Despite significant reductions in opioid requirements, pain scores were unchanged between the women in the ERAS group compared to control group. 3) More nausea and vomiting were observed in the ERAS group (55.6%) vs control group (38.5%) with an increase in post-operative day 2. The amount of antiemetics given to the women in both groups did not differ. 4) Thirty day rates of complications, readmission, mortality, and severity of complications did not differ between the two groups. 5) Enhanced recovery interventions led to a 2-4 day reduction in the mean length of stay compared with the control	IVB

					group ($p<0.004$). Almost half (46.1%) of women in the ERAS group were discharged the day after surgery compared with only 6.5% of women in the control group ($p<0.001$). The reduction in length of stay led to a 30 day total cost of care savings of $3000-$7600 per patient.	
Modesitt, Sarosiek, Trowbridge, Redick & Shah et al (2017)	To examine the effects of implementing an enhanced recovery protocol on surgical outcomes.	Before and after study	N=136 patients underwent the full ERAS pathway in which the majority underwent total abdominal hysterectomy with or without bilateral salpingo-oopherectomy. n=249 underwent light ERAS pathway with majority undergoing laparoscopic hysterectomy.	Primary outcome measured was length of stay. Secondary outcomes include postoperative opioid consumption as measured by morphine equivalents, complications (SSI, unplanned intubation, thromboembolic events, renal insufficiency or failure, UTI, MI, transfusion, sepsis, pneumonia, unplanned return to operating room, 30-day readmission rates, and mortality) as measured by reporting of incidence, and patient satisfaction measured by utilizing the Press Ganey infoEDGE surveys, and costs.	1) The median length of stay was significantly reduced after implementing the ERAS protocol in the ERAS group (3.0 vs 2.0 days; $p=0.007$). 2) The median pain scores were decreased in ERAS patients on post op day 0 (5.0 vs. 3.7, $p<0.001$). 3) Overall rate of complications was decreased from 40% to 21% ($p<0.001$) after ERAS implementation. 4) 145 discharged gynecology patients returned surveys and showed a significant improvement regarding pain control, on the question “staff worked together to care for you”, and “nurses kept you informed”. For patients on the light pathway intervention, patient satisfaction scores showed a marked improvement on pain control, team work question, and nursing question. 5) The median total 30-day hospital cost per patient were	IIIC

					decreased in all groups after ERAS implementation. The median costs decreased from $11,172 to $9899, p<0.001 in the full ERAS group. In the light pathway, it decreased from $8,277 to $7606, p<0.001).	
Mendivil, Busch, Richards, Vittori & Goldstein (2018)	To compare the outcomes of gynecologic oncologic patients exposed to an enhanced recovery after surgery (ERAS) protocol compared to interventions at the discretions of physicians.	Retrospective cohort study	A total of 177 patients participated in the study (n=86 patients in the ERAS group vs 91 patients in the control group)	Outcomes measured were length of stay, hospital costs, and patient readmission rates. Length of stay was defined as "the time from admission to discharge". A readmission was defined as a return to the hospital within 30 days of the surgical procedure. Cost was measured utilizing an accounting program called Allscripts product and EPSi. For the control group, cost was determined by diagnoses-related group codes which was compared to length of stay.	The implementation of an ERAS protocol led to a mean reduction of 3 days in hospital stay (8.04 days for control group vs 4.88 days for ERAS group, p=0.001). A reduction in hospital costs were also seen ($11,877/patient in control group vs. $9305.26/patient in ERAS group, p=0.04). Reduced readmission rates were evident, 2 readmissions in the ERAS group compared with 4 readmissions in the control group.	IVB
Myriokefalitaki, Smith, & Ahmen (2016)	To evaluate the outcomes of an enhanced recovery after surgery (ERAS) protocol in a gynecologic oncologic center.	Non-randomized controlled trial; before and after study.	The ERAS group consists of 66 cases who underwent abdominal surgery and 33 who underwent laparoscopic surgery (total n=99). The control group	Outcomes measured were length of stay, complications, and re-admission rates.	The mean length of stay for the ERAS group was 4.29+/- 2.78 days which is significantly less than control group 7.23 +/- 5.68 days (p<0.001). There were no significant differences in complications or re-admission rates.	IIIB

			consisted of 75 abdominal surgery cases and 24 laparoscopic procedures (total n=99).			

Appendix B

Enhanced Recovery After Surgery: GYN Surgery Clinical Practice Guideline

MedStar Southern Maryland Hospital Center		**Subject:** GYN ERAS CPG **Number:**	
Original Date:	**Review Date(s):**	**Revision Date(s):**	**Page 1 of 5**
Departments Involved: PACU, OR, surgery, anesthesia			

PURPOSE: To provide an evidence-based clinical practice guideline for the management of all GYN patients receiving surgery aged 18 and older.

POLICY: To provide care to surgical GYN patients that follows the ERAS guidelines set forth.

DEFINITIONS:

Enhanced recovery after surgery (ERAS): Management of surgical patients with an approach that limits disruption to normal physiological function and that restores any disturbances back to baseline as soon as possible. ERAS provides an evidence-based menu of care to expediate recovery.

Transverse abdominis block (TAP block): A peripheral nerve block that provides regional anesthesia to the abdominal wall. Effective for incision site pain.

NSAIDs: Non-steroidal anti-inflammatory drugs used for analgesia

PROCEDURE:

Preoperative

Preoperative counseling/optimization:

1) All patients undergoing gynecological surgery will receive education regarding the surgical procedure, and all ERAS interventions.
   a) Smoking and alcohol consumption should be stopped 4 weeks prior to the surgical procedure.
   b) Preoperative anemia should be assessed and corrected before the surgical procedure to avoid adverse effects from anemia and the need for intraoperative blood transfusion.

Routine preoperative bowel prep should be avoided

Preoperative fasting and carbohydrate treatment:

   c) Patients are able to consume solids up to 6 hours and clear liquids up to 2 hours prior to the induction of anesthesia except diabetic patients with delayed gastric emptying.
   d) The goal is to ensure a metabolically fed state, reduce postoperative insulin resistance, and improve perioperative well-being.

Multimodal Pain Management:

e) Celecoxib 200 mg PO, Gabapentin 600 mg PO, and Acetaminophen 1000 mg PO should be given prior to the induction of anesthesia so long as there are no contraindications.

Intraoperative

Infection prophylaxis:

2) Antibiotics should be administered within 30-60 min of incision

Avoidance of nasogastric/orogastric tubes

3) Routine use of nasogastric tubes should be avoided.
    - Orogastric tubes can be beneficial in laparoscopic or robotic surgery to reduce the risk of gastric perforation by trochar or veress needle insertion.
    - If utilized orogastric tube should be discontinued at extubation

Thromboprophylaxis

a) Gynecologic oncology patients undergoing major surgery lasting >30 min should receive VTE prophylaxis with LMWH or Heparin due to the increased risk of thromboembolism.
b) All patients should be given pneumatic compression stockings and sequential compression devices intraoperatively to prevent thromboembolism.

Standard anesthetic maintenance

c) Short acting agents such as Sevoflurane and Desflurane should be utilized.
d) Propofol based IV anesthetics have fewer side effects and help prevent PONV.
e) Avoidance of long-acting analgesics such as Morphine and Methadone. May use fentanyl or hydromorphone IV for pain management but do so sparingly.
f) During this intraoperative phase, can plan for use of regional techniques. Regional anesthetic techniques minimize PONV, opioid consumption and promote rapid awakening postop. TAP blocks have been proven to be beneficial in open gynecologic procedures.

Postoperative nausea and vomiting (PONV) prevention

4) Multimodal PONV Prevention
    - Due to the increased risk of PONV in this patient population, all patients should be given more than 2 classes of antiemetics.

Normothermia

5) Normothermia should always be maintained using forced air warming devices

Euvolemia

6) Euvolemia should be maintained intraoperatively. Avoid excessive crystalloid administration. If sustained hemodynamic instability experienced, administer vasopressors and colloids.

Postoperative

Oral intake:

7) If nasogastric tube was used intraoperatively, should be discontinued immediately postoperatively
8) Clear diet as tolerated immediately postoperatively
9) Intravenous fluids should be promptly discontinued once patients are able to tolerate clear fluids by mouth
10) Advanced to regular diet as tolerated

Nutrition:

11) Nutrition should be resumed within the first 24 hours after surgery

Urinary drainage:

12) Urinary catheters are preferably discontinued at the end of surgery
13) Otherwise, if there is no documented need, they should be discontinued within 24 hours

Mobility:

14) Patients should be out of bed for at least two hours day of surgery and at least 8 hours daily on subsequent days

Pain management: Multimodal approach

15) Regional techniques, ie: transverse abdominis plane block (TAP block)
    a) Should be considered for all open procedures with large incision sites
    b) Should be performed immediately after closing incision site
    c) Infiltration of surgical site with local anesthetic

16) Scheduled oral NSAIDs
    a) 15 mg Toradol IV every 6 hours for four doses
    b) Ibuprofen 800 mg PO every 6 hours

17) Scheduled acetaminophen
    a) 1,000 mg PO every 6 hours for patients with no or mild hepatic disease or every 12 hours for patients with moderate hepatic disease. Daily maximum of acetaminophen is 4,000mg for every 24 hours.

18) Restricted opioid use

    a) If patient is unable to take NSAIDs due to a contraindication: Tramadol 100 mg PO every 6 hours can be used instead.
    b) For pain rated 4-6 that is not resolved by used of NSAIDs, acetaminophen or Toradol, Oxycodone 5 mg PO can be given every 4 hours
    c) For pain rated 7-10, that is not resolved by used of NSAIDs, acetaminophen or Toradol, Oxycodone 10 mg PO can be given every 4 hours
    d) Breakthrough pain of greater than 7 after administration of oxycodone 10 mg: Hydromorphone 0.4 mg IV up two 2 times 20 minutes apart
    e) Patient controlled analgesia: Hydromorphone PCA only if pain of greater than 7 continues after 2 doses of IV hydromorphone

Ileus prevention:

19) Use of oral laxatives as needed: senna, docusate, magnesium oxide
20) Chewing gum

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Appendix C

Agree II Tool

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
Scope and purpose	1. The overall objective(s) of the guideline is (are) specifically described.							
	2. The health question(s) covered by the guideline is (are) specifically described.							
	3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.							
Stakeholder involvement	4. The guideline development group includes individuals from all the relevant professional groups.							
	5. The views and preferences of the target population (patients, public, etc.) have been sought.							
	6. The target users of the guideline are clearly defined.							
Rigor of development	7. Systematic methods were used to search for evidence.							
	8. The criteria for selecting the evidence are clearly described.							
	9. The strengths and limitations of the body of evidence are clearly described.							
	10. The methods for formulating the recommendations are clearly described.							
	11. The health benefits, side effects and risks have been considered in formulating the recommendations.							
	12. There is an explicit link between the recommendations and the supporting evidence.							
	13. The guideline has been externally reviewed by experts prior to its publication.							
	14. A procedure for updating the guideline is provided.							
Clarity of presentation	15. The recommendations are specific and unambiguous.							
	16. The different options for management of the condition or health issue are clearly presented.							
	17. Key recommendations are easily identifiable.							
Applicability	18. The guideline describes facilitators and barriers to its application.							
	19. The guideline provides advice and/or tools on how the recommendations can be put into practice.							
	20. The potential resource implications of applying the recommendations have been considered.							
	21. The guideline presents monitoring and/ or auditing criteria.							
Editorial independence	22. The views of the funding body have not influenced the content of the guideline.							

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	**2**	**3**	**4**	**5**	**6**	**7** *Strongly Agree*
	23. Competing interests of guideline development group members have been recorded and addressed.							
Overall Guideline Assessment	1. Rate the overall quality of this guideline.	**1** *Lowest possible quality*	**2**	**3**	**4**	**5**	**6**	**7** *Highest possible quality*
Overall Guideline Assessment	2. I would recommend this guideline for use.	*Yes*	*Yes, with modifications*					*No*

Adapted from AGREE Next Steps Consortium (2013). The AGREE II Instrument [Electronic version]. Retrieved from http://www.agreetrust.org/wp-content/uploads/2013/10/AGREE-II-Users-Manual-and-23-item-Instrument_2009_UPDATE_2013.pdf

Appendix D

Practitioner Feedback Questionnaire

1. Are you responsible for the care of patients for whom this draft guideline report is relevant? This may include the referral, diagnosis, treatment, or follow-up of patients.	Yes ☐	No ☐	Unsure ☐
If you answered "*No*" or "*Unsure*", there is no need to answer or return this questionnaire. If you answered "*Yes*", please answer the questions below and return to **[enter expected destination of surveys]**.			
	Strongly agree	Neither agree or disagree	Strongly disagree
2. The rationale for developing a guideline is clear.	☐	☐	☐
3. There is a need for a guideline on this topic.	☐	☐	☐
4. The literature search is relevant and complete (e.g., no key evidence was missed nor any included that should not have been) in this draft guideline.	☐	☐	☐
5. I agree with the methodology used to summarize the evidence included in this draft guideline.	☐	☐	☐
6. The results of the evidence described in this draft guideline are interpreted according to my understanding of the evidence.	☐	☐	☐
7. The draft recommendations in this report are clear.	☐	☐	☐
8. I agree with the draft recommendations as stated.	☐	☐	☐
9. The draft recommendations are suitable for the patients for whom they are intended.	☐	☐	☐
10. The draft recommendations are too rigid to apply to individual patients.	☐	☐	☐
11. When applied, the draft recommendations will produce more benefits for patients than harms.	☐	☐	☐
12. The draft guideline presents options that will be acceptable to patients.	☐	☐	☐
13. To apply the draft recommendations will require reorganization of services/care in my practice setting.	☐	☐	☐
14. To apply the draft guideline recommendations will be technically challenging.	☐	☐	☐
15. The draft guideline recommendations are too expensive to apply.	☐	☐	☐
16. The draft guideline recommendations are likely to be supported by a majority of my colleagues.	☐	☐	☐
17. If I follow the draft guideline recommendations, the expected effects on patient outcomes will be obvious.	☐	☐	☐
18. The draft guideline recommendations reflect a more effective approach for improving patient outcomes than is current usual practice. (If they are the same as current practice, please tick NA). *NA* ☐	☐	☐	☐
19. When applied, the draft guideline recommendations will result in better use of resources than current usual practice. (If they are the same as current practice, please tick NA). *NA* ☐	☐	☐	☐
20. I would feel comfortable if my patients received the care recommended in the draft guideline.	☐	☐	☐
21. This draft guideline should be approved as a practice guideline.	☐	☐	☐
22. If this draft guideline were to be approved as a practice guideline, I would use it in my own practice.	☐	☐	☐
23. If this draft guideline were to be approved as a practice guideline, I would apply the recommendations to my patients.	☐	☐	☐

Adapted from: Brouwers, M.C., Graham, I.D., Hanna, S.E., Cameron, D.A., & Browman, G.P. (2004). Clinicians' assessments of practice guidelines in oncology: The CAPGO survey**.** *International Journal of Technology Assessment in Health Care, 20*(4), 421-6.

Appendix E:

Process map prior to ERAS CPG Implementation

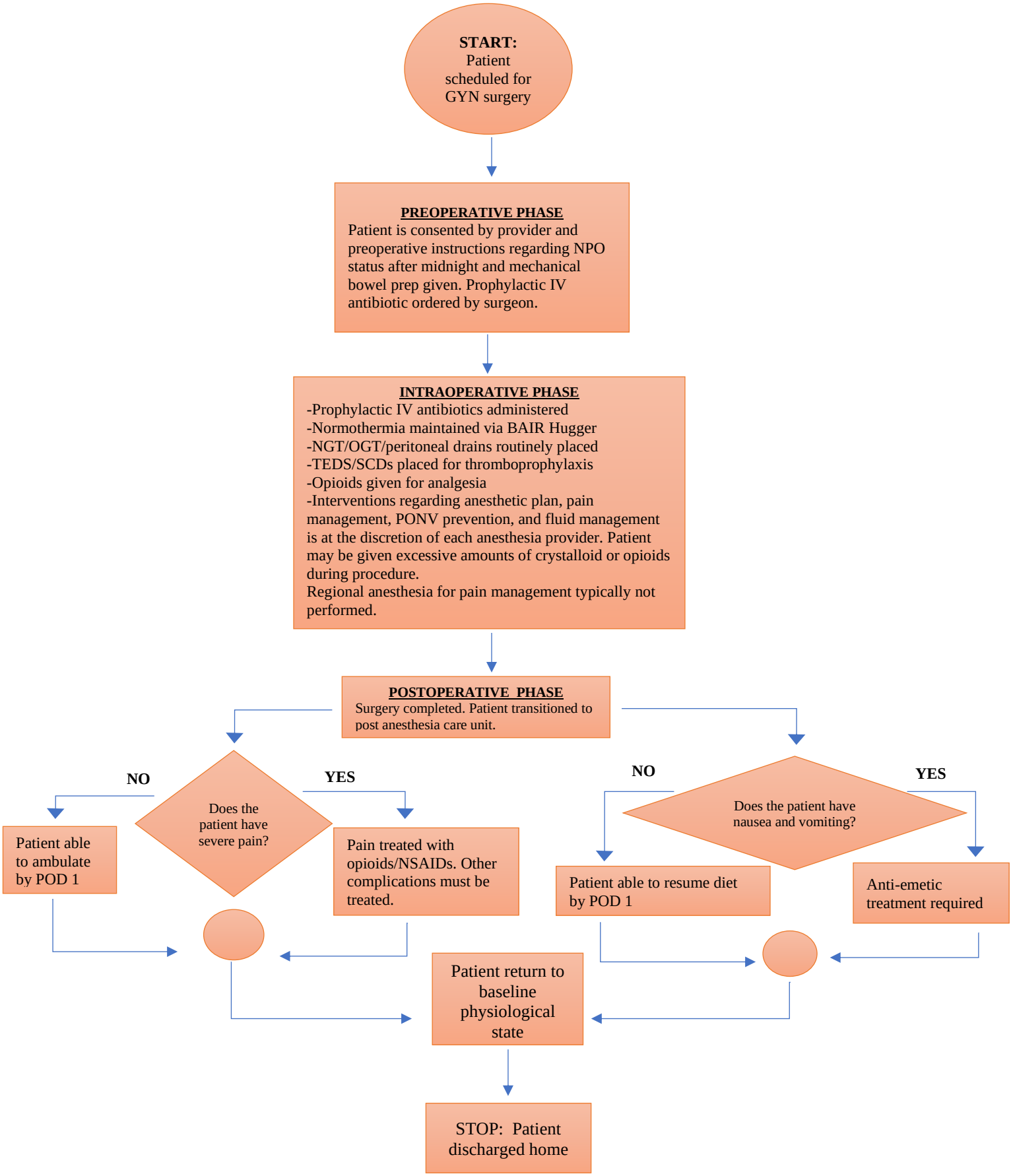

Table 1. *AGREE II Tool Domain Scores*

Appraiser #		# 1	#2	# 3	#4	Total
Domain 1: Scope and Purpose	Item 1	7	7	7	7	28
	Item 2	7	6	7	7	27
	Item 3	7	7	6	7	27
Obtained Scores						82
Calculated Domain Scores						97.2%
Domain 2: Stakeholder Involvement	Item 4	7	7	7	7	28
	Item 5	7	7	7	7	28
	Item 6	7	7	7	7	28
Obtained Scores						84
Calculated Domain Scores						100%
Domain 3: Rigour of Development	Item 7	7	7	7	6	27
	Item 8	6	5	7	7	25
	Item 9	4	7	7	6	24
	Item 10	7	7	7	4	25
	Item 11	6	7	7	7	27
	Item 12	7	7	7	5	26
	Item 13	4	6	6	7	23
	Item 14	5	5	7	6	23
Obtained Scores						200
Calculated Domain Scores						87.5%
Domain 4: Clarity of Presentation	Item 15	7	5	7	7	26
	Item 16	7	7	6	7	27
	Item 17	6	6	7	7	26
Obtained Scores						79
Calculated Domain Scores						94 %
Domain 5: Applicability	Item 18	7	7	7	7	28
	Item 19	6	6	5	7	24
	Item 20	6	7	6	7	26
	Item 21	7	7	6	6	26
Obtained Scores						104
Calculated Domain Scores						92.9%
Domain 6: Editorial Independence	Item 22	5	7	7	7	26
	Item 23	6	7	7	5	25
Obtained Scores						51

Calculated Domain Scores					89.6%
Overall Guideline Assessment	7	7	7	7	28
Calculated Domain Scores					100%
Total Obtained Scores	145	151	154	150	600
Overall calculated domain score					**92%**

Table 2. *PFQ Item Frequency*

	Strongly agree (% of total)	Neither agree or disagree (% of total)	Strongly disagree (% of total)
1. Are you responsible for the care of patients for whom this draft guideline report is relevant? This may include the referral, diagnosis, treatment, or follow-up of patients.	22 (100%)	0 (0%)	0 (0%)
2. The rationale for developing a guideline is clear.	22 (100%)	0 (0%)	0 (0%)
3. There is a need for a guideline on this topic.	22 (100%)	0 (0%)	0 (0%)
4. The literature search is relevant and complete (e.g., no key evidence was missed, nor any included that should not have been) in this draft guideline.	22 (100%)	0 (0%)	0 (0%)
5. I agree with the methodology used to summarize the evidence included in this draft guideline.	22 (100%)	0 (0%)	0 (0%)
6. The results of the evidence described in this draft guideline are interpreted according to my understanding of the evidence.	22 (100%)	0 (0%)	0 (0%)
7. The draft recommendations in this report are clear.	22 (100%)	0 (0%)	0 (0%)
8. I agree with the draft recommendations as stated.	22 (100%)	0 (0%)	0 (0%)
9. The draft recommendations are suitable for the patients for whom they are intended.	21 (95.5%)	1 (4.5%)	0 (0%)
10. The draft recommendations are too rigid to apply to individual patients.	0 (0%)	4 (18.2%)	18 (81.8%)
11. When applied, the draft recommendations will produce more benefits for patients than harms.	22 (100%)	0 (0%)	0 (0%)
12. The draft guideline presents options that will be acceptable to patients.	22 (100%)	0 (0%)	0 (0%)
13. To apply the draft recommendations will require reorganization of services/care in my practice setting.	0 (0%)	7 (31.8%)	15 (68.2%)
14. To apply the draft guideline recommendations will be technically challenging.	0 (0%)	4 (18.2%)	4 (81.8%)
15. The draft guideline recommendations are too expensive to apply.	0 (0%)	4 (18.2%)	4 (81.8%)
16. The draft guideline recommendations are likely to be supported by a majority of my colleagues.	22 (100%)	0 (0%)	0 (0%)
17. If I follow the draft guideline recommendations, the expected effects on patient outcomes will be obvious.	20 (90.9%)	2 (9.1%)	0 (0%)
18. The draft guideline recommendations reflect a more effective approach for improving patient outcomes than is current usual practice. (If they are the same as current practice, please tick NA).	21 (95.5%)	0 (0%)	1 (4.5%)
19. When applied, the draft guideline recommendations will result in better use of resources than current usual practice. (If they are the same as current practice, please tick NA).	20 (90.9%)	2 (9.1%)	0 (0%)
20. I would feel comfortable if my patients received the care recommended in the draft guideline.	22 (100%)	0 (0%)	0 (0%)

21. This draft guideline should be approved as a practice guideline.	21 (95.5%)	0 (0%)	1 (4.5%)
22. If this draft guideline were to be approved as a practice guideline, I would use it in my own practice.	22 (100%)	0 (0%)	0 (0%)
23. If this draft guideline were to be approved as a practice guideline, I would apply the recommendations to my patients.	22 (100%)	0 (0%)	0 (0%)

Adapted from: Brouwers, M.C., Graham, I.D., Hanna, S.E., Cameron, D.A., & Browman, G.P. (2004). Clinicians' assessments of practice guidelines in oncology: The CAPGO survey**.** *International Journal of Technology Assessment in Health Care, 20*(4), 421-6.