Does better documentation compliance with ERAS protocol translate to improved clinical outcome?

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STATEMENT OF ORIGINALITY

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

I certify that the intellectual content of this thesis is my own work and that all assistance received in preparing this thesis and sources have been acknowledged.

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ABSTRACT

Background: The Enhanced Recovery After Surgery (ERAS) programme is an evidence-based structured care pathway covering pre-operative, peri-operative, and post-operative care. ERAS was developed and used initially in colorectal surgery but now ERAS has been adopted in many disciplines of surgery. The key elements of the ERAS pathway include pre-operative counselling, nutrition optimisation, early mobilisation, standardised analgesic and anaesthetic regimens, and early removal of drains and catheters.

Documentation is an important part of ERAS as a way to communicate the action taken to other members of the team, it also allows audit and provision of progress reports of the programme. However, there is limited evidence available to identify if there is a relationship between documentation compliance and clinical outcomes in patients on a colorectal ERAS pathway.

Aim: The aim of this study is to determine if there is a relationship between documentation compliance, and clinical outcomes in patients on a colorectal ERAS pathway.

Hypothesis: The hypothesis was that there is a correlation between documentation compliance and improved clinical outcomes.

Method: This is a retrospective cohort study, single site study to explore if there was a correlation between documentation compliance and clinical outcomes in patients on a colorectal surgery ERAS pathway. Patient files were reviewed, and data was collected and entered into six categories (i) patient details, (ii) ERAS compliance, (iii) pre-operative, (iv) intra-operative, (v) post-operative and (vi) LOS-DC-readmission. This data was uploaded into SPSS for data analysis.

Results: A total of 97 patient files were reviewed who had been inpatients on the Colorectal Ward at RPA Hospital from January to April 2019 and January to April 2020. Overall compliance was broken down into the three pathways of ERAS in our centre, there were 39 patients under bowel resection with stoma, 37 patients under bowel resection and 21 patients under closure of stoma.

The data review revealed that compliance and documentation was poor. Bowel resection with stoma and closure of stoma had the highest clinical compliance, approximately 45%, while the poorest compliance of 26% were those on the bowel resection pathway. Documentation was also very poor. There were 61 (62%) patients without attempts to fill in the pathway form. There were many occasions when incorrect pathways were allocated and subsequently not corrected. In addition, ERAS in our centre was not protocol driven but medically driven. We also found the importance of a pre-admission clinic as part of ERAS. There was no relationship between documentation compliance, length of stay or Clavien-Dindo score. The Clavien-Dindo score was significantly higher in those patients where ERAS was not ordered when compared with being ordered during the episode of care.

Conclusion: There is no correlation between documentation compliance and clinical outcomes. Pre-admission counselling is a significant part of ERAS as this sets the expectations for patients and needing a dedicated person to provide this counselling is just as important.

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ABBREVIATIONS

AKI	Acute kidney injury
ANZCA	Australian and New Zealand College of Anaesthetist
APE	Abdominoperineal excision
B	Standardised beta
BD	Bis in die - Twice a day
BMI	Body mass index
ca	Cancer
CD	Crohn's Disease
CF	Clear fluid
CRC	Colorectal cancer
CRS	Cytoreductive surgery
DC	Discharged / Discharge
df	Degrees of freedom
ED	Emergency Department
eMR	Electronic medical record
ERAS	Enhanced Recovery After Surgery
ESPEN	European Society for Parenteral and Enteral Nutrition
ETOH	Alcohol use
Exp (B)	Odds ratio
Fe	Ferritin
GP	General Practitioner
Hb	Haemoglobin

HIPEC	Hyperthermic intraperitoneal chemotherapy
ICT	Information and communication technology
ICU	Intensive care unit
ID	Identification
IDC	Indwelling urinary catheter
IVC	Intravenous cannula
IVDU	Intravenous drug user
IVT	Intravenous therapy
JMO	Junior medical officer
LOS	Length of stay
MST	Malnutrition screening tool
MUST	Malnutrition Universal Screening Tool
NBM	Nil by mouth
NGT	Nasogastric tube
NRS	Numeric rating scale
NSAID	Non-steroidal anti-inflammatory drugs
NSW	New South Wales
OA	Osteoarthritis
PAC	Pre-admission clinic
PCA	Patient controlled analgesia
PE	Pelvic Exenteration
PG-SGA	Patient Generated Subjective Global Assessment
PI	Principle Investigator

PICC	Peripherally inserted central catheter
PONV	Post-operative nausea and vomiting
PRN	Pro re nata/ as needed
QID	Quater in die - Four times a day
RCT	Randomised control trials
REDCap	Research Electronic Data Capture
RFA	Recommendation for admission
RPAH	Royal Prince Alfred Hospital
S.E	Standard Error
SGA	Subjective global assessment
Sig	Significant
SLHD	Sydney Local Health District
SOOB	Sit out of bed
SSI	Surgical site infection
TDS	Ter die sumendus - Three times a day
TED	Thrombo-Embolic Deterrent
THR	Total hip replacement
TIA	Transient ischemic attack
TOV	Trial of void
TPN	Total parenteral nutrition
UC	Ulcerative Colitis
VAS	Visual analogue scale
VRS	Verbal rating scale

VTE	Venous thromboembolism
Wald	Wald Chi-squared test

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CHAPTER 1: INTRODUCTION

Enhanced Recovery After Surgery (ERAS) programmes incorporate a multimodal optimisation of patient care in the pre-operative, perioperative, and post-operative periods by following an evidence-based structured care pathway (Melnyk, Casey, Black, & Koupparis, 2011). Initially, this programme was developed and promulgated primarily for use within colorectal surgery. Recently, it has been expanded for use in other surgical sub-specialties (Cavallaro & Bordeianou, 2019).

A study conducted in 2014 at Royal Prince Alfred Hospital assessed the barriers to implementation of ERAS programmes. It was found that there were four themes upon which an ERAS programme was dependent on to be implemented and function effectively. These themes included patient-related factors, staff-related factors, practice-related issues, and resources. During the study, there was a dedicated ERAS coordinator on the Colorectal Ward, which at the time, was believed to be necessary for the ERAS program to run effectively (Lyon, Solomon, & Harrison, 2014).

The key elements of the ERAS pathway include pre-operative counselling, nutrition optimisation, standardised analgesic and anaesthetic regimens (epidural and non-opioid analgesia), and early mobilisation (Melnyk et al., 2011). Pre-operative counselling should include an explanation of the rationale behind ERAS, as well as discussing patient expectations. It is important to note that patient education has been associated with improved outcomes (Jankowski, 2017). Another key element is nutrition, wherein the goal of the pre-operative phase of ERAS is for patients to be able to accommodate high metabolic demands that are brought about by surgery. The ERAS pathway strategy has been shown to reduce pre-operative anxiety as well as reduce post-operative insulin resistance in colorectal surgery (Ljungqvist, Francis, & Urman, 2020). This is achieved through reducing the pre-operative starvation period and utilising complex carbohydrate drinks in non-diabetic patients. ERAS has ultimately reduced length of stay and improved patient satisfaction

(Noblett et al., 2006). Post-surgery, early ambulation is significant in protecting against deconditioning, reducing thromboembolic complications, and reducing insulin resistance, thus resulting in shorter hospital stay (Stethen et al., 2018).

It was noted that adherence to ERAS care pathways reduced patient stress due to surgery, maintained post-operative physiological function, and enhanced mobilisation after surgery (Gustafsson et al., 2019). This resulted in reduced rates of morbidity, faster recovery, and shorter length of stay in hospital. A systematic review established that ERAS had improved patient outcomes with no increase in adverse events among adults undergoing colorectal surgery (Greer et al., 2018). This study also associated ERAS with earlier hospital discharge, as well as reduced health care costs without increased complications or hospital readmissions.

The positive influence of ERAS programmes is well documented in the literature yet there are obvious difficulties or barriers to following the guidelines and protocol. One of the major barriers has been maintaining compliance with ERAS guidelines, as these guidelines from the ERAS Society (Gustafsson et al., 2019) started in 2005 and have been updated three times.

There have been several publications with regards to the compliance rate of ERAS programs that show a relationship between increased compliance and better patient outcomes (Feng et al., 2022; Barbero et al., 2021; Turaga, 2023; Rauwedink et al., 2019). Furthermore, an emphasis on training of personnel in the initial stage and continuous evaluation of the results was key to success (Pedziwiatr et al., 2015). Therefore, the aim of this study is to determine if better documentation compliance with the ERAS protocol also translates to improved clinical compliance and therefore better clinical outcomes.

CHAPTER 2: LITERATURE REVIEW

Enhanced Recovery After Surgery (ERAS) programmes involve the optimisation of patient care in the pre-operative, peri-operative, and post-operative states by following an evidence-based structured care pathway (Melnyk et al., 2011). This programme was developed for use in colorectal surgery in order to reduce the patient stress, maintain post-operative physiological function, and enhance mobilisation after surgery (Scott et al., 2015). This resulted in reduced morbidity rates, faster recovery, shorter lengths of hospital stay, and reduced healthcare costs without increased complications or hospital readmission (Lohsiriwat & Jitmungngan, 2019).

The positive influence of ERAS programmes is well documented in the literature, and yet there are obvious barriers to following the guidelines and protocol. Several publications regarding the compliance rate of ERAS programmes have shown a relationship between increased compliance and better patient outcomes. The study by Pedziwiatr et al. (2015) found that emphasis on the training of personnel in the initial stage and continuous evaluation of the results was key to success. In contrast patients, staff, practices, and resources were all found to be important aspects to implement an effective programme (Lyon et al., 2014). Furthermore, a dedicated ERAS coordinator in the Colorectal Ward was reported to be an essential component of the ERAS programme and essential for it to run effectively (Lyon et al., 2014).

The key elements of the ERAS pathway include pre-operative counselling, nutrition optimisation, early mobilisation, standardised analgesic and anaesthetic regimens, and early removal of drains and catheters (Melnyk et al., 2011). The following review will discuss the literature related to each section of the ERAS programme.

Pre-admission: Pre-operative counselling / empowering patients

Peri-operative information/counselling

Pre-operative counselling aims to improve patient knowledge, health, and outcomes by providing educational intervention before surgery (Handoll & Parker, 2008). Perioperative information and patient education are an important part of ERAS pre-admission as it helps to set the patient expectations around achieving early discharge (H. Forsmo et al., 2016). Providing patients with detailed and complete pre-operative information may reduce patient anxiety towards anaesthesia and surgery and the upcoming post-operative pain (Alanazi, 2014;Gan et al.,2014;Hounsome et al., 2017). Two studies are systematic reviews and included a large number of participants (Hounsome et al., 2017; Alanazi, 2014). One review concluded that pre-operative education intervention reduced pre-operative anxiety significantly (Alanazi, 2014) while in contrast the other review reported the effects of pre-operative information on peri-operative anxiety and other outcomes were minimally affected by format or timing (Hounsome et al., 2017). A further study by Gan et al. (2014) study was conducted with a relatively small population and the average time delay of 14 months from surgery date to survey allows potential for a significant recall bias. Therefore, the findings of this study may be questionable..

Patients provided with psychological support have been reported to experience reduced length of stay (LOS) and better post-operative outcomes (Forsmo et al., 2016). Patients also felt prepared and satisfied with their surgical experience when provided with procedure specific and patient-centred information sessions (Granziera et al., 2013;Sjoling et al., 2003). Part of the patient-centred approach in pre-admission clinic involves completing risk assessments for patients undergoing colorectal surgery to lessen the risk of complications. An example of risk assessment is the Waterlow assessment, which will be discussed further in this paper's nutrition section.

Pre-operative counselling provides the opportunity to discuss lifestyle modification with patients, such as smoking cessation and avoiding alcohol. Education and encouragement can benefit patients post-operatively with the reduction of respiratory complications (Gustafsson et al., 2019;Shabanzadeh & Sørensen, 2015). Myers et al. (2011) and Mills et al. (2011) found that pre-operative counselling reduced the rates of wound and pulmonary complications. A meta-analysis demonstrated little benefit for brief smoking interventions pre-operatively and recommended that intervention needed to start more than four to six weeks before the surgery and include nicotine replacement therapy (Thomsen et al., 2014). Smoking cessation discussions should start from the consultation with the surgeon because pre-admission clinic is normally booked closer to the surgery date or even the day before the surgery (Hughes, Stead, Hartmann-Boyce, Cahill, & Lancaster, 2014).

Many studies have shown that the primary outcome measure for pre-operative counselling/education is the length of stay but delay in discharge was not discussed (Anderson et al., 2003;Delaney et al., 2003;Gatt et al., 2005). Patients were satisfied if they were discharged after five or seven days (Vlug et al., 2012), but what made a difference in patients' perspective was the safe hospital treatment journey with a minimum of complications (Gualandi et al., 2019). Perioperative counselling is an essential part of ERAS to ensure patients comply with the ERAS protocol to reduce the length of stay but also implement early interventions pre-operatively to prevent intra- and post-operative complications.

Prehabilitation

Prehabilitation is a pre-operative recommendation but not mandatory in ERAS protocols. It is defined as a "process in the continuum of care that occurs between the time of diagnosis and the

beginning of acute treatment (surgery, chemotherapy, radiotherapy) and includes physical, nutritional and psychological assessments that establish a baseline functional level, identify impairments, and provide interventions that promote physical and psychological health to reduce the incidence and/or severity of future impairments"(Silver & Baima, 2013). A 4-week prehabilitation programme showed a link between increased pre-operative aerobic capacity and reduced complications. However, further research is required for ERAS protocols to make this mandatory (Barberan-Garcia et al., 2018).

Management of anaemia

ERAS protocols highly recommend pre-operative blood management for the prevention of anaemia in the post-operative period. This involves screening and optimising the patient's ability to replace their own red blood cells by optimising B12 and/or iron levels before surgery. Iron deficiency occurs when transferrin saturation is below twenty percent and serum ferritin concentration is below one-hundred micrograms per litre (Muñoz et al., 2014). There has been a focus on pre-operative blood management in colorectal and other gastrointestinal cancer surgery, primarily because of the high risk these patients have for presenting with iron deficiency anaemia and the desire to avoid blood transfusion (Hofmann et al., 2011).

Pre-existing anaemia is common for patients undergoing colorectal surgery due to chronic blood loss from tumours or chronic inflammation secondary to inflammatory bowel disease. Red blood cell transfusions are avoided as they may act as immunosuppressive agents. The effect of blood transfusion in acute surgical patients and the relationship between immunological impairment and cancer recurrence has been reported since the early 1980s (Burrows et al., 1987;Burrows & Tartter, 1982). Furthermore, blood transfusions given peri-operatively in colorectal surgical patients have

been shown to increase rates of surgical site infection and septic shock (Mazzeffi et al., 2017). It is part of the nutritional assessment to assess iron stores and assess the patient's ability to restore red blood cells after surgery if blood loss occurs. This optimises the patient and may avoid the need for blood transfusion (Eeles & Baikady, 2017;Klein et al., 2016).

Nutrition

Nutrition is one of the key elements of ERAS (Wilmore & Kehlet, 2001). Malnutrition pre-operatively is associated with impaired healing of the surgical wound, pressure ulceration, higher rates of infection, and prolonged hospital stay (Awad & Lobo, 2011;Gu et al., 2019;Mosquera et al., 2016). In developed countries, it is estimated that 24-65% of patients presenting for elective surgeries are at risk of malnutrition (Thomas et al., 2016). Nutrition on the ERAS protocol starts from pre-admission with nutrition assessment and patient education about fasting and carbohydrate loading, followed by early feeding post-operatively (Kehlet, 1997). Overall, these studies had good patient numbers and were well designed. However, most were only single centre studies. There were two number of systematic reviews that examined the effects of malnutrition on surgical outcomes, and they reported the importance of pre-operative malnutrition screening as malnutrition is associated with increased risk of poor postoperative outcomes (Awad & Lobo, 2011; Gu et al., 2019). Another study which included a pioneer of ERAS as one of the investigators found that pre and post operative nutritional support reduces morbidity in high-risk malnourished patients (Kehlet, 2017).

Nutrition assessment

The patient's medical history should include chronic diseases, infection, previous surgery, recent reduced dietary intake and weight loss to help identify patients at risk of malnutrition. Patients'

nutritional status is difficult to measure (Awad & Lobo, 2011). However, calculations of body mass index (BMI), estimation of the recent loss of subcutaneous fat and muscle mass as well as signs of specific nutritional deficiencies indicate current nutritional status (Klein et al., 1997). Validated tools such as the malnutrition screening tool (MST) are used to measure potential nutritional status and indicate if pre-operative nutrition supplementation is required (Reber et al., 2019).

MST is part of the Waterlow assessment. The Waterlow assessment was developed in the mid-1980s and is used to identify patients who are at risk of pressure ulcer development (Waterlow, 1985). The Waterlow assessment includes different components of assessment; body mass index (BMI), continence status, mobility, nutritional status, anaemia, smoking, medical comorbidities, drug history, and the duration and type of surgery (Thorn et al., 2013). This assessment determines if the patient needs an allied health referral and additional equipment, such as an air mattress, to reduce the risk of pressure injury. A review of pressure injury tools concluded that risk assessment using the Waterlow score may make little or no difference to pressure injury incidence compared with clinical judgment (Moore & Patton, 2019). However, in clinical practice it provides evidence of a risk assessment being undertaken which is required to cover medico-legal aspects of care and may provide guidance for less experienced clinicians (Hajhosseini et al., 2020). A copy of the Waterlow assessment tool can be found in Appendix 1.

The ERAS colorectal protocol considered that the reference standards for nutritional screening include the Subjective Global Assessment (SGA), the Patient-Generated Subjective Global Assessment (PG-SGA), and the Malnutrition Universal Screening Tool (MUST) (Gustafsson et al., 2019). An observational study conducted by Shaw et al. (2015) compared assessments of nutritional status and found that the PG-SGA was a superior tool. One hundred and twenty-six

patients participated. The results showed that the PG-SGA tool identified 71% of patients as malnourished or at risk and 29% of patients as well-nourished (Shaw et al., 2015).

Nurses' views on MST were that it was easy to use (Raja et al., 2008). It was also shown that nurses used their professional judgement and skipped screening for patients who 'looked healthy' or who were obese. Nurses were resistant to discussing patients' weight or measuring their weight and did not view that obese patients were also at risk of malnutrition (Raja et al., 2008). The inconsistent approach to certain patient groups suggests that assessment of nutritional status should be mandatory not selective.

MST was developed in Australia by Ferguson et al. (1999). The MST consists of two questions pertaining to appetite and recent unintentional weight loss. The results were scored between 0 to 5 and patients who scored ≥ 2 were considered at risk. Further assessment was needed, therefore referral to a dietician was required (Ferguson et al., 1999). The MST may not be the most sensitive tool, but it is the simplest and provides better compliance from clinicians when completing it. There is agreeance that having a dedicated nutritional assessment will identify obese or malnourished patients so their risk can be assessed accurately (Reber et al., 2019)

Obesity is defined as a BMI greater than 30.0kg/m² and this is calculated during the nutritional assessment ("Body Mass Index in Adults", 2014). Obese patients experienced a longer length of stay, were at higher risk of ICU admission, and had more complications such as wound and chest infections, and cardiac complications (Pedrazzani et al., 2020). There is some evidence for reducing BMI pre-surgery but only if the surgery can be delayed (Minnella & Carli, 2018). Some others argue that highly obese patients are too considerable a risk for ERAS, whereas others

suggest obese patients benefit significantly from ERAS programmes, as early mobilisation prevents complications (Shin et al., 2021).

Fasting

The ERAS protocol recommends minimal fasting times as part of reducing surgery-induced stress, maintaining blood glucose levels, and reducing dehydration (Scott et al., 2015). There is consensus within the literature regarding pre-operative fasting times with the majority advising that clear fluids are allowed up to two hours pre-anaesthetic (Ljungqvist & Søreide, 2003;Brady et al., 2003;Lambert & Carey, 2016; Smith et al., 2011). When to cease eating solid food pre-operatively is a little more contentious and may be based on patient history (Deane et al., 2007) and type of surgery (Ljungqvist & Søreide, 2003). The range of six to twelve hours of fasting, no food or drink, and then for up to several post-operative days, particularly after laparotomy are to reduce concerns of potential aspiration, anastomotic breakdown, and post-operative ileus (Maltby, 2006;Bisgaard & Kehlet, 2002).

According to the Australian and New Zealand College of Anaesthetists (ANZCA), clinical guidelines (ANZCA, 2017) the recommended fasting for limited solid food is six hours and two hours for clear fluids for elective surgical procedures. The same guidelines have been published in Europe and USA (ANZCA), 2017;Fasting et al., 1998;American Society of Anaesthesiologist Committee, 2011). In contrast, some advocate a light breakfast less than 6 hours before surgery. Miller et al. (1983) demonstrated that having early breakfast two to three hours before anaesthesia did not affect gastric volume (Miller, Wishart, & Nimmo, 1983) while Søreide et al. (1996) did not recommend this and still suggests six hours fasting pre-operatively after a light breakfast.

Overall, it is recognised that prolonged fasting can reduce vomiting and aspiration. However, it may also cause adverse side effects such as dehydration, thirst, hunger, and resistance to insulin (de Aguilar-Nascimento & Dock-Nascimento, 2010). Fasting guidelines should be assessed individually. Patients who are critically ill, have certain chronic illnesses, or are receiving other therapies may have slower gastric emptying. Fasting for six hours for these patients will result in starvation (Ali Abdelhamid et al., 2016). Patients who have protected airways can be fed enterally until the time of surgery (Passier et al., 2013;Peev et al., 2015). There is debate about the required fasting time for solid food. However, it has been demonstrated that the benefits of reduced fasting may outweigh the potential risk, particularly with selected surgeries.

Bowel preparation

Bowel preparation is the removal of intestinal contents through mechanical cleaning with oral or rectal measures (Ju & Min, 2021). Suggested benefits of using bowel preparation are reduced surgical site infection (SSI) and anastomotic leakage rates, and ease of bowel manipulation during surgery (Diakosavvas et al., 2020). However, routine bowel preparation is not recommended on ERAS pathways for colonic surgery but is often used in rectal surgery (Gustafsson et al., 2019). Bowel preparation can lead to dehydration, electrolyte disturbance, and discomfort that may not have clinical benefit for the patient (Sanders et al., 2001).

It was also shown that patients who underwent mechanical bowel preparation had increased infectious complications compared to patients who did not (Zmora et al., 2003;Bucher et al., 2005;Bretagnol et al., 2007). Patients who did not have mechanical bowel preparation had an earlier return of bowel function and shorter hospital stays (McKenna et al., 2012;Leys et al., 2005) but no difference was found in rates of anastomotic leaks or severity of infectious complications

(Ji et al., 2017). Oral antibiotics with mechanical bowel preparation has been demonstrated to reduce surgical site infection when compared to just mechanical bowel preparation alone (Scarborough et al., 2015;Garfinkle et al., 2017;Kiran et al., 2015). Overall, the use of mechanical bowel preparation has mixed clinical results and is not routinely recommended by ERAS guidelines.

Pre-operative carbohydrate

Pre-operative carbohydrate loading is given to mimic the normal metabolic response when breakfast is consumed. This response triggers a release of insulin that turns off the overnight fasting state and assists with normalising blood sugars (Ljungqvist & Søreide, 2003;(Tryba et al., 1983). Carbohydrate is administered to patients pre-operatively in the form of a high-dose glucose infusion or by providing a sufficiently concentrated carbohydrate-containing beverage (Ljungqvist & Søreide, 2003;Tryba et al., 1983;Thorell et al., 1996). The carbohydrate-rich clear fluid was made specifically for pre-operative patients. It contains polymers of carbohydrates to lessen the osmotic load, which then reduces gastric emptying time and reduces insulin resistance (Nygren et al., 1995;Jones et al., 2011;Awad et al., 2013).

Pre-operative oral carbohydrate supplementation in elective colorectal resection was assessed in a prospective randomised controlled trial (RCT) of 36 patients (Noblett et al., 2006). These patients were divided into three equal groups: group one fasted only, group two was given pre-operative oral water, and group three was given a carbohydrate drink. The length of time a drink was given prior to surgery was also noted. The median length of stay for the patient who received carbohydrate drinks was seven days compared with thirteen days in the water group and ten days

in the fasted group. Patients in the carbohydrate group had their first bowel movement on day three compared to day four in the fasting group, and day five in the water group (Noblett et al., 2006).

The study demonstrated that carbohydrate drinks may reduce the length of hospital stay and time to return to gastrointestinal function. These findings were supported by Mathur et al. (2010) who also showed a shorter length of stay for those who had carbohydrate drinks pre-surgery in patients having colorectal and liver resection. However, the fatigue experienced by both groups with and without the carbohydrate drinks was similar (Mathur et al., 2010). Consuming pre-operative carbohydrate supplementation for patients undergoing abdominal surgery is beneficial. Although there was no difference in clinical outcomes for patients who underwent laparoscopic cholecystectomies (Bisgaard et al., 2004). Therefore, pre-operative carbohydrate drinks are not necessarily useful for all types of surgery.

Nutritional support

Perioperative nutritional support included within the ERAS protocol has been proven to achieve better surgical results (Martínez-Ortega et al., 2022). Patients may be malnourished if they meet at least one of these factors: weight loss of 10-15% within 6 months; BMI less than 18.5; subjective global assessment grade C or serum albumin below 30g (Weimann et al., 2006). A study of three hundred ninety-five malnourished patients scheduled for laparotomy or thoracotomy were randomly allocated to either total parental nutrition (TPN) for seven to fifteen days before surgery and three days after surgery or no peri-operative TPN (Veterans Affairs Total Parenteral Nutrition Cooperative Study Group,1991). There were similar major complication rates in both groups. However, there were more infectious complications in the TPN group (Heyland et al., 2001).

Heyland et al. (2011) found that TPN reduced the complication rate in malnourished patients but did not influence mortality.

There is no evidence to support delaying surgery to institute nutritional support pre-operatively (Ali Abdelhamid et al., 2016). However, recent guidelines from the European Society for Parenteral and Enteral Nutrition (ESPEN) (Weimann et al., 2021) reported that for patients with severe nutritional risk, it is recommended to have nutritional therapy seven to fourteen days before major surgery including those with cancer, despite it delaying the procedure (Weimann et al., 2021). Pre-operative nutritional conditioning and interventions such as nutritional prehabilitation with exercise therapy have been shown to optimise overall nutritional status, increase patients' physical strength and decrease anxiety which leads to earlier surgical recovery and improved outcomes after cancer surgery (Borloni et al., 2019;Gillis & Wischmeyer, 2019). Benefit has also been demonstrated in patients with non-metastatic disease, with other studies reporting an improvement in long-term survival when prehabilitation, including nutritional support, was provided to patients (Carli et al., 2010;Gillis et al., 2014;Jensen et al., 2015;C. Li et al., 2013)

Immuno-nutrition

Immunosuppression caused by surgical stress is one of the principal factors associated with surgical site infection (Faist et al., 1986). Nutrients such as arginine, glutamine, and omega-3 fatty acids may regulate inflammation and increase the immune response post-operatively. It is recommended to start 14urgic-nutrition seven days prior to major surgery and continue it in the post-operative period in malnourished and high-risk patients (Arends et al., 2017;Weimann et al., 2006;McClave et al., 2013). Immuno-nutrition has only been found to be effective in surgical and not critically ill patients (Heyland et al., 2001;Griffiths, 2002). The way these nutrients are

administered, and the optimal combination, requires further research so the potential benefit for ERAS patients can be optimised (Beale, Bryg, & Bihari, 1999). Overall, 15urgic-nutrition reduced the length of stay, reduced infection, and improved the immune system (Xu et al., 2018;Drover et al., 2011).

Peri-operative/ post-operative

European Society for Parenteral and Enteral Nutrition (ESPEN) recommendations after surgery were the following: oral intake including clear fluids should be initiated after surgery for most patients, initiation of peri-operative parenteral nutrition therapy for patients that are expected to be nil by mouth for more than five days peri-operatively and for patients who are not able to tolerate oral intake above 50% of the recommended intake for more than seven days (Weimann et al., 2021). In addition, it was advised to regularly reassess patients' nutritional status during their stay in the hospital and provide dietary counselling after discharge for patients who received nutritional support therapy peri-operatively.

Early nutritional support and early feeding post-operatively lead to significantly reduced infectious complications, improved wound healing, faster resolution of ileus, reduced length of stay, reduced hospital cost, and decreased mortality (Abela, 2017). It did not increase rates of anastomotic dehiscence or post-operative ileus (Martínez-Ortega et al., 2022;Lewis, Egger, Sylvester, & Thomas, 2001;Schroeder et al., 1991;Andersen et al., 2006).

Studies have also shown that the use of chewing gum post-operatively can accelerate the return of the gastrointestinal function after an abdominal operation involving the bowel (Ge et al., 2015;Keenahan, 2014). Van et al. (2015) evaluated the effect of chewing gum on post-operative ileus and length of stay. The study found that 27% of the patients allocated to chewing gum group

developed post-operative ileus compared to 48% of the patients in the control group. The group of patients who chewed gum had a higher proportion of passed flatus within 48hrs and open bowels within four days of surgery. Similarly, Hwang et al. (2013) studied the effect of chewing gum after laparoscopic colorectal surgery and found that length of stay in the hospital was shorter compared to the control group.

Other studies have also shown that chewing gum does not benefit patients (Bonventre et al., 2014) but is safe to use (Lim et al., 2013). Some found that chewing gum increased bloating and indigestion suggesting that it was due to swallowed air during chewing gum (Zaghiyan et al., 2013;'Forrester et al., 2014). In summary, the use of chewing gum after colorectal surgery is an effective intervention for reducing post-operative ileus and can be used as part of ERAS (Ge et al., 2015;Roslan et al., 2020).

In most cases, stomach function returns to normal within 24-48 hours (about 2 days), small bowel within 12-24 hours, and the colon within 48-72hours (about 3 days) (Martindale, 2013). Protein can modulate the surgical stress response and post-operative catabolism, and ERAS was shown to increase protein and energy intake compared to standard care as well as improve patients' nutrition and metabolic state (Yeung et al., 2017;Lassen et al., 2009). Limiting excessive intravenous fluid administration, early institution of enteral feeding, and use of prokinetic medications to treat established feed intolerance are strategies to reduce post-operative gastrointestinal dysmotility and increase the chance of successful post-operative feeding (Ali Abdelhamid et al., 2016).

Routine administration of prokinetic metoclopramide within 24 hours after colorectal resection has been shown to accelerate gastrointestinal function and recovery (Al-Mazrou et al., 2017). Metoclopramide increases gastrointestinal motility without increasing biliary, gastric, or

pancreatic secretions (Isola et al., 2023) but does not alter the course of post-operative ileus (Cheape et al., 1991). Identifying early who is at risk of malnutrition and assessing patients' peri-operative nutrition status, especially for patients who are moderately or severely malnourished, obese, critically, or elderly, can improve patient outcomes and reduce healthcare costs.

Mobilisation

The definition of mobilisation is varied and includes sitting upright, transferring from bed to chair, rising from a chair, exercising in or out of bed, and walking in the room or hallway (Nieto-García et al., 2021;K. Klein et al., 2015;Tazreean et al., 2022). There are a range of protocols for early mobilisation but no consistent or current standardised definition within the literature for colorectal surgery. Some encourage sitting in a chair on the day of surgery post-operatively (O. Ljungqvist, Scott, & Fearon, 2017), while others encourage actual ambulation three hours after return to the ward (Cavallaro & Bordeianou, 2019). In some cases, the nature of surgery such as abdominoperineal excision of the rectum meant that patients were unable to mobilise (Baloch, Nordenvall, Johansson, Nygren, & Nilsson, 2021). Reduced post-operative mobilisation increases the risk of pneumonia, insulin resistance, and muscle weakness (Gustafsson et al., 2013;Lassen et al., 2009;Levy et al., 2011). Non-compliance with post-operative mobilisation guidelines increased length of stay (Stethen et al., 2018;Pashikanti & Von Ah, 2012). The majority of studies were a review of the literature, and many were single site studies which had significant variation in patient numbers (ranging from 30 to 637 patients). The limitations of the single site studies may not be applicable to a wider patient population due to variations in patient cohort at each study sites. However, the consensus of the literature is that mobilisation is a critical component of ERAS that shows a great impact on patient outcomes.

ERAS pathways often have the total distance or frequency of periods of walking. As part of the assessment at pre-admission, mobilisation is assessed, and it is recorded if any mobility aids are used. Education on the importance of sitting out of bed, ambulation, and deep breathing exercises post-operatively, are conducted by colorectal nurses so the patient understands what is expected. A randomised control trial (RCT) was conducted by Ni et al. (2018) with 120 patients undergoing an abdominal 18urgicall procedure. The intervention included pre-operative education with patients and their families, daily mobilisation during early, middle, and late periods of the day, and comprehensive safety assessments before ambulation. At day five post-op, patients could walk without assistance and had improved functional exercise capacity which was the same following cardiac surgery (Kanejima et al., 2020). Other outcomes included faster gastrointestinal recovery, improved sleep, and shorter length of stay. It should be noted that the extra allocation of staff to provide twice daily assisted walks was an unusual practice.

Despite ERAS guidelines recommending early mobilisation post-operatively and the obvious benefits to patients, compliance is low (Grass et al., 2018). A retrospective cohort study demonstrated more than half of patients did not mobilise as per recommended ERAS guidelines (Grass et al., 2018). This study identified risk factors for delayed mobilisation which included: emergency surgery, advanced age, and fluid overload. All these risk factors were associated with increased post-operative complications. Patient motivation is an important part of post-operative mobilisation, but some barriers may be outside the control of the patient.

Barriers and motivation

The most commonly reported barriers to mobilisation were the lack of staff to assist patients with out-of-bed activity (C. J. Brown et al., 2007), patient concerns about having a fall (C. J. Brown et

al., 2007), and the difficulties in mobilising due to excessive sedation, or delirium (Fontela, Forgiarini Jr, & Friedman, 2018). To overcome these barriers an RCT recruited ninety-nine colorectal patients with dedicated staff available to assist with transfer and walking post-operatively (Fiore Jr et al., 2017). This study found that mobilisation increased during the hospital stay. However, there was no improvement in the clinical outcomes of the assisted group. The results of this study were further supported by De Almieda et al. (2017) who also found no difference in clinical outcomes between an early mobilisation programme and a standard rehabilitation care group. However, they found patients had improved health-related quality of life and reduced the incidence and intensity of post-operative fatigue.

Patients are the drivers of their care including mobilisation during their hospital stay. Mobilisation can be used to motivate patients to participate in their care. A way to motivate patients is to document their progress or have a daily goal to achieve. Patients see mobilisation as an important part of their care and are aware of the impact it has on their recovery and well-being, not only physically but also mentally during their hospital stay and over time (Svensson-Raskh et al., 2020). Patients reported wanting to be involved and motivated to be discharged but they had concerns about what will happen after they were discharged (DeSai et al., 2021). Because of these concerns, post-operative follow-up with the surgeon and contact with an ERAS coordinator was seen as valuable to patients (Gramlich et al., 2017). The ERAS pathway is modified to have patients sit out of bed on the day after surgery, to reduce falls risk and allow the anaesthesia to wear off (Seow-En et al., 2021). However, in some cases, supervised mobilisation on the same day post-operatively can safely be done after colorectal surgery (Thörn et al., 2022).

Sit out of bed- Post-operative Day 0

Part of ERAS recommendations are for patients to sit out of bed on the day of the surgery (J Nygren et al., 2012). It has been shown that patients who sat out of bed were more alert of their surroundings, were easier to communicate with, able to have an oral intake, and breathe easier when sitting up compared to when they were lying in bed (Svensson-Raskh et al., 2020). Being in bed and in a lying position reduced the chances of the patient taking a deep breath and has been shown to have a negative impact on oxygenation (Jenkins et al., 1988;Nielsen et al., 2003).

Factors that prevented patients from post-operative mobilisation were pain, nausea, and fatigue (Martin Hübner et al., 2015;Gustafsson et al., 2019;D. Li & Jensen, 2019). Mentally preparing patients by providing information and pre-operative education, safety, as well as having competent healthcare workers were key factors to help patients mobilise post-operatively (Martin Hübner et al., 2015;Bardram et al., 2000). Although there were initiatives to help patients mobilise, sometimes patients' minds were just too preoccupied with the cancer diagnosis and their mortality making it hard for them to focus on tasks while admitted to the hospital (Stone et al., 2019;Werawatganon & Charuluxananan, 2005).

Pain control and drains

Routine gastric drainage is discouraged, and an optimal analgesia regime allows early mobilisation and early return of gut function, but this will be discussed later (Veenhof et al., 2012). Removing obstacles such as urinary catheters has been shown to accelerate patient mobilisation and reduce urinary tract infections (Duchalais et al., 2019). Surgical attachments such as drains, nasogastric tubes, intravenous lines, and epidurals and lack of patient motivation were seen as barriers to early mobilisation (Castelino, 2016). Some factors can predict delays to mobilisation such as advanced

age, physical/performance status, and malnutrition but there were also unforeseen events such as delirium or early surgical complications that required a return to the operating theatre (Grass et al., 2018).

To facilitate and improve post-operative mobilisation the patient must have adequate and appropriate pain management that reduces pain without excessive drowsiness. The utilisation of pumps that continuously deliver local anaesthetic medication directly to the wound bed rather than systemic narcotics has assisted in delivering these goals (Cheong et al., 2001). Minimally invasive techniques may result in less pain for patients (Tazreean et al., 2022). There is no evidence that early mobilisation has an impact on clinical outcomes (Alaparthi et al., 2020). This contradicts previous data which found that early mobilisation did impact on clinical outcomes.

Standardised analgesic and anaesthetic regimen

Disadvantages of post-operative pain

Post-operative pain management using multimodal analgesia is one of the key components of ERAS (Beverly et al., 2017). Uncontrolled post-operative pain delays mobilisation, and oral intake and increases the risk of chronic pain after surgery (Apfelbaum et al., 2003;Nimmo, Foo, & Paterson, 2017). Unresolved post-operative pain also contributes to secondary clinical complications such as venous thrombosis, pulmonary embolism, poor wound healing, myocardial infarction, pneumonia, and insomnia (Carr & Goudas, 1999;H. Breivik, 1998). Poor pain control post-operatively may contribute to the development of pneumonia as the patient is fearful of taking deep breaths (Kelkar, 2015).

The sympathetic activation caused by pain leads to higher oxygen consumption, hyperglycaemia, insulin resistance, higher risk of infection and most importantly it decreased the comfort and

satisfaction of patients (Wirz et al., 2021). In addition, when post-operative pain is managed well, it can improve the patient's quality of life, enhance early mobilisation, reduce the hospital length of stay and subsequent surgical costs (Kolettas et al., 2015;Garimella & Cellini, 2013). Good pain control also supports patients to return to their normal function (Horn & Kramer, 2023).

Within the literature, ERAS protocols demonstrate consensus that managing post-operative pain starts with a pre-operative assessment that includes pain history, directed physical exam, and pain control plan (Devin & McGirt, 2015;Nygren et al., 2012;Apfelbaum et al., 2012). This assessment is to identify factors that may impact the severity of the patient's post-operative pain and allow for planning of appropriate treatments in their pain management plan. (Nygren et al., 2012) The plan should take into consideration the type of procedure anticipated, patient age, history of chronic opioid use, and other comorbidities (Lespasio et al., 2019). Examples of comorbid patients that need to be considered are those that are obese and those that suffer from chronic pain. Obese patients are at increased likelihood of respiratory depression or sleep apnoea while chronic pain patients will require amounts of opioids that exceed their baseline dose (Garimella, 2013).

Factors identified during the pre-operative assessment that may predict the effect on the level of post-operative pain are age, anxiety levels, depression, and the anatomic location of surgery (Ip, 2009;Caumo et al., 2002;Schnabel et al., 2012). It is important that the patient and family are involved in the pre-operative education as involving patients in their care is an essential part of ERAS. Despite the recognition that pre-operative assessment is important, there is little focus within the literature and a paucity of evidence around the impact of it on post-operative pain, anxiety, and time to discharge (Shuldham et al., 2002;Walker, 2007).

Pain assessment

Pain assessment is needed for effective pain management. There are many instruments to assess pain but the two most widely used are the visual analogue scale (VAS) and the numeric rating scale (NRS) (Jensen et al., 1986). The numeric rating scale (NRS) is a verbal question asking patients to score their pain from zero (no pain at all) to ten (worst pain ever possible) (Jensen et al., 2001). While the visual analogue scale (VAS) is similar but written on paper and consists of a straight line with two endpoints defining extreme limits such as 'no pain at all' and 'extremely intense pain' (Hawker et al., 2011). These instruments assess pain intensity well and are equally sensitive in assessing acute pain after surgery. Both are reportedly better than the four-point verbal rating scale (VRS) (H. Breivik et al., 2008). The verbal rating scale (VRS) has four endpoints with the scale of pain including 'none', 'mild', 'moderate', and 'severe' (Haefeli & Elfering, 2006). Numeric rating scales (NRS) and visual analogue scales (VAS) have shown the same results in values of pain scores at various times while VRS underestimated the intense pain (Haefeli & Elfering, 2006). Overall, the numeric rating scale (NRS) is more practical and easier to understand for most patients (E. K. Breivik, Björnsson, & Skovlund, 2000).

Pain assessment at rest after surgery is to measure if the patient is comfortable in bed. However, pain assessment during movement is more important to ensure the patient has sufficient pain relief during mobilisation, deep breathing, and coughing. This is to reduce the risk of cardiopulmonary and thromboembolic complications after surgery (E. K. Breivik et al., 2000). Effective pain relief during activity may assist with improving mobilisation and consequently improve the long-term outcomes for patients after surgery (Harald Breivik & Shipley, 2007).

One of the fundamental principles of ERAS is using more than one analgesic modality to achieve successful pain control while reducing opioid-related side effects, this is called multimodal analgesia (Schwenk & Mariano, 2018). Multimodal analgesia consists of administering a variety of analgesics with different mechanisms of action. For example, multimodal analgesia may include oral analgesics and concurrent application of regional and systematic analgesia such as localised anaesthetic into the wound bed (Henrik Kehlet & Dahl, 1993). Multimodal analgesia reduces post-operative pain, minimises opioid-related adverse effects, and fast-tracks recovery which may result in reduced length of stay (Kaye et al., 2019).

Opioids

ERAS principles advise against the use of opioids and recommend opioid-sparing techniques to achieve early mobilisation, return of bowel function and fewer complications and shorten the length of stay. (Gustafsson et al., 2013;J Nygren et al., 2013;Carmichael et al., 2017; ERAS Compliance Group, 2015;O. Ljungqvist et al., 2017). Opioids continue to be used in anaesthesia and post-operative pain management for patient comfort, healing, and recovery (Nowak et al., 2020;Mandel, 2014). However, opioids can result in various side effects like sedation, respiratory depression, urinary retention, nausea/vomiting, and ileus. These common side effects may delay time to recovery and lead to an increased length of stay (American Society of Anesthesiologists Task Force on Acute Pain Management, 2012; Oderda et al., 2003). One of the primary side effects of opioids is respiratory depression which may lead to hypoxia and respiratory arrest (van der Schier et al., 2014). This is why regular monitoring of respiration and oxygen saturation is needed for patients on opioids post-operatively (Garimella & Cellini, 2013). Patients who had opioid-related adverse occurrences in the post- operative period had higher mean cost, longer mean length of stay, and increased readmission rates (T. Gan et al., 2004).

Pain control has been studied and it has shown that ERAS has addressed the key issues that delay post-operative recovery and prolong hospital stay. These are parenteral opioid analgesia, the need to maintain intravenous fluids due to gut dysfunction, and bed rest secondary to lack of mobility (Gustafsson et al., 2013). For colorectal surgery, the return of bowel function is one of the key milestones of patient recovery. The development of post-operative ileus and delay in return to normal bowel function has been related to the use of opioids. A total daily hydromorphone dose of greater than two milligrams per day was significantly associated with the development of ileus and the risk was even higher for patients who had open procedures (Barletta et al., 2011).

Opioid side effects and problems are dose-related, therefore strategies to reduce the dosage of opioids are useful (Kehlet, 2005). Studies exploring limiting the use of opioid regimens have shown a reduced incidence of post-operative ileus. Using lidocaine (Kranke et al., 2015), celecoxib (Raju et al., 2015), magnesium (Shariat Moharari et al., 2014), and epidural analgesia (Pöpping et al., 2014) decreased the use of opioids and reduced the prevalence of post-operative ileus formation. This was beneficial for the patient and the hospital as post-operative ileus doubles the hospital cost and added 6-13 days to the average length of stay (Asgeirsson et al., 2010;Vather & Bissett, 2013). Patients' exposure to opioid use put them at increased risk of addiction and substance use disorder and this was more so in patients who had a pre-existing history of depression or use of illicit drugs, alcohol, antidepressants, or benzodiazepines (Tan et al., 2015). In these cases, for patients who had a high tolerance for opioids, opioids may not always be effective for post-operative pain management (Tan et al., 2015). A useful strategy to reduce the dose of opioids included co-analgesics such as non-steroidal anti-inflammatory drugs (NSAID). However, they also come with complications, side effects, and risks (Marret et al., 2005).

Non-steroidal anti-inflammatory drugs (NSAIDs)

ERAS multimodal analgesia approach improves pain control but also aims to avoid the side effects of each drug. Part of this technique is administering paracetamol (ERAS Compliance Group, 2015) and using nonsteroidal anti-inflammatory agents (NSAIDS) which assist with decreasing the opiates requested and administered to patients, hence it helps with reducing the side effects of opioids (Lowder et al., 2003). The ERAS multimodal approach improves pain control but also avoids the side effects of each drug (Gustafsson et al., 2019). Non-steroidal anti-inflammatory drugs (NSAID) are used in both acute and chronic pain to block pain and inflammation in acute and chronic pain without the risk of drug abuse (Gupta & Bah, 2016). Patients benefit most if the NSAID starting dose is high then the dose is lowered when pain is successfully controlled to facilitate patient compliance. The benefits of using NSAIDs are shown in a few of the studies, such as improving psychological condition as it minimises patients' distress and sleep disturbances (Buvanendran et al., 2003; Srivastava et al., 2012) and reducing pain scores and decreasing opioid use (Rivkin & Rivkin, 2014).

For patients who are morbidly obese and elderly, it was found that if NSAIDs were used peri-operatively it led to reduced opioid use, pain intensity, and post-operative nausea and vomiting (PONV) in the first twenty-four hours (Michelet et al., 2012). However, the use of NSAIDs in morbidly obese patients is debated, Gupta et al (2016) reported that using NSAIDs in morbidly obese patients could increase the risk of post-operative haemorrhage (Gupta & Bah, 2016) while De Baerdemaeker & Margarson (2016) supported the use of NSAIDs although find that kerolac may increase the risk of postoperative haemorrhage after laparoscopic Roux-en-Y gastric by-pass. The well-known side effects of NSAIDs are gastrointestinal, renal, and cardiovascular

complications which older people have a higher baseline risk (Southworth et al., 2015;Davis & Robson, 2016).

In patients who underwent colonic resection the use of non-selective NSAIDs has been shown to increase anastomotic leak rate and therefore they should be used cautiously in colorectal surgery patients (Holte et al., 2009;Rosenberg & Harvald, 2007;M. Klein et al., 2009). Other findings, such as the increased risk of bleeding, were further supported by other studies (Masclee et al., 2014;Straube et al., 2009) and therefore while NSAIDs are safe to use and reduced the use of opioids and opioid side effects, they need to be used with caution in colorectal surgery.

Patient controlled analgesia (PCA)

Patient-controlled analgesia (PCA) provides patient autonomy and control over the amount and frequency of medication administered through the PCA pump (Garimella & Cellini, 2013). It is an effective and most common method for managing post-operative pain (Rawal, 2016). The primary benefit is the elimination of the painful waiting time between requesting and receiving the medication which in turn gives the patient improved pain control and greater satisfaction (Hudcova et al., 2006;Mohanty et al., 2018). There are disadvantages to using PCA which include limiting the patient's mobility due to lines, pumps, and tubing (Vadivelu et al., 2010) and susceptibility to human dosing error and mechanical issues that may cause harm to patients, adding increased costs to the healthcare system (Fanelli et al., 2016). Other side effects are related to the opioids administered via PCA such as nausea, sedation, apnoea, hypoxemia, hypoventilation, pruritus, and post-operative delirium (Motamed, 2022). PCA is a well-accepted form of pain relief for patients and health care providers (Stamer et al., 2002).

One of the most common side effects of analgesia is nausea and vomiting which can extend patients' hospital stay due to dehydration and slow return of adequate nutritional intake which may require the placement of a nasogastric tube and need more intravenous fluid administration (Gustafsson et al., 2019). ERAS protocols suggest that a multimodal approach to nausea and vomiting should be considered if opioid use cannot be avoided (Fearon et al., 2005). Post-operative pain control requires interprofessional contribution that starts from the pre-operative setting to patient recovery. Identifying patient risks and comorbidities early can predict the severity of patients' post-operative pain which allows the healthcare providers to develop an individualised analgesic regimen for better outcomes and increase patient quality of life (Horn & Kramer, 2023).

Early removal of indwelling urinary catheter (IDC) and removal of drains

Drains

Prophylactic surgical drains in colorectal surgery are placed to evacuate potentially contaminated fluid or blood or an abscess that accumulated in the extraperitoneal space (Averbach & Sugarbaker, 1995). Tsujinaka et al. (2008) reported that drains provide an early diagnosis of anastomotic complications or leaks by the identification of the output of the drain – whether it is bowel content, pus, or excessive fluids. An anastomotic leak can slow patients' recovery progress and be problematic after hospital discharge with slower wound healing, extended hospital stays, poor quality of life, and long-term impaired anorectal function if the anastomosis is low in the rectum (Nesbakken, Nygaard, & Lunde, 2001). An anastomotic leak has been associated with an increased cancer-specific mortality and local recurrence rate for patients who underwent rectal cancer surgery (Branagan & Finnis, 2005;Eberhardt et al., 2009;Law et al., 2007). Many previous studies demonstrate prophylactic drainage does not reduce or detect anastomotic leaks (Urbach et al., 1999;Petrowsky et al., 2004;Jesus et al., 2004;F Bretagnol et al., 2005;Denost et al., 2017) and did

not lessen the mortality, wound infection, or reoperation rates in colorectal surgery (Zhang et al., 2016). Some declare that using a prophylactic drain may encourage the formation of serous fluids (Lennox, 1984) and increase risk of an infection (Berliner et al., 1964;Nora et al., 1972). A most recent prospective international cohort study has found that intraperitoneal drain placement is not associated with earlier detection of post-operative collections but increase hospital stay and increase SSI risk (Collaborative, 2022). It has been reported that once the drain leaks pus or enteric output, it cannot guide the faecal fluid out of the abdominal cavity (Urbach et al., 1999) as the drain blocks quickly (Shear et al., 1965).

Drain placement and time to removal increased the length of stay of colorectal patients (Toh et al., 2021). There were additional negative effects of pain at the drain site and skin irritation reported by patients which was a further health burden for them and their family/carers (Addison et al., 2019). It is recommended not to use pelvic and peritoneal drains routinely on the ERAS protocol (Gustafsson et al., 2019). There is consensus among colorectal surgeons that if drains are to be used then early removal is preferable (Toh et al., 2022).

Indwelling urinary catheter (IDC)

An indwelling urinary catheter (IDC) is used in colorectal surgery to prevent urinary retention (Basse et al., 2000;Hilton, 1988) and to monitor urine output as a guide for post-operative fluid management (Schreiber et al., 2019). Patients who have an IDC for more than four days are likely to develop bacteriuria or candiduria (Stamm, 1991;Warren, 1991;Crouzet et al., 2007). After two days of catheterisation, there is an increased risk of urinary tract infections (Wald et al., 2008) and an IDC restricts a patient's mobility (Stahl et al., 2006). There is consensus within the ERAS

recommendations to routinely remove the indwelling catheter within one to three days after the surgery (Gustafsson et al., 2019).

Nasogastric tube (NGT)

Nasogastric tubes (NGT) are normally used to decompress the stomach in the setting of intestinal obstruction or ileus, but they are also used to administer nutrition or medication for those patients who cannot tolerate oral intake (Ten Broek et al., 2018;Blumenstein et al., 2014). The routine use of NGT has been reported as having no positive impact on patient outcome (Petrelli et al., 1993;Feo et al., 2004) and is not recommended in colorectal surgery (Gustafsson et al., 2019). Patients who do not have an NGT tolerate oral intake earlier (Carmichael et al., 2017;K. Li et al., 2011). Early feeding then leads to reduced hospital length of stay and fewer post-operative complications (Zhuang et al., 2013). NGTs fail to improve bowel function and do not reduce the risk of anastomotic leak but rather causes abdominal discomfort (Bauer, 2013;Nelson et al., 2007;Tanguy et al., 2007).

In summary, it is recommended that neither drains nor NGTs should be routinely used in colorectal surgery and early removal of urinary catheters should be facilitated as these only hinder patient mobility and increase the risk of urinary tract infections (Van der Leeden et al., 2016;McIntosh et al., 2022).

Measuring complications after surgery

Clavien-Dindo

Complications in surgery can result in increased cost, length of stay, take back to the operating theatre, legal issues, and further treatment (Collins et al., 1999;Coello et al., 2005). Clavien-Dindo is a tool to classify surgical complications and consists of seven grades (Grade I, II, IIIa, IIIb, Iva,

Ivb and V) (Dindo et al., 2004). Grade I complications are usually mild but Grade II and higher are more significant and require successively more complex interventions (Clavien et al., 2009). However, there are studies discussing the limitations, such as concerns about distinguishing between grades III and IV and not classifying intra-operative complications (Golder et al., 2023). Another study reported that Clavien-Dindo underestimated the burden of some complications after colectomy, and it also does not classify low-grade complications well (Widmar et al., 2021). The Clavien-Dindo classification is a validated tool and has been used widely in surgical literature (Myatt et al., 2012). A copy of the Clavien-Dindo definitions can be found on Appendix 2.

Compliance & documentation

Clinical documentation is used to communicate the action taken and the thoughts of the author to other members of the team, to support patient care, and to improve clinical outcomes through enhanced communication (Kuhn et al., 2015). It is recommended to continuously audit the key outcomes and regularly provide feedback to all the healthcare workers to sustain the ERAS programme (Gustafsson et al., 2019). Therefore, documentation is a crucial factor of ERAS (Labgaa et al., 2016). It enables a process to audit and provide progress reports of the programme. The audit feedback cycle can also contribute to system improvement.

Clinical documentation was the reported limitation of a study conducted across twelve hospitals in Europe. These studies assessed the adherence rate to ERAS in daily practice and examined the relationships between the importance of interventions and ERAS adherence rate (van Zelm et al., 2017). The study may have underestimated the ERAS protocol adherence rate. Their data had an average adherence rate of only 44% of the protocol in clinical practice. The investigators found that the interventions that had a higher rate of compliance were documented with greater attention

and may be considered important (van Zelm et al., 2017). The interventions with the highest adherence were antibiotic prophylaxis (95%), thromboprophylaxis (87%), and measuring body weight at admission (87%). Interventions with the lowest adherence were early mobilisation walking and sitting (9 and 6%, respectively). The adherence ranged between 16 and 75%, with an average of 44%. However, only >70% adherence to the protocol showed improved outcomes (Gustafsson et al., 2016).

There were no studies identified that reported on documentation of the ERAS pathway. Nurses play a key role in this, especially in the early post-operative period. A study prospectively assessed nursing workload before and after ERAS was implemented and found higher compliance with the pathway, and lower burden for the nurses (M. Hübner et al., 2015).

Higher compliance with ERAS is linked to better outcomes with lower incidence of surgical site infection, fewer post-operative complications, and shorter post-operative hospital stay (L. Li et al., 2017;ERAS Compliance Group, 2015;Feng et al., 2022), in comparison to no structured ERAS implementation (van Zelm et al., 2017).

CHAPTER 3: AIM OF THE RESEARCH AND STUDY DESIGN

The objective of this study is to determine if better documentation and compliance translates to improved clinical outcomes on the ERAS pathway. Specifically, this research aims to identify if there is a relationship between documentation compliance and clinical outcomes in patients on a colorectal ERAS pathway. The hypothesis was that there is a correlation between documentation compliance and improved clinical outcomes. The design chosen for this study was a retrospective cohort study. This study design was selected because the study began after the outcome of interest has already occurred. Any information about the patient's characteristics, treatment, or other management was obtained after the event (Brodbelt, 2009). This type of study is frequently called a chart review because the source of data is the medical records (Hess, 2004).

A limitation of a retrospective study is relying on historical records and pre-existing data that may be incomplete. Information of interest may not have been captured and there may be inconsistency in the quality of information recorded (Pan et al., 2005;Gearing et al., 2006). In contrast, the advantage of this study is that the existing data is readily accessible (Hess, 2004;Worster & Haines, 2004). It often only needs little time, effort, and money compared to other studies (Grimes & Schulz, 2002).

A retrospective cohort study was chosen because there was no intervention used but rather observing and analysing medical records to identify if there was a correlation between documentation compliance and the clinical outcomes for patients who had colorectal surgery and were on the ERAS pathway. A retrospective study can provide useful information that may have an important impact on clinical settings.

CHAPTER 4: METHODS

Ethics

Ethics approval was obtained at Sydney Local Health District (SLHD) X20-0307 & 2020/ETH01553, and clinical governance was also obtained at Royal Prince Alfred Hospital. A copy of the ethics approval letter can be found in Appendix 3.

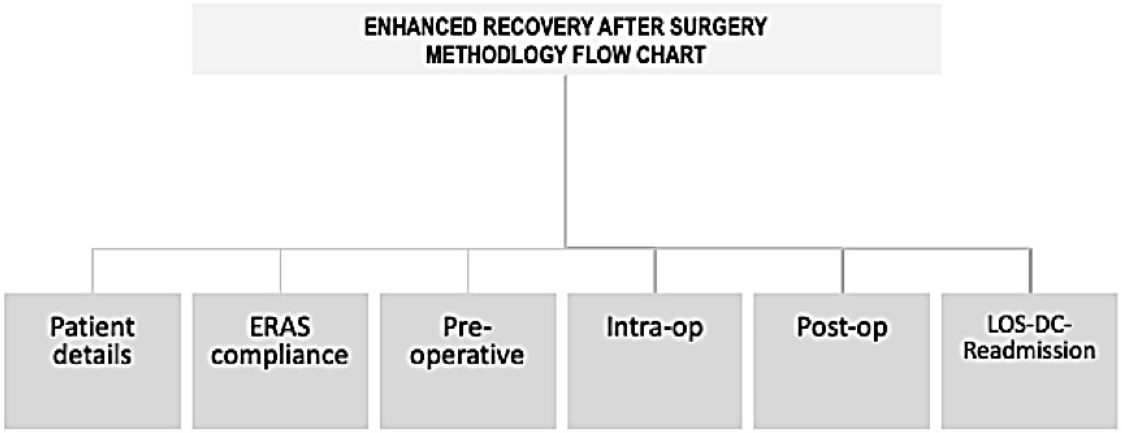
Patient population

The Sydney Local Health District ERAS clinical registry was accessed, and a list of patients enrolled on colorectal ERAS in 2019 and 2020 was obtained. The medical records of these patients were accessed and reviewed. All data collected were de-identified.

Data collection

Retrospective data on documentation regarding compliance with ERAS pathways was obtained by reviewing the medical records of patients. These data were entered into a Microsoft® Excel spreadsheet and then uploaded and stored in a database on Research Electronic Data Capture (REDCap) hosted by Sydney Local Health District. These data were divided within the Excel spreadsheets into six sheets labelled as shown in Figure 1.

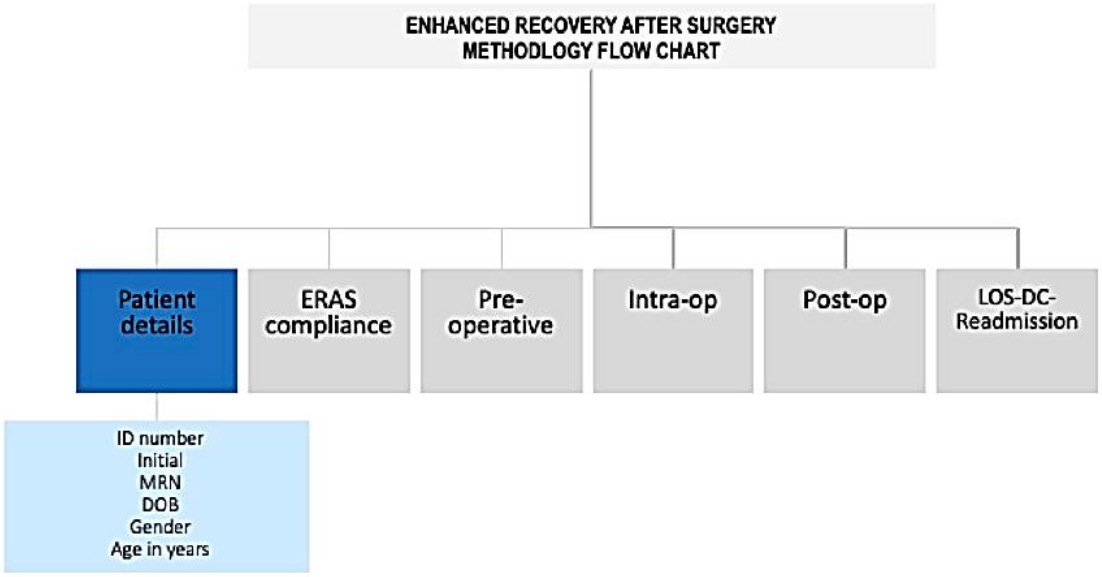
Figure 1. Image showing how the data was organised within the spreadsheet for ERAS.



Patient details data collected included study allocated identification (ID) number, patient initials, medical record number, date of birth, gender, and age in years at the time they had the surgery. Patients' ID numbers, medical record numbers, date of birth, and gender were on every Excel sheet to check patients' identification during data collection to eliminate errors. Figure 2 shows the data tree.

Patient details

Figure 2. Image showing the patient details data collected.



Compliance was determined by reviewing the clinical pathways that were allocated to the patient. These pathways outlined the expected trajectory of the patient's hospital stay and were compared to the actual trajectory. The expected trajectory or benchmark can be found below in Table 1. Documentation compliance was measured by examining pathways and medical record entries. Three pathways are used at our centre, (1) bowel resection (2) bowel resection with a stoma, and (3) closure of stoma. A copy of these pathways can be found in Appendix 4.

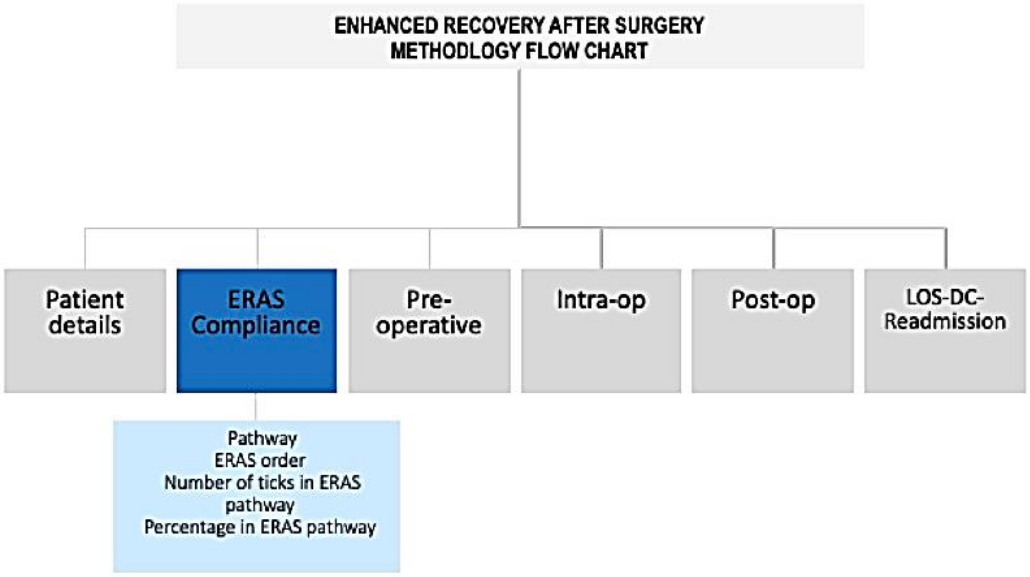
The expected length of stay (LOS) for each pathway is reported at the end of Table 1.

Table 1. Benchmark / targets used to assess the actual patient trajectory.

	Normative / Target values
Pre-operative	Pre-operative counselling/ optimisation The patient is seen at pre-admission clinic for consultation with an anaesthetist. Verbal education and ERAS booklet given to patients. Pre-operative assessment to identify risks and optimise. Pre-operative nutritional screening • Normal BMI 18.5- 24.9 • MST score >2; refer to a dietician. Avoid bowel preparation. Avoid fasting, fast from solid food for 6 hours before surgery, and clear fluid diet including carbohydrate clear fluids until 2 hours prior to surgery. Haematology • Ferritin level- adult female 20-220ug/L (premenopausal), adult female (postmenopausal) 30-370ug/L, adult male 30-620ug/L ((RCPA), 2021) • HB level – female 115-165 g/L, male 125-185 g/L (Lifeblood, 2021)
Post-operative	Avoidance of nasogastric tube No routine abdominal drainage – early removal of abdominal drains Early removal of urinary catheters – remove post-operative day one at 0600hrs for bowel resection and at day three for bowel resection with stoma. Multimodal post-operative analgesia – paracetamol as regular medication charted, PCA used and removed at day one or two depending on the pathway. Anti-thrombotic prophylaxis – compression stockings and heparin charted. Metoclopramide charted as a regular medication three times per day. Post-operative early oral intake
LOS- Discharge	Bowel resection – 4 days Bowel resection with stoma – 7 days Closure of stoma – 3 days Discharge advice should be given. Follow up phone call from the ERAS team

ERAS Compliance

Figure 3. Image showing the ERAS compliance data collected.



ERAS compliance data was recorded on a spreadsheet as detailed in Figure 3. The following data was collected:

1. The type of Pathway that the patient was allocated to.

2. When the ERAS order was requested – pre-admission, on admission or during the episode of care or not ordered. All patients would be on ERAS unless specified by the surgeons, as per the SLHD ERAS policy.

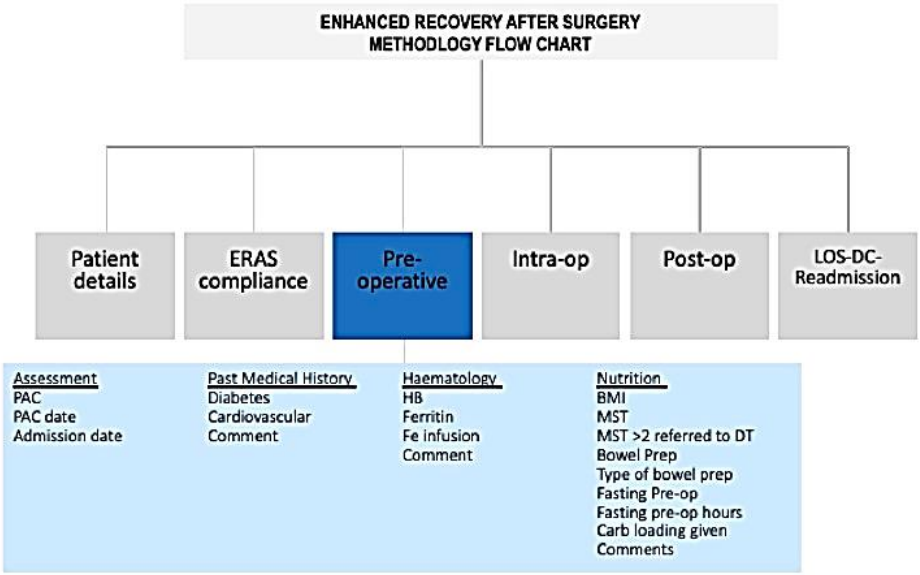
3. For each patient, the number of items on the pathway signed off correctly was counted and the percentage of completed documentation was calculated.

4. Comments around no ERAS form or wrong pathway were also documented.

5. The rest of the data were categorised into the domains of ERAS: Pre-operative care, intra-operative care, and post-operative care including length of stay/discharge/readmission which involved reviewing patient clinical outcomes. The following figures further explain the data collected under the ERAS domains.

Pre-operative

Figure 4. Image showing the pre-operative data collected.



The **pre-operative** data was broken down into four sections which included assessments, past medical history, haematology, and nutrition. Patients meet the multidisciplinary team including the colorectal clinical nurse consultant, anaesthetist, pre-admission nurse who recorded the patient's weight, height, and blood pressure baseline, and the stoma nurse if needed. However,

allied health professionals were only introduced to patients post-operatively when referrals were made.

1. Assessment data collected information about pre-admission clinic (PAC). This included the date when they were seen and their admission date.

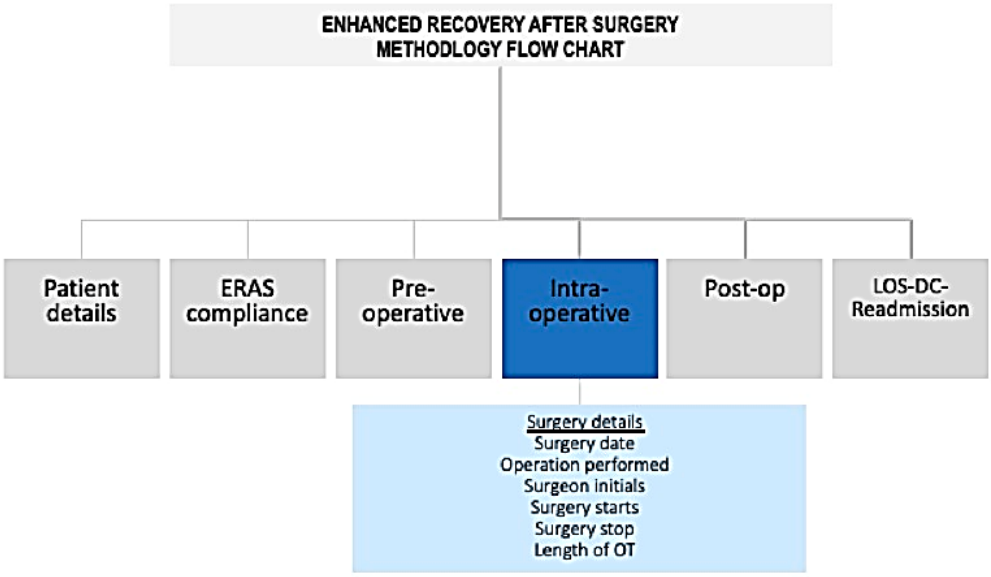
2. Past medical history was noted in PAC by the junior medical doctor and/or the colorectal clinical nurse consultant. Progress notes from electronic medical records identified if the patient had diabetes or cardiovascular disease. Other information was added for the description of other diseases or conditions and extra information regarding their past medical history (Appendix 5).

3. Haematology included the pre-operative haemoglobin and ferritin. The data also identified if a patient had an iron infusion prior to their surgery.

4. The last section documented nutrition which included patients' BMI and MST score. Referral to a dietitian was documented. An MST score above two indicates they should be referred to a dietician post-operatively. Information about bowel preparation was documented. Fasting times were documented. Information around carbohydrate loading pre-operatively and any other additional information was documented as text. MST assessment and BMI calculations were part of the Waterlow assessment as shown in Table 1. MST was developed in Australia by Ferguson et al. (1999), it consists of two questions regarding appetite and recent unintentional weight loss. The results are between 0 to 5, patients who scored ≥ 2 were considered at risk and further assessment was needed therefore were referred to a dietician (Ferguson et al., 1999).

Intra-operative

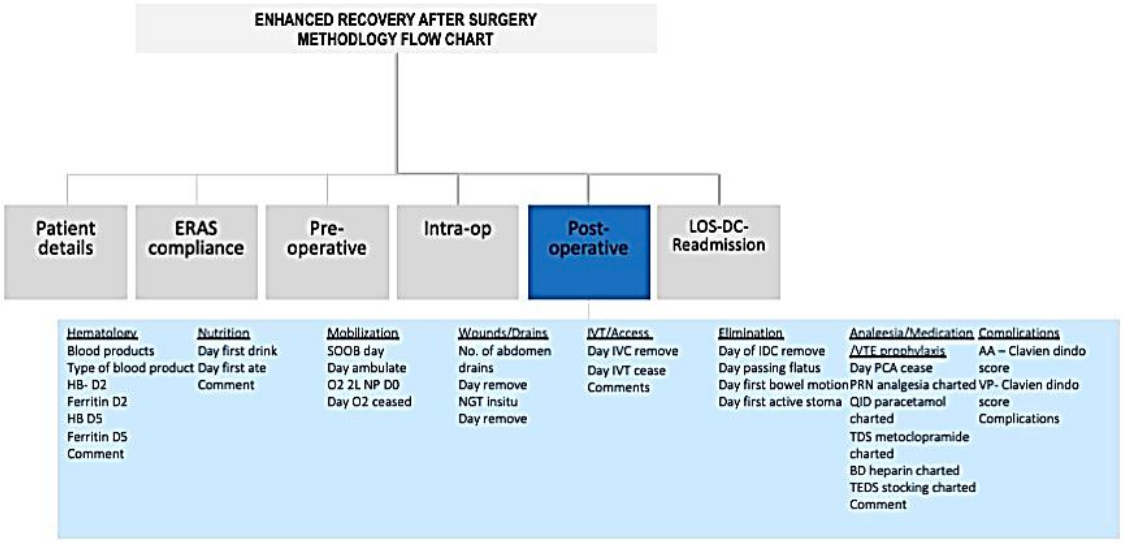
Figure 5. Image showing the intra-operative data collected.



The **intra-operative** data collected included the surgery date, operation performed, surgeon initials, surgery start time, and surgery stop time. The length of the operation was calculated in minutes.

Post-operative

Figure 6. Image showing the post-operative data collected.



Post-operative information was broken down into eight sections from the ERAS pathway. These were haematology, nutrition, mobilisation/physiotherapy, wounds/drains, intravenous therapy (IVT) /access, elimination, analgesia/medication/venous thromboembolism (VTE) prophylaxis.

1) The haematology section had six components – administration of blood products, and type, haemoglobin, and ferritin at post-operative day two and day five (if applicable).
2) Nutrition captured the post-operative day that the patient first ate and drank. It was noted if patients had an adjustment of their diet – such as returning to 'Nil by mouth' (NBM) status or returning to clear fluids (CF) or if they had a peripherally inserted central catheter (PICC) inserted for total parenteral nutrition (TPN).
3) Mobilisation. The ERAS pathway for mobilisation post-op includes the target of hours for sitting out of bed per day, starting from one to two hours per day and gradually aiming for up

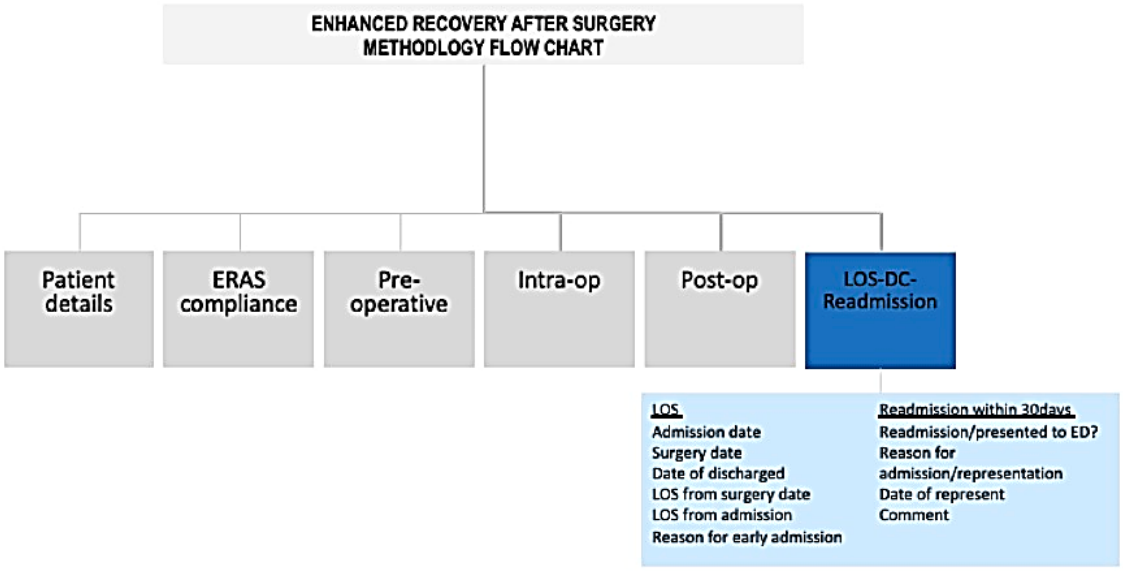
to four hours per day. The same concept applied to ambulating, starting from one hundred metres once per day, gradually increasing to one hundred metres four times per day. However, to capture mobilisation for this project, the first post-operative day that the patient sat out of bed (SOOB) and the day that they ambulated was recorded. The use of post-operative oxygen and the day that the oxygen was ceased was also recorded.

4) Wounds and drains data captured included the presence of drains, the 'number of abdominal drains' and the presence of a 'nasogastric tube'. The post-operative day that these were removed was also documented.
5) Intravenous therapy/access noted which post-operative day the IVC was removed, when the IVT was stopped, and if the IVT was restarted or if an IVC was re-inserted or fell out accidentally.
6) Elimination section captured the first post-operative day that the patient had their IDC removed, passed flatus, bowels opened and if applicable, the first time the stoma was active.
7) Analgesia/medication/ VTE prophylaxis captured the 'day the PCA ceased' followed by the use of pro re nata (PRN) which means as needed analgesia. This section also recorded whether paracetamol, metoclopramide (regular or PRN), heparin or enoxaparin, and TED stockings were charted in the patient's medication chart.
8) Complications were recorded using the Clavien-Dindo score (Dindo et al., 2004), which was scored independently by two researchers (AL & VP). Discrepancies were then discussed, and a decision was made on the agreed score.

Length of stay (LOS)- Discharge (DC)

Readmission

Figure 7. Image showing the length of stay, discharge and readmission data collected.



The patient's length of stay was measured from the date of surgery to the date of discharge. In some cases, patients were admitted days before surgery often because they lived remotely or were admitted through the emergency department (ED). The reason for an early admission was recorded. However, a decision was made to not include these days within the ERAS LOS.

Readmission within thirty days was documented as follows: 'readmission/presented to ED?', the reason for admission, date of presentation, and a comment section. All data was captured from eMR, medical and nursing progress notes, and the operation report.

The ERAS documentation compliance was based on the ERAS pathway paper form (Appendix 4) which were cited in the medical records. The ERAS pathways were located in the patient's bedside chart.

Data Management

Electronic medical records (eMR) and the paper medical record patient files were used as information sources. The data will be stored on the SLHD REDCap. Following the publication of the study, only the Principal Investigator (PI) will retain ongoing access to all study materials and data stored on the SLHD Research Electronic Data Capture (REDCap) respectively. The PI contacted SLHD Information and Communication Technology (ICT) to arrange for permission to be changed so only the PI can access the study folder.

Data analysis

Data was uploaded from Microsoft Excel into SPSS Version 27 (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp). Descriptive statistics were performed to describe the characteristics of these data. The mean and standard deviation and/or 95% confidence intervals were reported for normally distributed continuous variables. The median and percentiles were reported for non-normally distributed continuous variables.

Relationships between variables were calculated using Chi-Square (Fishers exact test where appropriate) within categorical variables and Spearman or Pearsons correlation in normally distributed data. Sub-analysis was calculated using different pathways, patient groups, and documentation compliances. Commonalities within and between groups were calculated and

reported. Linear regression and bivariate regression were performed using multiple models described within the results section. Statistical significance for all analysis was set at 0.05. The first regression model examined all factors related to documentation with complications defined as any Clavien-Dindo score of >0.

Data Cleaning

Data inspection was completed, the data set was reviewed and checked to identify any anomalies such as duplicate, or formatting errors. These were then corrected and rechecked for any inconsistencies. The format of data was standardised, units of measurement and categorical variables. This ensures consistency and facilities accurate analysis. Inconsistencies or erroneous data were double checked against the medical record and clarified.

CHAPTER 5: RESULTS

As described previously in the methods chapter, in our centre we have three ERAS pathways. These are (i)bowel resection with stoma, (ii)bowel resection without stoma and (iii)closure of stoma. The tables below summarise how our patients' clinical care and outcomes measure up when benchmarked against the key aspects of ERAS previously discussed within the Chapter 2 Literature review.

The results in these tables are expressed as a percentage of the total number of patients who have met the benchmark within the allocated pathway. The pathway has been broken down to pre-operative, post-operative and length of stay/ readmission and an average compliance reported for each pathway.

When all areas of the pathway were averaged, approximately 45% of patients on the bowel resection with stoma and closure of stoma pathway met the ERAS benchmark (Table 2 and Table 4). Those on the bowel resection pathway had the poorest compliance at only 26% (Table 3).

The results following the summary tables are set out in accordance with the order of data collection which was outlined within Chapter 4 Methods and provides a detailed analysis of these data.

Table 2. Pathway Compliance: Bowel resection with stoma (n=39)

Key aspects			Benchmark*	Documented % who met benchmark n=39	Mean (95%CI or IQR)	Comments
Pre-operative						
	Pre-admission clinic		1-week pre surgery	51%		
	Preop Fe Male		≥30	36%	168.25(95%-62.93,400.43)	Results for n=19
	Pre-op Fe Female		≥20	10%	68.50(95%CI: -38.91,175.91)	Results for n=16
	Pre-op Hb Female		≥115	44%	126.75(95%CI:90.67,162.83	Results for n=19
	Pre-op Hb Male		≥125	10%	122 (95%CI:94.13,149.87)	Results for n=8
	MST		<2	55%		Results for n=24
	Carbohydrate loading		Yes	18%		
	Fasting pre-operative		2hrs	49%	2.0 (95%CI 2.0,2.0)	Results for n=37
	Bowel prep		None	77%		
Post-operative						
	PCA cease		Day 2	54%	2.41(95%CI:1.77,3.05)	Results for n=32
	Regular paracetamol		Charted	95%		
	Antiemetic / prokinetic		TDS Metoclopramide	39%		
	DVT prophylaxis charted		Charted	59%		
	First time drink		Day 0	54%	0(IQR 1) (*95%CI:.33,1.18)*	Results n=37
	First time eat		Day 1	23%	4.08(95%CI:2.59,5.57)	Results n=37
	Sat out of bed		Day 0	10%	1(IQR 0) *(95%CI:.81,1.95)*	Results for n=37
	Mobilise		Day 1	54%	2 (95%CI: 1.20,2.42)	Results n=37
	First passed flatus		<48hrs	41%	2(95%CI:1.27,2.23)	Results n=20
	First bowel open		<48hrs	8%	4.0(95%CI1.52,6.48)	Results n=8
	First stoma active		<48hrs	41%		Results n=32
	NGT		None	74%		
	Cease IVT		Day 2	62%	2.89(95%CI:1.85,3.93)	Results n=37
	IVC remove		Day 3	47%	3.69(95%CI:3.01,4.37)	Results n=32
	IDC out		Day 3	59%	3.91(95%CI:2.73,5.09)	Results n=34
	Drains out		As per CRC surgeon	N/A	8.52(95%CI:5.61,11.43)	Results n=25
LOS/DC/Readmission						
	Discharged		Day 7	46%	12.46(95%CI9.46,15.46)	Range 2-39
	Compliance points checked		287 checked	0%	4.01(95%CI:1.72,6.30)	Range 0-24
	Readmission with 30 days		No readmission	87%		
Total						
	Pre-operative mean	39%				
	Post-operative mean	48%				
	LOS/DC/Readmission mean	44%				
Overall mean total		45%				

Note. CI= Confidence Interval. *Further details on ERAS benchmark can be found on Page 37 of Method section in Chapter 4

Table 3. Pathway Compliance: Bowel resection (n=37)

Key aspects	Benchmark	Documented % who met benchmark n=37	Mean (95%CI or IQR)	Comments
Pre-operative				
Attend pre-admission clinic	Pre surgery	69%		
Preop Fe Male	≥30	11%	119.86(95%CI: –28.37,268.08)	Results n=7
Pre-op Fe Female	≥20	14%	286.6(95%CI-332.42,905.62)	Results n=5
Pre-op Hb Female	≥115	16%	113.20(95%CI:85.62,140.78)	Results n=18
Pre-op Hb Male	≥125	22%	124 (95%CI: 108.61,139.39)	Results n=15
MST	<2	59%		Results n=23
Carbohydrate loading	Yes	43%		
Fasting pre-operative	2 hrs	48%	5.71(95%CI3.58,7.85)	
Bowel prep	None	65%		
Post-operative				
PCA ceased	Day 1	60%	1.45(95%CI:1.19,1.72)	Results n=33
Regular paracetamol charted	Charted	97%		
Antiemetic / prokinetic	TDS Metoclopramide charted	49%		
DVT prophylaxis	Charted	76%		
First time drink	Day 0	84%	.0(IQR 0) *(95%CI: -.02,.56)*	
First time eat	Day 1	38%	2(95%CI:1.89,3.03)	
Sat out of bed	Day 0	19%	1(IQR 0) *(95%CI:.80,1.26)*	
Mobilise	Day 1	89%	1(IQR 0) *(95%CI:.88,1.23)*	
First passed flatus	<48hrs	46%	2.32(95%CI:1.94,2.70)	Results n=34
First bowel open	<48hrs	16%	4.05(95%CI: 3.19,4.90)	Results n=32
NGT	None	89%		
Cease IVT	Day 1	56%	1.75(95%CI:1.26,2.24)	Results n=36
IVC remove	Day 2	49%	3.06(95%CI: 2.47,3.65)	Results n=33
IDC out	Day 1	62%	1 (IQR 1) (*95%CI: 1.20,1.71)*	Results n=35
Drains out	As per CRC surgeon	N/A	4.46(95%CI: 3.01,5.91)	Results n=13
LOS/DC/Readmission				
Discharged	Day 4	24%	7.05(95%CI:5.56,8.54)	Range 4-16
Documentation check points	206 checked	0%	8.91(95%CI:4.44,13.38)	Range 0-42
Readmission 30 days	No readmission	92%		
Total				
Pre-operative mean	39%			
Post-operative mean	59%			
LOS/DC/Readmission mean	37%			
Overall mean total	26%			

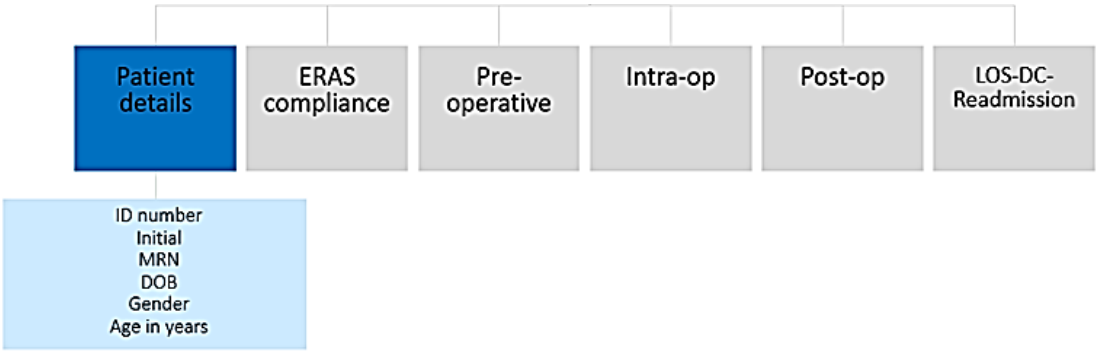
Note. CI= Confidence Interval. *Further details on ERAS benchmark can be found on Page 39 of Method section Chapter 4.

Table 4. Pathway Compliance: Closure of stoma (n=21)

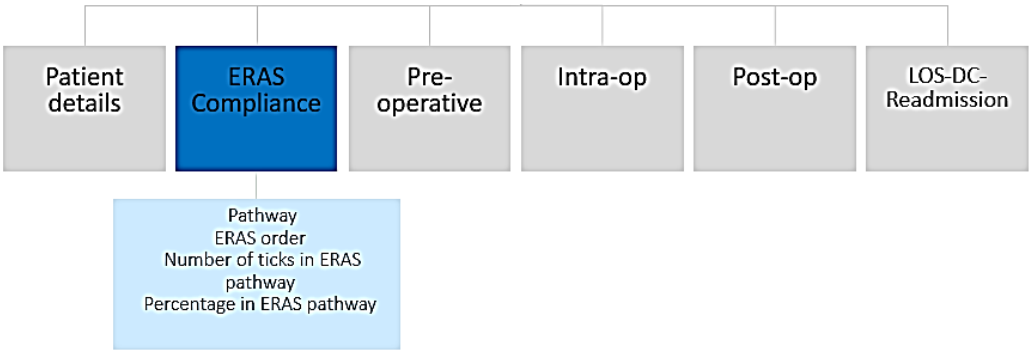
Key aspects		Benchmark	Documented % who met benchmark n=21	Mean (95%CI or IQR)	Comments
Pre-operative					
Pre-admission clinic		Pre surgery	62%		
Preop Fe Male		≥30	14%	173.33(95%CI:26.74,319.93	Results n=3
Pre-op Fe Female		≥20	5%	N/A	Results n=1
Pre-op Hb Female		≥115	5%	N/A	Results n=1
Pre-op Hb Male		≥125	38%	136(95%CI;105.47,166.53)	Results n=9
MST score		<2	67%		Results n=15
Carbohydrate loading		Yes	24%		
Fasting pre-operative		2hrs	48%	7.23(95%CI;4.91,9.57)	Results n=10
Bowel prep		None	95%		Results n=20
Post- operative					
PCA ceased		None	66%	1(IQR 3) *(95%CI: -.61,6.90)*	Results n=7
Regular paracetamol charted		Charted	89%		
Antiemetic / prokinetic		TDS Metoclopramide charted	33%		
DVT prophylaxis		Charted	81%		
First time drink		Day 0	90%	.00(IQR 0) (*95%CI: -0.6,.16)*	Results n=19
First time eat		Day 0	5%	3(95%CI:1.56,4.12)	Results n=19
Sat out of bed		Day 0	24%	1(IQR 1) *(95%CI:.16,1.29)*	Results n=19
Mobilise		Day 1	91%	1(IQR 1) *(95%CI:.47,1.01)*	Results n=19
First passed flatus		<48hrs	43%	1.91(95%CI:1.21,2.61)	Results n=11
First bowel open		<48hrs	62%	4.19(95%CI;3.56,4.82)	Results n=20
NGT		None	76%		
Cease IVT		0	50%	.50(IQR 1) *(95%CI: -.33,4.44)*	Results n=18
IVC remove		2	35%	3.00(95%CI:2.45,3.55)	Results n=20
IDC out		None	57%	2.89(95%CI:.19,5.59)	Results n=9
Drains out		As per CRC surgeon	N/A	8.75(95%CI:1.02,16.48)	Results n=4
LOS/DC/Readmission					
Discharged		Day 3	33%	9.24(95%CI:5.70,12.78)	Range2-30
Documentation check points		167	0%	6.90(95%CI:1.49,12.31)	Range 0-37
Readmission within 30 days		No readmission	100%		
Total					
Pre-operative mean	40%				
Post-operative mean	57%				
LOS/DC/Readmission mean	44%				
Overall mean total	50%				

Note. CI= Confidence Interval. *Further details on ERAS benchmark can be found on Page 37 of Method section Chapter 4.

Patient details



From January 2019-April 2019 and January 2020-April 2020, 97 patients were enrolled in the ERAS programme at RPA Hospital. There was an equal distribution of biologically assigned males (n=47) to females (n=50) patients. The mean age was 64 (± SD 17.0; range 21 - 90) years. The majority were over 50 years old (72%).



ERAS compliance

ERAS orders were divided into three categories (i) ordered at pre-admission (ii) during episode of care (iii) not ordered. Ordered at pre-admission included when ERAS was ordered prior to admission, and this was identified on the recommendation for admission (RFA) form with ERAS written in the order section. When ERAS was ordered during the episode of care it was written on the patient's electronic medical record (eMR) progress notes and/or the operation report. In total,

there were 52 (54%) patients who had ERAS ordered and 45 (46%) patients who did not have ERAS ordered.

On review of the documentation, there were many occasions when incorrect pathways were allocated. Table 5 below shows how an abdominoperineal excision (APE) was allocated to a bowel resection without stoma pathway and anterior resection was allocated to closure of stoma pathway. In addition, the documentation was very poor. There were 61 (62%) patients where there was no attempt to fill in the pathway form. The highest percentage of compliance with the ERAS pathway was only 42% for one patient.

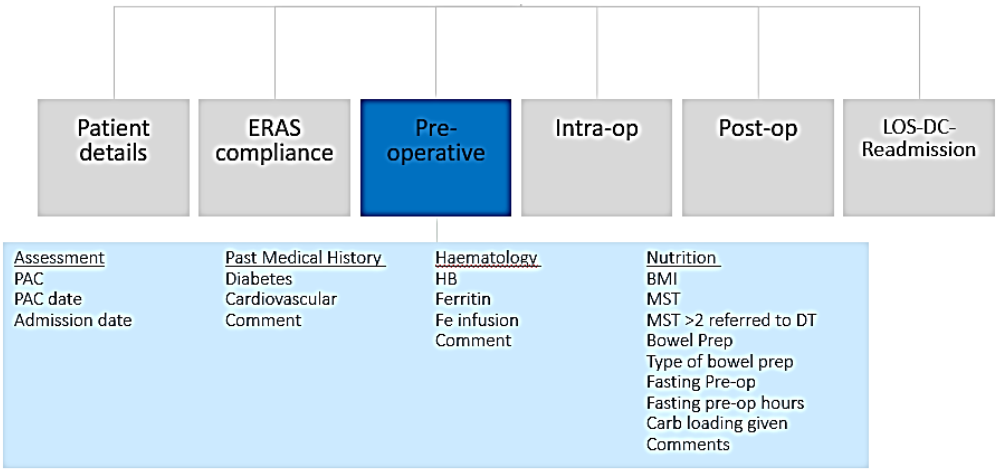
Table 5. Showing surgical procedure performed and allocated documentation pathway. The red numbers indicate errors in pathway allocation.

Surgery Category		**Pathway allocated in notes**			**Total**
		Bowel resection	Bowel resection with stoma	Closure of stoma	
	Abdominoperineal excision of the rectum	**1**	3	0	4
	Anterior resection with stoma +/- stoma	11	14	**1**	26
	Hemicolectomy	20	10	**1**	31
	Colectomy	2	5	0	7
	Closure of stoma	0	0	19	19
	Other surgery	3	7	0	10
Total		37	39	21	97

There was a weak correlation with being seen at pre-admission clinic and having better pathway documentation. This may indicate that documentation led to better communication of the pathway ($r=.268$: $p<0.01$).

There was no other relationship with the percentage of compliance points completed within the documentation related to clinical outcomes.

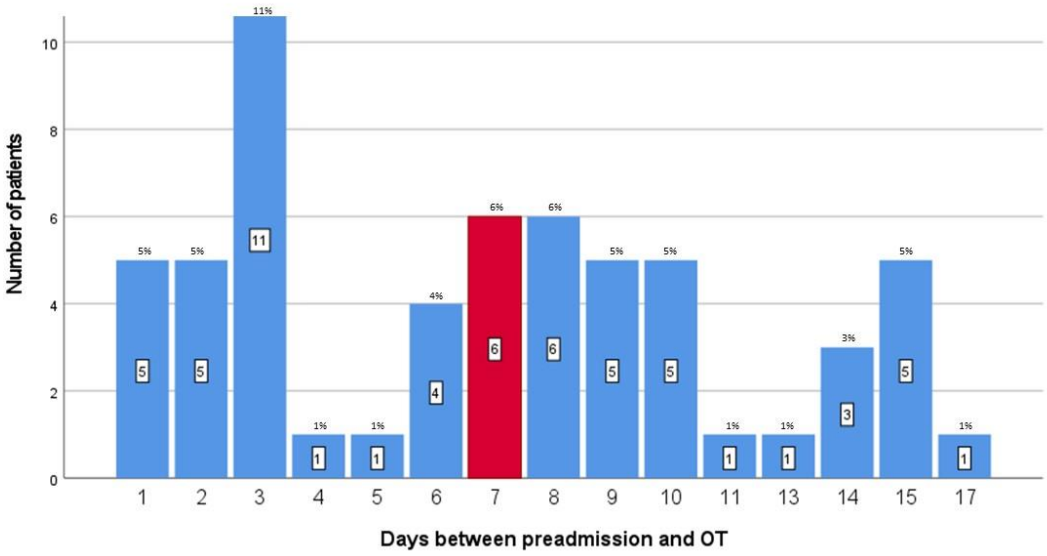
Pre-operative



Counselling at the Pre-admission clinic

There were 60 patients (62%) reviewed at pre-admission clinic (PAC) prior to surgery. The average time they were seen prior to operation date was 7 days (± SD 4.4; range 1-17days) (Figure 8). Eleven patients were seen three days prior to their surgery. Of all the patients seen in pre-admission clinic, 90% were seen within two weeks prior to their operation.

Figure 8. Graph of the days between pre-admission and operation.



Note. Graph showing the length of days between when patients were seen at pre-admission and OT. The red bar indicates the median and 6% of patients were within the median range. The percentage was calculated using the available data for 97 patients.

Thirty-seven patients did not have documentation about attending PAC. Sixteen (43%) of these were emergency procedures and eight were direct admissions or transfers from another hospital. This leaves ten patients without any documented reason for not attending pre-admission clinic (Table 6).

Those ten patients who had no documentation of PAC were most commonly having closure of stoma (n=6). Two patients had anterior resection ±stoma, one had a colectomy, and one had a hemicolectomy (Table 7).

Table 6. Number of patients seen / not seen at the pre-admission clinic.

Access to hospital / PAC	Seen	Not seen	Total
Emergency	0	18	18
Not emergency	42	8	50
Transfer or direct admission to hospital ward prior to surgery	0	11	11
Not seen at PAC	0	2	2
Not seen by all CRC* team at PAC	16	0	16
Total	60	37	97

*CRC = Colorectal Cancer

Table 7. Surgery category of patients seen at the pre-admission clinic.

Surgical category	Seen in PAC	Not seen in PAC	Total
Abdominoperineal excision	4	0	4
Anterior resection with stoma +/- stoma	19	7	26
Hemicolectomy	17	14	31
Colectomy	4	3	7
Closure of stoma	12	7	19
Other surgery	4	6	10
Total	60	37	97

Past medical history

The most common comorbidities included hypertension (30%), diabetes (11%), hypercholesterolemia (13%) and osteoarthritis (8%). A list of the other comorbidities can be found in Appendix 5.

Haematology

Only 24 (24.7%) patients had their blood ferritin documented pre-operatively and the mean ferritin level was 165.4 (± SD 243.4; range 8-1176). Of these 24 patients, 11 (46%) had ferritin results

below 100 µg/L. However, only two were documented as having received iron infusion pre-surgery.

Nutrition

The mean BMI was 26.9 (± 5.82; range 18 – 49) Kg/m2 and the majority of patients were classified as obese with 78% of patients having a BMI above 30Kg/m2.

Sixty-two (64%) patients underwent a nutritional assessment using the MST. Over one third (36%) were not assessed. Four patients had MST scores of two or above and out of these patients three were referred to the dietician pre-operatively (Table 8).

Two patients who had an MST score of one were referred to the dietician post-operatively. The reasons for this referral were documented as: (i) for stoma education and malnutrition, and (ii) for weight loss and total parenteral nutrition (TPN).

Table 8. Pre-operative MST scores

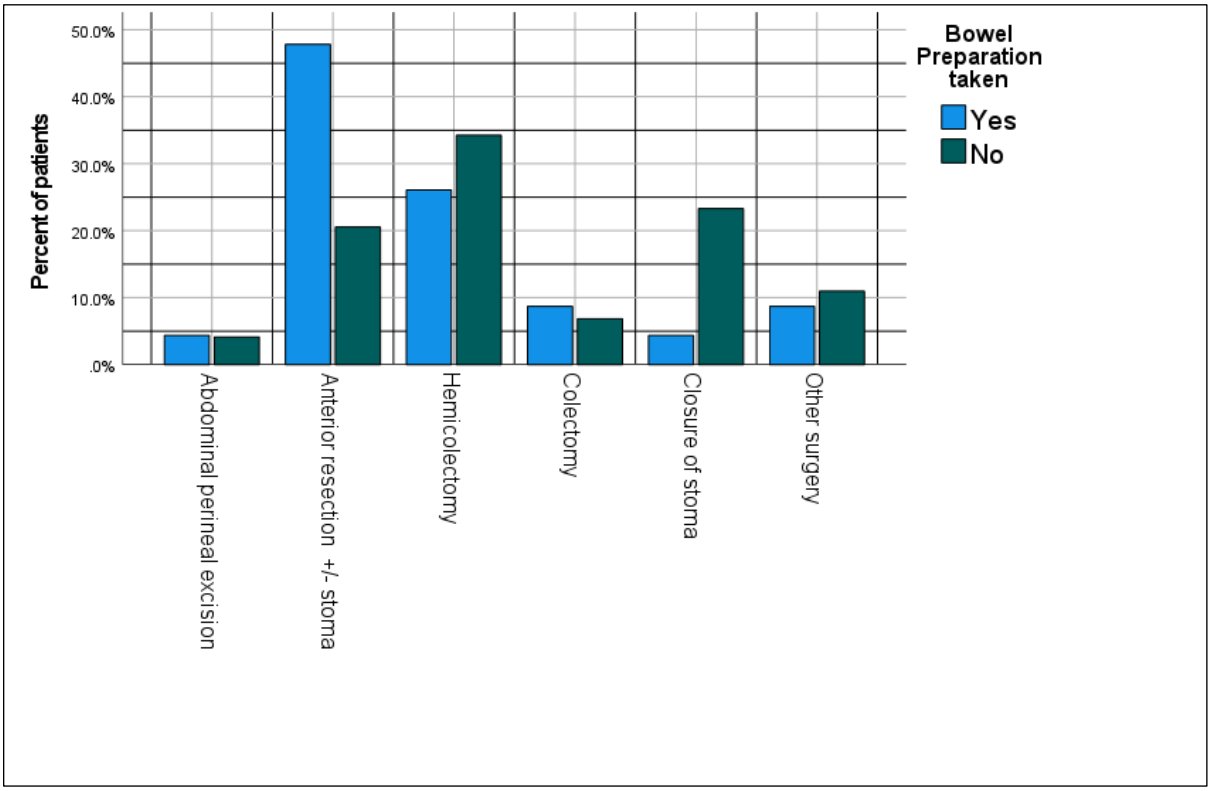
MST Score		Number of patients	Percent
	0	53	54.6
	1	5	5.2
	2	2	2.1
	3	2	2.1
	Total	62	63.9
	Missing	35	36.1
Total		97	100.0

Bowel preparation

Out of the 97 patients, 23 (24%) had bowel preparation prior to surgery, 73 (75%) patients had no bowel preparation and 1 (1%) patient had missing data. It is important to note that most patients undergoing a closure of stoma procedure do not get bowel preparation. The graph below breaks

down which operations had bowel preparation, and which did not. The patients undergoing a hemicolectomy had the greatest number of patients not having bowel prep and patients undergoing anterior resection had bowel prep most frequently (Figure 9).

Figure 9. Bowel preparation usage by surgical category.



Note. Graph showing the surgical category and who was documented to have bowel prep. The percentages are the percentage for the bowel prep group, i.e. 47.8% of the patients who had bowel prep had an anterior resection.

Fasting

Fifty-eight (61%) patients fasted less than 6 hours before the operation and the mean was 6 (± SD 4.7; range 2-12 hours). Distribution of fasting times is shown in Table 9.

Table 9. Length of time patients fasted.

Fasting time (hours)				
		Frequency	Percent	Cumulative Percent
Hours	2	54	55.7	56.8
	3	2	2.1	58.9
	6	2	2.1	61.1
	7	1	1.0	62.1
	8	1	1.0	63.2
	9	1	1.0	64.2
	10	2	2.1	66.3
	12	32	33.0	100.0
	Total	95	97.9	
	Missing	2	2.1	
Total		97	100.0	

The recommended fasting time for the ERAS protocol was two hours. Just over half (57%) of the patients met this criterion. The average fasting time of those patients who were seen in PAC was much shorter than the mean fasting time of those who were not seen in PAC; 3.3±3.43 hours versus 10.11±3.29 hours ($p<0.001$).

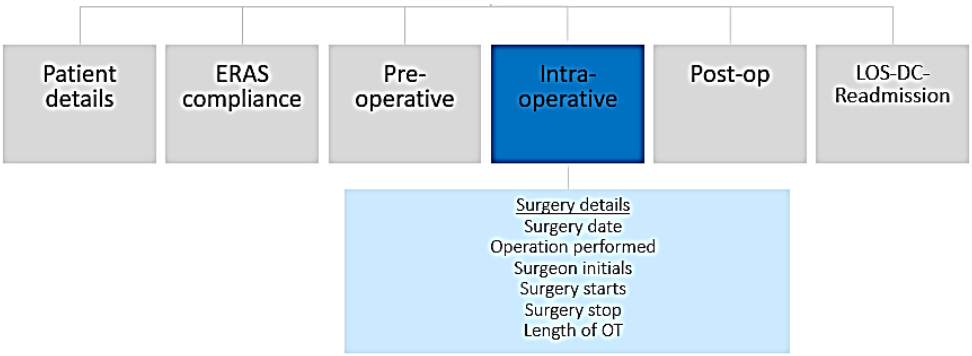
Carbohydrate loading

Twenty-eight (29%) patients had carbohydrate loading and 69 (71%) patients did not have carbohydrate loading. Out of the 69 patients who did not have carbohydrate loading, 11 had diabetes. The other reasons why the remaining 58 patients did not receive carbohydrate loading included: (i) Admitted as an emergency patient or transferred from another hospital n= 26.

(ii) They were only seen by the junior medical officer (JMO) who advised patients to fast from midnight n=9. (iii) Patient refused due to dietary requirements and were overwhelmed by the

carbohydrate instructions n=1. For the remaining 22 patients there was no reason documented why they did not have their carbohydrate loading.

Intra-operative



Operation time

The overall mean operating time was 204.6 minutes (95%CI 180.82,228.50: range 28– 550mins). The longest procedure was an abdominoperineal excision (Table 10 and Figure 10). Figure 11 demonstrates that the bowel resection pathway had the longest mean by minutes of operation.

Table 10. Length of operation time in minutes by each surgical category

Surgical category	**Length of OT in (minutes)**			
	Mean	Minimum	Maximum	Standard Deviation
Abdominoperineal excision	375.75	300	498	92.92
Anterior resection with stoma +/- stoma	320.42	158	550	104.08
Hemicolectomy	144.23	55	321	56.65
Colectomy	260.43	146	399	87.53
Closure of stoma	117.21	28	292	53.25
Other surgery	149.70	65	389	92.80

Figure 10. Graph showing length of operation in minutes by surgical category.

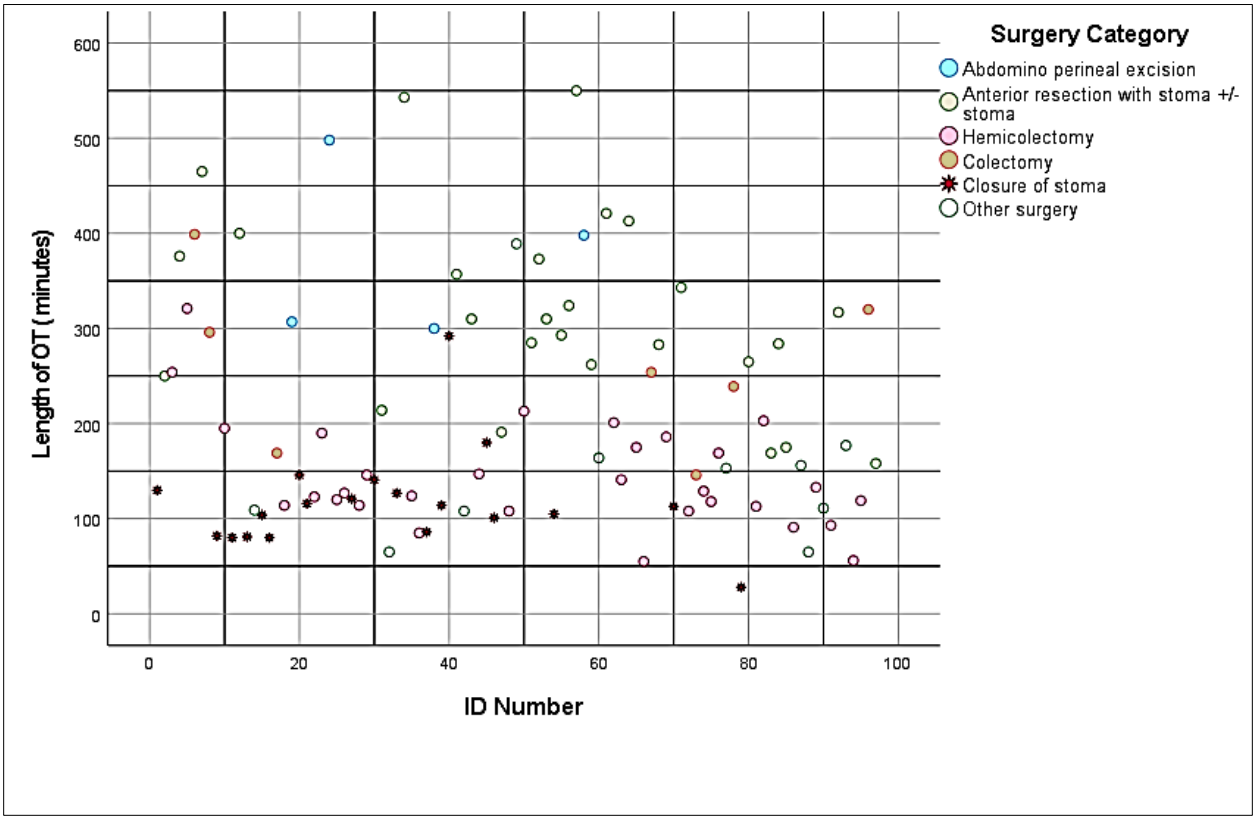
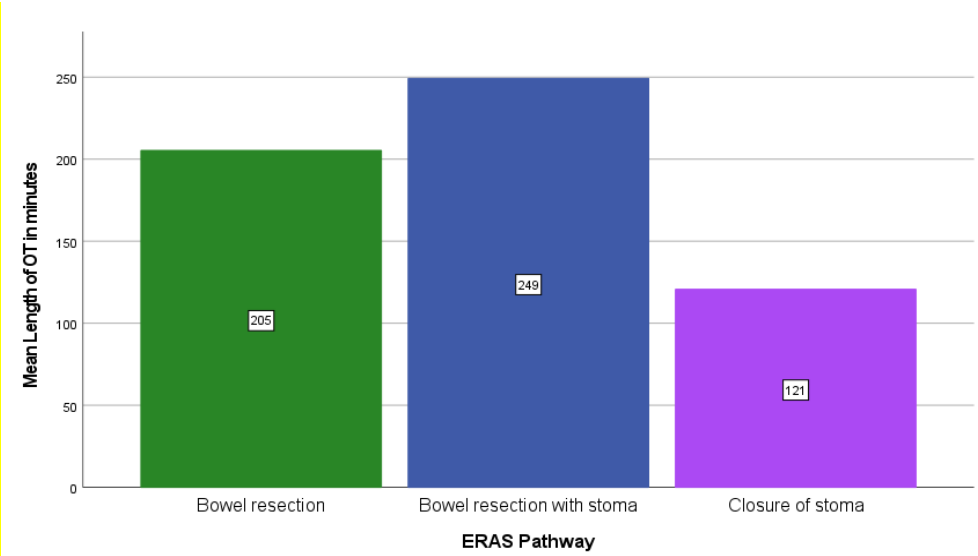
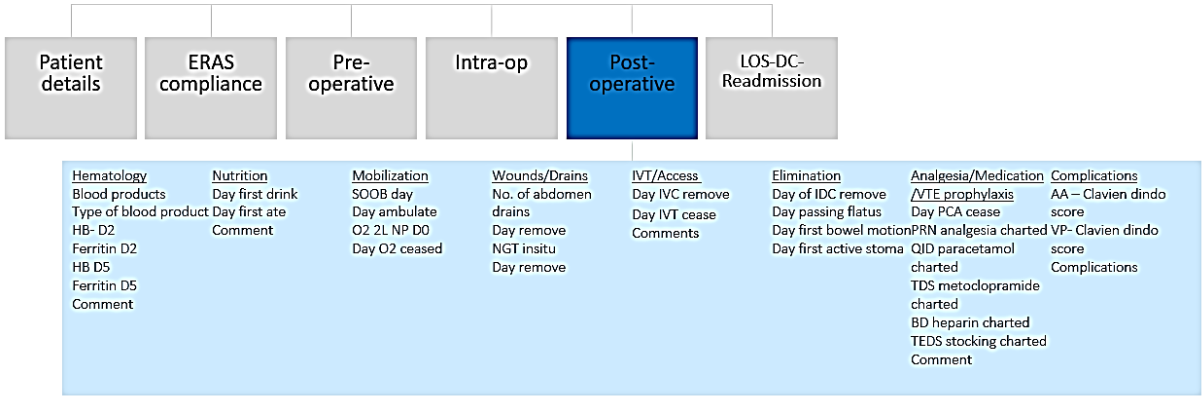


Figure 11. Mean length of OT in minutes by pathway.



Note. Graph showing the mean length of OT in minutes by pathway.

Post-operative



Haematology

Blood products were given to four (4%) patients post-operatively, these patients received packed red blood cells with one patient receiving both packed cells and an iron infusion during their hospital stay. Two of these patients received blood products over multiple days. On day two post-operatively there were 92 (95%) patients who had their Hb checked while on day five there were 22 (23%) patients already discharged. Out of the remaining 75 admitted patients, 68 (91%) patients had their Hb checked. Ferritin was not measured for any of the patients on day two or day five.

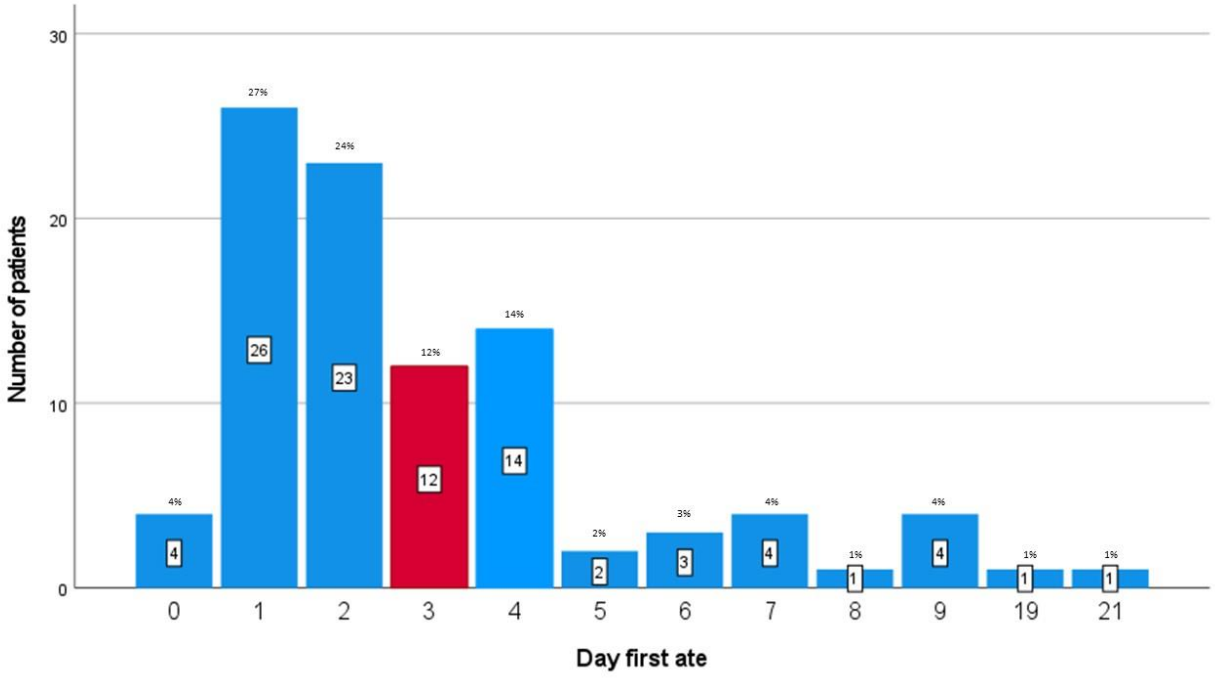
Being seen at pre-admission clinic and having a higher Hb had a significant relationship with a higher Hb on post-operative day two and five ($r=0.44$; $p<0.01$). Blood ferritin levels were not routinely measured during the episode of care so there was no way to measure if attending pre-admission clinic and attending to blood management impacted outcomes in this study.

Nutrition

Post-operatively, 70 (73%) patients had their first drink on the day of surgery and 21 (22%) patients on day one. The range was from 0-7 days and ± SD 1.0. There was one patient with no information

recorded. Only 4 (4%) patients had eaten post-operatively on the day of surgery and most patients ate on day one (26 patients; 27%). The mean day that patients first ate was day three (range 0-21 days) (Figure 12).

Figure 12. Graph of the post-operative day patients first ate.



Note. The graph shows the distribution of days when a patient first ate post-operatively. The red bar indicates the mean and 12% of patients were within the median range. The percentage was calculated using the available data for 96 patients.

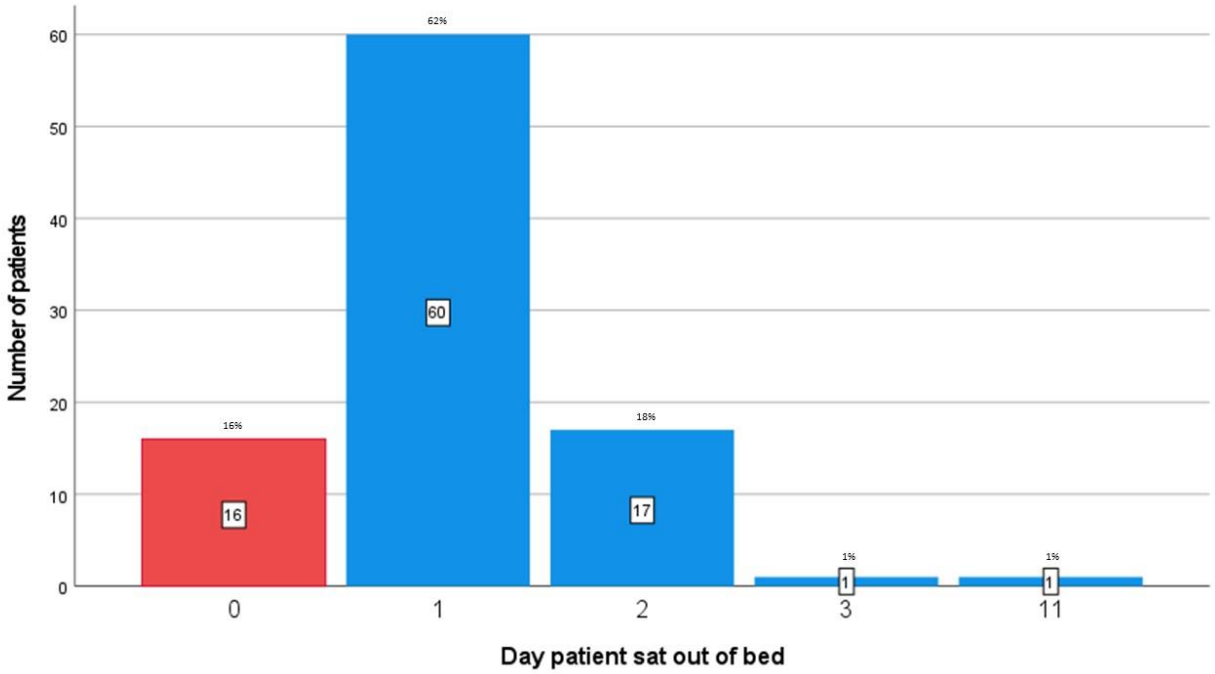
Mobilisation

Those patients classified as obese (BMI>30) were significantly slower in sitting out of bed than those who were not obese 1.5 ±0.80 vs 0.98±0.62 (p=0.05) but there was no difference in the day the patients first ambulated (p=0.333). There was a significantly shorter length of stay in patients who ambulated on day 1 post-operatively compared to those who did not, 6.08 ±5.107 vs

10.46±8.065 (p=0.019).The majority of patients were up and either sitting out of bed (Figure 13) and / or mobilising by day 2 (Figure 14).

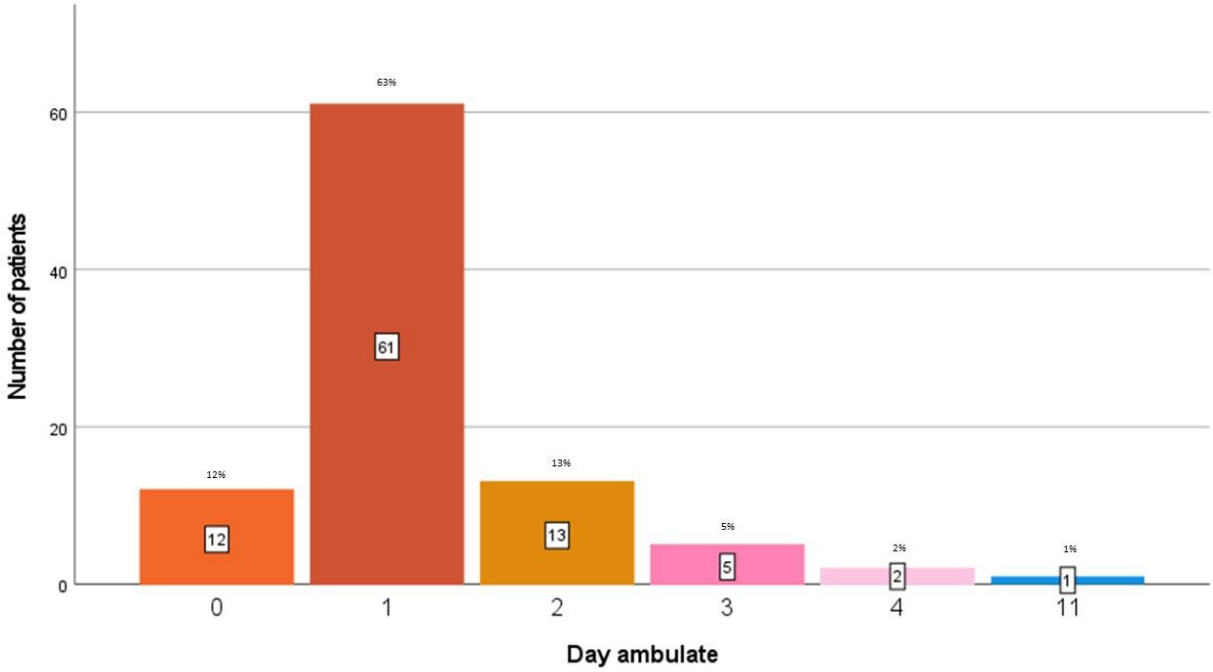
Earlier ambulation did not make any difference to the first day of passing flatus (p=0.510), or the first day of bowel motion (p=0.218) or complications (p=0.070) (Figure 15).

Figure 13. Graph showing the first post-operative day when a patient first sat out of bed.



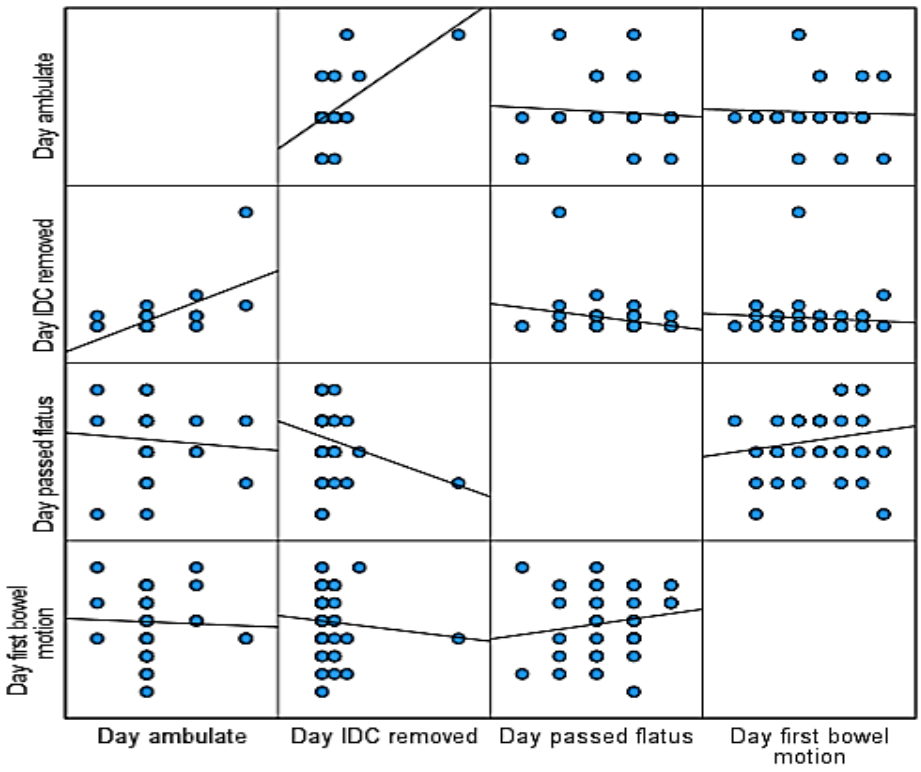
Note. The graph showing the first post-operative day when 95 patients sat out of bed. There were two patients missing documentation. Sixteen (17%) patients achieved the ERAS target to sit out of bed on the day of surgery which is shown in the graph with the red bar.

Figure 14. Graph showing the first post-operative day patients were able to ambulate.



Note. The graph showing the first day patients ambulated. Ninety-four patients' day of first ambulation was recorded and three were missing documentation. 86 (92%) patients first mobilised between their day of surgery and post-operative day two.

Figure 15. Graph showing relationships between the day first ambulated, IDC removed, passed flatus and first bowel motion.



Note. Graph shows no significant relationships between the day of first ambulation, IDC removal, passed flatus and first bowel motion.

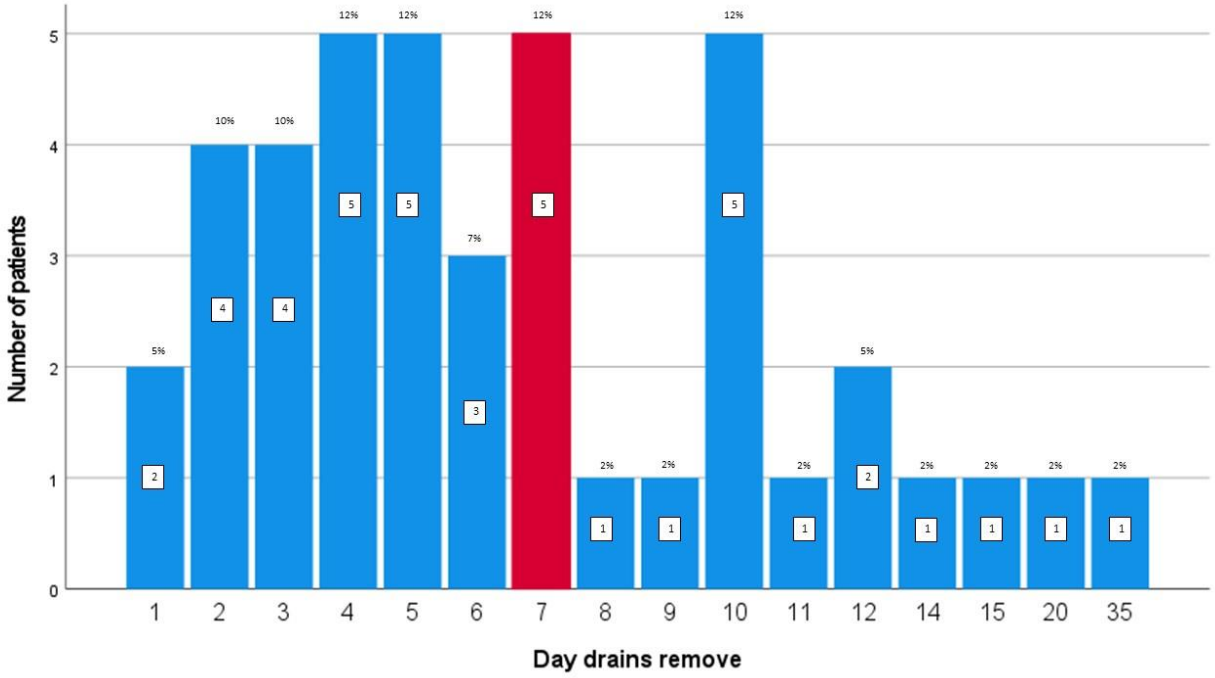
Drains

Abdominal drains

There were 53 (55%) patients with no drain and 44 (55%) patients who had a drain in situ post-operatively. Out of these patients, 37 (38%) patients had one drain, 6 (6%) patients had two drains and 1 (1%) had three drains. They were only 42 (43%) patients who had the day of drain removal documented, two patients had missing data (Figure 16). The two missing data were from patients admitted to the Intensive Care Unit (ICU) post-operatively and were transferred to the ward on

day 7 and day two respectively with no drain removal date recorded. Three patients had their drains fall out accidentally and one patient was discharged with a drain.

Figure 16. Graph showing the distribution of post-operative day drains were removed.



Note. Graph showing when the 42 patients had their drains removed. The bar in red represents the mean. Two unavailable data. The percentage was calculated using the available data for 42 patients.

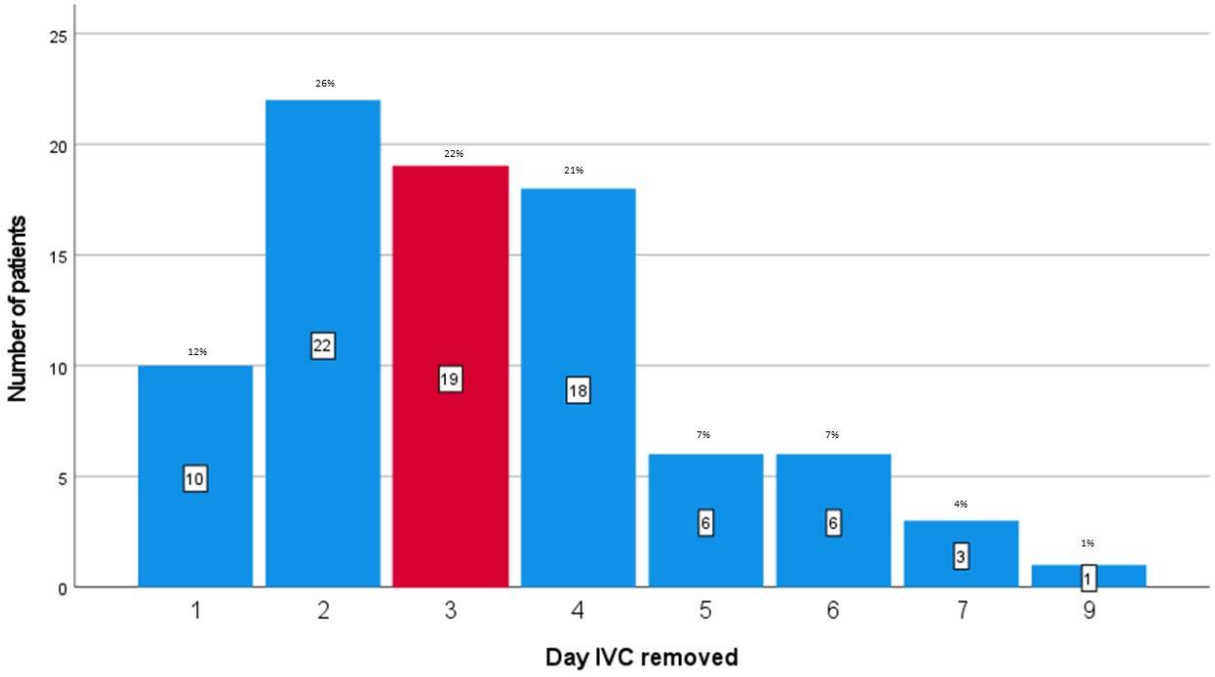
Nasogastric Tube (NGT)

The majority of patients did not have a nasogastric tube inserted (n=78; 80%). Of the 19 patients who had NGT, only 16 had the removal details documented. The length of time range that the NGT was in situ was 1- 19 days ± SD (5.1), with a mean of 7 days.

IVT/Access

All patients returned from operating theatre with an intravenous cannula (IVC) and intravenous therapy (IVT). However, only 85 had documentation of IVC removal and 91 had documentation of the day IVT was ceased. In 12 patients there was no record of the IVC and in 6 patients no record of when the IVT was ceased. The median length of time an IVC was in-situ was three days (Figure 17) whilst IVT was run for a median of two days.

Figure 17. Graph showing post-operative day IVC was removed.

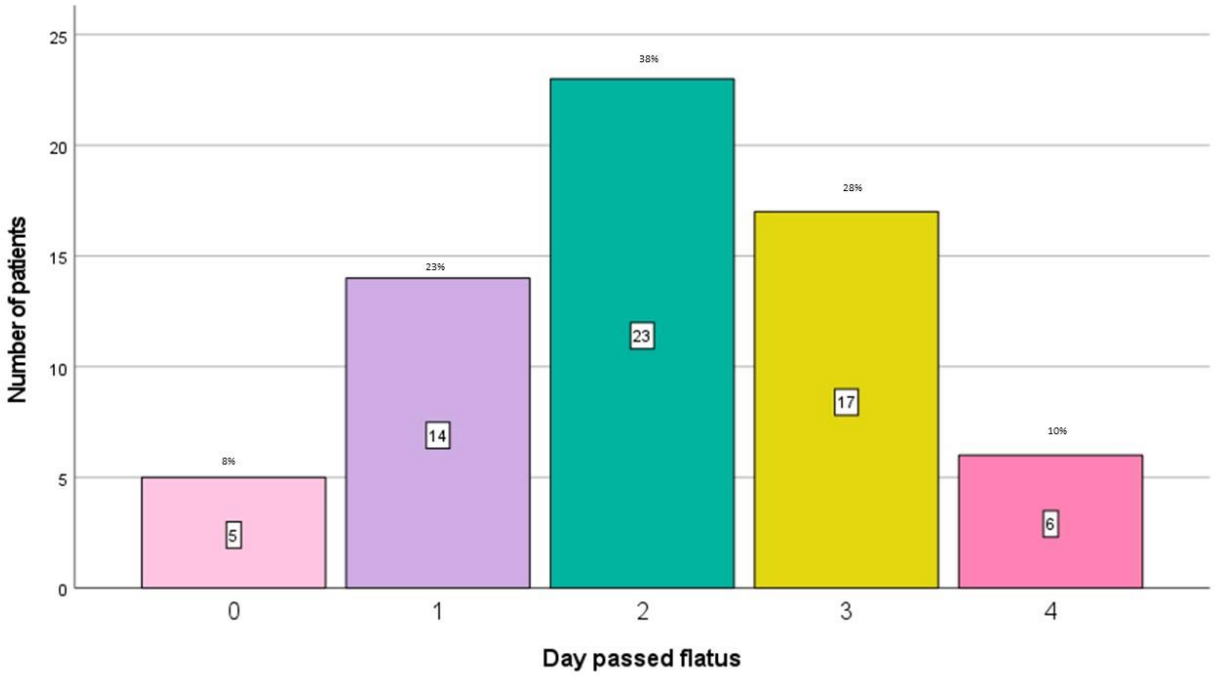


Note. Graph showing the day IVC was removed with the 85 patients. The percentage was calculated using the available data for 85 patients.

Elimination

The documentation around elimination was very poor. Thirty-two patients did not have the day they first passed flatus documented. One patient did not have their day of first bowel motion recorded. As shown in Figure 18, 23 (24%) patients had passed flatus on day two. The range was 0-4 days and ± SD 1.0.

Figure 18. Graph showing post-operative day when patients first passed flatus.

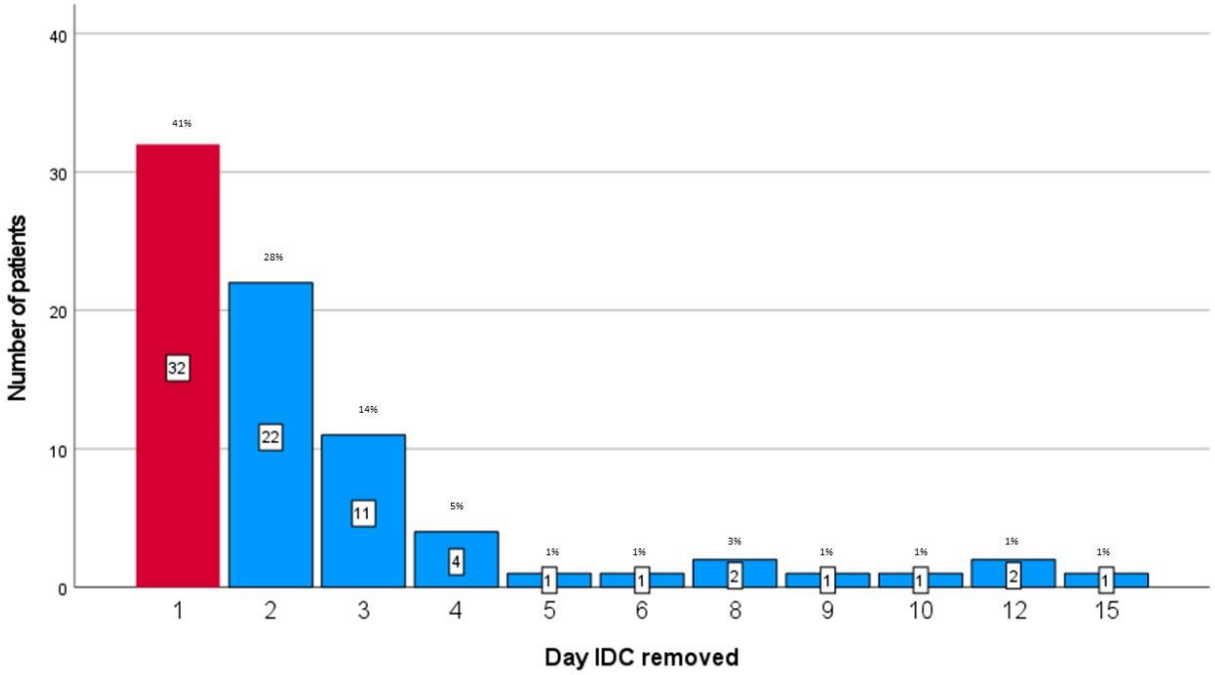


Note. Graph showing the 60 patients who had when they first passed flatus recorded. There were 37 missing data. The percentage was calculated using the available data for 60 patients.

There were only 78 patients who had catheter information documented. Nineteen patients did not have an IDC removal time recorded. Those that were recorded, most patients (68%) had the IDC removed on or before day two which is in accordance with the ERAS pathway. Nine patients experienced delays in catheter removal and the IDC remained in-situ after day four (Figure 19). The reasons for these delays were that; (i) four patients were unwell and had a Clavien-Dindo score >2; (ii) two patients failed trial of void (TOV) and IDC was re-inserted; (iii) one patient was

admitted to ICU post-operatively and was transferred to the ward on post-operative day seven; (iv) the remaining two patients had no clinical reason found on documentation.

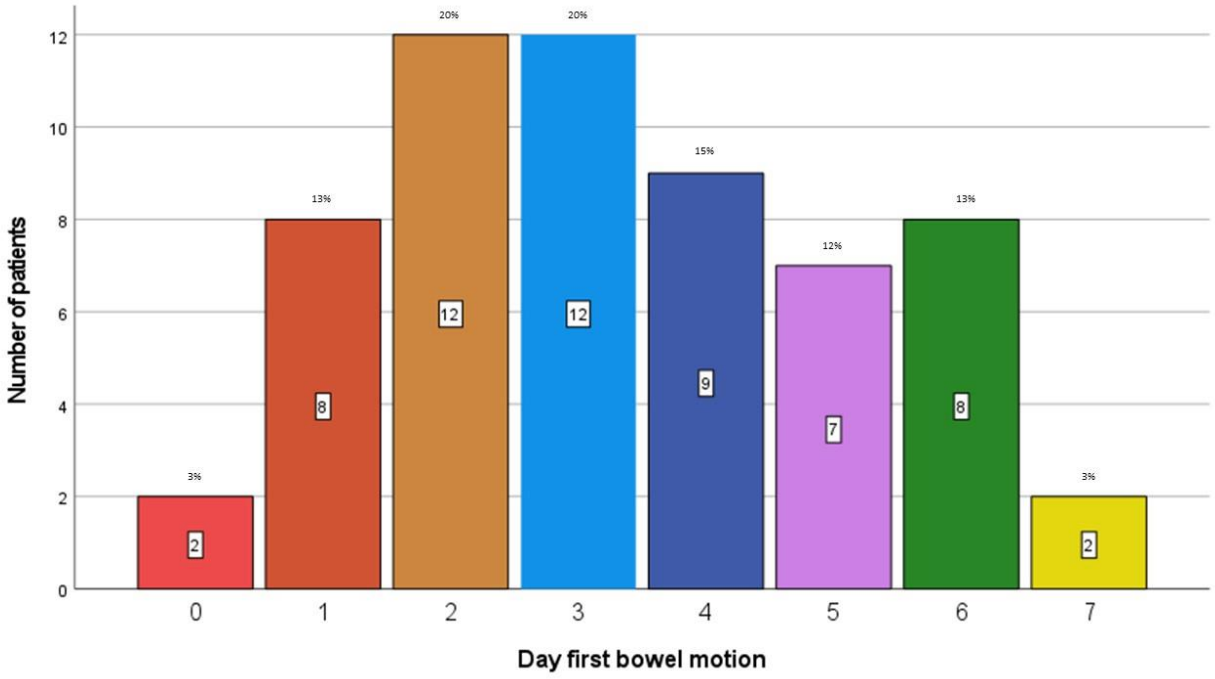
Figure 19. Graph of the post-operative day IDC was removed.



Note. Graph showing the 78 patients who had when their IDC removal day recorded. The red bar represents the ERAS target day (post-operative day 1) for removing the IDC which was achieved in 32 (41%) patients. The percentage was calculated using the available data for 78 patients.

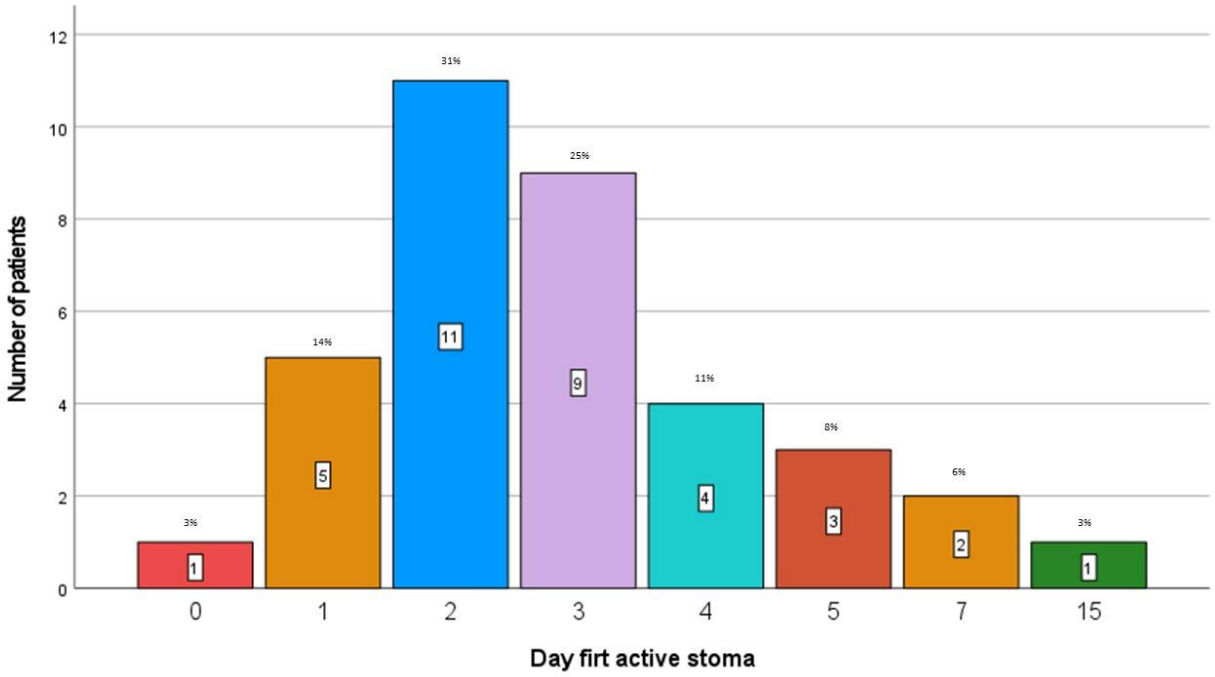
Ninety-six patients (including 36 with stoma) had the day of first defaecation (or stoma output) charted and one missing data as shown on Figure 20 and Figure 21. Twenty-three (38.3%) patients opened their bowels within 48 hours of operation. The range was 0-7 days ±SD 1.8. Seventeen (47%) patients had their first stoma activity within 48 hours of operation. The range was 0-15 days ±SD 2.5. The mean for both was three.

Figure 20. Graph of the first post-operative bowel motion



Note. Graph showing the distribution of 60 patients who had their day of first bowel motion recorded. The percentage was calculated using the available data for 60 patients.

Figure 21. Graph of the first post-operative stoma activity

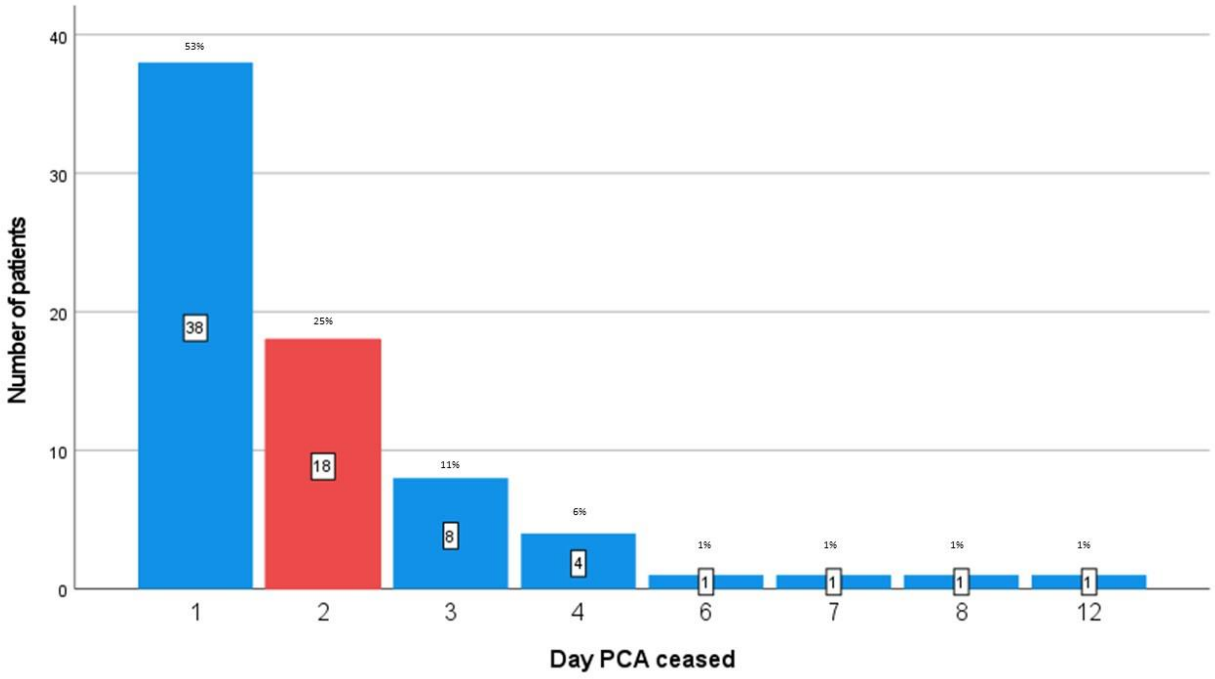


Note. Graph showing the 36 patients who had their stoma first active day recorded. The percentage was calculated using the available data for 36 patients.

Analgesia/Medication/VTE prophylaxis

Seventy-two (74%) patients had PCA, and 25 (26%) patients did not. Most patients had their PCA removed on day one. The range is shown on Figure 22.

Figure 22. Graph showing post-operative day PCA ceased.



Note. Graph showing the day of PCA removal for the 72 (74%) patients who had PCA. The red bar represents the mean. The percentage was calculated using the available data for 72 patients.

The pro re nata (PRN) analgesia was well charted for all patients. Metoclopramide however was poorly charted with the prescription found on less than half of patients' medication charts (Table 11). Five (5%) patients had PRN metoclopramide and /or paracetamol charted as PRN and one (1%) patient had ondansetron charted. There were only six (6%) patients who did not have VTE prophylaxis charted.

Table 11. Showing the number of patients who had their medications charted as per ERAS protocol.

Medications charted	Number of patients	Percent
PRN analgesia	97	100
QID paracetamol	91	94
TDS metoclopramide charted	40	41
BD heparin / daily clexane charted	91	94
TED stockings charted	59	61

Complications

The Clavien-Dindo was significantly higher in those patients where ERAS was not ordered when compared with being ordered during episode of care (p=0.032) (Figure 23).

Table 12. Documentation of complications by Clavien-Dindo Classification

Clavien-Dindo Grades	Number of patients (%)
Grade I	13
Grade II	14
Grade III	2
Grade IIIa	0
Grade IIIb	5
Grade IV	6
Grade Iva	0
Grade IVb	0
Grade V	1

Table 12 above demonstrated that out of ninety-seven patients there were forty-one (%) patients had complications post operatively.

Regression analysis examining the binomial outcome of complications or not

Linear regression and bivariate regression were performed using multiple models. The first regression model examined all factors related to documentation to see if these impacted on the development of complications measured by the Clavien-Dindo score. A Clavien-Dindo score of >0 was classified as a complication.

Table 13. Documentation variables included in the multi regression equation.

Variables in equation	B	S.E.	Wald	df	Sig.	Exp(B)
Pathway	0.328	0.307	1.143	1	0.285	1.388
When ERAS ordered	0.278	0.314	0.785	1	0.376	1.321
Percentage of compliance points in ERAS pathway	0.000	0.020	0.000	1	0.997	1.000
Seen at pre-admission	0.268	0.455	0.348	1	0.555	1.308
Surgery category	-0.253	0.134	3.584	1	0.058	0.776
Constant	-0.645	1.085	0.353	1	0.552	0.525

a. Variable(s) entered on step 1: Pathway, When ERAS ordered, Percentage of compliance points in ERAS pathway, Seen at pre-admission, Surgery Category.

Table 13 above demonstrates no predictive factor in development of complications related to documentation.

An analysis of patient factors was performed to identify if these were risk factors for increasing Clavien-Dindo score. The table below (14) identifies the variables included within the model and none were significant.

Table 14. Patient factor variables included in the second multi-regression equation.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Gender	-24.290	40192.919	0.000	1	1.000	0.000
	Age	-0.022	0.055	0.156	1	0.693	0.979
	Hb at pre-operation	-0.029	0.063	0.216	1	0.642	0.971
	Ferritin at pre-operation	0.004	0.007	0.361	1	0.548	1.004
	BMI	-0.110	0.160	0.477	1	0.490	0.896
	MST	-22.704	40192.953	0.000	1	1.000	0.000
	Extended VTE on D/C	-67.439	69616.192	0.000	1	0.999	0.000
	Seen at pre-admission	-96.271	131951.528	0.000	1	0.999	0.000
	Bowel preparation	-44.985	56841.386	0.000	1	0.999	0.000
	Fasting original data set	7.127	13397.654	0.000	1	1.000	1244.629
	Constant	106.721	99359.545	0.000	1	0.999	2.230E+46

a. Variable(s) entered on step 1: Gender, Age in years at the time of surgery, Hb at pre-operation, Ferritin at pre-operation, BMI, MST, Extended VTE on D/C? Y= 1 N=2, Seen at pre-admission, Bowel prep, Fasting original data set.

Discharge/ Readmission

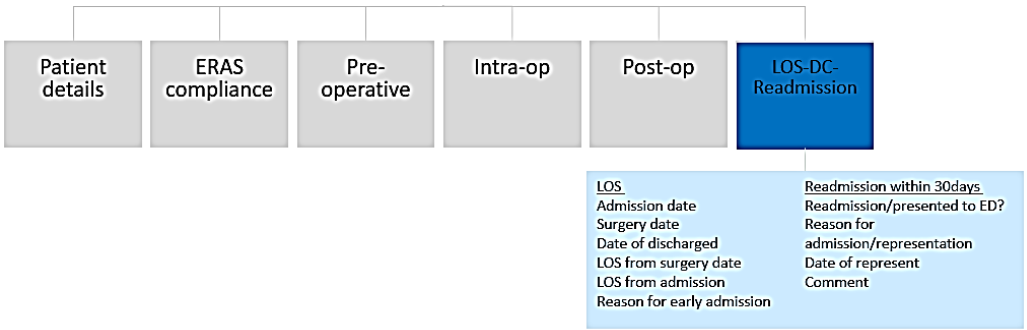


Table 15. Surgery performed and actual length of stay vs correct pathway benchmarked LOS.

Surgery category Appropriate pathway		Mean actual LOS	LOS as per pathway	Difference in LOS
Abdominoperineal excision	Stoma	15	7	**8**
Anterior resection +/- stoma	Stoma	13	7	**6**
	No stoma	7	4	**3**
Hemicolectomy	Stoma	17	7	**10**
	No stoma	8	4	**4**
Colectomy	Stoma	13	7	**5**
	No stoma	6	4	**8**
Closure of stoma	*Stoma	19	3	**16**
	No stoma	8	3	**5**
Other surgery	Stoma	11	7	**4**
	No stoma	6	4	**2**

** This demonstrates the misallocations of pathway.*

Readmission

There were 8 patients who presented to the emergency department within 30 days of discharge. The main reason patients represented to emergency was abdominal pain (50% of representations). Other reasons included wound ooze, bleeding stoma, diarrhoea, and syncope. The two tables below (16 and 17) further demonstrate the differences and inconsistency within the documentation and pathway allocation when reporting on readmission information. For example, there were 21 patients identified on the stoma closure pathway and 19 on the surgical category of stoma closure.

Table 16. Surgery Category by Readmission/presented to ED Crosstabulation

Surgery Category		Readmission/presented to ED		Total
		Yes	No	
	Abdominoperineal excision	0	4	4
	Anterior resection with stoma +/- stoma	6	20	26
	Hemicolectomy	2	29	31
	Colectomy	0	7	7
	Closure of stoma	0	19	19
	Other surgery	0	10	10
Total		8	89	97

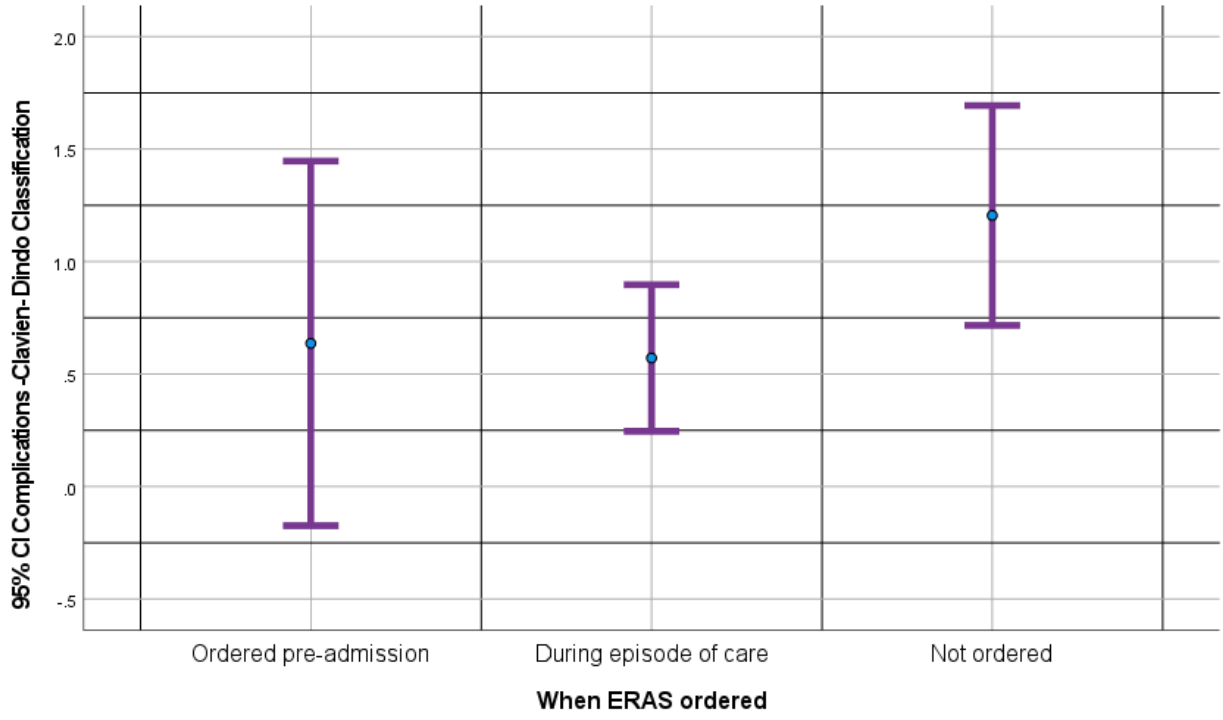
Table17. Allocated Pathway by Readmission/presented to ED Crosstabulation

Pathway		Readmission/presented to ED		Total
		Yes	No	
	Bowel resection	3	34	37
	Bowel resection with stoma	5	34	39
	Closure of stoma	0	21	21
Total		8	89	97

Compliance

The graph below demonstrates the relationship with patients who had ERAS ordered and their Clavien-Dindo score.

Figure 23. Graph showing mean Clavien-Dindo score by when ERAS was ordered.



Note. The Clavien Dindo score was significantly higher in those patients where ERAS was not ordered by a Medical Officer compared to those where ERAS was ordered during the episode of care (p=0.032).

The following chapter will discuss these data and draw the information together to provide a better understanding of the findings from this study.

CHAPTER 6: DISCUSSION AND CONCLUSION

The primary aim of this thesis was to identify if there was a relationship between documentation compliance and clinical outcomes in patients on a colorectal ERAS pathway. The hypothesis was that there is a correlation between documentation compliance and improved clinical outcomes. A retrospective study was undertaken to investigate the research question. This chapter summarises the key findings of this thesis and provides a critical discussion of these findings within the context of currently available literature.

Documentation Compliance

Our data suggests that documentation compliance does not correlate with clinical outcomes. The highest percentage of documentation compliance with the ERAS pathway was only 42% for one patient, while for 61 (62%) patients there was no attempt at completing the ERAS pathway. Documentation is a critical component of ERAS implementation that should guide clinical practice (Gustafsson et al., 2019). Our data demonstrated that the pathway was not widely utilised as a clinical guide. Previous studies compared compliance with ERAS protocols but there were no studies identified that examined ERAS pathway documentation compliance. This which leaves limited capacity to compare this thesis to other studies.

On the documentation review, there were many incorrect pathways allocated despite patients being seen at the pre-admission clinic (PAC). This was reflected in patients who were put on to the bowel resection with or without stoma pathway at PAC. For example, when a patient was seen at PAC with possible stoma on their consent form and placed on the bowel resection pathway but ended up requiring a stoma, or when a patient was put on the bowel resection with stoma pathway but did not end up needing a stoma. The ward staff did not change the ERAS pathway ordered. It was

also demonstrated that there were many pathway forms where it was evident that no attempt had been made to complete them.

Barriers to documentation

ERAS is a multimodal, team-based approach (Kehlet, 1997), and for the purposes of documenting in the pathway, there needs to be clear guidance as to which discipline is responsible for documenting in the ERAS pathway for each assessment. Unfortunately, the responsibility for documentation always falls to the nurses, which might be why documentation in the pathway is poor. Tasks conducted by other health care professionals are often missed and not captured if the documentation in the ERAS pathway is solely the responsibility of the nurses. One such scenario where missed documentation could be avoided would be where the physiotherapist assists a patient with mobilisation while the nurse is attending to their other duties. In this situation, we suggest that it should be the physiotherapist's task to complete the relevant mobility assessment in the ERAS pathway. Another example is the analgesia/medications/ VTE prophylaxis assessment, this is when the medical team prescribes patients' medications that are recommended as part of ERAS. This is charted by the medical team, including the treating team and anaesthetist. Therefore, if it truly is a multidisciplinary exercise, the ERAS pathway documentation of this assessment should be the responsibility of the medical staff.

Nurses' attitudes towards the ERAS pathway documentation may have also contributed to poor documentation. Similar to a previous study, the nurses in our centre may have seen it as a tick-box exercise that provided no added value to patient care (Henderson & Fletcher, 2015). In general, nurses view documentation as time consuming and it is often done at the end of the shift and can be rushed (Govasli & Solvoll, 2020). This could result in a lack of depth and missing important

details, which can potentially lead to poorer patient outcomes (Blair & Smith, 2012). In contrast, our data demonstrates that when nurses were responsible for clinical tasks, there was up to 97% compliance. These data demonstrate the disconnect that nurses see between documentation and clinical care and shows that they do not see documentation as an important part of clinical care within the ERAS model.

The ERAS pathway in our organisation is still in paper form rather than having it on the electronic medical record (eMR). This may have impacted the documentation compliance as most patient care documentation is found on eMR. It creates a duplication of documentation when nurses are already recording their activities through progress notes on eMR. It also makes it harder for staff to remember, as most documentation is now entered on eMR.

In summary, the two main issues with ERAS documentation are the wrong pathways and the need for greater attempts at completing the ERAS pathway forms. The lack of clear shared responsibility across the multidisciplinary team with the documentation, the mode of documentation and the nurses' attitude towards the documentation on ERAS pathways are seen as the barriers leading to poor documentation.

Clinical compliance

Although documentation on the ERAS pathway was very poor, the clinical care frequently met the ERAS protocol benchmark. In our study, the clinical compliance with key aspects of the ERAS clinical pathway ranged from the lowest compliance on nutrition, with only 4 (4%) patients eating their first meal on day one, to the highest compliance in mobilisation, with 86 (92%) patients ambulating on day one post-operatively. When broken down into three pathways, the overall clinical compliance was just 50% or lower. The closure of stoma pathway had the highest

compliance. Our study results were similar to a European study (van Zelm et al., 2017) that was conducted across twelve hospitals. The authors found that protocol adherence rates were an average of 44% (van Zelm et al., 2017).

Importance of counselling at PAC

In our results, counselling at the pre-admission clinic was key to success or to meeting the benchmark of the ERAS protocols. Perioperative information and patient education are an important part of ERAS pre-admission as it helps to set the patient expectations around achieving early discharge (H. Forsmo et al., 2016). The majority of patients were seen at the pre-admission clinic however, they received inconsistent information. Our results demonstrated that they were seen by multiple people, including the colorectal junior medical officer, and there was no dedicated ERAS nurse during the studied period of time. A Colorectal Nurse saw some of the patients while others were seen only by a junior doctor. This impacted the consistency of the education provided to patients and expectations were not set at PAC. This likely impacted on LOS and the patient's ability to meet ERAS protocol goals. Our data shows that patients who attended PAC had better ERAS clinical compliance post-operatively. However, there was a weak correlation with being seen at PAC and having better pathway documentation.

Patients who were only seen by the junior medical officer in the pre-admission clinic did not get their carbohydrate loading and did not receive correct advice on fasting times. Furthermore, the impact of getting the incorrect information and proper counselling at PAC demonstrated an effect on meeting the criteria with ERAS, such as their nutrition, blood management and pain management.

Nutrition

Nutrition within ERAS protocol starts from the pre-admission clinic with nutrition assessment and patient education about fasting and carbohydrate loading, followed by early feeding post-operatively (Kehlet, 1997). Nutritional screening was generally poor, and this could be due to different clinicians attending the pre-admission clinic. Zelm et al. (2017) reported that 59% of patients were screened. During screening, four patients were identified as being at risk and only one patient had a nutritional care plan implemented. Similarly, our nutritional assessment compliance was 64% and only two out of four patients who were identified as being at risk were seen by the dietician post-operatively.

The ERAS protocol recommends minimal fasting times as part of reducing surgery-induced stress, maintaining blood glucose levels, and reducing dehydration (Scott et al., 2015). In our study, 54 (55.7%) patients fasted two hours prior to their surgery. It was noted that patients who were only seen by the junior medical officer were advised to fast from midnight and were not provided carbohydrate loading even though according to the Australian and New Zealand College of Anaesthetists (ANZCA), clinical guidelines ((ANZCA), 2017) recommend, for elective surgical procedures, fasting for solid food is six hours and two hours for clear fluids. Only 29% of patients had carbohydrate loading. However, when auditing patient files, the documentation to confirm if this was actually consumed was not recorded. In this review we assumed that patients consumed the carbohydrate drink if it was given at pre-admission clinic. This is an important note for managing patients in the future and the need to confirm the consumption of their carbohydrate loading within the medical record.

Early feeding and nutrition post-operatively lead to significantly reduced infectious complications, improved wound healing, faster resolution of ileus, reduced length of stay, reduced hospital cost, and decreased mortality (Abela, 2017). Our post-operative nutrition compliance was poor. Our data shows only one patient under the closure of stoma pathway had their first meal on the day of surgery and 26 (27%) patients on day one under the other pathways. The diet was only changed if this was documented as the plan by the medical staff and was not routinely upgraded according to ERAS protocol.

Blood management

ERAS protocols highly recommend pre-operative blood management for the prevention of anaemia and reduced need for transfusion of blood products in the post-operative period. This involves screening and optimising the patient's ability to replace their own red blood cells by optimising vitamin B12 and/or iron levels before surgery (Melnyk et al., 2011). There has been a focus on pre-operative blood management in colorectal and other gastrointestinal cancer surgery, primarily because of the high risk these patients have for presenting with iron deficiency anaemia and the desire to avoid blood transfusion (Hofmann et al., 2011). Pre-operative iron replacement was poorly done in our organisation. Only 25% of all patients were screened for anaemia. Of these, 47% were identified as iron deficient. Only 18% of patients with iron deficiency received iron transfusions. Blood transfusions given peri-operatively in colorectal surgical patients have been shown to increase rates of surgical site infection and septic shock (Mazzeffi et al., 2017). Screening for iron studies is not in the pathology component of ERAS pathway pre-admission assessment and this may explain why many patients did not have this issue addressed. It was also unclear who was responsible for ensuring these bloods were attended to and subsequently reviewed.

For those two patients who received iron infusions, the treatment may have been too late to have an effect. The patients were seen at pre-admission on average 7 days prior to their surgery so they would have received iron infusions within a week of their operation. According to Nicholls et al. (2022) iron infusions should be given ideally greater than two weeks before surgery to achieve a clinically significant increase in the pre-operative haemoglobin concentration. Post-operatively, ferritin was not measured on any of the patients on day two or day five. Our data also showed a relationship between being seen at the pre-admission clinic and having higher a Hb at day two and five post-operatively.

Pain management

Internationally, ERAS protocols demonstrate consensus that managing post-operative pain starts with a pre-operative assessment that includes pain history, directed physical exam, and pain control plan (Devin & McGirt, 2015;Nygren et al., 2012;Apfelbaum et al., 2012). This was demonstrated in our data – there were 25 patients who did not have patient-controlled analgesia (PCA). According to our pathway the 21 patients under the closure of stoma pathway should have been the only patients without PCA. During the anaesthetist review at PAC, it may have been decided that the other four patients did not require PCA. Patients who attended PAC were reviewed by the anaesthetist. Post-operative pain medications were prescribed with 100% compliance by the anaesthetic team.

Overall, patients who were seen at pre-admission had shorter mean fasting times compared to those who were not seen, were issued with carbohydrate loading and given proper counselling. Attending pre-admission also showed that proper assessment can individualise patient care. This really highlights the importance of a pre-admission clinic where consistent counselling and education is

provided to patients. Patient and families also value the pre-admission ERAS education, they are keen to be involved and prepare for the expectations prior to surgery, therefore pre-operative education is important from the patient perspective (Poland et al., 2017).

Previous studies have reported that poor compliance occurred in the post-operative stage when patients are in the ward (Roulin et al., 2017;Aarts et al., 2018). This was not the case in our organisation. When we analysed the three pathways the mean compliance post-operatively ranged from 48% to 59% (Tables 2–4 Results Chapter 5 Pages 48-50).

Mobilisation

Our study found that there was a significantly shorter length of stay in patients who ambulated on day one post-operatively compared to those who did not. Our results were otherwise in keeping with De Almieda et al. (2017) who demonstrated no difference in any other clinical outcomes with early mobilisation. Earlier ambulation did not make any difference to the first day of flatus passed ($p=0.510$), or the first day of bowel motion ($p=0.218$) or complications ($p=0.070$). The majority of patients were either sitting out of bed or mobilising by day two. Obese patients were slower to sit out of bed (SOOB) but there was no difference in the day that obese patients first ambulated. This may have been related to nurses not able or willing to assist these patients out of bed early in the post-operative period due to their size.

Drain removal

The routine use of pelvic and peritoneal drains is not recommended on the ERAS protocol (Gustafsson et al., 2019). Drain placement and time of removal increased the length of stay of colorectal patients (Toh et al., 2021). Our data demonstrated that the mean day for the removal of

the drain was day 7 and the range of day of drain removal was from day one to twenty days. Currently there are no guidelines within the ERAS pathway used by our organisation detailing when to remove abdominal drains. The pathway also does not assist with the review of the drains and currently it only includes if drains are in situ with a yes or no tick box.

An IDC is used in colorectal surgery to prevent urinary retention (Basse et al., 2000;Hilton, 1988) and to monitor urine output as a guide for post-operative fluid management (Schreiber et al., 2019). The majority of the patients (68%) had their IDC removed on or before day two in our organisation, which is in accordance with the ERAS pathway. Similar to patient diet, IDC and intravenous catheter (IVC) removal still needed to be documented by the medical staff in a progress note before nurses removed them as per ERAS pathway. This further demonstrates that the clinical care is medically driven rather than protocol driven and progress through the pathway is dependent upon the medical officers.

Clinical compliance that affected length of stay (LOS)

Within the ERAS pathway, nasogastric tubes (NGTs) are difficult to categorise. It is uncertain whether they should be included as a drain or in the nutrition section. There were 19 patients who had a NGT post-operatively. These were removed on days ranging from 1 to 19, with the average being day 7. The presence of an NGT may indicate that a more complex procedure was performed. The routine use of NGTs has no positive impact on patient outcomes (Petrelli et al., 1993;Feo et al., 2004) and is not recommended in colorectal surgery (Gustafsson et al., 2019). NGTs delay oral intake and it has been found that patients who do not have an NGT tolerated oral intake earlier (Carmichael et al., 2017;K. Li et al., 2011). In our study, this was found to be true. Patients who had NGTs had the day of first oral intake ranging from day two to twenty-one. For these patients,

the length of stay was greater than those who did not have NGTs, because part of the criteria for discharge was to tolerate diet.

Post-operative complications appear to be the most significant driver impacting LOS and, thus, surgical morbidity should be stated within every protocol compliance assessment (Tevis & Kennedy, 2013). High levels of protocol standardization and systematic approaches to post-operative recovery can result in continued improvement in LOS and patient compliance over time. Patients who did not have ERAS ordered should not have been a part of this data and perhaps were not supposed to be on ERAS as they had higher Clavien-Dindo scores. Patients who had high Clavien-Dindo scores did not have any opt-out documentation from the colorectal team. However, according to the ERAS protocol, "the opt-out approach" has been adopted in our centre, with the endorsement of the respective medical heads of department. Only the patient's Attending Medical Officer can take a patient off ERAS.

Pre-operative and post-operative stoma education in ERAS was linked with shorter length of stay (H. M. Forsmo et al., 2016). However, our results for patients who were the under the bowel resection with stoma pathway exceeded the target length of stay (of 7 days) by 4-16 days. Not having stomal therapy on the weekend delayed earlier discharge for patients who had operations on Fridays due to inability to receive stoma education. These findings came from a study conducted by Lyon et al. at the same organisation (2014).

Barriers to ERAS implementation

Barriers to ERAS implementation include insufficient of work force, hospital resources, and of buy-in by the stakeholders (McLeod et al., 2015). Poor communication among team members is also a significant barrier (McLeod et al., 2015). In our organisation the common themes for

possible barriers to ERAS implementation was the lack of understanding of ERAS by all disciplines and that despite being on a pathway, the clinical care was medically driven rather than protocol driven.

There were 52 patients who had ERAS ordered by medical staff. Out of these, 39 patients had ERAS ordered during the episode of care which means 13 patients were seen at pre-admission without an ERAS order on their admission documentation. This demonstrates an inconsistency of understanding within the team of which patients will be enrolled in ERAS.

Post-operatively, the surgeons took a conservative approach to diet, and the nurses do not generally question these orders. This again reflects the lack of education of colorectal staff on ERAS. It also meant that surgeons were very much still in charge of the plan for the patients who were on the ERAS pathway, rather than adherence to the protocol. Nurses only upgraded patients' diet according to what was documented on patients' progress notes from the medical team. The same was true for the removal of IVC and IDC; they were removed only after medical orders. In our organisation this further demonstrated that post-operative care was more medically driven rather than protocol driven which impacted the ability to comply with ERAS.

Early mobilisation on the day of surgery was feared by nurses due to the belief that this would increase falls rates and hurt patients (de Groot et al., 2014). Only 16 (16%) patients sat out of bed post-operatively on the day of surgery and the possible reason was similar to Brown et al. (2018) who found that the nurses were not comfortable mobilizing patients and thought that this was the physiotherapist's role (D. Brown & Xhaja, 2018). The most reported barriers to mobilisation were the lack of staff to assist patients with out-of-bed activity (C. J. Brown et al., 2007), patient concerns about having a fall (C. J. Brown et al., 2007), and the difficulties in mobilising due to

excessive sedation or delirium (Fontela et al., 2018). Our nurses' perspective on mobilisation with ERAS were not explored in this study but it would be reasonable to assume that their understanding would reflect those within the literature.

The literature discussed that ERAS barriers can be overcome by having the support of the institution's leader and empowerment of nurses with consistent education, resources, and communication (D. Brown & Xhaja, 2018).

Nursing role and importance of a dedicated ERAS colorectal nurse

Nurses' roles in ERAS can be broken down into three groups: (i) frontline staff who provide daily care to patients (Wainwright et al., 2022), (ii) ERAS nurses who facilitate the ERAS programme by auditing and focusing on compliance (D. Brown & Xhaja, 2018) (iii) nursing leaders who create the right environment (Watson, 2017). There was some resistance from nurses when implementing ERAS and these reasons were: ERAS challenged existing practice, turnover in nursing leadership, high nursing staff turnover and burnout, and lack of consistent nursing educators, education content and plans (D. Brown & Xhaja, 2018).

Implementing evidence-based practice can place pressure on nursing staff. One institution found that in the initial stage of implementation nurses voiced fears of an increased workload, including added charting requirements (D. Brown & Xhaja, 2018). Nursing leadership is an important aspect of ERAS implementation and adapting evidence-based practices. Not only teaching the front-line staff but incorporating it into day-to-day work and patient care. Nursing managers create healthy nursing work environments that lead to a stable nursing workforce (Warshawsky et al., 2013). Having a stable environment assists with adaptation and sustainability of implementation. Nursing staff turnover can be disruptive with communication declining, consensus decreasing, a lack of

cohesiveness, higher workload, and overall decreased morale (Peng et al., 2023). Having ERAS champions will increase the likelihood of adoption of the ERAS protocol. The role of these champions would be to provide peer education and encourage communication and collaboration (McLeod et al., 2015).

Nurses play a significant role in ensuring that patient care follows the elements of ERAS pathways, as they are at the front line of delivering daily patient care. Nurses also provide pre-operative education and facilitate post-discharge pathways. They are also often in charge of coordinating tasks across various health care disciplines that are involved to ensure continuity of care is achieved (K. M. Brady et al., 2015).

Some of the nurses' tasks in the ERAS pathway is educating and setting expectations to patients, coaching of patients, monitoring, and documentation (Olle Ljungqvist et al., 2020). There is currently no ERAS coordinator solely focused on colorectal surgery in our hospital. However, there is an ERAS coordinator who functions at a health district level. A study conducted on the same organisation found that having an ERAS coordinator improved patient education and staff were found to follow the ERAS protocol. The coordinator would also conduct audits and ensure all disciplines followed the protocol (Lyon et al., 2014).

Recommendations

Overall, the findings from this thesis have provided insight on how to provide better delivery of ERAS to increase compliance and most importantly improve patient clinical outcomes. Based on the following findings, the recommendations suggested are ongoing staff education and collaboration, promoting healthy living, the use of chewing gum post-operatively, change of

pathway delivery and content, and post-op phone follow up to patients. These recommendations will only be possible with an employment of a dedicated ERAS nurse.

Promoting healthy living

Based on our study findings, patients were seen at PAC an average of 7 days prior to surgery. It may be too late at PAC to promote healthy living and perform any interventions. The best time to promote healthy living to patients is when patients have been identified as needing surgery. These include optimising patients' nutrition, a weight loss plan and smoking cessation. These should happen during the consultation with the surgeon when the patient is being consented for surgery and/or at the patients' general practitioner when being referred to the specialist. A meta-analysis demonstrated little benefit for brief smoking interventions pre-operatively and recommended that intervention needed to start more than four to six weeks before the surgery and include nicotine replacement therapy (Thomsen et al., 2014).

Some specifics that were identified are firstly the obese patients who were delayed in sitting out of bed. We should encourage general practitioners (GPs) to have that initial discussion regarding healthy lifestyle modifications, especially when patients are being referred to a colorectal surgeon. GPs could also refer patients to exercise physiologists and dietitians to help with this matter. We often think that the ERAS team only exists within the hospital organisation, but GPs play a big part in patients' ERAS journeys and should be involved from the start as well as post-operatively. There are currently no studies that involve GPs pre-operatively on ERAS which is the gap in the literature and more research could be conducted to assess the potential impact of GPs on a patient's ERAS journey.

Obese patients should be flagged at PAC as being likely to need physiotherapy assistance with mobilising post-operatively when admitted to the ward, especially sitting out of bed on the day of surgery. In addition, it was advised to regularly reassess patients' nutritional status during their stay in the hospital and provide dietary counselling after discharge for patients who received nutritional support therapy peri-operatively.

A better approach to pre-operative blood management is an important detail that may improve patient outcomes. After being seen in the specialist rooms and deciding on an operation, the patient should have a set of blood tests, particularly iron studies, so any interventions can be done early and have a maximal effect. Nicholls et al. (2022) suggested that iron infusions should be given ideally greater than two weeks before surgery to achieve a clinically significant increase in the pre-operative haemoglobin concentration.

Chewing gum

The use of chewing gum after colorectal surgery is an effective measure for reducing post-operative ileus and can be used as part of ERAS (Ge et al., 2015;Roslan et al., 2020). It can also accelerate the return of gastrointestinal function after an abdominal operation involving the bowel (Ge et al., 2015; Keenahan, 2014). This practise is not currently standard in our centre.

ERAS order

As found in this study, there were many incorrect pathways in patients' files. This could be prevented by ongoing education but also for the colorectal surgeons to specifically identify which pathway a patient should fall under. This could be written on the patient RFA or the post-operative plan in the operation report.

Pathway form

ERAS documentation was poorly done and fell under the responsibility of the nurses when ERAS should be a multidisciplinary team approach. One change for the pathway documentation would be clearly outlining which discipline is responsible for which assessments. Another suggestion would be having the ERAS pathway available electronically instead of in paper form. In this case it would be easier for all the disciplines to document as well as provide more accurate data when auditing.

In terms of the current content there are a few assessments that are done well, and some which could be improved. One improvement to provide a better assessment is including iron studies, it is part of ERAS however not included as a prompt on the pathology assessment. Post-operatively, drain assessment is currently just identifying if a patient has a drain. For better assessment of the drains, it should include the colour of the drain output and the drain volume. This may also assist surgeons with their decision to remove the drain earlier if this assessment is easily accessible.

Under the analgesia assessment section, it is currently just an assessment if the ERAS analgesia is charted which I think should be the responsibility of the medical officers. I believe it will be more useful for the nurses to assess patients' pain at rest and during movement, and for this to be included in the ERAS pathway. This will ensure that patients have sufficient pain relief to do daily activities post-operatively.

Lastly, perioperative assessment is currently not part of the ERAS pathway which misses valuable information and does not permit capturing correct information for auditing. Perioperative assessment could include the specific time patients fasted and if carbohydrate loading was

consumed. At present, it is assumed that if a patient was provided a carbohydrate drink at pre-admission that the patient drank this pre-operatively.

Post-operative phone follow up

Patients who were part of the ERAS programme and discharged earlier require more support and supervision at home (Bernard & Foss, 2014). For patients to feel supported and have a safety net, phone follow up with patients will be seen as valuable. It could also avoid unnecessary presentation to emergency. Phone calls after discharge have been shown to be well received by patients and result in fewer complications. The phone calls also provide reinforcement training and emotional support (Burch, 2012). This is currently not part of the ERAS protocol in our organisation as there is no dedicated ERAS nurse who can perform this function on a regular basis.

Ongoing education and collaboration

Patients frequently received inconsistent information from junior medical officers during PAC regarding fasting time and missed out on carbohydrate loading if not seen by the colorectal nurses. Ongoing education to the multidisciplinary team will avoid inconsistent information sharing to patients and other staff. This could be provided by 'champions' in each discipline responsible for education and audit.

Perhaps the first step towards improvement would be identifying or recruiting these champions. These champions could also meet regularly to review compliance and improvement of the pathways. It was noted that the anaesthetists had 100% compliance with their component of the ERAS pathways, potentially because they follow through the patients from pre-admission.

Educating staff will empower them to speak up if the ERAS pathway is not being followed, especially the frontline nurses who are delivering daily care to patients.

A structured and organised staff education programme helped in the implementation of ERAS. A study dedicated one month of education to all staff including nurses, patient care technicians, anaesthetists, and surgeons from all the clinical areas who would encounter an ERAS patient. The aim was to have a consistent message communicated throughout and learn the entire ERAS pathway from PAC to discharge (D. Brown & Xhaja, 2018). The nursing staff from the preadmission clinic through to discharge embraced ERAS as new evidence based practice because they saw the improved patient outcomes in the colorectal surgical patients (e.g. earlier discharges and fewer complications). In addition, two years later, there was increased institutional awareness about ERAS and its results in improving patient outcomes and patient experience. Successful implementation of ERAS relies on the fulfilment of the clinical protocol and buy-in from all health care professionals involved in the patient's surgical journey (Wainwright et al., 2022). Compliance with the ERAS clinical pathway will be discussed from pre- and post-surgery and then discharge.

All these recommendations can only be facilitated if there is dedicated colorectal ERAS coordinator to action and work closely with the current district ERAS nurse.

This thesis enhances the understanding of the overall compliance on ERAS clinically and on documentation on the study site hospital. It also provided some recommendations on the documentation process in terms of ERAS order and the documentation responsibility that should be shared across the multidisciplinary team. An important recommendation in this paper is involving GPs as part of the pre-operative phase by optimising their health through promotion of healthy living. For example, smoking cessation, optimising patients' nutrition, and weight,

prehabilitation and early detection of anaemia. The review of current practice highlights the importance of patients attending pre-admission clinic as this sets the expectation preoperatively. Consistent information can only be achieved by ongoing education to staff, so all staff are providing the same information and care to all patients according to the ERAS protocol.

Limitations of study

The general limitation of this study was the sample size. They were only 97 patients reviewed undergoing colorectal surgery. Ongoing audit of compliance would help to confirm these findings.

There were also limitations on capturing an accurate representation/readmission. There were 8 patients who presented to emergency. These readmissions were patients who represented to the same organisation where they had their surgery. RPA hospital is a tertiary hospital which accepts patients for colorectal surgery from across New South Wales (NSW). This means some patients may have presented elsewhere, and these episodes were not captured within the readmission within 30-day data.

Conclusion

The research conducted for this thesis has proved that there is no correlation with better documentation to improve clinical outcomes on the ERAS pathway. It has also provided an insight of the ERAS culture in our organisation. Our findings suggest that pre-admission counselling is a significant part of ERAS as this sets the expectations for patients and needing a dedicated person to provide this counselling is also just as important. It has also shown that ERAS is not protocol driven in our centre but very much medically driven, and it is not

supported by dedicated nursing staff. Going forward a dedicated nurse would assist leading ERAS for better patient outcomes and to create a better culture.

There is scope to further explore a change on the delivery mode of the ERAS pathway and to modify the contents to share the responsibility of documentation with other disciplines. It is also worth investigating involving GPs as part of ERAS to promote healthy living prior to surgery and to improve patient health outcomes after colorectal surgery.

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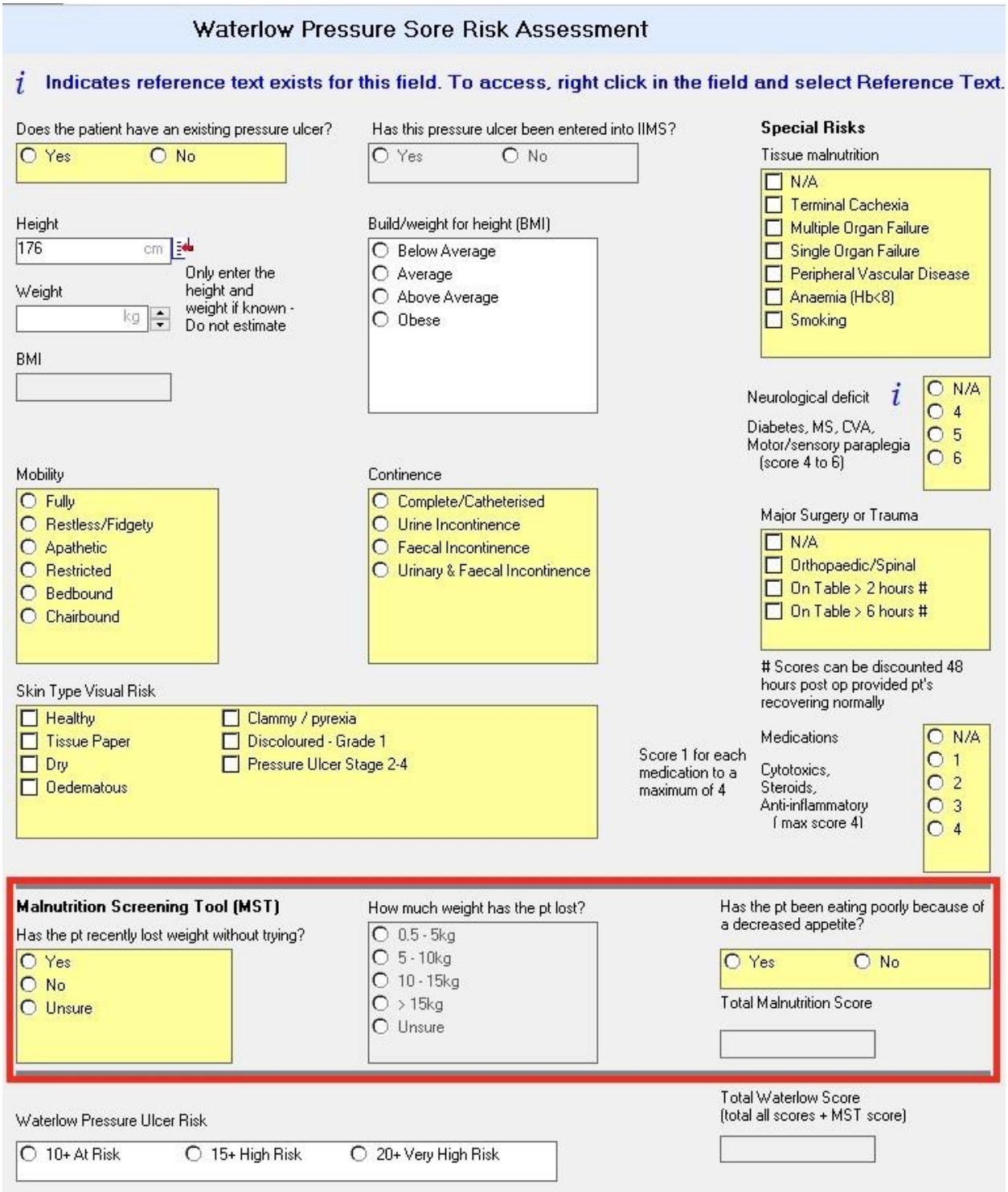
APPENDICES

Appendix 1 Waterlow assessment



Red rectangle focuses on the MST assessment.

Appendix 2 Clavien-Dindo table

Classification of Surgical Complications

Grades	Definition
Grade I	Any deviation from the normal post-operative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Acceptable therapeutic regimens are drugs as antiemetics, antipyretics, analgetics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included.
Grade III	Requiring surgical, endoscopic or radiological intervention
- IIIa	Intervention not under general anesthesia
- IIIb	Intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications) * requiring IC/ICU-management
- IVa	single organ dysfunction (including dialysis)
- IVb	multiorgandysfunction
Grade V	Death of a patient

**Brain haemorrhage, ischemic stroke, subarrachnoidal bleeding, but excluding transient ischemic attacks (TIA); IC: Intermediate care; ICU: Intensive care unit.*

From: Clavien: Annals of Surgery, Volume 250 (2). August 2009. 187-196

Appendix 3 Ethics approval letters dated 12 October 2020 and 07 September 2023

07 September 2023 – Amendment Approved

X20-0307 & 2020/ETH01553: Notification of an amendment to a research study - General Amendment (137294) - Approved

Reply | Reply All | Forward

no_reply@regis.health.nsw.gov.au
To cyoungnsw
Cc Agnes Le (Sydney LHD)
Thu 7/09/2023 7:15 AM

This sender no_reply@regis.health.nsw.gov.au is from outside your organization.

137294_SLHDPRIVACYCOMPLIANCEFORM V2 18.7.23 tracked.docx.docx 44 KB
137294_ERAS Mastercode Version 2, 24 July 2023 clean.docx.docx 29 KB
137294_ERAS Mastercode Version 2, 24 July 2023 tracked.docx.docx 29 KB
137294_SLHDPRIVACYCOMPLIANCEFORM V2 18.7.23 clean.docx.docx 43 KB

Date of Decision Notification: **07 Sep 2023**
Greater than low risk review pathway

Dear Associate Professor Christoph Young,

Thank you for submitting an Amendment for the following study;

X20-0307 & 2020/ETH01553: Does better documentation compliance with ERAS protocol translate to improved clinical outcome?

The Amendment has been reviewed on 07 Sep 2023, by the Executive Officer as delegated by the HREC Chair and has been approved.

Notification of an amendment to a research study - General Amendment with form ID 137294

The following is included in this approval**:

- ERAS- Protocol (Version 5, 23 August 2023)
- Data Collection Form (Version 3, 25 July 2023)
- Master Code Sheet (Version 2, 24 July 2023)
- SLHD Privacy Compliance Form (Version 2, 18 July 2023)
- RDMP (25 August 2023)
- **New title:** *Does better documentation compliance with ERAS protocol translate to improved clinical outcome?*
- Addition of the following Investigators: A/Prof Jonathan Hong and A/Prof Vicki Patton to the Study.
- Removing the following Investigators: Dr Caroline Wright, Dr Kim Hill, Kris Louis and Sally Auld from the Study.

Please Note: *SLHD Privacy Compliance Form and Master Code Sheet has been edited to update the version number and date on all pages of the document to align with the version number and date on file name. Clean and tracked copies of the approved documents are attached.*

In accordance with the National Statement, chapter 4.7; you must seek ethical approval from the HREC of the Aboriginal Health and Medical Research Council (AHMRC) if you intend to use ATSI status in any presentation or publication.

It is noted that the Sydney Local Health District Ethics Review Committee (RPAH Zone) is constituted in accordance with the National Statement on Ethical Conduct in Human Research, 2007 (NHMRC).

This email constitutes ethical and scientific approval only.

For NSW authorised sites (listed in REGIS): A Site General Amendment form will need to be submitted to each affected site. You are not required to upload this form or the ethics approved documents into the site form but you will need to identify this approved amendment form ID (137294).

Please contact us if you would like to discuss any aspects of this process further, as per the contact details below.

Yours Sincerely,

Keshani Ajith Piyantha
Assistant Administrator
Research Ethics & Governance Office | Royal Prince Alfred Hospital
Missenden Road CAMPERDOWN NSW 2050
Tel 02 9515 8200 | keshani.ajithpiyantha@health.nsw.gov.au
****COVID-19 Response**** https://www.slhd.nsw.gov.au/rpa/Research/covid19response.html
For information about submitting an application through REGIS https://www.slhd.nsw.gov.au/rpa/research/regis.html

Ethics Letter of Approval 12 October 2020

ADDRESS FOR ALL CORRESPONDENCE
RESEARCH ETHICS AND GOVERNANCE OFFICE
ROYAL PRINCE ALFRED HOSPITAL
CAMPERDOWN NSW 2050
TELEPHONE: (02) 9515 6766
EMAIL: SLHD-RPAEthics@health.nsw.gov.au
REFERENCE: X20-0307 & 2020/ETH01553

Health
Sydney
Local Health District

12 October 2020

This letter constitutes ethical approval only. You must NOT commence this research project at ANY site until you have submitted a Site Specific Assessment Form to the Research Governance Officer and received separate authorisation from the Chief Executive or delegate of that site.

Dear Professor Young,

Re: Protocol No X20-0307 & 2020/ETH01553 - "Enhanced Recovery After Surgery (ERAS) protocol compliance after implementation of educational sessions and ERAS nursing cards on a Colorectal Unit"

The Executive of the Ethics Review Committee, at its meeting of 12 October 2020 considered your correspondence of 9 October 2020. In accordance with the decision made by the Ethics Review Committee at its meeting of 12 August 2020, ethical approval is granted.

- The research project meets the requirements of the *National Statement on Ethical Conduct in Human Research*.
- The Committee granted a waiver of the usual requirement for the consent of the individual for the use of their health information in a research project, in accordance with the *Health Records and Information Privacy Act 2002* (NSW) and the NSW Privacy Commissioner's Statutory guidelines on research and the NHMRC Guidelines approved under Section 95A of the Privacy Act 1988.

This approval includes the following:

- HREA (Version 3, 30 September 2020)
- Study Protocol (Version 4, 7 October 2020) * see additional condition below
- Participant Information Sheet (Version 3, 7 October 2020)
- ERAS- Poster (22 May 2020)
- ERAS- Nursing Guide cards (Version 1, 22 May 2020)
- Follow email/letter (Version 1, 20 September 2020)
- Pre-Implementation Survey (Version 3, 7 October 2020)

- Post-Implementation Survey (Version 3, 7 October 2020)
- ERAS Clinical Pathway Bowel resection with Stoma (Audit Form)
- ERAS Clinical Pathway Bowel resection (Audit Form)
- ERAS Clinical Pathway Closure of stoma (Audit Form)
- ERAS Audit Survey (Version 2, 29 September 2020)
- ERAS Presentation (Version 3, 3 October 2020)
- Master Code Sheet (Version 1, 20 September 2020)
- Privacy Compliance Form

*In accordance with the National Statement, chapter 4.7; you must seek ethical approval from the HREC of the Aboriginal Health and Medical Research Council (AHMRC) if you intend to use ATSI status in any presentation or publication.

You are asked to note the following:

On the basis of this ethics approval, authorisation may be sought to conduct this study within any NSW/QLD/VIC/SA/WA/ACT public health organisation and/or within any private organisation which has entered into an appropriate memorandum of understanding with the Sydney Local Health District, Sydney Local Health Network or the Sydney South West Area Health Service.

The Committee noted that authorisation will be sought to conduct the study at the following site:

- Royal Prince Alfred Hospital

- This approval is valid for **five** years, and the Committee requires that you furnish it with annual reports on the study's progress beginning in **October 2021.** If recruitment is ongoing at the conclusion of the five year approval period, a full re-submission will be required. Ethics approval will continue during the re-approval process.
- This human research ethics committee (HREC) has been accredited by the NSW Department of Health as a lead HREC under the model for single ethical and scientific review and is constituted and operates in accordance with the National Health and Medical Research Council's *National Statement on Ethical Conduct in Human Research* and the *CPMP/ICH Note for Guidance on Good Clinical Practice*.
- You must immediately report anything which might warrant review of ethical approval of the project in the specified format, including unforeseen events that might affect continued ethical acceptability of the project.
- You must notify the HREC of proposed changes to the research protocol or conduct of the research in the specified format.
- You must notify the HREC and other participating sites, giving reasons, if the project is discontinued at a site before the expected date of completion.
- If you or any of your co-investigators are University of Sydney employees or have a conjoint appointment, you are responsible for informing the University's Risk Management Office of this approval, so that you can be appropriately indemnified.

Appendix 4 ERAS Pathways- Bowel resection

NSW GOVERNMENT Health
Sydney Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery
CLINICAL PATHWAY
BOWEL RESECTION

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Surgeon: **Consented Operation:** **Date:**

ASSESSMENT	PRE ADMISSION CLINIC Date: ____/____/____
Consent	☐ Has patients' consent been signed
Tests	☐ Chest Xray ☐ ECG
Pathology	☐ Group and Hold ☐ FBC, EUC, COAGS ☐ CEA if Applicable
Mobilisation / Physiotherapy / Oxygen Therapy	☐ Does the patient use any mobility aides_____ ☐ Educate re sitting out of bed the night of surgery ☐ Educate re sitting out of bed, ambulation and deep breathing exercises post-operatively
Observations	☐ Weight _____kg ☐ Height _____m ☐ BMI _____ ☐ MST _____ if >2 refer to Dietitian ☐ Baseline vital signs: HR: _____ BP: _____ Oxygen Sats: _____
Medications / VTE Prophylaxis	☐ Bowel Prep ☐ Yes ☐ No ☐ Instructions given - ☐ Surgeon ☐ Nurse ☐ Educate patient re possibility of enema pre operatively ☐ Educate patient on TED stockings which will be provided in TPU ☐ Educate patient on VTE prophylaxis ☐ Anticoagulants to cease on ___/___/___ (Patient educated re same)
Pain Management	☐ Education: Post-op PCA / pain control
Wounds / Drains	☐ Patient educated regarding presence of IDC ☐ Patient educated regarding +/- drain post-operatively
Nutrition	Patient educated re: ☐ No solid food from 24:00hrs pre-operatively (Clear Fluids for 24hrs if Bowel Prep) ☐ Clear Fluids up to 2 hours pre-operatively ☐ Strictly NBM once patient has left home ☐ Carbohydrate Loading
Pressure Area Care (Waterlow Score)	
Falls Risk Assessment	
Current Support Services and Referrals to be made	☐ ERAS booklet given to patient - ☐ Surgeon ☐ Nurse ☐ Read before PAC ☐ CLD discussed with patient and information pamphlet given to patient. ☐ Do you have any current support services in place? _____ ☐ Will you require any services post operatively? _____ ☐ How will you be getting home? _____ ☐ Are you the primary carer for others? _____ ☐ Social Worker ☐ Compacks ☐ Community Nurses ☐ Occupational Therapy ☐ Physiotherapy ☐ Dietitian
Nursing Staff: **Name / Signature:**	

BINDING MARGIN - NO WRITING

170217 SP

ERAS CLINICAL PATHWAY— BOWEL RESECTION—TRIAL FORM

MR 45/59B

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Operation Performed:

ASSESSMENT	DAY OF SURGERY Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 1 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations						☐ EUC ☐ FBC ☐ CRP ☐ CLD Form Updated				
Hygiene	☐ Post-op sponge					☐ Assisted shower				
Mobilisation / Physiotherapy	☐ Sit out of bed 1-2hrs ☐ Incentive Spirometry ☐ Oxygen therapy					☐ Sit out of bed for 2hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x1 ☐ ☐ Cease oxygen				
Observations	☐ Standard observations per protocol ☐ PCA observations per protocol ☐ 1/24 Urine Output for 24hrs ☐ SFBC (input / output) ☐ BSL as per protocol ☐ Assess pain and nausea ☐ Enter height and weight					☐ Standard observations per protocol ☐ Continue monitoring FBC ☐ BSL as per prototocol ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ PCA ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD					☐ Cease PCA ☐ PRN oral analgesia ☐ Regular Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD				
Wounds / Drains	☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N How many: _____ ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record					☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record				
IV Therapy / Access	☐ IVC Day_____ ☐ Position_____ ☐ IV Therapy					☐ Cap IVC ☐ IVC Day_____ ☐ Position_____ ☐ Cease IVT				
Elimination	☐ IDC insitu ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N					☐ IDC remove 06:00hrs ☐ Post Removal Void _____ mls ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N				
Nutrition	☐ Free Fluids ☐ Low Residue diet					☐ Low Residue diet				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

BINDING MARGIN - NO WRITING

ASSESSMENT	DAY 2 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 3 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations	☐ EUC ☐ FBC ☐ CLD Form Updated					☐ EUC ☐ FBC ☐ CRP ☐ CLD Form Updated ☐ Appointments made ☐ Discharge Referral written ☐ Discharge Card discussed ☐ Bowel Function Booklet discussed				
Hygiene	☐ Independent shower					☐ Independent shower				
Mobilisation / Physiotherapy	☐ Sit out of bed for 3hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x2 ☐ ☐					☐ Sit out of bed for 4hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x3 ☐ ☐ ☐				
Observations	☐ Standard observations as per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea					☐ Standard observations as per protocol ☐ BSL as per protocol ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD					☐ PRN oral analgesia ☐ Regular Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD ☐ Discharge scripts in progress				
Wounds / Drains	☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 2400hrs + record					☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 2400hrs + record				
IV Therapy / Access	☐ Remove IVC									
Elimination	☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N					☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N				
Nutrition	☐ Low Residue diet					☐ Low Residue diet				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION

ASSESSMENT	DAY 4 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 5 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations	☐ EUC ☐ FBC ☐ CLD Form Updated									
Hygiene	☐ Independent shower									
Mobilisation / Physiotherapy	☐ Sit out of bed for 4 hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x4 ☐ ☐ ☐ ☐									
Observations	☐ Standard observations per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea									
Analgesia / Medications / VTE Prophylaxis	☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD									
Wounds / Drains	☐ Review wounds - Change dressing if required. ☐ Drains removed as per team ☐ Care of wounds at home discussed									
IV Therapy / Access										
Elimination	☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N									
Nutrition	☐ Low Residue diet									
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

VARIANCE CODES

N	No Variance

1. SYSTEM RELATED		2. PATIENT RELATED	
S1	Delay in test / procedure availability	P1	Pre-op complication
S2	Delay in test / procedure results	P2	Intra-op complication
S3	Delay in ambulance /hospital transport	P3	Post-op complication
S4	Delay in availability of bed at another facility	P4A	Development of DVT/PE
S5	Delay in availability of community support/ equipment/supplies	P4B	Pain management issues
S6	Other	P4C	Nausea + vomiting
		P4D	Does not tolerate diet
3. PRACTITIONER RELATED		P4E	Unstable observations
PR1	Delay in medical consultation	P4F	Ileus / bowel obstruction
PR2	Delay in allied health consultation	P4G	Infection (chest / urine)
PR3	Delay in nursing intervention	P4H	Wound complication
PR4	Delay in consultation due to Public Holiday / Weekend / Other	P4I	Anuria
PR5	Inadequate discharge planning	P4J	Elevated/increasing creatinine
PR6	Other	P4K	IDC dislodgement
		P5	Unplanned return to OT
		P6	Unplanned transfer to ICU
		P7	Existing co-morbidities
		P8	Non–compliance
		P9	Other

COLORECTAL SPECIFIC CERS CRITERIA

- PR Bleeding > 200mls fresh blood
- Haematemesis
- Vomiting unresponsive to PONV for > 2hrs
- Severe abdominal pain +/- distention
- Unexpected discharge of bile, enteric fluid or faeces from a wound or drain
- Temperature > 38.5 with rigors
- New onset of urine output < 100mls in 4 hours

BINDING MARGIN - NO WRITING

Appendix 4.2 Bowel resection with stoma pathway

Health
Sydney
Local Health District
NSW GOVERNMENT

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery
CLINICAL PATHWAY
BOWEL RESECTION WITH STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Surgeon: **Consented Operation:** **Date:**

ASSESSMENT	PRE ADMISSION CLINIC Date: ____/____/____
Consent	☐ Has patients' consent been signed
Tests	☐ Chest Xray ☐ ECG
Pathology	☐ Group and Hold ☐ FBC, EUC, COAGS ☐ CEA if Applicable
Mobilisation / Physiotherapy / Oxygen Therapy	☐ Does the patient use any mobility aides_____ ☐ Educate re sitting out of bed the night of surgery ☐ Educate re sitting out of bed, ambulation and deep breathing exercises post-operatively
Observations	☐ Weight _____kg ☐ Height _____m ☐ BMI _____ ☐ MST _____ if > 2 refer to Dietitian ☐ Baseline vital signs: HR: _____ BP: _____ Oxygen Sats: _____
Medications / VTE Prophylaxis	☐ Bowel Prep ☐ Yes ☐ No ☐ Instructions given - ☐ Surgeon ☐ Nurse ☐ Educate patient re possibility of enema pre operatively ☐ Educate patient on TED stockings which will be provided in TPU ☐ Educate patient on VTE prophylaxis ☐ Anticoagulants to cease on ___/___/___ (Patient educated re same)
Pain Management	☐ Education: Post-op PCA / Pain Busters / Oral Analgesia
Wounds / Drains / Stoma	☐ Patient educated regarding presence of IDC ☐ Patient educated regarding +/- drain post-operatively ☐ Preoperative Stoma education and Siting.
Nutrition	Patient educated re: ☐ No solid food from 24:00hrs preoperatively (Clear Fluids for 24hrs if Bowel Prep) ☐ Clear Fluids up to 2 hours pre-operatively ☐ Strictly NBM once patient has left home ☐ Carbohydrate Loading
Pressure Area Care (Waterlow Score)	
Falls Risk Assessment	
Current Support Services and Referrals to be made	☐ ERAS booklet given to patient - ☐ Surgeon ☐ Nurse ☐ Read before PAC ☐ CLD discussed with patient and information pamphlet given to patient. ☐ Do you have any current support services in place? _____ ☐ Will you require any services post operatively? _____ ☐ How will you be getting home? _____ ☐ Are you the primary carer for others? _____ ☐ Social Worker ☐ Compacks ☐ Community Nurses ☐ Occupational Therapy ☐ Physiotherapy ☐ Dietitian
Nursing Staff: **Name / Signature:**	

BINDING MARGIN - NO WRITING

170217 SP

ERAS CLINICAL PATHWAY— BOWEL RESECTION WITH STOMA—TRIAL FORM

MR 45/59C

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION WITH STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Operation Performed:

ASSESSMENT	DAY OF SURGERY Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 1 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations						☐ EUC ☐ FBC ☐ CRP ☐ CLD Form Updated				
Hygiene	☐ Post-op sponge					☐ Assisted shower				
Mobilisation / Physiotherapy	☐ Sit out of bed 1-2hrs ☐ Incentive Spirometry ☐ Oxygen therapy					☐ Sit out of bed for 2hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x1 ☐ ☐ Cease oxygen				
Observations	☐ Standard observations per protocol ☐ PCA observations per protocol ☐ 1/24 Urine Output for 24hrs ☐ Stoma observations per protocol ☐ SFBC (input / output) ☐ BSL as per protocol ☐ Assess pain and nausea ☐ Enter height and weight					☐ Standard observations per protocol ☐ PCA observations per protocol ☐ 4/24 Urine Output ☐ Stoma observations per protocol ☐ SFBC (input / output) ☐ BSL as per protocol ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ PCA ☐ Pain Busters ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD					☐ PCA ☐ Pain Busters ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD				
Wounds / Drains	☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N How many: _____ ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record					☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record				
IV Therapy / Access	☐ IVC Day_____ ☐ Position_____ ☐ IV Therapy					☐ IVC Day_____ ☐ Position_____ ☐ IV Therapy				
Elimination	☐ IDC insitu ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N					☐ IDC insitu ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N				
Nutrition	☐ Free Fluids ☐ Low Residue diet ☐ Stoma diet (Ileostomy)					☐ Low Residue diet ☐ Stoma diet (Ileostomy)				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION WITH STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

ASSESSMENT	DAY 2 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 3 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations	☐ EUC ☐ FBC ☐ CRP ☐ CLD Form Updated					☐ EUC ☐ FBC ☐ CRP ☐ CLD Form Updated				
Hygiene	☐ Supervise shower					☐ Independent shower				
Mobilisation / Physiotherapy	☐ Sit out of bed for 3hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x2 ☐ ☐					☐ Sit out of bed for 4hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x3 ☐ ☐ ☐				
Observations	☐ Standard observations as per protocol ☐ 4/24 Urine Output ☐ Stoma observations per protocol ☐ SFBC (input / output) ☐ BSL as per protocol ☐ Assess pain and nausea					☐ Standard observations as per protocol ☐ Continue monitoring all output on FBC ☐ Cease stoma observations ☐ BSL as per protocol ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ Cease PCA ☐ Pain Busters ☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD					☐ Remove Pain Busters ☐ PRN oral analgesia ☐ Regular Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD				
Wounds / Drains	☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record					☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record				
IV Therapy / Access	☐ Cap IVC ☐ IVC Day_____ ☐ Position_____ ☐ Cease IVT					☐ Remove IVC				
Elimination	☐ IDC Insitu ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N ☐ Stoma Education					☐ IDC remove 06:00hrs Post Void + Residual: V1. _____ R1. _____ V2. _____ R2. _____ V3. _____ R3. _____ ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N ☐ Stoma Education				
Nutrition	☐ Low Residue diet ☐ Stoma diet (Ileostomy)					☐ Low Residue diet ☐ Stoma diet (Ileostomy)				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

NSW GOVERNMENT Health
Sydney Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION WITH STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

ASSESSMENT	DAY 4 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 5 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations	☐ EUC ☐ FBC ☐ CLD Form Updated					☐ EUC ☐ FBC ☐ CLD Form Updated				
Hygiene	☐ Independent shower					☐ Independent shower				
Mobilisation / Physiotherapy	☐ Sit out of bed for 4 hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x4 ☐ ☐ ☐ ☐					☐ Sit out of bed for 4 hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x4 ☐ ☐ ☐ ☐				
Observations	☐ Standard observations per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea					☐ Standard observations per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD					☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD				
Wounds / Drains	☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record					☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ TDS revac ☐ Change drainage bags at 24:00hrs + record ☐ Drains removed as per team				
IV Therapy / Access										
Elimination	☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N ☐ Stoma Education					☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N ☐ Stoma Education				
Nutrition	☐ Low Residue diet ☐ Stoma diet (Ileostomy)					☐ Low Residue diet ☐ Stoma diet (Ileostomy) ☐ Diettitian Review				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION WITH STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

ASSESSMENT	DAY 6 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 7 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations	☐ EUC ☐ FBC ☐ CLD Form Updated ☐ Appointments made ☐ Discharge Referral discussed ☐ Discharge Card discussed					☐ EUC ☐ FBC ☐ CLD Form Updated				
Hygiene	☐ Independent shower					☐ Independent shower				
Mobilisation / Physiotherapy	☐ Sit out of bed for 4 hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x4 ☐ ☐ ☐ ☐					☐ Sit out of bed for 4 hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x4 ☐ ☐ ☐ ☐				
Observations	☐ Standard observations per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea					☐ Standard observations per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD ☐ Discharge scripts in progress					☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD				
Wounds / Drains	☐ Review wounds ☐ Drains removed as per team					☐ Review wounds - Change dressing if required ☐ Drains removed as per team ☐ Care of wounds at home discussed				
IV Therapy / Access										
Elimination	☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N ☐ Stoma Education ☐ Stoma Supplies					☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N ☐ Stoma Education				
Nutrition	☐ Low Residue diet ☐ Stoma diet (Ileostomy)					☐ Low Residue diet ☐ Stoma diet (Ileostomy)				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
BOWEL RESECTION WITH STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

VARIANCE CODES

N	No Variance

1. SYSTEM RELATED		2. PATIENT RELATED	
S1	Delay in test / procedure availability	P1	Pre-op complication
S2	Delay in test / procedure results	P2	Intra-op complication
S3	Delay in ambulance /hospital transport	P3	Post-op complication
S4	Delay in availability of bed at another facility	P4A	Development of DVT/PE
S5	Delay in availability of community support/ equipment/supplies	P4B	Pain management issues
S6	Other	P4C	Nausea + vomiting
		P4D	Does not tolerate diet
3. PRACTITIONER RELATED		P4E	Unstable observations
PR1	Delay in medical consultation	P4F	Ileus / bowel obstruction
PR2	Delay in allied health consultation	P4G	Infection (chest / urine)
PR3	Delay in nursing intervention	P4H	Wound complication
PR4	Delay in consultation due to Public Holiday / Weekend / Other	P4I	Anuria
PR5	Inadequate discharge planning	P4J	Elevated/increasing creatinine
PR6	Other	P4K	IDC dislodgement
		P5	Unplanned return to OT
		P6	Unplanned transfer to ICU
		P7	Existing co-morbidities
		P8	Non–compliance
		P9	Other

COLORECTAL SPECIFIC CERS CRITERIA

- PR Bleeding > 200mls fresh blood
- Haematemesis
- Vomiting unresponsive to PONV for > 2hrs
- Severe abdominal pain +/- distention
- Unexpected discharge of bile, enteric fluid or faeces from a wound or drain
- Temperature > 38.5 with rigors
- New onset of urine output < 100mls in 4 hours

Appendix 4.3 Closure of stoma pathway

Health
Sydney
Local Health District
NSW GOVERNMENT

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery
CLINICAL PATHWAY
CLOSURE OF STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Surgeon: **Operation:** **Date:**

ASSESSMENT	PRE ADMISSION CLINIC Date: ____/____/____
Consent	☐ Has patients' consent been signed
Tests	☐ Chest Xray ☐ ECG
Pathology	☐ Group and Hold ☐ FBC, EUC, COAGS
Mobilisation / Physiotherapy / Oxygen Therapy	☐ Does the patient use any mobility aides_____ ☐ Educate re sitting out of bed the night of surgery ☐ Educate re sitting out of bed, ambulation and deep breathing exercises post-operatively
Observations	☐ Weight _____kg ☐ Height _____m ☐ BMI _____ ☐ MST _____ if > 2 refer to Dietitian ☐ Baseline vital signs: HR: _____ BP: _____ Oxygen Sats: _____
Medications / VTE Prophylaxis	☐ Bowel Prep ☐ Yes ☐ No ☐ Instructions given - ☐ Surgeon ☐ Nurse ☐ Educate patient on TED stockings which will be provided in TPU ☐ Educate patient on VTE prophylaxis ☐ Anticoagulants to cease on ___/___/___ (Patient educated re same)
Pain Management	☐ Education: Post-op pain control
Wounds / Drains	☐ Patient educated regarding +/- presence of IDC ☐ Patient educated regarding +/- drain post-operatively. ☐ Patient educated regarding wound care post-operatively
Nutrition	Patient educated re: ☐ No solid food from 24:00hrs pre-operatively (Clear Fluids for 24hrs if Bowel Prep) ☐ Clear Fluids up to 2 hours pre-operatively ☐ Strictly NBM once patient has left home ☐ Carbohydrate Loading
Pressure Area Care (Waterlow Score)	
Falls Risk Assessment	
Current Support Services and Referrals to be made	☐ ERAS booklet given to patient - ☐ Surgeon ☐ Nurse ☐ Read before PAC ☐ CLD discussed with patient and information pamphlet given to patient. ☐ Do you have any current support services in place? _____ ☐ Will you require any services post operatively? _____ ☐ How will you be getting home? _____ ☐ Are you the primary carer for others? _____ ☐ Social Worker ☐ Compacks ☐ Community Nurses ☐ Occupational Therapy ☐ Physiotherapy ☐ Dietitian
Nursing Staff: **Name / Signature:**	

BINDING MARGIN - NO WRITING

170217 SP

ERAS CLINICAL PATHWAY— CLOSURE OF STOMA—TRIAL FORM

MR 45/59D

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
CLOSURE OF STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

Operation Performed:

ASSESSMENT	DAY OF SURGERY Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 1 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations						☐ EUC ☐ FBC ☐ CLD Form Updated				
Hygiene	☐ Post-op sponge					☐ Assisted shower				
Mobilisation / Physiotherapy	☐ Sit out of bed 1-2hrs ☐ Incentive Spirometry ☐ Oxygen therapy					☐ Sit out of bed for 2hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x2 ☐ ☐ ☐ Cease oxygen				
Observations	☐ Standard observations per protocol ☐ SFBC (input / output) ☐ BSL TDS ☐ Assess pain and nausea ☐ Enter height and weight					☐ Standard observations per protocol ☐ Continue monitoring FBC ☐ BSL TDS ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ PRN Oral Analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD					☐ PRN oral analgesia ☐ Regular Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD ☐ Calmoseptine Cream provided.				
Wounds / Drains	☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N How many: _____					☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N				
IV Therapy / Access	☐ IVC Day_____ ☐ Position_____ ☐ Cease IV Therapy once tolerating diet.					☐ Cap IVC ☐ IVC Day_____ ☐ Position_____ ☐ Cease IVT if not already				
Elimination	☐ Post Op Void: _____ mls ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N					☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N				
Nutrition	☐ Free Fluids ☐ Low Residue diet					☐ Low Residue diet				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
CLOSURE OF STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

ASSESSMENT	DAY 2 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance	DAY 3 POST-OPERATIVE Date: ___/___/___	AM	PM	ND	Vari-ance
Procedures / Investigations	☐ EUC ☐ FBC ☐ CLD Form Updated ☐ Appointments made ☐ Discharge referral written ☐ Discharge Card discussed ☐ Bowel Function Booklet discussed					☐ EUC ☐ FBC ☐ CLD Form Updated				
Hygiene	☐ Independent shower					☐ Independent shower				
Mobilisation / Physiotherapy	☐ Sit out of bed for 3hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x3 ☐ ☐ ☐					☐ Sit out of bed for 4hrs ☐ AM and ☐ PM ☐ Ambulate 100 metres x4 ☐ ☐ ☐ ☐				
Observations	☐ Standard observations as per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea					☐ Standard observations as per protocol ☐ Continue monitoring all output on FBC ☐ BSL as per protocol ☐ Assess pain and nausea				
Analgesia / Medications / VTE Prophylaxis	☐ PRN oral analgesia ☐ QID Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD ☐ Discharge scripts in progress					☐ PRN oral analgesia ☐ Regular Paracetamol ☐ TDS Metoclopramide ☐ TED stockings ☐ Heparin 5000u BD				
Wounds / Drains	☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N					☐ Review wounds ☐ Drain(s) in situ ☐Y ☐N ☐ Drains removed per team ☐ Care of wounds at home discussed				
IV Therapy / Access	☐ Remove IVC									
Elimination	☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N					☐ Passing urine adequately ☐ Passing flatus ☐Y ☐N ☐ Bowel motion ☐Y ☐N				
Nutrition	☐ Low Residue diet					☐ Low Residue diet				
Pressure Area Care (Waterlow Score)										
Falls Risk Assessment										
Nursing Staff AM Name / Signature										
Nursing Staff PM Name / Signature										
Nursing Staff ND Name / Signature										

BINDING MARGIN - NO WRITING

Health
Sydney
Local Health District

ROYAL PRINCE ALFRED HOSPITAL

Enhanced Recovery After Surgery

CLINICAL PATHWAY
CLOSURE OF STOMA

SURNAME	MRN
OTHER NAMES	☐ MALE ☐ FEMALE
D.O.B. _____/_____/_____	M.O.
ADDRESS	
LOCATION	

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

VARIANCE CODES

N	No Variance

1. SYSTEM RELATED		2. PATIENT RELATED	
S1	Delay in test / procedure availability	P1	Pre-op complication
S2	Delay in test / procedure results	P2	Intra-op complication
S3	Delay in ambulance /hospital transport	P3	Post-op complication
S4	Delay in availability of bed at another facility	P4A	Development of DVT/PE
S5	Delay in availability of community support/ equipment/supplies	P4B	Pain management issues
S6	Other	P4C	Nausea + vomiting
		P4D	Does not tolerate diet
3. PRACTITIONER RELATED		P4E	Unstable observations
PR1	Delay in medical consultation	P4F	Ileus / bowel obstruction
PR2	Delay in allied health consultation	P4G	Infection (chest / urine)
PR3	Delay in nursing intervention	P4H	Wound complication
PR4	Delay in consultation due to Public Holiday / Weekend / Other	P4I	Anuria
PR5	Inadequate discharge planning	P4J	Elevated/increasing creatinine
PR6	Other	P4K	IDC dislodgement
		P5	Unplanned return to OT
		P6	Unplanned transfer to ICU
		P7	Existing co-morbidities
		P8	Non–compliance.
		P9	Other

COLORECTAL SPECIFIC CERS CRITERIA

- PR Bleeding > 200mls fresh blood
- Haematemesis
- Vomiting unresponsive to PONV for > 2hrs
- Severe abdominal pain +/- distention
- Unexpected discharge of bile, enteric fluid or faeces from a wound or drain
- Temperature > 38.5 with rigors
- New onset of urine output < 100mls in 4 hours

BINDING MARGIN - NO WRITING

Appendix 5 Other past medical history

Patient co-morbidities and number of patients

Medical History	Number of patients
Cardiovascular	
AF	8
Valvular heart disease	5
Cardiomyopathy	1
Arrythmia	3
HTN	29
Ischemic heart disease	5
Respiratory	
Asthma	9
Chronic dyspnoea of probable restrictive syndrome	1
COPD	5
Pleurisy	1
Pneumonia	1
Sleep apnoea	2
Smoker	1
Gastrointestinal	
Acute diverticulitis	4
Bowel obstruction	1
IBD	12
GORD	16
Hepatitis	2
IBS	1
Liver impairment	1
Primary biliary cirrhosis	1
Primary sclerosing cholangitis	2
Rectal polyp	1
Recurrent sigmoid volvulus	1
Genitourinary	
Acute Kidney Injury (AKI)	1
Cystectomy	1
Prostatism	1
Recto vesical fistula	1
Renal impairment	1

Transurethral resection of prostate	1
Tubal ligation	2
Cancers	
Appendiceal ca	1
Bladder mass	1
Colorectal ca	12
Breast cancer	2
Lung ca	2
Lymphoma	1
Melanoma	2
Metastatic ca – no primary	1
Neurofibromatosis type 1	1
Prostate ca	6
Renal carcinoma	2
Tongue ca	1
Musculoskeletal	
Chronic back pain	1
Fracture left femur	1
GOUT	3
Osteoarthritis (OA)	8
Osteopaenia	1
Osteoporosis	3
Rheumatoid arthritis	1
Total hip replacement (THR)	2
Transverse myelitis	1
Central Nervous System	
Chronic L LL pain	1
Dysautonomia- orthostatic	1
Fibromyalgia	1
Lumbar canal stenosis	1
MS	1
Seizures	1
Small fibre neuropathic pain	1
Transient ischemic attack (TIA)	3
Endocrine	
Diabetes	11
Hypercalcemia	1
Hypothyroidism	4

Psychiatric	
Dementia	2
Anxiety	3
Bipolar	2
Depression	3
Haematological	
Anaemia	4
Vein thrombosis	6
Dermatological	
Autoimmune dermatomyositis	1
Shingles	1
Surgery	
Appendectomy	4
Bilateral adrenalectomy	1
C section	2
Cataract	2
Cholecystectomy	1
Colonoscopy	1
CRS and HIPEC	1
Hepatectomy	1
Hernia repair	2
Hysterectomy	3
Shoulder reconstruction	1
Small bowel resection	1
Thyroidectomy	2
Tonsillectomy	1
Whipple's procedure	1
Other	
Dust mites	1
Obesity	3
Cystoid macular oedema	1
Chemorad	1
ETOH abuse	1
Insomnia	1
IVDU	2
Systemic lupus erythematosus (SLE)	1
Hypercholesterolaemia	13