

Title Page

Title

The development of a Nursing Acuity Score for the care of postoperative patients undergoing elective colorectal resection.

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1. Overview

1.1 Background:

With the increasing number of laparoscopic colorectal resections performed worldwide there is a need to examine changes in the nursing care being delivered postoperatively. There have been no studies to date conducted to measure the difference in nursing hours and effort required to care for patients who have had laparoscopic colorectal resections when compared with open colorectal resections in the acute post operative period.

1.2 Aim:

To develop a tool to measure and define nursing effort in the postoperative care of patients undergoing colorectal resection. This would assist with decision making around staff resourcing and skill mix that could benefit perceived nursing workload and the quality of patient care.

1.3 Objectives:

- To examine nursing views about differences in postoperative workload between invasive and minimally invasive colorectal procedures through the development of a survey of specialised colorectal nurses (n=19). A 7 point visual analogue Likert Scale was used to rate their responses.
- To develop and pilot a tool, The Concord Nursing Acuity Score, to a small sample of colorectal surgical patients (n=15)
- To apply the Concord Nursing Acuity Score to two larger cohorts of Laparoscopic patients (n=46) and Open patients (n=42).
- To determine through statistical analysis whether the tool was useful in detecting a statistically significant difference in Nursing Acuity Scores between the invasive and minimally invasive cohorts.

1.4 Methods:

Nursing perceptions were assessed by a questionnaire. The questionnaire was developed by the author in collaboration with senior nursing and medical colleagues of the colorectal department.

Following completion of the nursing perception assessment, an acuity tool was developed. Six nursing activities were chosen for inclusion. These were diet/feeding, drains and catheters, wound management, vital observations, intravenous and parenteral infusions/medications, mobility and assistance with Activities of Daily Living (ADL's). Data was also collected on age, sex, Body Mass Index (BMI) and an American Society of Anaesthesiology (ASA) score. Each nursing activity was assigned a score and a time. A pilot study of 15 patients was first conducted to assess the tool. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS).

1.5 Results:

Nineteen of 23 nurses returned a completed survey. The results from the perception study found that nurses perceived the post operative care for patients undergoing laparoscopic surgery required less time and effort.

Eighty eight patients were included in the full population study. Forty one patients underwent open colorectal resection and 42 patients underwent laparoscopic colorectal resection. Five patients were converted from laparoscopic to open but were included in the laparoscopic group. In all measured nursing

activities there was a statistically significant lower score and time in the laparoscopic group compared with the open group. There was also a strong statistically significant correlation between nursing time and the acuity score.

1.6 Conclusion:

This study has developed a tool which has demonstrated there is a measureable difference in the nursing time and effort required to care for patients who have had elective laparoscopic colorectal resections when compared with patients who have had elective open colorectal resections in the acute post operative period. This study will allow managers to appreciate how demanding the workload is for nursing staff on colorectal surgical wards and the importance of staffing a mix of adequate specialised nurses and allied health staff to ensure optimal patient care. Further research could determine the “generalisability” of the Concord Nursing Acuity Score to other clinical populations.

2. Introduction:

Despite laparoscopic colorectal surgery being in the literature since 1991,^{1,2} there are few, if any papers describing nursing outcomes or any variation in care required from a nursing perspective in the post-operative period.

The purpose of this study is to create a tool that can measure the workload of the nursing staff on the colorectal unit when looking after patients who have had elective laparoscopic or elective open colorectal resections. Much of the surgery performed on the colorectal unit at Concord Hospital is laparoscopic but open surgery is also performed regularly. Part of this study asks nursing staff what they think about laparoscopic colorectal resection surgery and how they feel it compares with looking after patients who have had open colorectal resections. The study will then investigate how the postoperative care of these patients differs by developing a tool to measure nursing effort. Creating a nursing specialty specific tool can offer information about productivity that can only be otherwise subjectively assumed.³ This tool will help to demonstrate a true reflection of the nursing workload on the ward and the specialised staffing needs of the unit.

Minimally invasive (laparoscopic) colorectal surgery has the potential to enhance patient outcome through decreasing post operative pain, shortening length of stay, enabling early resumption of pre surgical lifestyle and earlier return to work.^{1,2,4-7} Other surgical benefits to laparoscopy include smaller incisions, a decreased risk of adhesion formation due to less physical injury to intra abdominal structures, fewer wound infections and a shorter post operative ileus^{2,4,7,8} Smaller incisions lead to a better cosmesis for patients.^{2,7} Laparoscopic colorectal resections have been associated with a better immune and inflammatory response leading to improved postoperative outcomes.^{2,4} Furthermore, reduced blood loss and reduction in blood transfusion has been identified as having an oncologic benefit.² Laparoscopy has revolutionised colorectal resections and has been associated with decreased overall morbidity and better postoperative outcomes than open resections.^{2,4}

It is well documented that early concerns regarding oncological safety due to the risk of port-site tumour recurrence after laparoscopy are unfounded and the rate of cancer recurrence in an open wound is similar.^{2-5,6} Baker et al (2002) compared laparoscopic versus open abdominoperineal resection (APR) and found no difference in the mean length of overall survival, and no difference in overall

recurrence rate and concluded laparoscopic APR does not compromise cancer specific survival outcomes.⁸

Between 1991 and 2000 there was a relatively slow uptake of laparoscopic colorectal surgery by surgeons. Reasons identified for the delayed introduction included the complexity of the surgery requiring training and a long learning curve, and also because operations were complex and challenging due to the inadequacy of equipment available at the time. Over the past 10 years however, there has been an increase in the numbers of laparoscopic colorectal surgical procedures being performed due to improvement and availability of equipment required.¹

3 . Literature review:

3.1 Colorectal surgical nursing

With the increasing number of laparoscopic colorectal resections performed worldwide there is a need to examine the benefits for patients and the impact on the nursing care delivered. We were unable to locate any studies conducted to measure the difference in nursing hours and effort required to care for patients who have had laparoscopic colorectal resections when compared with open colorectal resections in the post operative period.

For the past 20 years, there has been considerable interest in measuring nursing workload.⁹ Workload is described as the amount of performance required to carry out nursing activities in a specified time period.¹⁰

In Australia, there has been no analysis of the extent to which nursing workload has increased with rising patient acuity and shorter length of stay¹¹. Increased patient acuity can be referred to as an increase in nursing workload, in terms of the combined effect of reductions in patients lengths of stay and rising patient severity of illness.¹² In order to understand the impact minimally invasive colorectal surgery has had in changing the way nurses deliver postoperative care, a tool to measure the intensity of care must be developed.

3.2 Colorectal resection nursing acuity measurement tools

There are numerous factors that require consideration when attempting to measure nursing workload. Nursing acuity and dependency tools, which can be used to categorise patients by their conditions and inform staffing levels, skill mix and workforce development needs were first identified in the mid 1990's.¹³ Much of the interest surrounding nursing intensity and acuity is due to the vast changes influencing the role of nursing itself. The evolution of nursing and the way in which nurses practice is strongly influenced by ever increasing medical, pharmaceutical and technological developments.¹⁴ The level of nursing intensity today is considerably different to what it was in the past. Nursing intensity is described as a combination of the amount of care required and the skill level at which the care is provided.¹⁵ Increased patient acuity in wards means nurses are taking on the care of more complex patients than in the past.¹⁶ The nursing workforce is confronted with the challenge of meeting competing demands as hospital activity and patient acuity have increased during the 20th century.¹⁷ Technological expansion and increased consumer expectations, have made the work environment a more complex, challenging and stressful place for nurses to

practice. In spite of the ever evolving healthcare environment, nursing knowledge and expertise continue to expand to meet these changes¹⁸.

Workforce projections indicate this year (2013) there will be a shortfall of 61 000 registered nurses in Australia.¹⁹ The shortage of hospital nurses may be linked to unrealistic nurse workloads.²⁰ This is concerning for managers who will struggle to staff their wards with appropriately skilled nurses. If laparoscopic surgery can minimise the time and effort spent by nurses on their shift, then managers will be better able to distribute the staff they have between patients who require more nursing care amongst the laparoscopic patients who require less nursing time and effort to care for them.

3.3 Measurement of nursing acuity for patients undergoing colorectal resection

In order to determine the most appropriate way to develop a tool to measure nursing acuity, a literature search was undertaken to gain an understanding of what other tools had previously been developed. These tools were evaluated to determine if there was relevance to the current study. As part of the literature search, key words such as colorectal, laparoscopic, acuity, nursing activities and patient care were used. We used a variety of databases including Ovid Nursing and Cinahl. We limited the search to English language but did not limit the search

by year of publication or between medical and nursing publications. A multitude of publications which are discussed below are available examining patient and nursing acuity however most aim to establish a staff allocation tool across a wide variety of nursing specialties or assess the reliability of those tools previously developed. No studies were identified in the literature that assessed the workload of nurses caring for patients following laparoscopic and open colorectal resection. Overall the responsibility of patient care across all domains of nursing mainly rests with the Registered Nurse. There is a general consensus as to what constitutes the work nurses do despite there not being a clear statement of job responsibilities for nurses. A study by Shuriquie et al (2006) developed a survey which was derived from the King's Nurse Performance Scale which looked at the physical, psychosocial, communication, professional and management domains of nursing care. This tool looked at 84 items indicative of nursing activities and each nurse respondent was asked to tick a box corresponding to whom they thought to be carrying out the activity, for example the Registered Nurse, Doctor , nurses aid or family member. The results of this study show that the majority of activities and therefore the majority of workload was thought to be carried out by the Registered nurses themselves.²¹

This study did not look at the factors that contribute to the day to day activities of surgical nurses that make up their “workload”.

Padilha et al (2008) describes a tool to measure nursing workload using the Nursing Activities Score (NAS) in the Intensive Care Unit. The authors explored the association between NAS and patient variables including gender, age, length of stay, ICU discharge and treatment in the ICU. The score is obtained on the basis of 23 NAS items. These items include basic activities, laboratory work, medications, hygiene procedures, care of all drains, mobilisation and positioning, support and care of relatives, administrative and managerial activities, ventilatory and cardiovascular support, IV replacement, cardiac and resuscitation support, haemofiltration, renal, neurological and metabolic support. The NAS score shows the percentage of time spent by a nurse to the direct care of the critically ill patient in a 24hour period. By identifying the risk factors for high nursing workload demand, meeting staff requirements to achieve care demands should be met. Their results showed patients who undergo more aggressive treatment with a greater number of interventions demanded a higher nursing workload and therefore requiring a higher number of nurses.²²

Padhila's assessment of nursing effort is appropriate in the intensive care of patients requiring multi organ support. These factors cannot be applied to the ward care as in the present study.

Several piloted and validated trials utilise the acuity tool, developed by the Association of UK University Hospitals (AUKUH) and Leeds University.²³ This tool reflects both patient acuity and dependence on nursing resources. It was developed to recruit appropriate skilled and experienced nurses to general wards. General wards often contain patients with a large range of conditions, including life threatening ones.²³ The AUKUH tool looks at five levels of care on these wards. It enabled nurse unit managers to organise their staffing levels based on patient dependency rather than bed occupancy. Hurst et al (2008) states that what the AUKUH shows, is that for nurses to be efficient and effective, enough staff with the appropriate knowledge and skills are needed, particularly when seriously ill patients are nursed on general wards.²³

This study is important to understanding the skill mix required in modern surgical wards, and that with increasing complexity of patients, higher skilled staff are required.

A literature review by Morris et al (2006) using medline, psychlit, CINAHL and Cochrane databases, analysed the way in which nursing intensity and patient dependency are linked to nursing workload. They examine definitions of nursing workload, intensity, patient dependency, indirect and direct patient care. The current understanding of what has an impact on the nurses' workload and what should be considered in the allocation of nursing resources is unclear and greatly dependent upon potentially inadequate systems of workload measurement. The authors aim was to define and bring together the major concepts identified in the literature that relate to nursing workload. They then devised a model to illustrate the way in which workload is defined according to the amount or level of work the nurse must perform to carry out their job. The result of their analysis was to merge and build a more holistic and complex depiction of nursing work. The authors suggest that understanding the level of the nurse's workload is crucial in determining appropriate resource planning.²³

This study is important as it defines many of the terms used to describe nursing workload. It recognises that nursing workload is a complex mix of all of these descriptions. Our study however, is looking at the workload of nurses that are directly related to patient care.

Others report nursing workload can be measured with self report survey tools to question how nurses spend their time on selected nursing tasks that could determine how best to staff their unit with appropriate skill mix.¹⁸ Included in these surveys were tasks such as documentation, medication administration, patient education, ADL's, nutrition and nursing tasks specific to a specialty if required. Participants recorded an average time per task in minutes and an average number of times task was performed.¹⁸

Shu et al (2010) reported on the development of the nursing Workload Intensity Measurement System (WIMS).¹⁷ This system, based on a nursing theory and nursing diagnosis, was designed to identify critical indicators for workload measurement across an entire hospital looking at multiple wards during a one week period. It was purely designed to determine staffing requirements and not specific nursing duties for individual patient care as in the present study.

Endacott et al (1996) looked at critical care units in the UK and discusses the issues surrounding the workload measurement systems. They looked at a variety of Patient Classification Systems (PCS) and reported on these. Patient scoring systems reflect patient dependency rather than the work of the nurse. It is essential that systems are developed to measure nursing workload as patient

specific scoring systems will not enable nurses to safeguard the totality of their workload.¹⁴

In the 1980's, the Patient Assessment and Information System (PAIS) was introduced to Victoria, Australia. This system uses indicators of dependency to classify each patient into one of six groups to estimate nursing usage. An amount of time is allocated for each indicator and these are totaled to provide the amount of time required to care for that particular patient.¹¹ The more indicators, the greater the demand for nursing resources. The nursing activities used are a mix of indirect and direct patient care.¹¹

Another method used in Australia to determine nursing resources is diagnostic related groups (DRG's). This is a system of categorising patients into specific groups based on diagnosis and other characteristics. This method assesses the severity of illness for acute inpatients, therefore determining the resources required to care for them.¹¹

It is apparent from the literature that there is no validated measure to define nursing effort in the post operative care of patients undergoing colorectal resection. It is however, beneficial to see what nursing measurement tools are available and why they are being used.

3.4 Perception tools

In addition to searching for literature on Nursing Acuity Tools, it was also important to access articles relating to how nursing perception tools are designed, measured and analysed. A search of nursing perception studies in CINAHL was undertaken and reviewed.

McRae (2003)²⁵ designed, tested and administered three instruments to explore the role of how men as obstetrical nurses are perceived by nurses, pregnant women and male registered nurses. The first instrument was a ten item demographic questionnaire with an open ended question used as a measure of the dependent variable. Responses were coded on a 10 point multidimensional social attitude scale. Scores could range from 1 “extremely negative” to 10 “extremely positive”. A score of 5 or 6 represented a neutral response. To test for inter-rater reliability of the scale used, two experienced intrapartum nurses were asked to independently code the responses on a 10 point scale.

The second instrument was a 15 item questionnaire. Twelve demographic questions and three fixed – alternative (yes-no) questions and one open ended question were used.

The third instrument was a nine item questionnaire with 8 demographic questions and one sentence completion. Responses were ranked on a scale ranging from 1 negative to 3 positive. Again reliability of the scale was performed by three obstetrical nurses and three pregnant women. A cover letter explaining the study was mailed and a self addressed stamped envelope was provided for the return of the completed questionnaire. Data was analysed using SPSS.²⁵

Oroviogicoechea et al 2009 developed and designed a questionnaire to explore the perceptions of nurses about the implementation of a computerised information system in clinical practice. They developed their questionnaire in three stages:

1. Questionnaire design – derived from the literature and expert review of content and design.
2. Pilot Test – distributed to a small sample of nurses to test for reliability and validity. This was then reviewed.
3. Factor Analysis – the new version was distributed to a larger sample of nurses.

They had a preliminary list of items that would be used in the questionnaire and this was distributed and discussed with two of the hospitals experts. Both open

and closed ended questions were considered for inclusion in the questionnaire.

Advantages and disadvantages were considered. A forty three item questionnaire combining open and closed responses was used to allow an objective evaluation of satisfaction and attitudes together with descriptions of the personal experiences of nurses. Also used was a five point Likert rating scale from “strongly agree” to “strongly disagree” The middle point was used to allow nurses a neutral response. Data analysis was carried out using SPSS.²⁶

A study by Teasley et al (2007) examined the use of the Individual Workload Perception Scale (IWPS) to measure nurse satisfaction in a small rural hospital in order to make positive changes in the work environment for nurses. The IWPS is a validated tool with responses provided on a 5 point Likert scale ranging from 1 “strongly agree” to 5 “strongly disagree”. The instrument measures nurse self reported perceptions of key characteristics of the work environment including manager support, unit support, peer support and perceived workload. The tool is short and can be completed without substantial time commitments on the part of the nursing staff. Data was analysed using SPSS.²⁷

Although these nursing perceptions studies were not directly related to the colorectal project, it was helpful to see what methods were used to measure nursing perception and how these studies were analysed.

Due to the lack of literature currently available examining nursing workload in a colorectal setting, it was agreed that a nursing perception tool should be developed to measure the perceived benefits nurses observe in the recovery of patients who have undergone elective laparoscopic colorectal resections versus traditional open elective colorectal resections. Secondly, it was important to determine whether there were perceived differences in the nursing intensity required to care for patients undergoing laparoscopic colorectal surgery.

4. Perception Study

4.1 Method

The purpose of the first part of this study was to develop an instrument to determine if nurses perceive differences in postoperative outcomes for patients who had undergone elective laparoscopic colorectal resections (LAP) versus those who had undergone a traditional elective open colorectal resection (OPEN) by laparotomy.

Secondly, the study aimed to determine if the nurse participants considered there were benefits for patients having laparoscopic colorectal surgery, and if there was less time and effort required by these nurses to look after them. Lastly, the study aimed to identify whether these nurses considered LAP surgery preferable to open surgery.

The participants in this study were nurses currently working in the specialised colorectal ward. Nurses voluntarily completed the survey. Therefore as no patients were involved there was no risk of harm to patients or potential breaches of confidentiality and ethics approval was not required.

LAP colorectal surgery is practised expertly at the Concord colorectal surgical unit. The unit is seen as a high volume training unit for subspecialist colorectal surgeons in Australia and New Zealand. This was one of the foremost reasons for developing the instrument to assess nursing perceptions of the benefits to patient outcomes and for nursing workload. Between January 2006 and December 2008 39.5% of colorectal cancer resections at our institution were performed using LAP techniques. From January 2009 to December 2012 there was a noteworthy shift at our institution with 60% of colorectal cancer resections performed using LAP techniques.

A survey was developed for the specific purpose of this investigation as the literature review failed to locate a relevant survey applicable to colorectal resection surgery (**appendix 1**). The first 20 questions were grouped into 10 sets of paired questions to assess for perceived differences between LAP and OPEN surgery. The questionnaire was presented with paired questions to avoid the perception of bias ²⁸ on the part of the authors towards either LAP or OPEN surgery. This method of questioning allowed the respondents a free range of responses; thus it was possible that whichever surgery had been performed the respondents may find the patients either equally easy or equally difficult on any

question. Statistical comparison of the results was performed using a paired T test as the responses had a normal distribution .²⁸

The questionnaire, which was developed by the authors, was a subjective paired comparison problem where the nurse respondents were asked to use a 7 point modified visual analogue Likert scale to rate their responses. This range was selected as the authors believed it allowed both a range of possible responses and a “midpoint” for ease of analysis. The final three questions had nurses circle the response they felt were most appropriate.

Within the questionnaire each respondent was asked to compare the same activity between two different patient groups – those who have undergone LAP resections in comparison to those who have undergone OPEN resections.

The survey was exclusively targeted at nurses working in the specialist acute care colorectal unit. The questionnaire was distributed by attaching it to the nurses’ fortnightly pay-slips with a letter of explanation and inviting their participation. For ease of return, respondents were asked to place the completed survey in a box placed at the nurses’ station on the colorectal unit.

Definitions of the questions asked within the questionnaire are included in Table 1.

Table 1: Definitions of “paired” questions included in the survey

<i>Question</i>	<i>Definition</i>
1. Transfer patient from bed to chair	1.Nursing effort required to transfer a patient from bed to chair following LAP or OPEN colorectal surgery
2. Showering of patient	2. Nursing effort required to shower patients following LAP or OPEN colorectal surgery
3. Independent mobilisation	3. Speed at which patients regain their ability to mobilise independently following LAP or OPEN colorectal surgery
4. Tolerate full ward diet	4. Speed at which patients regain the ability to tolerate a full diet following LAP or OPEN colorectal surgery
5. Time to removal of drains, catheters, lines	5. Length of time before surgical drains, indwelling urinary catheters and intravenous lines were removed following LAP or OPEN colorectal surgery
6.Wound complication	6. Frequency of the development of wound complications following LAP or OPEN colorectal surgery
7. Pain	7. Degree of pain experienced by patients following LAP or OPEN colorectal surgery
8. Self-care of stoma	8. Speed with which patients become independent with stoma care following LAP or OPEN colorectal surgery
9. Overall post-operative complications	9. Frequency with which patients develop general complications following LAP or OPEN colorectal surgery
10. Nursing effort required	10. Overall nursing effort required to care for a patient following LAP or OPEN colorectal surgery

When developing the questionnaire there were several reviews and shorter trials to assess the understanding of the questions and their wording. Prior to

distributing the survey, it was reviewed by a series of individuals with expert knowledge including two colorectal surgeons, the colorectal nurse unit manager and colorectal cancer care co-ordinator. However, the authors acknowledge it was not possible to use a concurrent assessment against a “gold standard” instrument as none existed.

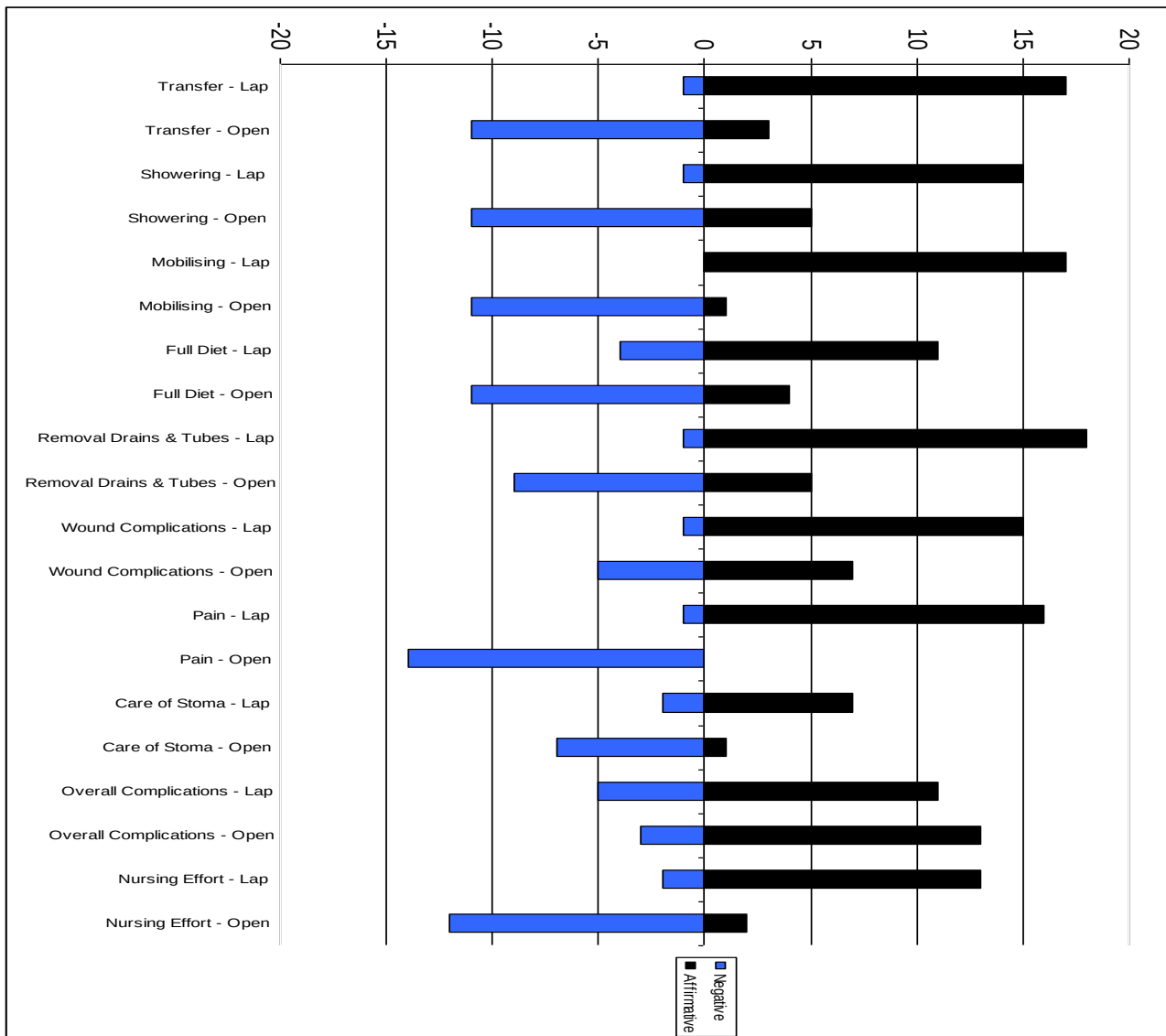
4.2 Results:

Surveys were distributed to 23 specialist colorectal nurses who worked in the Concord colorectal surgical unit. We had a response rate of 82.6%, 19 of the 23 surveys distributed were completed and returned. This high response rate was achieved by attaching the survey to the nurses’ pay slips and having a conveniently located “return” box at the nurses’ station. The nurses surveyed had a range of experience from 1.50-32.00 years (mean 16.13 years). The years of colorectal nursing experience ranged from 1.50-22.00 years (mean of 8.97 years). The nursing classification included enrolled nurses (ENs; n=2), clinical nurse consultants (CNCs; n=2), with the majority being registered nurses (RNs; n=9) and clinical nurses specialists (CNSs; n=6). The results reflect the perceptions of nurses with a broad range of colorectal experience, many who have witnessed the introduction of laparoscopic colorectal surgical procedures into our facility

which ideally positions them to make comparisons with traditional open colorectal surgery.

The results of the questions using the Likert scale are summarised in a graph format (**Graph 1**). Within this graph the questions are displayed in successive pairs. Our Likert scale had a range from 1-7 with 1 representing the most favourable (affirmative) response and 7 the least favourable (negative) response. Therefore, an assumption was made that the mid-point or number 4 on the Likert scale was a neutral response and was not included in the summarised data. All responses from the nurses less than 4 were considered affirmative responses and all greater than 4 were considered negative responses. The highest possible affirmative or negative response is 19, based on the number of nurses who returned the questionnaires.

Graph 1: Results of the questions using the Likert scale



Statistical analysis of the nurses' perceptions reported in Table 2 revealed statistical significant p-values ($p < 0.05$) in the following questions: transferring; showering; mobility; diet; removal of surgical drains, catheters and lines; wounds; pain; stoma care and nursing effort. The only exception where statistical significance was not found was the question regarding overall complications (**Table 2**). Within this question the mean score for OPEN was 4.8 and the mean score for LAP was 4.7. This difference was not statistically significant. These findings are expanded further in the discussion section.

Table 2: Mean visual analogue scale scores for respondents ratings of various activities and characteristics compared between elective open and laparoscopic colorectal operations

<i>Activity or characteristic</i>	<i>Open (mean)</i>	<i>Lap (mean)</i>	<i>p (paired t-test)</i>
1. Transfer patient from bed to chair	4.6	2.6	<0.001
2. Showering of patient	4.4	2.9	<0.001
3. Independent mobilisation	4.7	2.6	<0.001
4. Tolerate full ward diet	4.7	3.5	<0.001
5. Time to removal of drains, catheters, lines	4.2	2.6	<0.001
6. Wound complication	3.8	2.6	<0.004
7. Pain	5.3	3.1	<0.001
8. Self-care of stoma	4.7	4.0	<0.005
9. Overall post-operative complications	4.8	4.7	<0.889
10. Nursing effort required	4.7	3.3	<0.001

In the final three questions the nurses were asked to circle the response they felt was most appropriate. Eighty-three percent (83%) of nurse respondents felt patients who had undergone a LAP resection had a shorter length of stay than patients who had undergone an OPEN resection.

Seventy-two percent (72%) of nurses surveyed would prefer to look after a patient who had undergone LAP rather than OPEN resections.

Finally, nurses were asked to imagine they had a close friend or relative requiring an elective colorectal resection and to identify which procedure they would advocate. Eighty three percent (83%) of nurses reported they would advocate LAP surgery while 11% of nurses would advocate an OPEN procedure. This clearly indicates these specialist nurses perceive there are benefits to having LAP resections. The remaining 6% of respondents felt there was no difference or had no opinion.

4.3 Discussion:

With the increasing interest in laparoscopic colorectal resections world-wide, there is a need to examine the benefits for patients and the impact on the nursing care required. The primary finding was that the nurses perceived that a patient

who has had a LAP resection compared with an OPEN resection had improved outcomes in terms of a quicker and less complicated postoperative course. There was also a general consensus from the cohort of nurses surveyed that it takes less effort to care for a patient who has had a LAP resection compared with an OPEN resection. However, there have been few if any nursing studies conducted to compare our findings.²⁹

The respondents scores for the two paired patient groups were correlated as they are naturally linked.²⁸ During data analysis this became evident in the crosstabulations and also in the correlation coefficients in the t-test results.

The Wilcoxon matched paired signed-rank test and the paired t-test gave virtually identical p-values identifying consistency and statistical significance in the nurses perceptions favouring LAP over traditional OPEN surgery in the majority of questions. The one exception was the question pertaining to overall post-operative complications. The authors believe the results from this question were inconsistent with all others as the Likert scale was inadvertently reversed for this set of paired questions. For all other questions, a lower score represented a more favourable or affirmative response. For the paired questions regarding overall complications the reversed direction of the Likert scale meant a lower score

represented more frequent complications or a negative response. We believe the respondents did not detect this change in direction of the scale, thus skewing the results.

Baker et al (2002) & Hageman *et al* (2008) reported LAP patients have smaller incisions so it is not surprising that our results confirm patients have less pain, are able to shower more easily and mobilise more quickly. These smaller incisions require less narcotic analgesia, therefore allowing patients to tolerate a diet sooner. Mobilising earlier and tolerating a diet allows for indwelling urinary catheters and intravenous lines to be removed earlier. It was also noted that surgical drains were also removed sooner following LAP surgery.^{8,6} This is a direct comparison of the positive responses the nurses gave in regards to perceived favourable postoperative outcomes for the patient but also to the nurses looking after those patients. Nurses felt that LAP patients were easier to transfer, shower, mobilise, tolerated their diet, experienced less pain and were generally easier to care for.

In the Concord colorectal unit it has become common practice for LAP patients to be showered day 1 postoperatively and the OPEN patients to be sponged in bed. This practise has been adopted due to the perception that LAP patients have less

pain and are more mobile and therefore shower with greater ease and this was reflected in the graphed data (**Graph 1**). This is variable and based on individual patient assessment.

The majority of the nurses who were experienced in the colorectal field would advocate laparoscopic surgery to their close friend or family member requiring an elective colorectal resection. The rationale behind this question was to determine which type of operation nurses' perceived had better patient outcomes. This is not to suggest that nurses have any influence or decision making over what operation is available to patients. This survey was conducted at an institution where LAP surgery is common practice and nurses are aware that LAP surgery is offered to patients considered appropriate by their surgeon. We speculate from this result that nurses feel strongly that the postoperative outcome for a patient during their stay in hospital is positive.

The perceived benefits in the reduced nursing effort required to care for patients undergoing LAP resections raises the question of what can be done with the potential nursing time saved. From the findings it is believed the LAP patients require less nursing hours of care. There are several assumptions that can be drawn from these findings; fewer nursing hours spent caring for LAP patients

frees up nursing time to care for patients with more complex nursing care requirements. LAP patients could potentially be discharged earlier allowing earlier access to hospital beds and ultimately a higher throughput of patients. It is not envisaged that there would be any decrease in the number of full time equivalent (FTE) nurses required on the colorectal unit. Any decrease in patient acuity related to LAP resections will be compensated for by higher turnover of patients, the fact that not all patients are suitable candidates for LAP surgery and increased opportunities for continued improvement strategies. Any time savings that may result from caring for LAP patients could potentially be redirected to provide ongoing education to current staff and the support and education to newer members of the nursing team and students. Therefore we can conclude that there are perceived benefits for both nurses and patients following laparoscopic colorectal surgery in the postoperative period.

Nursing dissatisfaction is linked to high rates of nurses leaving the profession, poor morale, poor patient outcomes and increased financial expenditure. Understanding factors that contribute to job dissatisfaction could increase nurse retention.³⁰ Murrells (2009) reported a dramatic increase in both dissatisfaction and burnout was associated with poorer staffing levels and that mortality increased by 7% for every patient added to the average nurses' workload.³¹

Decreased patient demands may perhaps lead to less 'burnout' of nursing staff, better staff retention rates, educational opportunities, and increased job satisfaction. There is no evidence in the literature reviewed to support or dispute our findings, although when higher levels of nurse job satisfaction are experienced, there is an increase in morale and commitment which makes it more likely that a nurse will stay in the profession.³⁰

It is well documented there is a global shortage of nurses^{32,33} and if a more supportive, cohesive and satisfying work environment can be created then retention rates may be higher. This can be supported by our preliminary findings of perceived reduced nursing effort to care for LAP patients.

We acknowledge limitations to this study as it was conducted at a single site with a long history of minimally invasive abdominal surgery. The nurses perceptions may not be generalised to other centres or indeed other units within the local health district. We acknowledge that nurses may have a biased opinion towards laparoscopic surgery. Other centres could use our method and instrument to conduct comparison studies.

4.4 Conclusion:

Our study reports on the findings of a survey from a cohort of nurses working in a specialist colorectal unit in a major teaching hospital, comparing LAP to OPEN colorectal surgery. It demonstrates that there is a definite perception from colorectal nursing staff that LAP patients return to a preoperative level of function faster, experience less pain and have fewer wound complications. Secondly, less effort is required to care for patients who have had a LAP surgery compared with the effort to look after a patient who has had an OPEN operation. We can also surmise from these results that the future of nursing care required on the ward will be quite different to how it is currently, with a move towards more operations being performed laparoscopically.

From this data we instigated a plan to create a nursing acuity score for acute care colorectal nursing. Due to the global nursing shortage we hope that if LAP surgery could lead to a less intensive workload, nurses can be attracted, retained and more appropriately allocated.

5. Pilot Study

5.1 Method (Pilot Study)

Following the results of the preliminary perception study, in which nurses perceived significantly more nursing time and effort was required to care for patients having open colorectal resections than for those who had a laparoscopic resection, it was appropriate for a more comprehensive study to be undertaken to confirm these results. A pilot study involving the design of a nursing acuity tool to measure the time and effort spent looking after patients who had either had a laparoscopic or open colorectal resection was developed. It is hoped that this tool could be later tested to confirm its suitability for all patients undergoing major abdominal surgery for non colorectal conditions.

Upon commencement of the study, key stakeholders were identified. These stakeholders had an interest in the quality of content and the standard of outcome. They were chosen for their expertise and knowledge in colorectal surgery. They included a consultant colorectal surgeon whose role was to support the author and provide guidance during the study; a Clinical Nurse Consultant (CNC) who had been involved with the preliminary study and who would provide

ongoing education and support to the ward staff; the Nurse Unit Manager (NUM) who approved the project implementation on the colorectal unit and would provide ongoing support to the ward nurses; the ward nurses who collected the data for the pilot study, and a statistician who reviewed the statistical data independently to ensure accuracy and who continued to be a stakeholder in the project.

As no validated measurement tool had been identified to define nursing effort in the post operative care of patients undergoing elective colorectal resection, a round table discussion with the key stakeholders was held where comments were invited to determine issues of relevance surrounding tool development. It was decided that the tool should contain six common nursing tasks including;

1. Diet/feeding
2. Drains and catheters,
3. Wound management
4. Observations
5. Intravenous and parenteral infusions/medications
6. Mobility and assistance with daily living (ADL's).

These particular activities were decided upon following consultation with stakeholders and an extensive literature search. The tasks that were chosen needed to be common to both laparoscopic patients and open patients. They also needed to be tasks for which the time taken by nurses to perform the tasks could be monitored and recorded.

Nursing activities can be broken down into general and specific subcategories.³⁴ General nursing comprises activities related to patient's personal hygiene, mobility, making beds and food distribution. Specific nursing activities comprises the distribution of medications and infusions.³⁴ Specific tasks also extended to observations, wound management, drain and catheter care. Another way of describing nursing activities is by direct and indirect patient care. Direct care involves tasks that are physically being done for the patient for example showering and applying wound dressings. Indirect care involves tasks that do not involve "hands on care". This can include report writing and completing care plans.³⁵ To enable this study to be replicated it was important to incorporate activities that were performed for both laparoscopic and open patients, but also activities that are transferrable into any surgical ward. The activities focused upon

in this study were the measurable direct nursing care activities. Throughout the literature review, there were many examples recorded of how nurses spend their time for various purposes. Lundgren et al (2001) and Furaker (2006) observed nurses in the ward setting in Sweden. Their results found that nurses spent the majority of their time on direct patient care.^{34,36} Westbrook et al (2011) observed nurses in a teaching hospital in Sydney and also found that nurses spent the majority of their time on direct patient care and medication tasks. Their results show that in an average hour a nurse performed 17.3 medication tasks and 10.3 direct patient care tasks.³⁵ From these results and following discussion with the stakeholders, the six direct care nursing activities were chosen as they were deemed to be the most significant activities consuming the majority of the nurses' time and were performed for both laparoscopic and open colorectal patients.

A template was designed to record the data and each activity had a column to document an estimated time taken to perform the task and a score (**appendix 2**). The tool also recorded age, sex, Body Mass Index (BMI) and an American Society of Anaesthesiology (ASA) score. It is important to record these non-medical and preoperative factors due to the impact these characteristics may have on the nursing care given and the potential outcomes for patients. The ASA physical status classification system is a system for assessing the fitness of patients before

surgery. It is regarded by hospitals as a scale to predict perioperative risk. It is a good measure of a patients' overall physical status and medical co morbidities.³⁷ A study carried out at Westmead Hospital in Sydney confirmed that preoperative factors are important in contributing to non medical delays in discharge and longer postoperative length of stay after elective colorectal resections.³⁷ That study included preoperative factors such as age, sex and an ASA score. Age is seen to be a significant cause of delay in discharge. The Australian Bureau of Statistics projects that the number of people in Australia aged 85 and older will be between 1.6 million and 2.7 million by 2051. Australia will experience a similar increase in incidence of geriatric surgery over the next 40 – 50 years.³⁸ The Westmead study showed that patients aged 70 years or older had a greater risk of being delayed compared with patients younger than 70.³⁷ Also shown to be significant were patients' ASA scores. Median hospital length of stay increased with increasing ASA scores. It has been suggested however that higher ASA scores may directly be associated with longer length of stay but not via a delay in discharge.³⁷

In our study we chose to include a BMI score. It is commonly perceived that surgery in obese patients is associated with poorer outcomes than in those within a healthy weight range.³⁹ Obesity is a common healthcare problem. A study by Balentine et al (2010) concluded that an elevated BMI is associated with increased

wound complications in both minimally invasive and open rectal surgery.⁴⁰ As well as surgical outcomes being compromised with obese patients, the nursing care delivered can also be challenging. With very obese patients mechanical lifting or team lifting may be required. This is time consuming and adversely impacts upon the nursing effort required. Patients that have a large abdominal incision, combined with a high BMI are seen to be more difficult to look after than patients with a high BMI but with a much smaller incision. This is due to the degree of pain associated with a larger incision. These patients require more post-operative analgesia which is usually a patient controlled parenteral narcotic. This has the effect of making the patient more drowsy and increases the risk of falls. As a result nurses need to be more involved with the mobilization of these patients.

After deciding what should be included in the scoring sheet, ethics approval was sought to commence the pilot study through the Sydney Local Health Network Human Research Ethics Committee, Concord Hospital. Approval was granted by the committee to allow the study to begin immediately.

Several in-service sessions were provided on the Colorectal Unit to ensure the nurses had sufficient information about the purpose of the study and what their

role would entail. Information sheets were provided to the nurses (**appendix 4**) for them to refer to for the duration of the study.

It was determined that 15 patients would be an appropriate number to use in the initial pilot study to assess the tool for ease of use and to determine whether the chosen nursing activities could be measured and statistically analysed. It was also a basis for estimating the required sample size for the main study. The participants would be a mix of laparoscopic and open elective colorectal resections. The mode of surgery depended on the surgeon's preference, which was determined by the patients past surgical and medical history, nature of pathology, patient's size and preference. The acuity scoring sheet was attached to the patients' notes at the end of the bed. The nurse who was looking after a patient who had either a LAP or OPEN procedure was to estimate the time taken to complete the selected task and record an appropriate score associated with that task. The scoring sheet was to be completed on the morning shift, as this was determined to be when the selected activities were being performed most frequently. If there was a different nurse looking after the patient the next day, they would take over filling in the scoring sheet and so it would continue until the

patient was discharged. On discharge the completed sheets were placed into a folder that was situated in the NUMs office. Once the data had been collected and completed on 15 patients, it was transferred into an excel spreadsheet and the data was analysed using the Statistical Package for the Social Sciences (SPSS).

5.2 Results

Fifteen patients were included in the pilot study to assess the tool for ease of use. The results of this study show that there was a trend towards there being less time and effort required by nursing staff to care for patients who had laparoscopic colorectal resections compared with patients who had open colorectal resections. As expected, there were too few numbers included in the pilot study to show a statistical significant difference. It did however allow us to assess how effective the nursing staff were at filling in the scoring sheet. It also highlighted problems with how the six nursing tasks were being scored and how these could be rectified prior to commencement of the main study.

There were nine laparoscopic patients, 6 open patients and 1 patient who had been converted from LAP to OPEN. One open patient was not included in the results as they left the ward and went to the high dependency unit during the postoperative period.

Scoring

The scores assigned for the variables were summated for the duration of the patients stay in hospital. This way scores could be compared between the laparoscopic and open groups.

Diet: In the pilot study, diet was scored from 1-4. One being no diet and 4 being fully dependent on the nurse to feed the patient. The score was recorded as the sum of each day for the total length of stay. In the laparoscopic group the mean diet score was 17. For the open group the mean diet score was 25. This difference was not statistically significant with $p=0.19$ (students t Test).

In the pilot study diet time was also assessed. The mean diet time was 26 minutes in the open group and 19 minutes in the laparoscopic group. Again this difference was not statistically significant $p=0.49$ (students t Test). After the pilot study was complete, it became clear that both laparoscopic and open patients were initially nil by mouth and then self fed regardless of the type of surgery. If they could not self-feed often family members would assist. This meant that nurses were not required to spend time on this aspect of the post-operative care. As a result of this diet time was not included in data collection for the total study population.

Drains/Catheters/Stoma: The drain score was the sum of the total number of drains the patient had on return from the operating theatre. This number was then grouped into number categories. The results showed there was a significantly higher mean drain score (38) in the open group than the laparoscopic group (14) ($p < 0.01$ t test). As expected, there was also a statistically significant difference in mean drain time, which is the amount of time that nurses spent recording, emptying and removing drains. The mean time that nurses spend attending to the drains in the open group was 189 minutes compared with a mean time of 58 minutes in the laparoscopic group ($p < 0.01$ t Test).

Wound Management: Wound management was scored from 1 – 4 with 1 being an intact dressing to 4 being a complex wound dressing. It was surmised that the more complex the wound, the more time and effort would be spent by nurses attending to these dressings. The results show that in the open group there was a mean score of 18 compared with a mean score of 10 in the laparoscopic group ($p = 0.04$) (Wilcoxon Rank Sum W Test). This showed that open operation patients were seen to have more complex dressings to attend to. Nurses took longer attending to these dressings with a mean time of 37 minutes in the open group and a mean time of 17 minutes in the laparoscopic group ($p < 0.01$).

Observations: The score for the observations was the frequency with which they were performed. Observations included blood pressure, pulse rate, temperature, and respiration rate. All patients that return to the ward postoperatively with a patient controlled analgesia (PCA) have observations performed on them every hour for 8 hours then 4th hourly thereafter unless otherwise required. It was surmised that patients who had minimally invasive surgery would have less pain and would therefore require acute pain relief for a shorter amount of time than patients who had open surgery with larger incisions and more pain. Therefore laparoscopic patients would be expected to require fewer observations performed on them, requiring less time and effort by the nurses.

Observations were scored from 1 – 4. One being observations were performed once during a shift and 4 being 1-2 hourly. The mean score for the open group was 27 where as the mean score for the laparoscopic group was 15. This was a statistically significant difference. ($p=0.03$) The observation time was the cumulative time to record nursing observation. The mean for the open group was 147 minutes and the mean for the lap group was 116 minutes. This difference was not statistically significant ($p=0.46$)

Intravenous and parenteral infusions/medications: In the pilot study a score was assigned depending on grouped totals of medications. A score of 1 was assigned to 0-4 medications to a score of 4 for more than 13 medications or any form of central venous access. The mean medication score in the open group was 32 compared with 17 for the laparoscopic group. This difference was not statistically significant ($p=0.07$). The medication time was measured as the cumulative time required to administer medications. In the open group it was 429 minutes compared with 223 minutes for the laparoscopic group. Again there was no statistically significant difference ($p=0.09$).

Mobility/Activities of Daily Living (ADL's): A score of 1-4 was used to assess nursing effort required for patient mobility and assistance in activities of daily living. One indicated fully independent to 4 indicated fully dependent. The mean mobility score for the open group was 27 compared with 16 for the laparoscopic group. This difference was not statistically significant ($p=0.07$). The mean time involved for open patients was 266 minutes compared with 144 minutes in the laparoscopic group ($p=0.06$).

Length of Stay: The length of stay was the final outcome measure as it was influenced by the type of operation and as an overall result of the above variables. The median (range) length of stay (LOS) for the laparoscopic group was 6 (5-21) days. The median LOS for the open group was 13 (10-20) days. This was not statistically significant $p=0.08$. This was calculated using the Wilcoxon Rank Sum W Test.

Sample size calculations:

The pilot study was also conducted as a basis for estimating the required sample size for the main study. As the “score” variables (diet management score, drains and catheters score, etc.) were measured at the ordinal level, the pilot results for the ratio-scaled “time” variables were examined as a basis for calculating sample size. As shown in **Table 3** the frequency distributions of all variables were positively skewed. As the skewness was least for postoperative stay, this variable was used as a basis for the calculation of required sample size.

Table 3: Summary statistics for the “time” variables in the pilot study of 15 patients. Times are indicated in minutes except for postoperative colorectal ward stay which is measured in days.

	Range	Median	Mean	Skewness
Diet management time	0-185	20.0	31.2	3.0
Drains, catheters and stoma care time	10-275	67.5	101.6	1.0
Wound management time	4-146	23.5	29.9	3.0
Observations time	30-310	112.5	135.2	1.3
IV and parenteral infusions & medications score	65-725	170.0	293.1	1.2
Mobility and ADL’s (in full?) time	25-620	162.5	206.5	1.5
Total time for all above management activities	154-1729	593	797.0	0.7
Postoperative colorectal ward stay (days)	5-21*	9.5	10.9	0.6

* Does not include 5 days stay in the intensive care unit by a single patient.

At a significance level of 0.05 and a power of 80% it was calculated that a sample of 38 patients per group would be required to detect a difference of 3.5 or more days stay between patients having an open operation and patients having a laparoscopic operation. Therefore it was decided that a total target of at least 40

patients would be set for the open operation group and 40 for the laparoscopic group.

5.3 Discussion:

This pilot study involved the design of an acuity tool to measure and compare the time and effort nurses spent looking after patients who had either laparoscopic colorectal resections or open colorectal resections. The results of the pilot study show the activities assessed were appropriate measures of nursing activities; they could be measured and could be statistically analysed.

From the results of the pilot study we decided to discount one of the measured activities. From the data collected it became clear that patients who had open or laparoscopic surgery were nil by mouth for the first day and then self feeding from then on. Kitchen staff placed and set up the trays in the patients rooms or the patients relatives would be there to help. This meant that nurses were not spending any time on this particular aspect of post operative care. It was therefore decided that diet time would not be recorded in the main study.

Variables showing statistically significant differences

There were several nursing activities showing statistically significant differences between the two groups. Included in these were the drains, catheters and stoma measures, as well as the wound management and observation score. In each of these activities nurses were spending more time and effort attending to these tasks for the open group of patients than the laparoscopic group. Open patients scored higher when drains and catheters and stomas were grouped into their categories than the laparoscopic group. This meant that drains and catheters in the open group were in for longer and nurses were having to empty, measure and change these drains for longer. The results of the pilot study showed that the laparoscopic group had their drains in for less time and therefore nurses were spending less time and effort having to look after them.

This was also the same for wound management. It has been reported that advantages of laparoscopic colorectal surgery include smaller surgical incisions and fewer wound related complications.^{4,5} Patients in the pilot study who had open colorectal surgery had dressings that were more complex and needed nurses to spend more time and effort to attend to them. Laparoscopic patients

tended to have dressings that remained intact until discharge requiring very little time or effort from nurses.

The pilot study also showed that nurses were performing observations on the open group of patients more frequently for longer than on the laparoscopic patients. Patients who have laparoscopic surgery have less postoperative pain and less need for narcotic analgesia.⁶ Nurses are therefore required to record observations for them less frequently.

Variables that did not show a statistically significant difference

There were some results from the pilot study that did not show statistically significant differences between the patient groups. These included observation time, intravenous/parenteral infusions/medications and mobility/ADL's.

Both laparoscopic and open patients return to the ward with intravenous narcotic analgesia requiring frequent observations to be performed for them. These observations take the same amount of time for both groups regardless of type of surgery, but laparoscopic patients require observations for less time because their analgesia requirements are less.

The results from the pilot study showed there was no statistical significance between the laparoscopic and open patients with regards to intravenous and parenteral infusions/medications and Mobility/ADL's. However the results indicated a definite trend towards the open group of patients requiring more time and effort from nurses in both these categories and it was expected that with a greater sample size, a statistical significance would be shown.

After reviewing the way in which data was captured during the pilot study it was decided that some changes were needed to the acuity scoring sheet and the way in which the data would be collected (**appendix 3**). As mentioned previously, it was decided that diet time would not be recorded as this post operative activity required no input from the nursing staff. Changes were also made to how the drains/catheters and stoma data would be collected. In the pilot study a score was assigned depending on grouped totals of drains. For the main study it was decided that, when each patient returned from theatre, the number of drains would be recorded. For the pilot study, medications were assigned a score depending on grouped totals. Again for the main study it was decided that the number of individual medications would be recorded for each patient.

During the collection of data in the pilot study, the nursing staff on the ward were responsible for recording the score and times. The initial collection of data was recorded poorly. Although the nursing staff had a good understanding of the project and the tool being used, they were still not completing the forms adequately. A meeting was held with the key stakeholders and it was decided that, as the nurses were only estimating the times it took them to perform the assigned tasks, it would be acceptable that the author of this project and a cohort of senior nursing members representing the team leaders of the shift on the ward should collect the data for the main study. Before commencing the collection of data, nurses were timed with a stop watch performing the tasks on the acuity sheet. This was cross checked with the senior members of staff to ensure it was accurate. Nurses with different experience levels were all timed performing the same tasks for both laparoscopic and open colorectal patients. The times were recorded by the author and the senior members of the nursing staff on multiple occasions. The author was a Registered Nurse with a colorectal nursing background in both the ward and operating theatre. The senior members of the ward included the Nurse Unit Manager, the Stomal Therapist and the Nurse Educator. These times were then used for the main study. The data was collected retrospectively from patient files.

5.4 Conclusion:

Based on the preliminary results and sample size it was determined that a larger study should be conducted as it could give meaningful data on nursing care differences between open and laparoscopic colorectal surgery. From this pilot study we felt that the variables of BMI, ASA, age and sex should also be included in the full study analysis.

6. Total population

6.1 Methods:

As discussed above, power calculations revealed at least 40 patients would be required in each group. The total numbers eventually attained were 88. There were 41 patients undergoing open operations and 42 patients undergoing laparoscopic operations. Five operations were converted from a laparoscopic to open approach, these patients were included in the laparoscopic arm so results could be interpreted as an *intention to treat* approach.

Changes to methodology in main study:

The pilot study demonstrated the methodology could be replicated in the main study. However, some modifications were required and these are highlighted below.

The pilot study emphasised inconsistencies when junior and inexperienced nursing staff were required to collect data. Therefore, it was decided only senior nursing staff would time nurses completing the duties being recorded for the study and that the principle author would be the primary data collector. This

would minimise inter-observer variability and improve consistency of data collection, thereby producing the most reliable data for statistical analysis.

Changes in measurement of variables: (Appendix 3)

Diet

Measurement of the diet score remained the same for the total population as it was for the pilot study. Diet time was not measured for the total population. This was because nursing staff were not required to spend time on this activity as explained in the above section.

Drains/Catheters and Stomas

Measurement of the drain time was the same for the total population as it was for the pilot study. Drain score was changed for the total population. The score was recorded as the total number of drains/catheters and stomas rather than as a score assigned to a numerical group. This was to reduce the “skewness” of the score distribution. Having scores measured on an ordinal scale would facilitate statistical analysis by non-parametric methods.

Wound Management

There were no changes to the methodology in the measurement of wound management time or score.

Observations

There were no changes to the methodology in the measurement of observation time or score.

Intravenous and parenteral infusion and medication score

There were no changes to the methodology for the medication time. However, the way in which the medication score was recorded was changed. In the pilot study a score was assigned depending on grouped totals of medications. For the full population, medications were counted individually and this became the score.

Mobility and ADL's

There were no changes to the methodology for the mobility/ADL's time or score.

Demographic factors

As part of the analysis of the full population study, certain demographic factors were recorded. Included were ASA, age, sex and BMI. The reason for inclusion of these categories was explained in the methodology section for the pilot study.

Statistical Analysis

The data for all nursing tasks in both the laparoscopic and open groups had a non-parametric distribution which allowed statistical analysis using the Mann Whitney Test.

6.2 Results:

Data was collected on 88 patients for six different measures of nursing acuity. Table 4: summary of the data for both groups of patients and also shows the pattern of distribution.

Table 4. Summary statistics of the nursing activities scores and times involved (minutes) and length of postoperative stay (days).

	Range	Median	Mean	Skewness
Diet management score	6-66	15.0	17.3	2.1
Drains, catheters and stoma care score	0-56	10.0	13.6	1.5
Drains, catheters and stoma care time(mins)	10-365	67.5	83	2.0
Wound management score	4-40	9.0	10.8	2.1
Wound management time(mins)	0-310	15.0	23.7	4.7
Observations score	4-40	15.0	16.0	1.2
Observations time (mins)	20-310	80.0	90.6	2.0
IV and parenteral infusions & medications score	8-232	36.5	47.2	2.5
IV and parenteral infusions & medications time(mins)	40-759	160.0	216.1	1.9
Mobility and ADL's score	4-78	15.0	18.8	2.0
Mobility and ADL's time (mins)	20-1235	147.5	195.3	2.0
Postoperative hospital stay	4-34	8.0	9.43	2.1

Patient Demographics

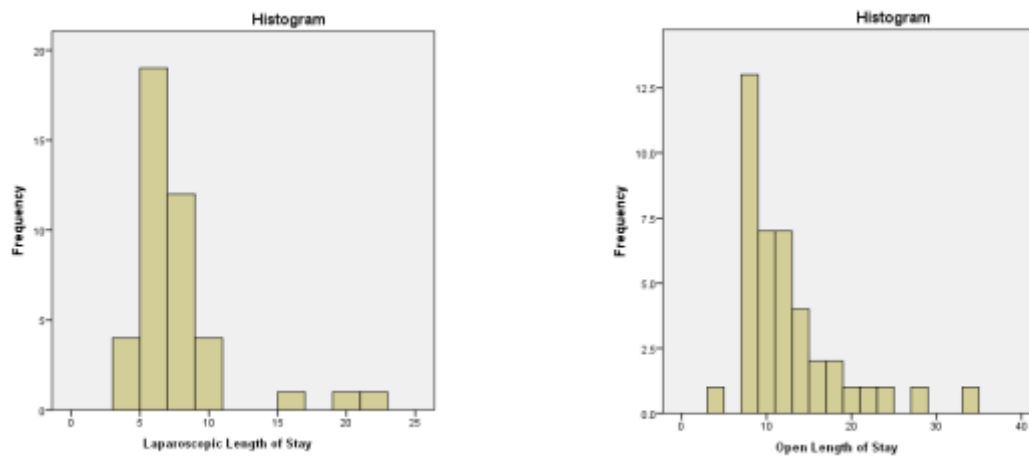
Table 5: Association between background variables and type of operation.

	Category	Laparoscopic operation (Completed) n(%)	Chi Squared	P
Sex	Female	16/33 (49)	0.01	0.912
	Male	26/55 (47)		
ASA	1	26/51 (51)	0.81	0.666
	2	12/26 (46)		
	3-5	4/11 (36)		
Age	16-49	7/16 (44)	0.36	0.986
	50-59	6/12(50)		
	60-69	10/22 (46)		
	70-79	12/23 (52)		
	80-99	7/15 (47)		
BMI *	<30	26/47 (55)	0.09	0.956
	30 -39.9	12/23 (52)		
	>40	2/4 (40)		

* There was no data available for 14 patients on height or weight.

There was no association between patients Age, Sex, ASA or BMI and the type of operation that they received. The type of operation that patients had depended on other factors such as previous surgery, pathology, anatomical location of pathology and patient or surgeon preference.

Total Length of Stay Laparoscopic & Open (Graph 2)

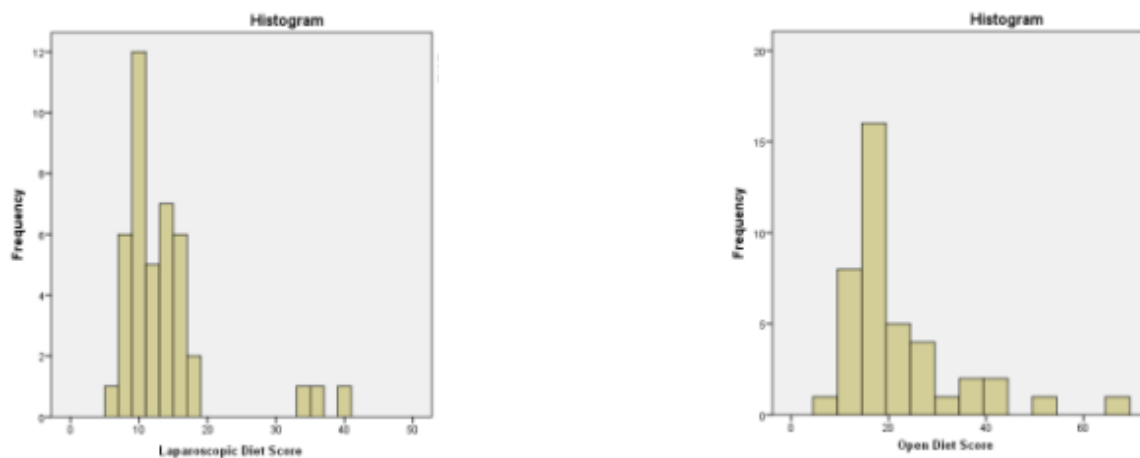


In the laparoscopic group, patients had a median length of stay of 6.0 days (range 4-21). In the open group the median length of stay was 9.0 days (range 4-34), this increased length of stay in the open group was statistically significant ($p < 0.001$).

Patients attending Concord Hospital for colorectal surgery are often elderly with multiple co-morbidities, increasing the length of stay for both laparoscopic and open groups. During the study period post-operative care was not formally an

“enhanced recovery program”. Enhanced recovery principles of early mobilisation, early diet, reducing narcotic medications and also an attempt to remove drains as early as possible had been adopted for both open and laparoscopic patients.⁴¹

Diet Management Score (Graph 3)

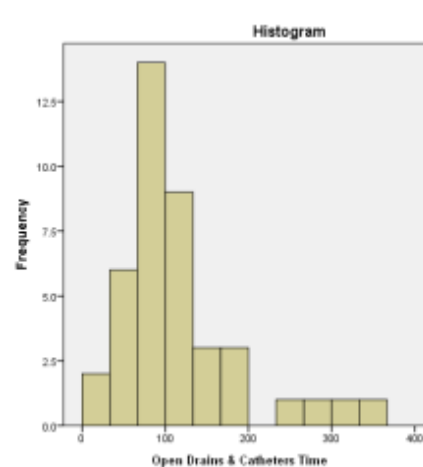
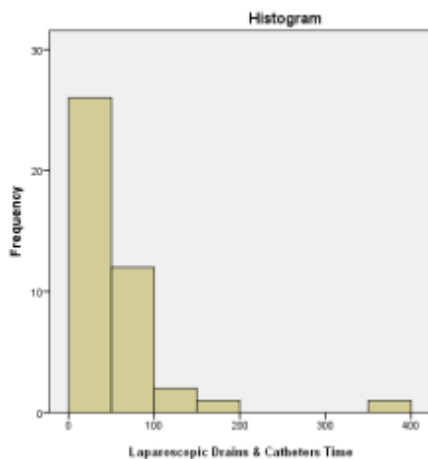
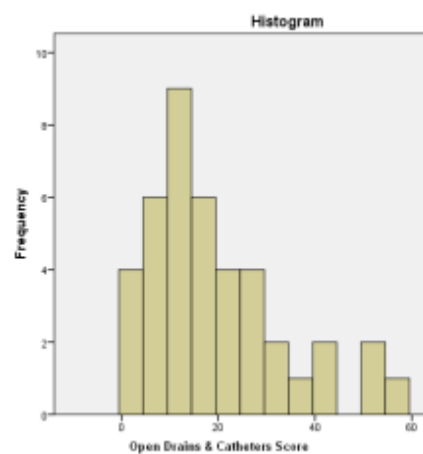
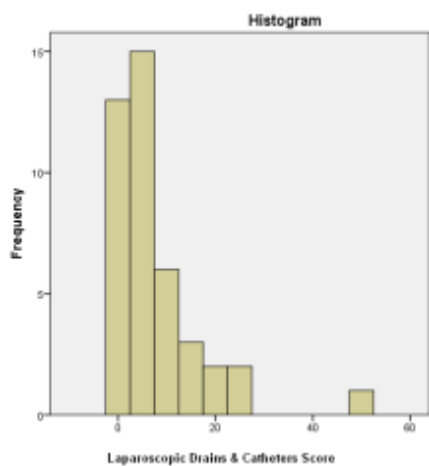


The median diet score for the open group was 18 (range 7 – 66) compared with the median diet score for the laparoscopic group of 11.5 (range 6 – 39) $p < 0.001$.

As discussed previously, we decided not to measure time as patients were either “nil by mouth” or were eating independently and therefore did not take up time in a nurses shift. The score measured the level of assistance required by the patient. The results show patients in the laparoscopic group were becoming

independent with their diet earlier therefore resuming and tolerating a diet earlier than the patients who had open resections. Patients in the open group were seen to be “nil by mouth” for longer than the laparoscopic group therefore requiring more effort from nursing staff delivering IV fluids or other nutritional support. This is in keeping with other studies where patients who had laparoscopic colorectal surgery have an earlier gut function.⁴²

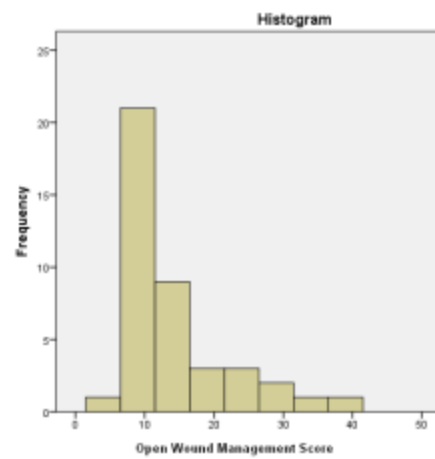
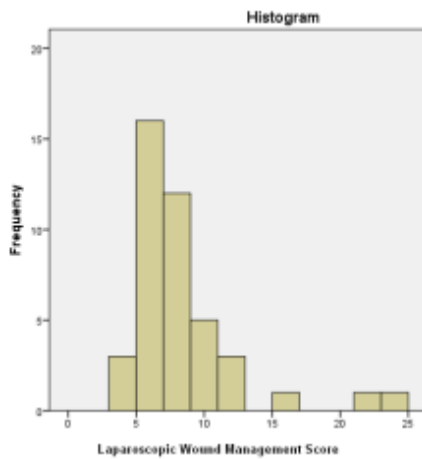
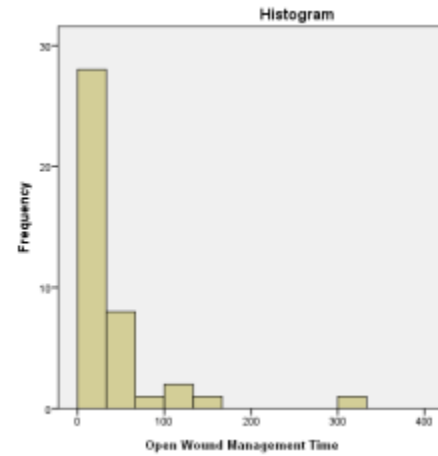
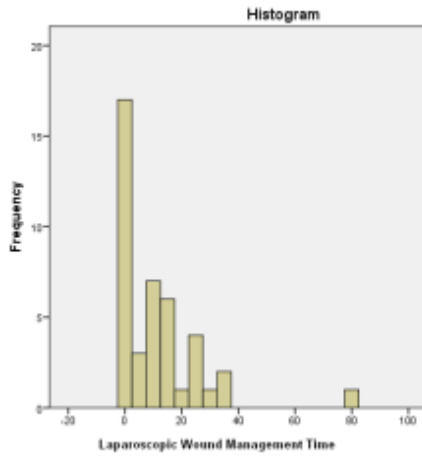
Drains, Catheters and Stoma care Score and Time (Graph 4)



The median drain score for the open group was 15 (range 1-56) compared with the median drain score for the laparoscopic group of 5 (range 0-49) $p<0.001$. The median drain time for the open group was 85 minutes (range 15-335) compared with the median drain time for the laparoscopic group of 40.5 minutes (10-365) $p<0.001$.

Laparoscopic patients were seen to have drains and catheters in for less time than patients who had open surgery. Consequently, patients became less dependent on nursing staff as they were able to move about more freely without cumbersome drains and catheters attached. Furthermore, nurses spent less time during the course of the patients hospitalisation managing, emptying and measuring drains from these patients. The open group required more nursing time and effort as they had drains and catheters in situ for longer. The amount of time spent looking after stomas for both the laparoscopic and open patients was time consuming at the very early stage of the postoperative period but became less for both groups as the Stomal Therapy Nurses took over the role of providing education and support.

Wound management score and time (Graph 5)

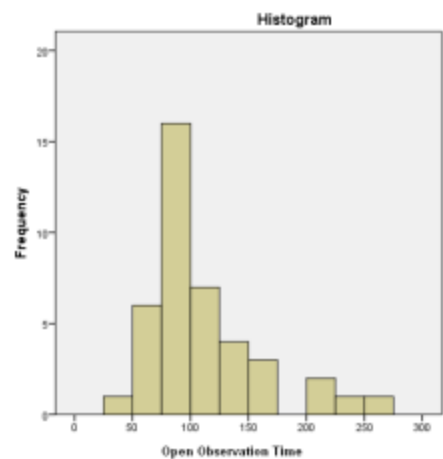
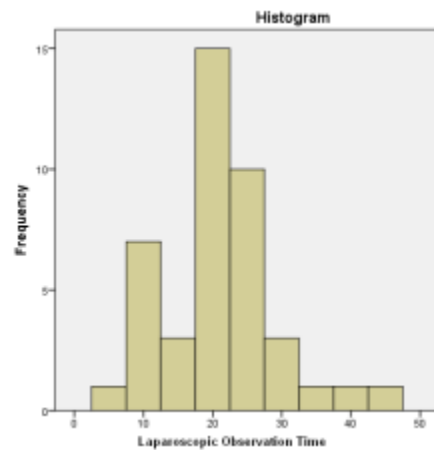
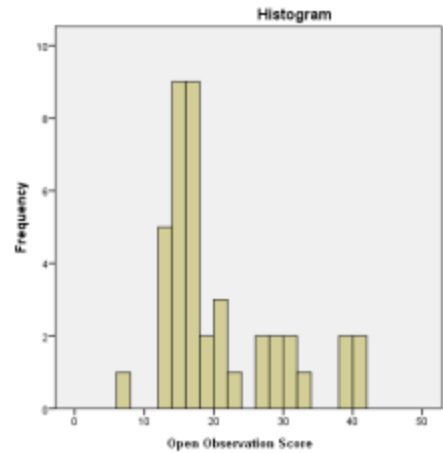
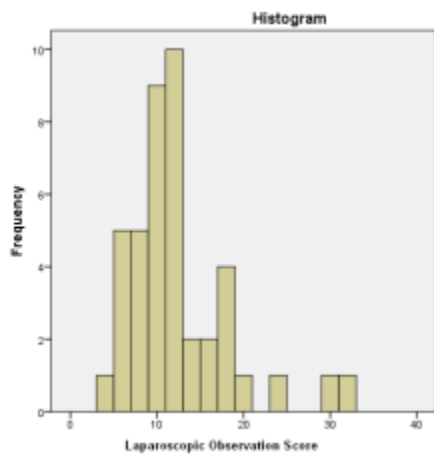


The median wound score for the open group was 11 (range 4-40) compared with the median wound score for the laparoscopic group of 7 (range 4-23) $p < 0.001$.

The median wound time for the open group was 20minutes (range 0-310) compared with the median wound time for the laparoscopic group of 10minutes (range 0-80) $p<0.001$.

The wound management results for the laparoscopic group revealed patients had either simple dressings performed or their wound dressing remained intact until the day of discharge, when the dressings were removed and wounds left exposed. Less time and effort was required by the nursing staff during their shift attending to wound care. The results indicate there were more wound complications seen in the open group leading to more complex dressings and more nursing time spent attending to dressings. Furthermore, wound complications may lead to increased pain, requiring extra medications to be administered, patients being less mobile and ultimately a delay in discharge.

Observation Score and Time (Graph 6)

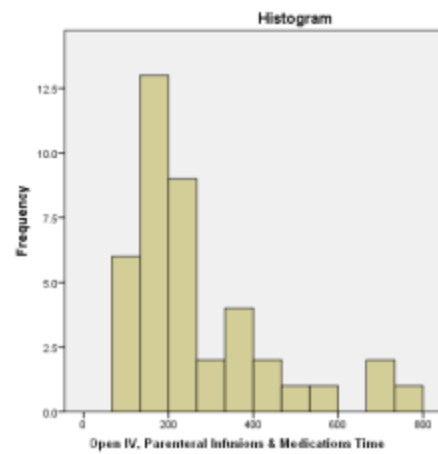
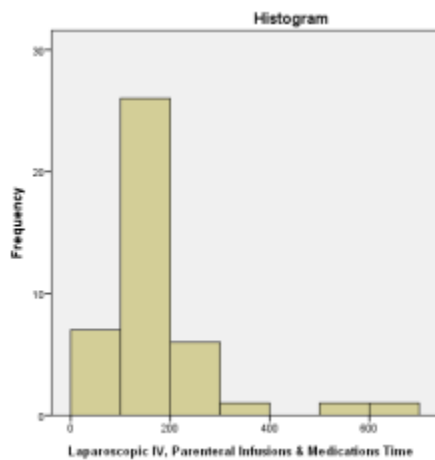
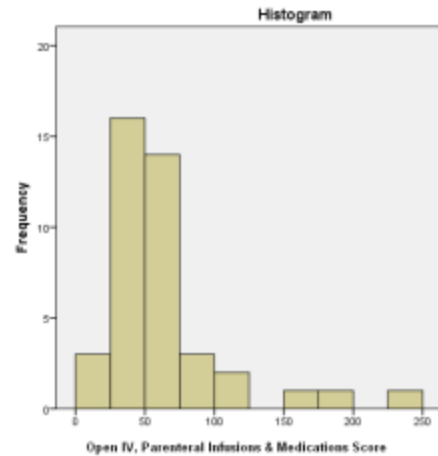
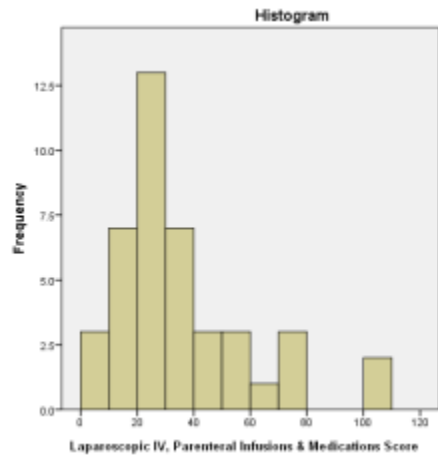


The median observation score for the open group was 16 (range 7-40) compared with the median observation score for the laparoscopic group of 11 (range 4-32) $p < 0.001$.

The median observation time for the open group was 92.5 minutes (range 30-260) compared with the median observation time for the laparoscopic group of 60minutes (range 20-310) $p<0.001$.

The results from this section show, that although nursing staff were performing the same observations for both laparoscopic and open patients, the laparoscopic patients were requiring less frequent recording of observations earlier in their post operative course. All patients that return to the ward postoperatively with a PCA have observations performed on them every hour for 8 hours then 4th hourly thereafter unless otherwise required. The results have demonstrated that PCA's are removed earlier in the laparoscopic group due to less post-operative pain, subsequently vital observations are not required to be performed as frequently. Once the PCA is no longer required, observations are generally performed once on a nurses' shift. Patients who had open surgery require observations to be performed for longer and more frequently due to their pain control requirements, therefore requiring more nursing time and effort for longer.

IV/Parenteral Infusions and Medication Score and Time (Graph 7)

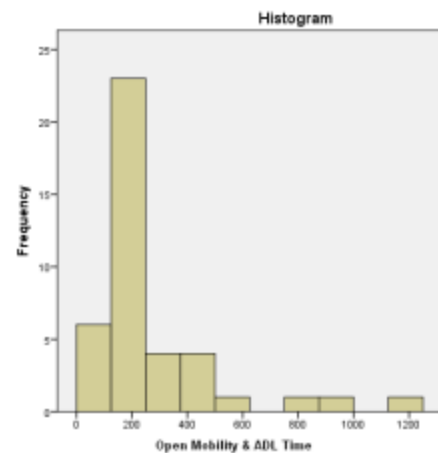
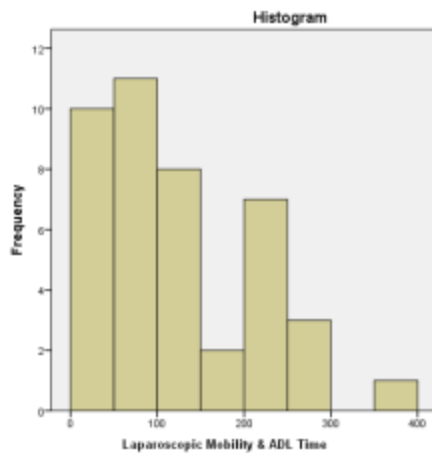
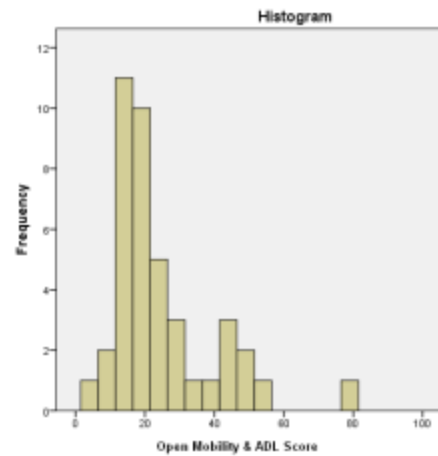
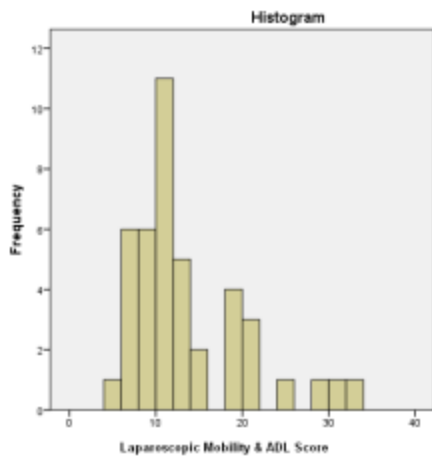


The median medication score for the open group was 49.5 (range 12-232) compared with the median medication score for the laparoscopic group of 28.5 (range 8-101) $p < 0.001$.

The median medication time for the open group was 212.5 (range 40-759) compared with the median medication time for the laparoscopic group of 149.5 (range 40 – 675) $p < 0.001$.

Patients in both groups require pain relief mainly in the form of PCA. These patients are also being administered IV antibiotics and IV fluids by the nursing staff. From the results, the nurses spend less time and effort administering medications to the laparoscopic patients. From earlier results the laparoscopic patients are seen to be tolerating their diet earlier than the open patients so are therefore able to have their pain relief and antibiotics orally sooner than the open patients. They are also able to have their IV fluids taken down as they are able to eat and drink. Preparing IV antibiotics, IV fluids and IV pain relief takes up a large part of a nurses shift. In order to administer IV medication the nurse must collect the equipment to draw up the medications, locate the keys to the locked drug cupboard (for S4 & S8 medications), have the medication checked by another qualified nursing staff member, physically draw up and mix the medication and then administer it. Being able to administer oral medications takes considerably less time and effort in a shift.

Mobility and ADL Score and Time (Graph 8)



The median mobility score for the open group was 19 (range 4-78) compared with the median mobility score for the laparoscopic group of 11.0 (range 5-32) $p < 0.001$.

The median mobility time for the open group was 192.5 (range 20-1235) compared with the laparoscopic group of 97.5 (range 20-395) $p < 0.001$.

This score was measured by how dependent or independent the patients were on nursing staff to assist them with their activities of daily living requirements. The laparoscopic group of patients were mobilised to the shower with nursing assistance on either the day of surgery or day 1 postoperatively. The open patients were sponged in bed and assisted with their transfer to a chair on day 1. During the initial post operative period, both sets of patients require intense nursing time and effort. From the results, it can be seen that the laparoscopic patients who are mobilized sooner than the open patients become independent more quickly and require less time and effort from the nursing staff throughout the duration of their stay.

6.3 Summary of results

Differences between open and laparoscopic surgery

Table 6: Differences between open and laparoscopic surgery in median “score” and “time” measures of management intensity, and total management time, and length of postoperative stay.

	Open operation range, median	Laparoscopic operation range, median	Mann- Whitney p
Diet management score	7-66, 18.0	6-39, 11.5	<0.001
Drains, catheters and stoma care score	1-56, 15.0	0-49, 5.0	<0.001
Drains, catheters and stoma care time (mins)	15-335, 85.0	10-365, 40.5	<0.001
Wound management score	4-40, 11.0	4-23, 7.0	<0.001
Wound management time (mins)	0-310, 20.0	0-80, 10.0	<0.001
Observations score	7-40, 16.0	4-32, 11.0	<0.001
Observations time (mins)	30-260, 92.5	20-310, 60	<0.001
IV and parenteral infusions and medications score	12-232, 49.5	8-101, 28.5	<0.001
IV and parenteral infusions and medications time (mins)	40-759, 212.5	40-675, 149.5	0.001
Mobility score	4-78, 19.0	5-32, 11.0	<0.001
Mobility time (mins)	20-1235, 192.5	20-395, 97.5	<0.001
Total time (hours)	2.4-40.7, 10.4	2.0-24.6, 6.2	<0.001
Postoperative hospital stay (days)	4-34, 9.0	4-21, 6.0	<0.001

Table 6 demonstrates all the measured activities have statistically significant lower median scores and median times for laparoscopic colorectal surgery than for open colorectal surgery. This confirms the results from the initial perception study that nurses believed there was a difference in the effort required for nursing care between laparoscopic and open colorectal surgery.

Correlation between score and time

We found across all variables there was an association between the score and time measures.

The “score” and “time” measures were strongly positively associated for the variables; drains/catheters, observations and mobility, and the variables of wound management and IV infusions/ medications were moderately associated (Table 5).

Table 7: Spearman rank correlation coefficients between each “score” variable and its corresponding “time” variable.

Correlation between	Spearman coefficient	P
Drains & catheters score and time	0.90	<0.001
Wound management score and time	0.71	<0.001
Observations score and time	0.91	<0.001
IV infusions/ medications score and time	0.60	<0.001
Mobility and ADLs score and time	0.92	<0.001

This strong statistically significant correlation between nursing time and the acuity score that was developed for the purpose of this study, shows that they are essentially measuring the same thing and therefore the score may be used in future nursing studies as an acuity measure.

Table 8: Outcomes by age (continuous variable)

	Spearman correlation coefficient	P value
Diet management score	0.30	0.004
Drains, catheters and stoma care score	0.07	0.490
Drains, catheters and stoma care time	0.14	0.181
Wound management score	0.23	0.033
Wound management time	0.04	0.706
Observations score	0.18	0.095
Observations time	0.18	0.098
IV and parenteral infusions and medications score	0.34	0.001
IV and parenteral infusions and medications time	0.22	0.044
Mobility score	0.39	0.001
Mobility time	0.42	0.001
Total time (hours)	0.34	0.001
Postoperative hospital stay (days)	0.27	0.012

Age was positively correlated with diet management score, wound management score, IV/parenteral infusions/medications score and time, mobility score and time, total time and postoperative hospital stay. The strongest associations were with mobility. In each case the dispersion of scores or times increased with

increasing age; that is, while scores were mostly low and times short for patients aged less than 50 years, scores and times were not only higher but much more variable for older patients. These results of age affecting both scores and times in laparoscopic and open surgery were expected. Surgery is associated with higher morbidity and mortality in elderly patients with colorectal cancer compared with younger patients.⁴³ With the increase in patients' age there is an expected increase in ASA classification.⁴⁴ This means that elderly groups of patients already have in a way a disadvantage because they have pre existing problems that will make their post operative course more complicated. Longer length of stay in elderly patients may be the result of, amongst other factors, physical de-conditioning and fatigue or postoperative complications.⁴⁵ In terms of the nursing care being delivered to these patients, regardless of type of surgery, elderly patients demanded a higher level of care from the nursing staff during the postoperative period.

Outcomes by ASA

Table 9: Differences between patients with an ASA of 1 and those with an ASA greater than 1 median “score” and “time” measures of management intensity, and total management time, and length of postoperative stay.

	ASA = 1 range, median	ASA > 1 range, median	Mann-Whitney p
Diet management score	6-66, 12	7-44, 16	0.062
Drains, catheters and stoma care score	0-52, 10	0-56, 8	0.565
Drains, catheters and stoma care time	10-365, 70	15-320, 65	0.729
Wound management score	4-40, 8	4-35, 10	0.279
Wound management time	0-105, 15	0-310, 14	0.650
Observations score	4-40, 14	5-40, 15	0.790
Observations time	20-296, 80	30-310, 80	0.832
IV and parenteral infusions and medications score	8-232, 32	8-152, 55	0.002
IV and parenteral infusions and medications time	40-725, 155	40-759, 185	0.097
Mobility score	4-51, 14	6-78, 18	0.021
Mobility time	20-770, 110	20-1235, 205	0.011
Total time (hours)	120-1659, 426	175-2440, 536	0.060
Postoperative hospital stay (days)	4-34, 7	4-23, 8	0.170

There were 51 patients with an ASA of 1, 26 with an ASA of 2, but only 10 with an ASA of 3 and 1 with an ASA of 5. Because of the small numbers in the latter two categories the ASA score was dichotomized as 1 versus >1.

Patients with an ASA greater than 1 had significantly higher IV/parenteral infusions/medications scores, higher mobility scores and higher mobility time than patients with an ASA of 1.

Different risk factors may have differential relative impact on a specific complication. Numerous studies have explored the association between outcome and risk factors for surgical procedures. Comorbidities affect outcomes after colorectal surgery. Comorbidity is an independent risk factor for adverse outcome after colorectal surgery.⁴⁶ In the results of this study patients who had a higher ASA score than patients who had a lower score preoperatively were seen to require more nursing time and effort in regards to medications and mobility. Regardless of type of surgery or preoperative risk factors, both these nursing tasks take up a large part of a nurses' shift postoperatively. A patient with a higher ASA score will usually be on medications before surgery. It follows that postoperatively there will be more medications prescribed so more effort and time will be needed from nursing staff to prepare and administer drugs to these

patients than those patients with a lower ASA score and who are on less medications. Often patients with higher ASA scores have cardiac or respiratory comorbidities preoperatively. As well as being on numerous medications for this, motivating patients to get up and walk can be problematic. Following major abdominal surgery amongst other things, pulmonary complications is an important cause of postoperative morbidity. It contributes to significant increases in length of hospital stay, overall hospital costs and patient discomfort. Patients who are mobilized early are seen to have a shorter length of hospital stay and less postoperative complications.⁴⁷

Outcomes by BMI

Table 10: Differences between patients with a BMI of < 30 with a BMI of 30 or higher on median “score” and “time” measures of management intensity, and total management time, and length of postoperative stay.

	BMI < 30 range, median	BMI ≥ 30 range, median	Mann-Whitney p
Diet management score	7-66, 13	6-44, 14	0.094
Drains, catheters and stoma care score	0-52, 9	1-52, 8	0.902
Drains, catheters and stoma care time	10-365, 65	15-320, 50	0.505
Wound management score	4-40, 9	4-35, 8	0.325
Wound management time	0-80, 10	0-310, 15	0.714
Observations score	5-40, 14	4-26, 13	0.907
Observations time	25-310, 75	20-140, 75	0.458
IV and parenteral infusions and medications score	8-232, 37	11-152, 35	0.012
IV and parenteral infusions and medications time	40-725, 160	40-445, 165	0.399
Mobility score	4-51, 15	6-78, 13	0.082
Mobility time	20-460, 135	20-1235, 135	0.064
Total time (hours)	120-1659, 440	175-2440, 445	0.157
Postoperative hospital stay (days)	4-34, 8	4-23, 7	0.228

BMI could not be calculated for 14 patients whose height or weight was not recorded.

There were 47 patients with a BMI less than 30 and 23 with a BMI between 30 and 39.9 . As there were only 4 patients with a BMI of 40 or higher, BMI was dichotomized at < 30 versus 30 or higher in the above table.

The only significant association between BMI and the score, time and outcome measures was the patients with a BMI less than 30 had a higher score on IV/parenteral infusions/medications than those with a higher BMI.

Obesity has long been considered as a risk factor for complications following colorectal surgery.⁴⁰ Studies have shown a variable association between increasing BMI and postoperative complications.⁴⁰

According to Leroy et al 2005, obesity does not have an adverse impact on the postoperative outcomes of laparoscopic colectomy. Obese patients can fully benefit from the advantages of minimally invasive surgery.⁴⁸

In regards to the postoperative care of patients with a higher BMI in both Laparoscopic and open surgery, results have shown that the nursing tasks performed were not influenced negatively or positively for either the laparoscopic

patients or the open patients who had higher BMI scores. Although there is much in the literature which talks about complication rates in patients with a higher BMI, in terms of nursing care and BMI scores there was little association between open and laparoscopic and the measured nursing tasks.

Outcomes by Sex

Table 11: Differences between males and females in median “score” and “time” measures of management intensity, and total management time, and length of postoperative stay.

	Male range, median	Female range, median	Mann-Whitney p
Diet management score	6-66, 14	7-44, 15	0.966
Drains, catheters and stoma care score	0-56, 10	0-52, 11	0.887
Drains, catheters and stoma care time	10-365, 70	15-320, 60	0.911
Wound management score	4-40, 9	4-35, 9	0.259
Wound management time	0-146, 15	0-310, 10	0.018
Observations score	4-40, 15	5-40, 13	0.560
Observations time	20-310, 80	30-260, 80	0.856
IV and parenteral infusions and medications score	8-232, 36	8-152, 37	0.993
IV and parenteral infusions and medications time	40-759, 165	40-445, 160	0.370
Mobility score	5-52, 15	4-78, 16	0.590
Mobility time	20-990, 145	20-1235, 170	0.535
Total time (hours)	120-1949, 453	143-2440, 510	0.990
Postoperative hospital stay (days)	4-34, 8	4-23, 8	0.627

The only significant difference was the wound management time was greater for males than for females. This was not seen in the wound management score. This may finding may be due to male patients requiring more time with care and education of their wounds. There was no difference in any other measure of acuity between males and females in the study cohort. The general feeling amongst practicing nurses is that younger male patients are more demanding and require more effort and time for postoperative care. There is no documentation of this in the English literature nor has a formal nursing perception study been done on this in the past. It is certainly a subject for future research.

6.4 Discussion:

The purpose of this study was to design a tool that could measure differences in time and effort given by nurses to patients who had either elective laparoscopic colorectal resections or elective open colorectal resections on a specialised colorectal unit. The results from our study show that in each measured activity less time and effort is used by nursing staff caring for patients who had elective laparoscopic colorectal resections compared with those patients who had elective open colorectal resections.

There are numerous documented studies reporting on patient outcomes following laparoscopic colorectal resections. Laparoscopic colorectal surgery has been demonstrated to reduce postoperative infections and length of stay due to less tissue trauma, modulation of postoperative immune and inflammatory responses and improved gut function after surgery.⁴² Other benefits of laparoscopic colorectal surgery also include decreased post operative pain and shortened length of stay.^{2,7} Smaller incisions lead to a better cosmesis for patients and have been associated with a better immune and inflammatory response leading to improved postoperative outcomes.^{2,4,7} Furthermore, reduced blood loss has been identified as a benefit.¹

To date there have been no studies which have measured and reported on differences in nursing care in terms of the time and effort required to care for patients who have undergone laparoscopic colorectal surgery compared with open colorectal surgery. This study reports on these differences.

For laparoscopic colorectal surgical patients to be effectively managed on the ward, it is essential to provide education to nursing staff, patients and their families. For nursing staff there needs to be an understanding of the surgery being performed and why an accelerated post operative care course is possible.

Laparoscopic colorectal surgery has challenged much of the standard postoperative care plans used for colectomy. Optimal postoperative care of the laparoscopic colectomy patient requires an appreciation of the faster recovery enjoyed by these patients.⁴⁹ The results of our study show experienced nurses working in our colorectal unit have implemented adequate management strategies to care for the laparoscopic patients appropriately. The reduced acuity of laparoscopic patients not only frees up time for the nursing staff to be caring for the more complicated open resection patients, but also allows a higher turnover of patients through the unit. For a major tertiary referral hospital with a busy colorectal cancer centre, a high throughput of patients is essential to adequately meet demand for beds. As a tertiary referral centre, the patients referred to Concord Hospital can be complex and have a surgical history and co-morbidities that make effective management a challenge. The time saved in nursing hours and effort looking after laparoscopic patients, as shown in our results, can free up much needed time and effort to look after complex emergency patients, elderly patients, and the patients who have had open colorectal surgery. If there is to be an accelerated rate of postoperative care in the acute postoperative period and therefore a higher throughput of patients, there needs to be adequate staffing levels and skill mix on the ward to meet the

care requirements of the patients. Management of laparoscopic patients through the acute post operative period requires adequate and appropriate resources because of the shorter hospital stay. As soon as a bed becomes available it will be filled with a new patient. Intuitively staffing expertly trained nurses to cope with this high turnover is essential when implementing an accelerated rate of post operative care.⁵⁰ Designing a postoperative laparoscopic colorectal resection pathway may be beneficial to ensure that laparoscopic patients are cared for efficiently. This pathway would contain an expected postoperative course for laparoscopic patients. New nursing staff and junior doctors who are rotated through different specialties would find this pathway beneficial as there would be an implemented structure in the way the laparoscopic patients are managed after surgery. This pathway would also be useful for patients and their families and be an aid to nurses in explaining about the post operative care of laparoscopic colorectal surgery. The pathway should begin at the pre admission clinic where patients need to be introduced in advance of their admission of the predicted accelerated rate of expected recovery compared with having open colorectal surgery. They should be informed that they will be expected to be independent of the nurse at an earlier stage than someone who has a traditional laparotomy. Family members also need to be informed that patients who have laparoscopic

colorectal resections will be expected to be discharged from hospital sooner than someone who had an open colorectal resection. Adequate arrangements can then be made at home for patients to be discharged to. If there is early intervention to educate the patient and their families that they will return to their pre surgical level of function earlier than what was traditionally expected, then the accelerated postoperative course will be effective. Currently post operative colorectal care is taking on a multidisciplinary enhanced recovery approach and this will see an evolution of nursing roles and acuity.

The findings from this study have shown that age does impact on post operative nursing effort required of nursing staff for both the laparoscopic and open patient groups. The strongest association was shown between age and mobility. The catchment area around Concord Hospital has an ageing population ⁵¹ resulting in increased numbers of elderly patients being admitted for colorectal surgery. Regardless of type of surgery, elderly patients required more time and effort from the nursing staff in the acute post operative period. The elderly are often admitted to the hospital from care facilities where there is a pre-existing high level of care required to assist with their daily living needs. This high level of care takes up much more time in a nurses' shift so adequate staffing must be considered when admitting such patients. Age can also affect length of stay. Age

has been shown in both groups to affect outcomes in diet, wound management, medications and mobility. This intuitively will affect the total time required by nursing staff to care for elderly patients and also increase length of postoperative stay as well. Many of the elderly patients will require review from allied health professionals to ensure they are safe for discharge. Early assessment at the pre admission clinic of a patient's social situation and medical history would mean early intervention of appropriate allied health involvement to prevent delay in discharge. Patients are often left on the surgical ward awaiting assessment from allied health after they are surgically fit to be discharged. This would include gerontology, physiotherapy, occupational therapy, social work and dietetics. This assessment would form the early part of the laparoscopic care plan to ensure that the accelerated post operative care course for these patients is not delayed and there are adequate arrangements made early on for the patient to be properly cared for after leaving hospital.

Other non-surgical factors that were looked at were ASA, sex and BMI. There was no statistically significant influence from these factors and the measured nursing activities. This shows that it is type of surgery and not pre surgical factors that affect post-operative care.

The results of this study have shown the tool that we developed to measure nursing acuity for the care of patients undergoing colorectal surgical has been successful. There was a statistically significant correlation between the time and score of all measured activities. This demonstrates that it is the type of surgery rather than non-surgical factors that influence the time and effort required by the nursing staff on the ward. Therefore this study could be replicated on other surgical units in order to validate the acuity tool. The nursing tasks measured were chosen as they were common to both laparoscopic and open colorectal resection patients but these tasks are also common to most surgical units. Specialties undertaking abdomino-pelvic surgery such as urology, gynaecology, upper gastro intestinal and hepatobiliary surgery could use this acuity tool to examine the nursing effort required for their patients who have major surgery. As the results of this study have shown that time and acuity score are effectively measuring the same thing, only the acuity score would be required data collection and analysis. This would make collection of data far simpler as there would be no need to time the nursing staff performing the selected task.

6.5 Conclusion:

The outcome of colorectal surgical procedures is influenced by a variety of factors, including the quality of care.⁵² Nurses and adequate staff are critical to the safe, cost effective and quality patient care in every health care setting.⁵³ This is essential in the colorectal unit to ensure that patients who have had colorectal resections are cared for by specialised nursing and allied health to ensure optimised patient care and ultimately provide an efficient throughput of patients on the ward. Coordination between the surgical team and the postoperative team is essential to obtain all the benefits associated with the proper management of these patients.⁴⁸ One of the major challenges for nursing administrators is to accurately match available personnel resources to patient needs.³ A tool measuring how much time and effort nurses spend caring for both the laparoscopic and open patients on the colorectal ward needed to be developed in order to see how important it is to have adequate expert nursing staff to cope with the specialised demands of the laparoscopic patients but also the challenging very complex postoperative care of the patients who have had open surgery. Both require specialised care, but the demands of the nurses differ between the two surgeries. This tool enables us to show very clearly how high the demands of the colorectal nursing staff are. Investing in registered nurses to be trained to

specialise in colorectal surgery will impact positively on the successful management of the patients on this ward during their postoperative course.

7. Limitations:

This study was conducted at a single centre. The nursing and medical staff are experienced and trained in colorectal surgery and post-operative care. The ward is a designated colorectal surgical unit with expert nurses caring for the patients. If this study had been conducted in a hospital where there was a mix of general surgical patients on a ward, or a combined medical/surgical unit with a team of general surgical nurses, the results may have been different. The colorectal surgeons at Concord Hospital have extensive experience in performing both laparoscopic and open colorectal surgery. Postoperatively, patients may experience different outcomes at centres where laparoscopic or complex open colorectal surgery is not performed routinely.

Nursing activities may vary from country to country and this should be considered for others wishing to apply this tool internationally.

It was not possible for the researchers who conducted the study and the nursing staff to be blinded as to which patients had open or laparoscopic colorectal resections. This could potentially allow bias. From the results of the perception study, it shows that the majority of nursing staff on the ward had a pre conceived opinion that laparoscopic colorectal resection patients took less time and effort to

care for than open colorectal resection patients in the acute post operative period. Therefore nursing staff could have potentially treated the laparoscopic patients differently to the open patients. Practically, this would be difficult. Nursing staff performed the same tasks on all the patients regardless of type of surgery and these tasks were timed and scored the same way. However, it is recognized that this issue was a potential weakness in the study.

Patients included in the study were all having elective surgery. These patients received bowel preparation and education prior to their surgery. Patients who have time to come to terms with their surgery beforehand have a better outcome than patients who have emergency surgery who are not bowel prepped and have no time to prepare for their post operative course⁵⁴. Emergency patients should be included in any replicated studies to see if there is a difference in the nursing care required postoperatively between emergency and elective patients.

8 . Appendices

Appendix 1

Questionnaire for colorectal nurses

This is a survey we are asking nurses working in the area of colorectal surgery to complete. There are no right or wrong answers it is about **your overall** perception of caring for patients in the early post-operative phase who have had either an elective open or elective laparoscopic resection, regardless of diagnosis.

Firstly, some personal data:

- A. How long have you been a nurse? _____ (years / months)
- B. How long have you worked in a specialist colorectal unit? _____ (years / months)
- C. Are you still working in a specialist colorectal unit? Yes No
- If no, where are you currently working? _____
- D. What is your highest nursing classification? (please circle one only)

AIN EN RN CNS CNE CNC NUM

Please complete the following questions by ticking the one box (or number) that most closely relates to your overall experience and opinion.

1. ***In your opinion***, do patients who have had an **elective laparoscopic** colorectal resection transfer easily from bed to chair?

Very easily						With great difficulty
1	2	3	4	5	6	7

2. ***In your opinion***, do patients who have had an **elective open** colorectal resection transfer easily from bed to chair?

Very easily						With great difficulty
1	2	3	4	5	6	7

3. ***In your opinion***, describe the ease of showering patients who have had an **elective open** colorectal resection?

Very easy						Very hard
1	2	3	4	5	6	7

4. ***In your opinion***, describe the ease of showering patients who have had an **elective laparoscopic** colorectal resection?

Very easy						Very hard
1	2	3	4	5	6	7

5. ***In your opinion***, are patients who have had an **elective open** colorectal resection quick to mobilise independently?

Very quick						Very slow
1	2	3	4	5	6	7

6. ***In your opinion***, are patients who have had an **elective laparoscopic** colorectal resection quick to mobilise independently?

Very quick						Very slow
1	2	3	4	5	6	7

7. ***In your opinion***, how easy is it for patients who have had an **elective open** resection to tolerate a full ward diet?

Very easy						Very difficult
1	2	3	4	5	6	7

8. ***In your opinion***, how easy is it for patients who have had an **elective laparoscopic** colorectal resection to tolerate a full ward diet?

Very easy						Very difficult
1	2	3	4	5	6	7

9. ***In your opinion***, does it take long to remove drains, catheters and lines from patients who have had an elective laparoscopic colorectal resection?

Very easy						Very hard
1	2	3	4	5	6	7

10. ***In your opinion***, does it take long to remove drains, catheters and lines from patients who have had an **elective open** colorectal resection?

Very easy						Very hard
1	2	3	4	5	6	7

11. ***In your opinion***, how frequently do patients who have had **elective open** colorectal resection develop wound complications?

Very rarely						Very frequently
1	2	3	4	5	6	7

12. ***In your opinion***, how frequently do patients who have had **elective laparoscopic** colorectal resections develop wound complications?

Very rarely						Very frequently
1	2	3	4	5	6	7

13. ***In your opinion***, what degree of pain do patients have after an elective laparoscopic colorectal resection?

Very little						A great deal
1	2	3	4	5	6	7

14. ***In your opinion***, what degree of pain do patients have after an elective open colorectal resection?

Very little						A great deal
1	2	3	4	5	6	7

15. ***In your opinion***, how quickly do patients who have had an **elective laparoscopic** colorectal resection look after their own stoma?

Very quickly						Very slowly
1	2	3	4	5	6	7

16. ***In your opinion***, how quickly do patients who have had an **elective open** colorectal resection look after their own stoma?

Very quickly						Very slowly
1	2	3	4	5	6	7

17. ***In your opinion***, how frequently do patients who have had an elective laparoscopic colorectal resection develop complications?

Very frequently						Infrequently
1	2	3	4	5	6	7

18. ***In your opinion***, how frequently do patients who have had an elective open colorectal resection develop complications?

Very frequently						Infrequently
1	2	3	4	5	6	7

19. ***In your opinion***, describe the effort required to look after a patient who has had an **elective laparoscopic** colorectal resection?

Very easy						Very hard
1	2	3	4	5	6	7

20. ***In your opinion***, describe the effort required to look after a patient who has had an **elective open** colorectal resection?

Very easy						Very hard
1	2	3	4	5	6	7

21. ***In your opinion***, is the length of stay for a patient who has had an **elective open colorectal** resection shorter than that of a patient who has had an **elective laparoscopic colorectal** resection?

Longer after an elective open resection	Longer after a elective laparoscopic resection	About the same	No opinion
---	--	----------------	------------

22. Would you prefer to look after a patient who has had an:

Elective open resection	Elective laparoscopic resection	About the same	No opinion
-------------------------	---------------------------------	----------------	------------

23. If you or a close friend or relative was advised to have an operation which could be performed either elective laparoscopically or elective open, which would you advise?

Elective open resection	Elective laparoscopic resection	No difference	No opinion
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Thank you very much for taking the time to fill out this survey.

When completed, please place the survey in the box on the front desk in Ward 1 East.

Appendix 2 Acuity Score Sheet (Pilot Study)

DIET	DRAINS & CATHETERS & STOMA	WOUND MANAGEMENT	OBSERVATIONS (Frequency)	INTRAVENOUS AND PARENTERAL INFUSIONS/ MEDICATIONS	MOBILITY/AOL'S
No Diet = 1	No Drains = 1	Intact = 1	< 6 hourly = 1	0 to 4 = 1	Fully Independent = 1
Independent = 2	1 Drain = 2	Simple Dressing = 2	4 per Day = 2	5 to 8 = 2	Minimal Assistance = 2
Minimal Assistance = 3	2 Drains = 3	Vac Dressing = 3	6 per Day = 3	9 to 13 = 3	Moderate Assistance = 3
Fully Dependent = 4	≥ 3 Drains = 4	Complex Dressing = 4	1 - 2 Hourly = 4	Any central venous access or >13 = 4	Fully Dependent = 4
Time Taken (min)	Time Taken (min)	Time Taken (min)	Time Taken (min)	Time Taken (min)	Time Taken (min)
Day 1	Day 1	Day 1	Day 1	Day 1	Day 1
Day 2	Day 2	Day 2	Day 2	Day 2	Day 2
Day 3	Day 3	Day 3	Day 3	Day 3	Day 3
Day 4	Day 4	Day 4	Day 4	Day 4	Day 4
Day 5	Day 5	Day 5	Day 5	Day 5	Day 5
Day 6	Day 6	Day 6	Day 6	Day 6	Day 6
Day 7	Day 7	Day 7	Day 7	Day 7	Day 7
Day 8	Day 8	Day 8	Day 8	Day 8	Day 8
Day 9	Day 9	Day 9	Day 9	Day 9	Day 9
Day 10	Day 10	Day 10	Day 10	Day 10	Day 10
Day 11	Day 11	Day 11	Day 11	Day 11	Day 11
Day 12	Day 12	Day 12	Day 12	Day 12	Day 12
Day 13	Day 13	Day 13	Day 13	Day 13	Day 13
Day 14	Day 14	Day 14	Day 14	Day 14	Day 14

Appendix 3 Revised Acuity Score Sheet (Full Population)

DIET		NUMBER OF DRAINS / CATHETERS		WOUND MANAGEMENT		OBSERVATIONS (frequency)		NUMBER of INTRAVENOUS AND PARENTERAL INFUSIONS/ MEDICATIONS		MOBILITY/AOL'S	
No Diet = 1		No Drains = 0		Intact = 1		< 6 hourly = 1		Total the number each day		Fully Independent = 1	
Independent = 2		1 Drain = 1		Simple Dressing = 2		4 per Day = 2				Minimal Assistance = 2	
Minimal Assistance = 3		2 Drains = 2		Voc Dressing = 3		6 per Day = 3				Moderate Assistance = 3	
Fully Dependent = 4		3 Drains = 3 etc		Complex Dressing = 4		1 - 2 Hourly = 4				Fully Dependent = 4	
Do Not Count		Time Taken (mins)		Time Taken (mins)		Time Taken (mins)		Time Taken (mins)		Time Taken (mins)	
Day 1		Day 1		Day 1		Day 1		Day 1		Day 1	
Day 2		Day 2		Day 2		Day 2		Day 2		Day 2	
Day 3		Day 3		Day 3		Day 3		Day 3		Day 3	
Day 4		Day 4		Day 4		Day 4		Day 4		Day 4	
Day 5		Day 5		Day 5		Day 5		Day 5		Day 5	
Day 6		Day 6		Day 6		Day 6		Day 6		Day 6	
Day 7		Day 7		Day 7		Day 7		Day 7		Day 7	
Day 8		Day 8		Day 8		Day 8		Day 8		Day 8	
Day 9		Day 9		Day 9		Day 9		Day 9		Day 9	
Day 10		Day 10		Day 10		Day 10		Day 10		Day 10	
Day 11		Day 11		Day 11		Day 11		Day 11		Day 11	
Day 12		Day 12		Day 12		Day 12		Day 12		Day 12	
Day 13		Day 13		Day 13		Day 13		Day 13		Day 13	
Day 14		Day 14		Day 14		Day 14		Day 14		Day 14	

Appendix 4 Nurse Information Sheet

Nursing Acuity Study

- This study will be initially piloted using 15 patients
- The patients used will have had either an elective open or laparoscopic colorectal resection
- Initially the study will involve the nurse looking after the patient and an expert nurse being either Gayle or Ian.
- Two acuity forms will be placed in the patients bedside notes to be filled in at midday each day independently of each other by the nurse and the expert.
- The patient ID sticker is to be placed on the top.
- The patients height and weight can be taken from preadmission forms and added to the top.
- The study will take into consideration two parts; time and effort.
- The categories are
 - Diet
 - Drains and Catheters
 - Wound management
 - Observations (frequency)
 - IV/parenteral infusions /medications
 - Mobility /ADLs
- Each category has a score from 1 to 4
- One being the least amount of work required to 4 being the most.
- You will estimate the time it takes you from collecting equipment to performing the task to completion.
- After the initial pilot, all being well, the study will increase in size and duration.
- What we are looking at is a direct comparison between lap and open resections and the effect if any these procedures have on nursing time and effort.

If you have any questions you can contact Gill Richardson on extension 75520.

Thank you for your assistance with this nursing study.

Appendix 5 Ethics approval for main study and perception study

Contact: Sydney South West Area Health Service (SSWAHS)
Human Research Ethics Committee – CRGH
Concord Repatriation General Hospital (CRGH)
Concord NSW 2139
Telephone: (02) 9767 5622 Fax (02) 9767 6569
Email: ethicscrgh@email.cs.nsw.gov.au

Our Ref: (HREC/10/CRGH/184)



CONCORD
REPATRIATION GENERAL
HOSPITAL

17 December 2010

Ms Gillian Richardson
Gastro & Liver Services
Ground Floor West
CONCORD RGH

Dear Ms Richardson,

Re: HREC/10/CRGH/184 CH62/6/2010-138 – G Richardson
Development of a nursing acuity (effort) score in the post operative care of colorectal cancer patients.

Thank you for submitting the above project for single ethical and scientific review. This project was first considered by the Expedited Ethical Review Panel of the Sydney South West Area Health Service Human Research Ethics Committee – CRGH Zone at its meeting held on 17 November 2010. 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.

This lead HREC 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*.

I am pleased to advise that the Committee has granted ethical approval of this research project.

The documents reviewed and approved include:

- LNR Application Form – submission code AU/6/9A87016
- Nursing Acuity Study – outline
- Nursing Acuity Score

The HREC has provided ethical and scientific approval for the following sites:

1. Concord Repatriation General Hospital

Please note the following conditions of approval:

1. You will 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, (including Serious Adverse Events).
2. Proposed changes to the research protocol, conduct of the research, or length of HREC approval will be provided to the HREC for review in the specified format.
3. You will notify the HREC, giving reasons, if the project is discontinued at a site before the expected date of completion.

Appendix A

THE CHECKLIST

Use of this Checklist is optional in NSW public hospitals. It is designed to assist in identifying when a proposed QI activity entails ethical 'risks'. For more detailed information related to each statement, please see *Considerations for reviewing QI activities*. This Checklist may be modified for use with local HRECs.

Section 1: ISSUES THAT MAY REQUIRE CONSENT

TRUE/FALSE

1. The project involves direct contact with patients, consumers, or members of the public.
2. The project poses additional risks or burdens to the patient beyond their routine care.
3. The data to be collected is of a sensitive nature or application.
4. The purpose of the activity is not 'directly related' to the patient's disease, illness or its management.
5. The data will be used or available in such a way that may identify individuals.

F
F
F
F
F

If the response to any of the above statements is "true", you should contact your nominated HREC delegate (or designated institutional body) to discuss. **Informed consent** is usually required. If approval is required, you will need to provide a project outline, including a description of how you intend to gain consent, as well a participant information statement.

Section 2: PRIVACY and CONFIDENTIALITY

TRUE/FALSE

6. There is no process for de-identification of data.
7. Access to personal information will extend beyond those who are members of the clinical care team, or to others who normally do not have access to the patient's record, or to other data sets.
8. The project involves rare conditions or a small community.
9. Data will be selected or identified by:
 - Aboriginal or Torres Strait Islander status; or
 - Ethnic, religious or minority group.
10. Data will be collected beyond that which is normally collected in routine care.

F
F
F
F
F

If the response to any of the above statements is "true", you will need to provide more information and you **may need full Ethics Committee approval**. Please provide a brief explanation and a description of the consent process with your application, and contact your nominated HREC or QI delegate to discuss.

Section 3: OTHER IMPLICATIONS

TRUE/FALSE

11. The project uses 'new' interventions, protocols or equipment.
12. The project will involve allocation of patients to groups to enable comparisons.
13. The project will involve genetic tests/testing.
14. The project may potentially infringe the rights, privacy or professional reputation of carers, health professionals or institutions.
15. The project involves use of placebo.

F
F
F
F
F

If the response to any of the above statements is "true", you will need to provide more information and it is **highly likely you will need full Ethics Committee approval** for your project. Contact your HREC representative.

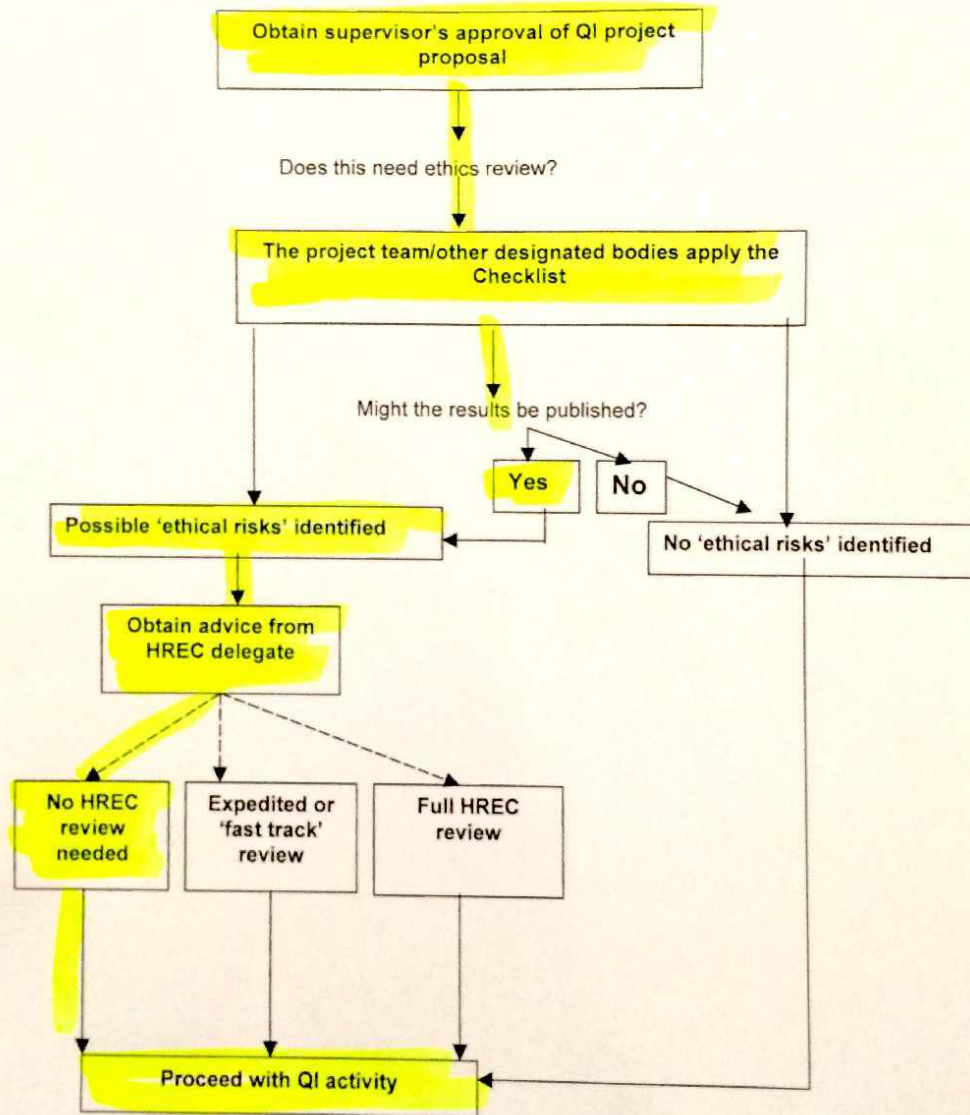
16. The project is likely to generate data that may lead to publication.

T

If responses to all of the above statements in the checklist are 'false', then no ethical risks have been identified with this project and no ethics review is required.

Appendix B

ETHICS REVIEW PROCESS



9. Acknowledgements

This dissertation would not have been possible without the guidance and the help of several people who contributed and extended their valuable assistance and expertise in the preparation and completion of this study.

Firstly I would like to express my deepest appreciation to my supervisor Dr Anil Keshava who has offered invaluable assistance, support and guidance throughout the entire process of this project.

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