The impact of preoperative education by a nurse-led Acute Pain Service on pain management for cardiac surgical patients.

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Abstract

The aim of this research was to compare the pain experience of cardiac surgical patients who attended the Acute Pain Service (APS) education program with cardiac surgical patients who did not attend the APS. The participants of both groups, pain levels, consumption of total analgesia, anxiety levels, satisfaction with pain management, ratios of self-administered bolus doses and failed attempts on Patient Controlled Analgesia (PCA) device and their length of hospital stay were compared.

The findings indicated no statistical significant differences between the two groups being investigated in relation to pain levels, total analgesia consumed, anxiety levels, satisfaction with pain management, total demands and delivery attempts on the PCA and their length of hospital stay. The clinical implications are significant. The preoperative pain management education program provided by APS clinical nurses for cardiac surgical patients does not have the positive outcomes expected.

Key words: pain levels, anxiety, satisfaction, Patient Controlled Analgesia (PCA), Acute Pain Service (APS), analgesia, Adult Learning Theory

Statement of Original Authorship

The work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution. This thesis contains no material previously published or written by another person that I am aware of except where due references are made.

Signed:

Date:

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Snezana Stolic

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List of acronyms and abbreviations

APS Acute Pain Service

STAI State-Trait Anxiety Inventory

ALT Adult Learning Theory

TPCH The Prince Charles Hospital

PCA Patient Controlled Analgesia

NRS Numerical Rating Score

VAS Visual Analogue Scale

AHCPR Agency for Health Care Policy and Research

IASP International Association for the Study of Pain

ASA American Society of Anaesthesiologists

NHMRC National Health and Medical Research Council

Chapter One-Introduction

Chapter One- Introduction

1.1. Introduction

An overview of this research including the study background, hypotheses, research questions, research methodology, statistical analysis, research results, and clinical implications are provided in this chapter.

1.2. Background to the research

The aim of this research was to determine the effectiveness of an Acute Pain Service (APS) preoperative pain management education program provided by a clinical specialist nurse-led on the pain experiences of cardiac surgical patients. This study compared pain experiences of cardiac surgical patients who attended the APS education program with cardiac surgical patients who did not attend the APS education program. Pain experiences were measured using postoperative pain levels, postoperative consumption of analgesia, preoperative and postoperative anxiety levels, postoperative satisfaction with pain management, postoperative total number of boluses of analgesia and failed attempts on Patient Controlled Analgesia (PCA) device and patients length of hospital stay for both groups. The hypotheses being tested in this study are described on page 15.

This study focuses on the cardiac surgical patients post operative pain experiences. Pain is a complex phenomenon. There are three key elements that influence the patient's pain experience; the physiological aspect of pain, psychological factors and the subjective nature of pain. The cardiac surgical procedure causes damage to nerve pathways resulting in the physiological aspect of pain.

Pain resulting from acute surgical injury can be termed nociceptive pain. Nociception is a painful physical response to noxious or tissue damaging stimuli. Nociceptive impulses from surgical trauma are transmitted from the site of injury to the spinal cord and evoke a complex sequence of neuroendocrine physical responses. Pain is defined physically as

'the noxious stimulation of threatened or actual tissue damage' (Geach, 1987 p12). The problem of this definition is some healthcare professionals base their management of pain purely on the physiological aspects of pain using analgesia as their major pain relief intervention strategy even though there are other factors that relate to pain, it is not possible to separate the mind from the body. Although pain has a physiological basis there are psychological responses that influence how an individual experiences and expresses their pain including the stress responses such as anxiety and the concept of suffering produced once the impulse reaches the brain (Ferguson, 1992).

Pain is a result of biochemical processes. However, nerve pathways, physiological responses and psychological factors do not explain the entire phenomenon (Conner and Deanne, 1995). Each individual perceives and interprets pain based on his/her own experiences and it is at this point that pain becomes different for each person (Lerch and Park, 1999). This subjective nature of pain is the third key element of pain. McCaffery originally proposed in 1968 (p 95) this definition of pain "whatever the experiencing person says it is existing whenever the experiencing person says it does". This definition of pain reflects the subjective nature of pain and the belief that the person experiencing the pain is therefore the best person to accurately describe and treat their pain. Pain is a personal experience and cannot be shared with others. Although pain is a universal experience no two people experience pain in the same way its exact nature remains a mystery (McCaffery and Beebe, 1989). Due to the uniqueness of each person it is impossible to predict each individual response to post operative pain.

The most complete definitions of pain address all three key aspects namely physiological, psychological and subjective components of pain. Two definitions are used to guide this study; pain is an 'unpleasant sensory and emotional experience in association with actual or potential tissue damage or described in terms of such damage' (Merskey and Bogduk, 1994 p 210) and 'whatever the experiencing persons says it is existing whenever the experiencing person says it does (McCaffery, 1989 p 95). Understanding and defining pain is essential for effective pain management.

Studies have reported that cardiac surgical patients continue to report moderate to severe pain levels (Watt-Watson and Stevens, 1998). Effective pain management by APS education programs is the focus of this study. Pain management is an important nursing role. There are three aspects to pain management:

1. assessment of pain intensity,
2. pain relief interventions (pharmacological and non pharmacological) and
3. evaluation of pain relief techniques.

Assessment of pain and patient feedback informs health care professional's decisions when prescribing and administering analgesics. Healthcare professionals must rely on self-reported pain levels there are no objective measures of pain such as pain thermometer. Pain rating scales can be used by patients in an attempt to communicate the level of pain they are experiencing because of the subjective nature of pain. This study utilizes self-reported pain rating scales in order to measure cardiac surgical patient's postoperative pain levels.

Health care professionals provide effective pain relief interventions by utilizing pharmacological methods such as administering analgesia and Patient Controlled Analgesia (PCA) delivery systems combined with nonpharmacological interventions such as relaxation techniques and preoperative education. This study compared the preoperative education by APS for pain management of cardiac surgical patients with the usual preoperative education for cardiac surgical patients. The PCA device was used in this study as a pain relief intervention and bolus doses and failed attempts on the PCA were measured for the effectiveness of pain control. Many general surgical studies have reported the benefits of preoperative education in reducing preoperative anxiety, postoperative pain levels, consumption of analgesia and length of hospital stay and improving satisfaction with care given (Hathaway, 1986, Devine, 1992, Schwartz-Barcott et al., 1994).

Recognizing the problem of surgical patients continuing to report high pain levels the Royal College of Surgeons of England and The College of Anaesthetists in September

(1990) jointly published recommendations that multidisciplinary specialist Acute Pain Service (APS) education programs could be implemented as a method of delivering more effective post operative pain management. Since this report, the problem of acute pain has been addressed by a number of professional bodies including the International Association for the study of Pain (1992), the American Pain Society (1995) and the American Society of Anaesthesiologists (1995). The role of APS education in pain management has received increasing attention to date. Since APS was first described by (Ready et al., 1988), a number of publications have described the considerable positive impact on pain management of APS in surgical wards (Bardiau et al., 1999, Tighe et al.,1998). The introduction of APS programs has been linked to reduced reports of post operative pain for general surgical patients (Bardiau et al., 1999, Mackintosh and Bowles,1997, Miakowski et al.,1999, Sartain and Barry,1999) reductions in the amounts of opioids being consumed (Bardiau et al., 1999), reported increases in patient satisfaction regarding pain management (Tighe et al., 1998) and reductions in length of hospital stay (Miakowski et al., 1999).

Research has demonstrated the benefits that preoperative education and Acute Pain Service education programs exerts on postoperative pain levels, anxiety levels, consumption of analgesia, satisfaction with cares, recovery and length of hospital stays for patients having general surgery (Devine, 1992, Hathaway, 1986) but little work has focused specifically on preoperative pain education by Acute Pain Service (APS) for cardiac surgical patients on their pain experiences. This study focused on pain management APS programs for cardiac surgical patients.

The hypotheses being tested in this study reflect previous findings for general surgical patients. The independent variables being tested are the Acute Pain Service program and Adult Learning Theory. The dependent variables being tested are pain levels, analgesia consumed, anxiety, satisfaction with pain management, boluses of analgesia and failed attempts on PCA device and patient's length of hospital stay.

The hypotheses being investigated in order to measure effective pain management by preoperative APS education program, in this study are:

Cardiac surgical patients who attended structured preoperative pain management education by clinical nurse specialist from the APS will:

1. Report less average postoperative pain scores
2. Consume less postoperative average analgesia
3. Report less average pre and postoperative anxiety levels
4. report higher average satisfaction scores regarding postoperative pain management
5. make fewer ratios of self-administered boluses and failed attempts on the Patient Controlled Analgesia device postoperatively
6. have shorter average length of hospital stay

than cardiac surgical patients who did not attend the preoperative APS education program

Research investigating the effects of preoperative education for cardiac surgical patients has produced mixed results (Shuldham et al., 2002). Asilioglu and Celik (2004) reported reductions in anxiety for cardiac surgical patients who received preoperative education. Cupples (1991) demonstrated cardiac surgical patients who received education had higher knowledge levels, more positive mood states and more favourable physiological recoveries than cardiac surgical patients who did not receive preoperative education.

Contrary views have also been reported. Studies investigating cardiac surgical patients receiving preoperative instructions on methods to relief pain have found no differences in regards to analgesia use, postoperative pain levels, length of stay or anxiety (Shuldham et al., 2002). Researchers have found high levels of anxiety associated with cardiac surgery thus prohibiting learning to take place in the pre operative phase (Redman, 1988).

Many researchers suggest applying the principles of Adult Learning Theory to specialized preoperative education programs such as APS in pain management is well suited to cardiac surgical population (Mirka, 1994, Palazzo, 2001). Cardiac surgical

patients are highly motivated adult learners and have an intense need to know. Cardiac surgical patients are likely to learn particularly if they can see the link between the pain information provided and their well being. Learning about pain and pain management is an integral part of the operative process (Wheatly et al., 1991).

The APS at the study hospital was reviewed against published research addressing APS for general surgical patients. This research was undertaken in order to establish whether or not cardiac surgical patients at this research hospital experience the same positive outcomes on pain management after participating in the study hospitals APS education program.

The aim of the APS at the study hospital is to inform patients of pain relief methods and pain rating scales used by health care professionals to monitor patient's levels of pain in order to reduce pain levels following surgery. The key assumption is that an informed patient is better able to understand and manage their pain experience. The Acute Pain Service provides pre operative education for approximately 70% of cardiac surgical patients. Post operative individualized education is provided by the APS clinical nurse specialist to all uncomplicated cardiac surgical patients. The service is fundamentally an education service.

This study was designed to elucidate the consequences of preoperative pain management education given before admission by a nurse-led APS to cardiac surgical patients. This study measured any demonstrated benefits on postoperative pain levels, postoperative amounts of analgesia consumed, pre and postoperative anxiety levels, satisfaction with pain management, postoperative ratios of failed attempts and doses delivered on Patient Controlled Analgesia (PCA) and the length of hospital stay following a first episode of cardiac surgery. The design of this study and the hypotheses being investigated reflect previous research studies and findings.

Studies investigating the effects of preoperative pain education by APS for cardiac surgical patients are scant. This research is the first study conducted at this study hospital

with the aim of investigating the impact of a preoperative nurse led, anesthetist supervised, pain management education program provided by this hospital's APS. Based on this study the health professionals providing this APS service can make evidence based decisions regarding the delivery of pre operative pain management education to use in future. Other providers of small group education programs for surgical patients may benefit from the findings of this study.

1.3. Methodology

This research utilizes a quasi-experimental, multiple measures study design to investigate cardiac surgical patient's anxiety levels and postoperative pain experiences. A pilot study was undertaken to test the method and instruments. The pilot study sample was made up of 40 participants, 20 cardiac surgical patients who attended the preoperative APS education program and 20 cardiac surgical patients who did not attend the preoperative APS education. All adult patients admitted for cardiac surgery from all cardiac surgical wards were invited to participate in this research. Eighty-eight patients were approached by the researcher.

The final sample size included 80 cardiac surgical patients, 51 cardiac surgical patients who attended the preoperative APS education (intervention group) and 29 cardiac surgical patients who did not attend the preoperative APS education (control group), including the 40 cardiac surgical patients from the pilot study. Two patients refused to participate, two had preoperative complications, two had postoperative complications and two patients did not receive Patient Controlled Analgesia devices as a pain management technique. The homogeneity of the sample by collecting data only from cardiac surgical patients and maintained using the inclusion and exclusion criteria presented on page 70.

1.3.1 Instruments

The aim of this study was to establish the impact of the preoperative pain management education program by Acute Pain Service on the pain outcomes of cardiac surgical patients.

Four main instruments were used for data collection;

1. Demographic Data form (Appendix A)
2. State-Anxiety Questionnaire (Appendix B)
3. American Pain Society In-patient Outcome Questionnaire (Appendix C) and the
4. Patient Control Analgesia Observation Chart (Appendix D)

The *Demographic Data Form* was used by the investigator to collect personal details about the participants for example gender, age and education levels.

The *State-Anxiety Questionnaire* is a 20-item self report scale that assesses an individual's perception of an associated stress, for example imminent surgery. The State-Anxiety Questionnaire was derived from the State-Trait Anxiety Inventory (STAI) (Spielberger, 1983). The State-Anxiety Questionnaire consists of 20 statements on a 4-point scale and is used to assess momentary or situational anxiety (Spielberger, 1983). Each item in the State-Anxiety Questionnaire is given a weighted score of 1 to 4. To obtain scores for the State-Anxiety Questionnaire, the weighted scores for the 20 items were added. Possible scores range from a minimum of 20 to a maximum of 80 (Spielberger, 1983). Higher scores indicate higher levels of the anxiety. The aim of the questionnaire is to provide a weighted score on "how the person feels right now" (Calvin and Lane, 1999). The State-Anxiety Questionnaire was completed preoperatively and postoperatively to establish participant's anxiety levels.

The *American Pain Society In-patient Outcome Questionnaire* (1995) is the third instrument used in this study. To assist organizations in evaluating quality of pain management, the American Pain Society developed the patient outcome questionnaire.

The questionnaire has been endorsed by the Agency for Health Care Policy (AHCPR) (1992) and has been recommended as a tool to measure patient satisfaction with pain management. The majority of the 22 questions are scored using Likert scales while others require a yes/no response. To obtain scores for the American Pain Society In-patient Outcome Questionnaire, each 5-point Likert scale and yes responses were weighted and summed. Possible scores range from a minimum of 27 to a maximum of 89, lower scores indicated the participants were more satisfied with pain management. The aim of the questionnaire is to indicate how satisfied the participants are with their pain management and to assess the patient's pain intensity. Pearson correlations ranged from -0.08 to -0.26 and $P<0.05$ (Ward and Gordon, 1996). Reliability of this instrument has been established with prior investigations demonstrating an internal consistency of Cronbach's alpha rating from 0.72 to 0.81 (Bostrum et al., 1997, Calvin and Lane, 1999). This instrument was used to establish participant's satisfaction with pain management during the post operative interview on day four or five.

After the pilot study was conducted, it was found that many patients were satisfied with pain management; even patients experiencing high levels of postoperative pain were very satisfied with the pain management they received. Similar findings (high levels of pain accompanied by high satisfaction) have been obtained by other investigators (Ward and Gordon, 1994). In an effort to establish a clear relationship between satisfaction with pain management and pain severity, questions 6 to 16 were added to the American Pain Society Inpatient Outcome Questionnaire for the main study. These questions asked patients specific satisfaction questions related to medications and the cares provided by nurses and doctors. These questions were weighted and summed to calculate a satisfaction score. For example, patients were asked "Was the level of pain you experienced what you expected?" the additional questions were included to examine differences between patient's expectations and experiences. The reliability of the instrument was maintained by using additional questions that were similar to those from previous studies (Ward and Gordon, 1996). Satisfaction's scores and American Pain Society Inpatient Outcomes total scores did not differ when assessed during the pilot and

during main study. Patients maintained low American Pain Society Inpatients Outcome scores and therefore high satisfaction throughout the study.

The *Patient Controlled Analgesia (PCA) Observation Chart* is used by health care professionals at the study hospital. Patient Controlled Analgesia is provided to most cardiac surgical patients at the study hospital as postoperative pain relief. The number of failed attempts is determined by the number of times the patient pushes the demand button attached to the PCA device to self administer analgesia but still within the lockout time. The lockout time (usually 5 minutes) is prescribed by the anesthetist after surgery to prevent patients from overdosing on narcotic analgesia. Deliveries are the number of times the patient pushes the demand button to successfully self administer prescribed doses of analgesia outside of the lockout time. This information was stored in the central processor of the PCA device as history data. Nursing staff routinely assess the devices history along with pain intensity every two to four hours in order to establish if the patient is receiving effective pain management. The documentation of demands and deliveries by nursing staff was recorded on the patients PCA Observation Chart. Ellis, Blouin and Lockett (1999) established the importance of the relationship between the number and patterns of attempts to self administer analgesia with average pain intensity scores. The reliability of the instrument has been between the pain intensity scores and the number of failed attempts for the first 24 hours ($r = 0.74$, $p < 0.000$). This data was collected for the study after patients were discharged from the hospital.

Pain assessment is performed 2 to 4 hourly in conjunction with the routine inspection of the PCA device. Nurses ask patients to self report their pain intensity by identifying a number between ‘0 and 10’ with verbal endpoints such as 0 indicating no pain and 10 indicating worst possible pain that reflect the patients current level of pain. During the routine assessment of patients self reported pain intensities and PCA device history, nurses also record the total amount of analgesia consumed in total milligrams measured (Morphine) or micrograms measured (Fentanyl). Data were collected from the PCA Observation Chart after the participants were discharged from the hospital.

In summary, using these four main instruments addressed the research hypotheses which reflected key concepts of pain levels, anxiety and satisfaction as noted by the jointly published 'Report of Working Party on Pain after Surgery' from the Royal College of Surgeons in England and the College of Anaesthetists in September (1990).

1.3.2. Data collection process

1.3.2.1. Recruitment of participants

The cardiac surgical patients who attended the APS education session (intervention group) and the cardiac surgical patients who did not attend the APS education session (control group) were both recruited on the night before surgery by the investigator who provided each potential participant with a participant information sheet (Appendix E) and consent form (Appendix F). Cardiac surgical patients were invited to participate if they meet the inclusion criteria and agreed to participate. The inclusion and exclusion criteria are documented on page 70. The pilot study confirmed the feasibility of the method. Power calculations were established based on the pilot results. The method adopted in the main study was identical to the pilot with two exceptions; the inclusion of a shorter version of the American Pain Society Inpatient Outcome Questionnaire to the preoperative interview and questions 6 to 16 were added as discussed earlier in this chapter.

1.3.2.2 Phase I Pre-operative interview

The consenting participants were interviewed by the researcher the night before surgery. Cardiac surgical patients from both groups were asked to complete a *Demographic Data Form* during the first interview. The participants were asked their age, gender, education levels, income and nationality. They were then asked to complete a *State-Anxiety (S-Anxiety) Questionnaire*. This established the participant's preoperative level of anxiety. Two participants declined to participate in the research. The details of the small number of people who refused to participate were not included in this research.

1.3.2.3 Phase II Post operative interview

Cardiac patients who consented to remain in the study and continued to meet the inclusion criteria were visited by the researcher on the fourth or fifth day after surgery at a time convenient to the patient. Participants were asked to complete the *State-Anxiety Questionnaire* and the 14-item *American Pain Society In-patient Outcome Questionnaire*. The State-Anxiety questionnaire was repeated post operatively to establish participants post operative anxiety levels. The American Pain Society In-patient Outcome questionnaire established self report pain levels using a visual analogue score (VAS) and satisfaction with pain management.

1.3.2.4 Phase III Post discharge data collection

After patients were discharged further data were collected. The researcher collected data from the PCA observation charts, medication charts, theatre reports and patients' medical notes after the consenting participants were discharged. Permission to access patient's charts was granted via the study hospitals ethics committee and the Director of Medical Records. The PCA Observation Chart is used to record PCA data, self reported pain levels and analgesia consumed for the first two days following surgery. Data collected from medication charts recorded all analgesia provided for the entire post operative period. During surgery anaesthetist record the total amount of analgesia a patient receives on the theatre report. The length of stay for each participant was recorded in their medical notes and collected after participants were discharged.

In summary, data were collected from participants in three stages; the night prior to surgery preoperative anxiety scores and a one off pain intensity score were obtained, day 4 or 5 postoperatively a postoperative anxiety score, pain intensity score and satisfaction with pain management score were obtained from interviews with the participants and following discharge information regarding multiple measures of pain intensity, analgesia consumed, bolus doses and failed attempts on the Patient Controlled Analgesia and length of hospital stay was collected from chart audits.

1.4. Data Analysis & Results

Six hypotheses guided this research. Research questions were formulated in order to guide data collection and analysis. An overview of how data was collected for each hypotheses and analysis of results are presented in this section.

The research question: do cardiac surgical patients who attended the APS education have the same general demographic characteristics as the cardiac surgical patients who did not was addressed. This question was addressed to ensure assumption of homogeneity was met and both groups had the same demographic characteristics to reduce any possible confounding effects.

The Demographic Data Form devised by the research team was used in this study to collect personal characteristics such as age, gender, income, education completed and nationality of each participant. This data were collected during the preoperative interview by the researcher. The data were entered into SPSS. Numerical frequencies were calculated both groups.

Of the participants who received Acute Pain Service (APS) education 65% were male and 35% female. Of the participants who did not receive the APS education 90% were male and 10% were female, the education competed was different for the two groups, 33% of cardiac surgical patients who attended APS had completed tertiary education compared with only 17% of cardiac surgical patients who did not attend APS competing tertiary education. The research results indicated that the demographic data was not evenly distributed between the two groups. Therefore, these result indicated gender and education completed were factors that required consideration in the final analysis.

The first hypothesis investigated was;

> Cardiac surgical patients who attended the structured pre-operative education from the clinical nurse specialist from the Acute Pain Service (APS) will ***report less average postoperative pain scores*** than cardiac surgical patients who did not attend the APS education.

The following research questions were addressed:

1. Is there a difference in average pain levels on the day of surgery (Time 1) for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS education program?
2. Is there a difference in average pain levels on the first day after surgery (Time 2) for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS education program?
3. Is there a difference in average pain levels on the second day after surgery (Time 3) for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS education program?
4. Is there a difference in average pain levels on the fifth day after surgery (Time 4) for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS education program?

In order to answer research questions 1, 2 and 3 the data was collected from the PCA observation charts after patients were discharged from hospital. In order to answer research question 4 the researcher asked the participants to complete a Visual Analogue Score during their postoperative interview which occurred four or five days after surgery. This was completed as part of the American Pain Society Inpatient Outcome Questionnaire. The collected pain scores were entered into SPSS. The mean score for each participant were calculated for time 1, time 2, time 3 and time 4. Descriptive statistics were calculated for the two groups. One-Way Analysis of Variants (ANOVA)

was used to calculate mean differences in pain levels between both groups at each time point. The results indicated unbalanced numbers of females to males and completed education between both groups. The characteristics of gender and education completed did not meet the statistical assumption homogeneity of variances and could not be used as co-variants. Therefore gender and education completed were entered into the factorial analysis but found not to give different results. The findings show that pain levels for cardiac patients from both groups were reduced over time. However, the results indicated no statistical significant differences between the two groups in relation to average pain levels; therefore the first hypothesis was not supported.

The second hypothesis investigated was that;

> Cardiac surgical patients who attended the structured pre-operative education from the clinical nurse specialist from the Acute Pain Service (APS) will ***consume less average postoperative analgesia*** than cardiac surgical patients who did not attend the APS education program.

The following research questions were addressed:

1. Is there a difference in the average amounts in micrograms of Fentanyl, milligrams of Morphine or grams of Panadol consumed on the day of surgery (Day 0) for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?
2. Is there a difference in the average amounts in micrograms of Fentanyl, milligrams of Morphine, grams of Tramadol or grams of Panadol (paracetamol) consumed on the day after surgery (Day 1) for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?
3. Is there a difference in the average amounts in micrograms of Fentanyl, milligrams of Morphine, grams of Tramadol or grams of Panadol (paracetamol) consumed on the day of surgery (Day 2) for cardiac surgical patients who

attended the APS education compared with cardiac surgical patient who did not attend the APS program?

4. Is there a difference in the average amounts in micrograms of Fentanyl, milligrams of Morphine, grams of Tramadol or grams of Panadol (paracetamol) consumed on the day of surgery (Day 4/5) for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?

The researcher collected information regarding consumption of analgesia from chart audits following discharge of participants. The analgesia consumed data were entered into SPSS. The mean amount of opioid analgesia (Fentanyl and Morphine) for each participant on the Day 0, Day 1, and Day 2 was calculated. The mean amounts of paracetamol for each participant were calculated for Day 0, Day 1, Day 2 and Day 5. Tramadol has the same mode of action of opioids and therefore is not administered on the day of surgery when patients are receiving PCA analgesia. From the second day following surgery patients PCA are discontinued and Panadol (paracetamol) and Tramadol are administered as oral analgesia. Descriptive statistics were calculated for both groups. One-Way ANOVA was used to calculate any mean differences in the amount of analgesia consumed between the two groups. Gender and education completed were built into factorial design but found not to give different results for the two groups.

The results indicated the amount of analgesia consumed decreased overtime however, the mean differences in the amount of analgesia (Morphine, Fentanyl, paracetamol and Tramadol) did not differ between both groups being investigated. The results indicated no statistical significant differences between the both groups in relation to average consumption of analgesia; therefore the second hypothesis can not be supported.

The third hypothesis investigated was that;

> Cardiac surgical patients who attended the structured pre-operative education from the clinical nurse specialist from the Acute Pain Service (APS) will ***report less average pre and postoperative anxiety scores*** than cardiac surgical patients who did not attend the APS education program.
>
> The following research questions were addressed:
>
> 1. Is there a difference in average pre operative anxiety scores for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?
> 2. Is there a difference in average post operative anxiety scores for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?

Participant's State-Anxiety levels were collected preoperatively and postoperatively using the State-Anxiety Questionnaire. The 20-items were summed for each participant in order to calculate an individual State-Anxiety score. The means, medians, standard deviations and ranges were calculated for both groups. The t-test was used to calculate any mean differences in preoperative anxiety levels between the two groups. Preoperative and postoperative average anxiety scores for both groups were also calculated. The results indicated preoperative average anxiety scores were similar between the both groups being investigated. Both groups had reduced postoperative average anxiety scores however; both groups' postoperative anxiety scores were similar. The findings indicated no statistically significant differences between both groups in relation to average preoperative and postoperative anxiety scores; therefore the third hypothesis can not be supported.

The fourth hypothesis investigated was that;

> Cardiac surgical patients who attended the structured pre-operative education from the clinical nurse specialist from the Acute Pain Service (APS) will ***report higher average satisfaction scores regarding post operative pain management*** than cardiac surgical patients who did not attend the APS education program.

The following research questions were addressed:

1. Is there a difference in average American Pain Society In-patient Outcome Questionnaire Scores for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?
2. Is there a difference in average satisfaction scores post operatively for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?

During the postoperative interview participants were asked the American Pain Society In-patient Outcome Questionnaire. The American Pain Society In-patient Outcome Questionnaire measures satisfaction with postoperative pain management. Items from the questionnaire were summed for each participant and satisfaction scores were calculated using SPSS. The mean, median, range and standard deviation were also generated. The data were further analyzed using t-test.

The overall average American Pain Society Inpatient Outcome scores and satisfaction scores related to pain management for both groups were calculated. This study found that the majority of patients reported high levels of overall satisfaction with pain management. However, there were no mean differences or no statistical significant differences in American Pain Society Inpatient Outcome Questionnaire scores or satisfaction scores between both groups being investigated; therefore the fourth hypothesis can not be supported.

The fifth hypothesis investigated was that;

> Cardiac surgical patients who attended the structured pre-operative education from the clinical nurse specialist from the Acute Pain Service (APS) will ***make fewer ratios of self-administered boluses and failed attempts on the Patient Controlled Analgesia device post operatively*** than cardiac surgical patients who did not attend the APS education program.
>
> The following research question was addressed:
>
> 1. Is there a difference in average ratio of self-administered boluses and failed attempts on the Patient Controlled Analgesia device post operatively for cardiac surgical patients who attended the APS education compared with cardiac surgical patient who did not attend the APS program?

The PCA observation chart is completed postoperatively for all cardiac surgical patients who receive PCA's. The number of failed attempts and number of demands of analgesia are recorded from the PCA device's history. The investigator collected the data from the PCA observation charts from consenting participants after they were discharged. This information was collected and entered into SPSS. The mean, median and standard deviation were calculated using the ratios of the number of failed attempts and number of deliverers on the PCA for each participant. The results from the two groups were compared. The t-test was used to detect any statistically significance differences in the ratios of self-administered bolus doses and failed attempts on the PCA for both groups.

The results indicated no statistically significant differences between the two groups in relation to average ratios of the number of failed attempts and number of deliveries on the PCA; therefore the fifth hypothesis can not be supported.

The sixth hypothesis investigated that;

> Cardiac surgical patients who attended the structured pre-operative education from the clinical nurse specialist from the Acute Pain Service (APS) will ***have a shorter average length of hospital stay*** than cardiac surgical patients who did not attend the APS education program.
>
> The following research question was addressed:
>
> 1. Is there a difference in average length of hospital stay for cardiac surgical patients who attended the APS education compared with cardiac surgical patients who did not attend the APS program?

The length of stay for each participant was collected from their medical records by chart audit following discharge. The data were entered into SPSS. The mean, median and standard deviations were calculated. The t-test was used to analyze any statistically significance differences between both groups in regard to the average length of hospital stay. The results indicated no statistical significant differences between the two groups in relation to average length of hospital stay; therefore the sixth hypothesis can not be supported.

In summary, the results indicate no statistically significant differences between both groups in relation to most demographic data, pain levels, analgesia consumed, anxiety levels, satisfaction with pain management, self-administered and failed attempts on PCA's and length of hospital stay. Therefore, the hypotheses can not be supported and the null hypotheses were accepted. The significance of these findings is discussed in detail in Chapter 5.

1.5. Ethical Considerations

This study was granted ethical approval from The Prince Charles Hospital and Queensland University of Technology. All patients approached were informed of their

right to refuse to participate or to withdraw from the study at any time without penalty. This study did not alter the treatment or care provided by the hospital. All patients were provided with the usual standard of education and care. All participants in this study were informed of the risks and benefits and provided written consent. Confidentiality was maintained and completed questionnaires and forms stored in accordance with NHMRC guidelines.

1.6. Outline of the thesis

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1.7. Definitions

The definitions used to inform this research are:
Pain is defined in this study as "whatever the person says exist whenever he/she says it does" (McCaffery, 1968 p 95) as well as "unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (Merskey and Bogduk, 1994 p 210).

Seligman (1975 p 112) calls fear "a noxious emotional state that has an object" and anxiety "the chronic fear that occurs when a threatening event is in the offing but is unpredictable".

Suffering can be defined as "the state of severe distress associated with events that threaten the intactness of the person" (Cassel, 1982 p 639).

Originally Knowles (1980 p 43) defined andragogy or Adult Learning Theory "as the art and science of helping adults learn in contrast to pedagogy as the art and science of teaching children or a model of assumptions about learning" and currently Knowles (1998 p 124) has defined adult learning "as the process of adults gaining knowledge and expertise.

Education is defined originally by Knowles (1980 p 41) "as a lifelong process of continuing inquiry" and revised in recent years by Knowles (1998 p 10) "as an activity initiated by one or more agents that is designed to effect changes in the knowledge, skills and attitudes of individuals, groups or communities.

Learning emphasizes the persons in whom the change occurs or is expected to occur (Knowles, 1998 p 10). "Learning is the act or process by which behavioural change, knowledge, skills and attitudes are acquired" (Boyd et al, 1980 p 100-101).

The joint report in September (1990) by the Royal College of Surgeons of England and College of Anaesthetist recommended Acute Pain Service programs to include multidisciplinary teams with specific staff and resources to provide a framework in which postoperative pain can be managed more effectively.

1.8. Conclusion

The aim of this current study was to compare the pain experiences of cardiac surgical patients who attended preoperative education program provided by the Acute Pain Service with cardiac surgical patient who did not attend the APS preoperative education program. Pain levels, analgesia consumption, preoperative anxiety, bolus doses and failed attempts on PCA and length of hospital stay for patients from both groups were measured.

Pain is a complex phenomenon and a very personal experience that cannot be shared with others (McCaffery and Beebe, 1989). The surgical procedure causes physical damage to

pathways resulting in the physical aspects of pain (Ferguson, 1992). Once the pain impulses reach the brain the psychological aspects of pain are produced (Puntillo, 1990). Individuals interpret and perceive pain based on their own experiences. Due to the uniqueness of each person this is the point at which pain becomes different (Ferguson, 1992). Traditional pain management using pharmacological interventions can be supplemented with pre operative education programs such as Acute Pain Service.

Studies investigating APS for general surgical patients have produced positive pain outcomes (Bardiau et al., 1999, Miakowski et al., 1999, Sartain and Barry, 1999). Studies investigating preoperative education for cardiac surgical patients have reported favourable psychological outcomes in terms of mood and anxiety (Asilioglu and Celik, 2004, Cupples, 1991). However, studies investigating preoperative education for cardiac surgical patients have mixed results. Many researchers suggest applying the principles of Adult Learning Theory to specialized preoperative education programs such as pain management APS programs is well suited to the cardiac surgical population (Mirka, 1994, Palazzo, 2001). There are few studies investigating APS education programs for cardiac surgical patients. This study found no statistically significance differences in mean pain levels, mean analgesia consumed, mean anxiety scores, mean ratios of bolus doses of analgesia and failed attempts on PCA, mean satisfaction with pain management scores and mean length of stays between cardiac surgical patients who attended the preoperative pain management APS education program compared with cardiac surgical patients who did not the preoperative pain management APS education program. Based on these results the hypotheses were rejected and the null hypotheses accepted. These findings indicate that the APS education program at the hospital where the research was completed does not have the desired positive impact. The APS as it stands does not impact positively on the pain outcomes of this group of patients. The next chapter reviews previous studies relevant to this research.

Chapter 2-Literature Review

Chapter Two - Literature Review

2.1. Introduction

This study aimed at determining the effectiveness of the preoperative Acute Pain Service (APS) pain management program for cardiac surgical patients as provided by a clinical nurse specialist compared with cardiac surgical patients who did not attend the preoperative APS pain management education program. The literature review discusses three major issues, the first issue is the definition of pain, the second issue is the multidimensional aspects of cardiac surgical patient's pain experiences and the problems of inadequate postoperative pain control for cardiac surgical patients. The final major issue addresses in this section is pain management including strategies that incorporate pain management patient education provided by APS using Adult Learning Theory.

2.2. Pain

2.2.1. Definition of pain

Pain is an unpleasant sensation a cause of suffering. Defining the phenomenon of pain is the first step to understanding pain and pain management (Jurf and Nirschl, 1993). Pain is defined from three different perspectives; those definitions focusing on the physical aspects, those focusing on both the physical and psychosocial components of the pain experience and third group of definitions that focus on subjective experience of pain.

Acute surgical injury results in pain. Nociceptive impulses from surgical trauma are transmitted from the site of injury to the spinal cord and evoke a complex sequence of neuroendocrine physical responses (Holder et al, 1995). Medical models often reflect medico-centrism, looking for expert biological physical explanations (Johansson et al., 1999). Some definitions focus entirely on the physiological aspects of the pain experience such as Geach's (1987 p12) "the noxious stimulation of threatened or actual tissue

damage". Or "pain is primarily a signal that body tissues are being or have been injured" (Sternbach, 1986 p 1).

Pain is a complex phenomenon. Pain is a result of biochemical processes but damage to nerve pathways does not explain the entire phenomenon (Conner and Deanne, 1995). The definition by Merskey and Bogduk (1994 p 210) that pain is an "unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" describes pain in terms of physical and psychosocial aspects.

Defining pain in a purely physiological sense does not adequately address the complex interplay of psychological factors and subjective experiences of the person. Pain is defined by Fordyce (1986 p 49) as "a complex set of events involving peripheral stimulation from any of several possible modalities, the neural and cognitive processing of those stimuli, almost certainly emotional expression and ensuing behaviour". Sternbach (1986 p 1) described pain "is a highly personal variable experience that is influenced by cultural learning, the meaning of the situation, attention and other cognitive activities". The subjective nature of a person pain constitutes a major problem (McGuire, 1984) to health care professionals as there are no direct objective measures of pain sensations such as a pain thermometer (McCaffery and Beebe, 1989), the views of the person experiencing the pain are not adequately acknowledged by medically minded health professionals who dictate dose of analgesia, frequency of administration and length of treatment (Puntillo, 1990). The problem with the medical approach to pain management is that pain is a very personal experience and cannot be shared with others. No two people experience pain in the same way and although pain is a universal human experience, its exact nature remains a mystery. It is not possible to separate the mind from the body therefore pain always has physical, psychological and subjective components (McCaffery and Beebe, 1989).

The third concept in defining the pain experience is the subjective nature of pain, where the patient's expectations, perceptions and worries are the focus. McCaffery (1968 p 95) originally defined pain "as whatever the experiencing person says it is existing whenever

the experiencing says it does". Individuals experience pain in different ways; therefore, a definition needs to incorporate the subjective nature of pain.

Definitions that incorporate the subjective elements of pain encourage health care professionals to accept the view that pain is an experience not just a sensation and that patient self report of pain should be accepted even when tissue damage is not clearly evident (Watt-Watson and Stevens, 1998).

A comprehensive definition of pain addresses all concepts acknowledging a combination of the physical, psychosocial and subjective concepts associated with pain. The two definitions used to inform this research are Merskey and Bogduk (1994 p 210) "pain is unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" explaining the physical and psychosocial aspects as well as "pain is whatever the experiencing person says it is existing whenever the experiencing person says it does" by McCaffery (1968 p 95) explaining the subjective aspects of pain.

2.2.2. Cardiac Surgical Patients Pain

Pain is a complex phenomenon (Blakely and Page, 2001) and has multidimensional aspects. Pain impulses travel up the spinothalamic tract to the brain to produce the three components of pain: the physical sensation of pain, the psychological response to pain and the subjective behavioural aspects of pain (Jurf and Nirschl, 1993).This section discusses physical, psychological and subjective aspects of the cardiac surgical patient's pain experience.

The physical aspects of pain involve the actual tissue and nerve damage that occurs during surgery. The psychological responses include the stress responses such as anxiety and the concept of suffering produced once the pain impulses reach the brain. Suffering can be defined as "the state of severe distress associated with events that threaten the intactness of the person" (Cassel, 1982 p 639). Suffering occurs when an impending destruction of the person is perceived, and continues until the threat of disintegration has

passed or until the integrity of the person can be restored in some manner (Sternbach, 1986). The subjective response to pain is the point at which the person perceives and interprets the pain; this is the point at which pain becomes different for each person. The subjective responses of pain are based on their individual experiences and consists of social elements such as sociocultural background, values, environment, motivation, age, gender and personality (Ferguson, 1992).

PHYSICAL ASPECT

The pain of surgery begins with the incision that causes tissue damage. The resultant damage activates nociceptors, present in the skin and the underlying tissues (Heffline, 1990). Nociceptors produce the sensation of pain. Cardiac surgery involves many pain sensitive structures most commonly a median sternotomy with invasion of subcutaneous muscle and visceral tissues and grafting procedures involving several sites. For example many patients receive an internal mammary artery (IMI) graft that requires manipulations and retraction of the sternum and electrocautery to dissect the artery from the chest wall all of these procedures can result in reports of moderate to severe pain (Watt-Watson and Stevens, 1998).

PSYCHOLOGICAL ASPECT

Pain is often a stimulus for psychological stress responses such as agitation, restlessness and anxiety. Seligman (1975 p 112) defines anxiety as ‘a chronic fear that occurs when a threatening event is in the offing, but is unpredictable’. The emotions of anxiety and suffering are produced once the pain impulses reach the cerebral cortex (Heffline, 1990). Patients cared for in intensive care units reported that pain was their greatest worry (Cullen et al., 2001).

The relationship between pain and anxiety are cyclic in nature with pain and anxiety exacerbating each other. Anxiety is associated with higher pain intensity (Cullen et al., 2001). Anxiety may contribute to pain perception by activating pain pathway resulting in

the need for psychological support (Cullen et al., 2001). Anxiety, depression, sleep disturbances and distress have been found to increase the patient's perception of pain (Van Dalfsen and Syrjala, 1990). It is not unusual for cardiac surgical patient to be anxious, given the severity of their illness, the environment of intensive care and the complex treatments they undergo (Cullen et al., 2001).

SUBJECTIVE ASPECT

The cardiac surgical procedure produces the physical aspect of pain and the psychological state of the individual influences his or her perception of pain. The individual's subjective perception is the point at which the person becomes aware of the pain and does not depend solely on the degree of physical damage (Carr, 2001). Each individual perceives and interprets pain based on his or her individual experience and it is at this point that pain becomes different for each person (Lerch and Park, 1999).

A person's beliefs and value systems will influence how they respond to questions regarding pain. Studies have shown that many patients wait to request pain medication until their pain is severe, having expected that nurses will know that they were in pain (Jurf and Nirschl, 1993). Individuals identify and give meaning to their pain using social elements such as environmental, sociocultural background, motivation, age, gender, fears, expectations and personality (Ferguson, 1992). The findings of a prospective study of two hundred consecutive adult cardiac surgical patients 121 male and 79 female found generally patients under 60 years of age reported higher pain levels than older patients, female patients report higher pain intensity than males (Mueller et al., 2000).

Culture is an important variable in determining an individual's responses to pain. Patients learn what is expected and what is accepted by their culture (Celia, 2000). Pain management may vary in relation to cultural differences. Socially acceptable means of expressions of pain and interventions of pain relief may reflect language and cultural differences for instance in the Islamic culture pain is expressed verbally, nonverbally and

with emotion. Immediate pain relief is desired and larger amount of analgesia may be required (Cullen et al., 2001).

2.2.3. Summary of Pain

The two definitions of pain adopted to guide this research are: "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" (Merskey and Bogduk, 1994 p 210) and "whatever the experiencing person says it is existing whenever the experiencing person says it does"(McCaffery, 1968 p 95). Pain is a multidimensional complex phenomenon; the combination of the two definitions incorporates the physical, psychological, subjective and psychosocial aspects of pain which provide a sound basis for pain management.

The physical aspects of cardiac surgical patient's pain experiences involve the actual tissue damage that occurs in surgery (Heffline, 1990). The psychological aspects include stress responses, anxiety and the concept of suffering (Cassel, 1982). The subjective nature of pain addresses individual interpretations of pain. The psychosocial aspects influence individual's perceptions of pain such as sociocultural. The physical, psychological, subjective and psychosocial aspects of the cardiac surgical patient's pain experience affect the meaning of pain for the individual patient (McCaffery and Beebe, 1989).

2.3. Pain Management

Postoperative pain management involves three stages. The first step in effectively managing pain involves accurate individual subjective assessment of pain status (Kwekkeboom & Herr, 2001). The second step in effective pain management is the implementation of pain relief interventions (pharmacological and nonpharmacological) (Summer and Puntillo, 2001) and thirdly the evaluation of pain relief measures (Cullen et al., 2001). The three stages will be described in this section.

2.3.1. Assessment of Pain

The gold standard for assessing pain status is the patients self report (Kwekkeboom & Herr, 2001). There are many factors that hinder good pain assessment among patients in intensive care units. Research has shown nurses have not always valued the patient's subjective reports of pain (Brunier et al., 1995, Ferrell et al., 1991). Historically, pain assessment by health care professionals was performed based on the physical overt and covert signs and objective symptoms of pain such as pallor, hypertension, dilated pupils, skeletal muscle tension, increases in respiratory rate and heart rate, nausea, weakness, prostration and loss of consciousness (Christoph, 1991, McCaffery and Ferrell, 1992a, Meinchart and McCaffery, 1983). Nurses often underrated the patients actual pain experienced. Nurses have mistrusted and disagreed with patient's reports of pain intensity levels (Watt-Watson and Stevens, 1987), not always using assessment tools, but rather implemented pain relief measures based on their own values and beliefs (Dalton et al., 1999). Nurses may not anticipate the level of discomfort resulting from increased activity after surgery (Watt-Watson and Stevens, 1998). Nurse's inadequate knowledge of pain and pain management is a barrier to effective pain relief (Brunier et al., 1995, Clark et al., 1996, Vorterms et al., 1992, Wallace et al., 1995). There are complexities of assessing pain and performing ongoing assessments of pain relief. The patient is the only authority on his/her pain (McCaffery and Beebe, 1989). Only the patient can feel the pain. The sensation of pain is completely subjective (McCaffery and Beebe, 1989).

Studies continue to report patients undergoing cardiac surgery have considerable unrelieved pain (Puntillo, 1990, Puntillo and Weiss, 1994). One study has reported cardiac surgical patients continue to report moderate degrees of postoperative pain intensity that did not diminish over the first three postoperative days (Puntillo and Weiss, 1994), these patients on average had inadequate frequencies of assessment of pain. Assessment of pain needs to be consistent with the subjectivity and multidimensional aspects of the pain experience. Variability in patients responses is not being recognized consistently by nurse as patients continue to report moderate to severe pain after cardiac surgery (Watt-Watson and Stevens, 1998).

All patients after cardiac surgery have endotracheal tubes in place this limits their ability to communicate their pain verbally and maybe a contributing factor to confirm findings that cardiac surgical patients experience considerable unrelieved pain after surgery due to reduced and inadequate pain assessment by health professionals. The ability to communicate verbally is inhibited by equipment such as endotracheal tubes, medications and illness conditions that result in altered levels of consciousness, restricted vision and limited movement (Shuldham, 2002).

In summary, cardiac surgical patients continue to report moderate degrees of post operative pain intensity; pain assessment continues to be a problem for the cardiac surgical patient (Watt-Watson and Stevens, 1998). On average cardiac surgical patients have inadequate frequencies of assessment of pain performed (Watt-Watson and Stevens, 1998). Nurses implemented pain relief measures based on their own values and beliefs (Hancock, 1996). Nurse's ratings of pain often underrepresented the actual pain experienced by patients. Nurse inadequate knowledge of pain and pain management is a barrier to effective assessment of pain. Nurses need to receive current education about frequency of pain assessment and subjective pain rating tools to better strengthen their assessment skills especially when patients have inability to verbally communicate pain intensities (Watt-Watson and Stevens, 1998).

2.3.2. Pain relief interventions

Pain relief interventions are the second stage of pain management and include pharmacological and nonpharmacological interventions (Summer and Puntillo, 2001).

Prescription and administration of analgesia is the main pain relief intervention implemented by medical staff for postoperative pain management (Summer and Puntillo, 2001). Most analgesics work by inhibiting the activation of nerve pathway fibres. The three types of analgesics used by patients participating in this study were opioids, Non Steroidal Anti-Inflammatory Drugs (NSAID) and peripherally acting analgesics.

Opioids remain the backbone of pharmacological interventions by health care professionals for the treatment of surgical pain (Summer and Puntillo, 2001). Opiates work by regulating nociceptive transmission partly due to inhibiting the chemicals and other neurotransmitters from sensory neurons. The most commonly used opioids are Morphine, Fentanyl or Pethidine (Jurf and Nirschl, 1993).

Morphine is an excellent drug for post operative pain because it alters the perception of pain at the spinal cord with resultant analgesic effect (McEvoy et al., 1995) and it reduces myocardial oxygen consumption and workload with little effect on heart rate or cardiac output (Wild, 1992). Morphine increases histamine release and vasodilatation.

Fentanyl is often the opioid of choice for postoperative cardiac surgical patient because it is rapid acting (Summer and Puntillo, 2001) loses it effectiveness quickly and has minimal haemodynamic alterations. The ability to lose it effectiveness quickly is important because of the possibility of the side-effect of respiratory depression (Summer and Puntillo, 2001).

Studies in cardiac surgical settings have found patients receive infrequent, inadequate analgesia doses or no opioid analgesia despite unrelieved pain in the first three days after Coronary Artery Bypass Graft (CABG) surgery (Watt-Watson and Stevens, 1998). Nurses inadequate knowledge of analgesia and pain experiences may contribute to this (Hancock, 1996).

Puntillo and Weiss (1994) measured analgesia administration and the magnitude of pain experienced by 60 cardiac and 14 abdominal vascular patients during the first few days. The findings of this study indicated patients received small amounts of analgesia even though their pain intensity was moderate.

A recent study of 225 Coronary Artery Bypass Graft surgical patients' compared nurses' pain knowledge and management practices to pain intensity and amounts of analgesia administered. Data was collected from 4 Canadian hospitals on the third day follow

surgery. Patients reported moderated to severe pain but only received 47% of their prescribed analgesia (Watt-Watson and Stevens, 1998). The Agency for Health Care Policy & Research (AHCPR) (1992) has reported that about half the postoperative patients suffer needlessly due to under medication. For most people, opioid analgesics are essential for the relief of moderate to severe postoperative pain the most common reason for undertreatment of acute pain is inadequate frequency of opioid administration (Summer and Puntillo, 2001).

The second main type of analgesic used for post operative patients are Nonsteroidal Anti-Inflammatory drugs (NSAID). These drugs inhibit prostaglandin synthesis by modifying nociception (Du be and Koo, 1992) the reduction of prostaglandin synthesis may also occur in other areas where prostaglandins are essential such as kidneys and gastric mucosa, therefore NSAID may result in gastric ulceration (Du be and Koo, 1992, Portenoy, 1987).

The third type of analgesic use for postoperative patients is peripherally acting analgesics such as paracetamol. These analgesics are effective in treating mild to moderate non visceral pain (Dahl et al., 1990, Ferrante, 1993). These analgesics are commonly used a few days post surgery and are not effective in treating severe pain.

The management of postoperative pain has been recognized as inadequate with researchers continuing to show a majority of patients continue to report moderate to severe postoperative pain (Abbott et al., 1992). Undertreatment of postoperative pain has been associated with negative patient outcomes such as reduced mobility, increase occurrence of complications such as thrombosis and increase in hospital stay (Dietrick-Gallagher et al., 1994).

ANALGESIA ADMINISTRATION

Analgesics can be administered using a variety of routes. Historically the administration of opioids for cardiac surgical patients by health care professionals was via intravenous

injection or infusion, intramuscular injection, rectal, oral or subcutaneous routes (Lerch and Park, 1999).

Two problems associated with these routes have been identified (Holder et al, 1995);

1. 'Peaks' and 'trough' effect, causing inadequate serum levels of the drug (Veselis, 1988). This may result in fluctuations of pain and respite, and
2. Patients required close monitoring due to the accumulating effects of the drug (Lerch and Park, 1999) and the risk of adverse side effects.

Recent advances in medical technology have provided new improved methods of delivering analgesia. These include administration via epidural injections and Patient Controlled Analgesia (PCA).

Epidural analgesia is administered via injection into the cerebrospinal fluid using a syringe pump. The epidural route is not risk free. Problems associated with catheter placement can lead to potential complications for example haemotoma, abscess, formation and cord damage (Cousins and Bromage, 1988). Continuous infusions into the cerebrospinal fluid of opioids have been found to have an accumulative effect (Lerch and Park, 1999).

Patient Controlled Analgesia (PCA) is an interactive method of pain management that allows patients to self treat their pain, usually via intravenous route or epidural route using PCA machine and a button. The PCA machine has a microprocessor that allows health care professionals to provide a prescribed dose of drug and set lockout periods to prevent misuse or overdose. In situations where patients cannot self administer analgesia the PCA machine can be programmed to supply continuous infusion of opioids and it is the nurses responsibility to administer bolus or supplementary doses. Much of the benefits of PCA therapy relates to the subjective and psychosocial aspects of pain relief (Lam et al., 2001).

PCA therapy has many advantages when compared with nurse-controlled analgesia including reliable analgesic effects, improved patient autonomy, decreased anxiety by facilitating an increased sense of control for the patient and decreases the dependence on health professionals for pain relief (Summer and Puntillo, 2001, White, 1988), flexible adjustments to individual needs and prevention of accidental needle injury among medical staff (Tsang and Brush, 1999). PCA can be programmed to provide an individualized rate and dose. This allows optimum drug titration, rapid onset of analgesia, reduced anxiety and provides a safe and efficient technique of delivering pain relief (Dubois, 1989). PCA avoids compulsory analgesia for patients who do not need it . For cardiac patients recovering from surgery, optimal analgesia can result in reduced stress, decreased duration on mechanical ventilation, lower risks of postoperative complication (Tsang and Brush, 1999).

Patient Controlled Analgesia (PCA) is often promoted as a method of pain control that increases patient's sense of control as well as providing analgesia. PCA's however are not without drawbacks. Difficulties with PCA include cost of device, patient acceptance of mechanical device, the reluctance of nursing personnel to accept, patients inability to push the button, inability to comprehend the function of the device or the desire to participate in their own care. Many studies have not found benefits in PCA use over traditional intravenous continuous infusions of opioids (Lam et al., 2001, McGrath et al., 1989).

A study investigating 69 cardiac surgical patients who received either PCA therapy or nurse-administered morphine medication reported no significant advantage in using PCA in postoperative pain scores. The data showed that the quality of pain control and pulmonary function for the first 24 to36 hours following surgery were comparable in both groups (Tsang and Brush, 1999). Another investigation conducted on 66 elective cardiac surgical patients compared PCA to nurse-controlled analgesia. This study assessed pain levels hourly using a visual analogue scale, morphine consumption, levels of sedation and respiratory rate for 24 following discontinuation of mechanical ventilation. The authors found no significant differences for pain or sedation scores. The PCA group had lower

respiratory rates and consumed significantly more morphine. The study confirmed no advantage in using PCA for cardiac surgical patients when compared with nurse-controlled analgesia.

PCA is designed to provide patients with greater control however patients continue to report moderate to severe pain factors that may contribute to lack of efficacy are inadequate knowledge of patients on how to effective use the PCA device and patients disbeliefs on using narcotics to manage their pain (Knoerl et al., 1999). Patient education is very important when PCA therapy is used as patients need to understand how when to report pain intensity and when to self administer bolus doses of medication (Tsang and Brush, 1999). Surgical patients who received teaching on how to use the PCA therapy have reported better postoperative pain control (Knoerl et al., 1999, Timmons and Bower, 1993).

In summary, the advantages of PCA include increased self control of pain for the patient, and have the potential to decrease dependence on health professionals for pain relief (Summer and Puntillo, 2001, White et al., 1980, White, 1988). In addition, the use of PCA has been found to reduce anxiety and provide a safe and efficient technique of delivering pain relief (Dubois, 1989).

Limitations have also been identified including patients lack of understanding on how to use PCA therapy, patient's reluctance to use the mechanical device and/or to take drugs. Difficulties with PCA include cost of device, the reluctance of nursing personnel to accept, patients inability to push the button, cardiac surgical patients level of consciousness, inability to comprehend the function of the device or the desire to participate in their own care. Patients expect to feel a certain amount of pain and are unlikely to seek maximize effectiveness.

NONPHARMACOLOGICAL INTERVENTIONS

Pain relief intervention can include pharmalogical and non pharmacological interventions or a combination of interventions. Although pharmacological interventions are often an essential component of an analgesia treatment plan, the benefits of nonpharmacological pain relief interventions cannot be underestimated. The aims of nonpharmacological pain relief interventions are to decrease the perception of pain by frequently focusing on interventions that promote distractions, relaxation and reduce stressful emotions such as anxiety. Preparatory information, relaxation and distraction techniques activate inhibitory systems located in the brain that result in a reduction of distress and related muscle tension (Summer and Puntillo, 2001). The Acute Pain Management Guidelines developed by the Agency for Health Care Policy and Research (AHCPR) state that patients who receive preoperative information related to pain management reported less pain and have shorter lengths of stay that patients who do not receive this specialized teaching (Agency for Health Care Policy and Research, 1992). Preparatory information given before surgery is effective in helping patients cope and manage their pain better (Knoerl et al., 1999).

Preparatory information and education in combination with PCA use can offer supplementation to analgesia pain management techniques by reducing anxiety and improving cognitive control (Barsevick and Johnston, 1990, Faucett, 1991). Patient education is very important when patients are expected to use a PCA as they need to understand how to use their machine in order to optimize medication use (Timmons and Bower, 1993). Preoperative teaching has been shown to reduce fear of the unknown, thereby decreasing stress and anxiety and assisting with control of pain (Hathaway, 1986, Lisson, 1989).

2.3.3. Evaluation of pain relief intervention

The third phase in pain management is evaluation of pain relief measures.
Pain evaluation is crucial in the process of pain management because it answers the question ‘How effective are the pain interventions?’ When patients are in pain health care

professionals must evaluate pain relief interventions to determine if we have succeeded (McCaffery and Beebe, 1989). Pain and distress in cardiac surgical patients can be monitored through systematic assessment. When communication is difficult by endotracheal tubes and/or altered consciousness it is necessary to assess pain by nonverbal communication. Effective communication between the patient and members of the heath care team regarding a patient's pain and its management is a vital element to evaluating patient's pain levels and effectiveness of pain relief interventions (Ferguson, 1992). Cardiac surgical patients self reported pain levels, administration of analgesia and provision of nonpharmacological interventions need to be accurately documented to provide relevant information to members of the health care team and provides continuity of care. This allows for necessary adjustments to pain relief interventions to meet the needs of the individual patient (Jurf and Nirschl, 1993).

2.3.4. Summary of Pain Management

Studies evaluating cardiac surgical patient's pain experiences have reported moderate to severe unrelieved postoperative pain levels. Cardiac surgical patients on average received infrequent and inadequate analgesia doses over the first three postoperative days and have infrequent assessments of pain levels performed (Watt-Watson and Stevens, 1998).

Lack of knowledge and inordinate fear by health care professionals of pain and effective management of the adverse effects of analgesia is limiting the effectiveness of pain management measures.

Modern techniques such as Patient Controlled Analgesia in theory have advantages when compared with nurse-controlled analgesia because they permit patients self control over their own pain experience. However patients lack of acceptance and comprehension of how to use PCA machines have limited its effectiveness.

Cardiac surgical patients recovering from surgery require optimal analgesia using techniques such as PCA and nonpharmacological techniques such as preoperative

education related to pain management to potentially reduce anxiety and reduce postoperative reported pain levels.

2.4. Pain Education for Cardiac Surgical Patients

Education is defined as "an activity initiated by one or more persons that is designed to effect changes in the knowledge, skills and attitudes of individuals, groups or communities" (Knowles, 1998 p 10). Learning is a phenomenon of internal change that is characterized by a flash of insight that results in behavioural change (Campbell, 1999).

Patient education is an important nonpharmacological pain relief intervention that nurses can provide in the management of postoperative pain. Some of the techniques include information sharing, patient education and relaxation techniques (Ferguson, 1992). Studies have shown that giving relevant information can minimize postoperative pain and anxiety (Davies, 1988, Richardson et al., 1994).

Patient misconceptions and lack of knowledge about pain management are significant barriers to adequate pain relief (Ward et al., 1993, Ward and Gordon, 1994).

Hathaway (1986) reviewed 68 studies using a cumulative total of 2413 general surgical patients in experimental groups and 1605 general surgical patients in control groups, endorsing the positive effect of preoperative teaching on postoperative outcomes. The sample included studies written in English where preoperative education was an independent variable with postoperative outcomes as the dependent variable. The prerequisites for the analysis were adult participants and accurate statistical analyses. The results showed that on average patients receiving any form of preoperative teaching had more positive outcomes that 67% of a similar group who did not receive teaching. The limitations of the analysis were Hathaway (1986) did not distinguish the point of measurement after surgery.

The meta-analysis of Devine and Cook (1986, p60) reviewed 102 studies focusing on how psycho-educational interventions influenced recovery, postoperative pain and satisfaction with care. The studies included in the analysis had to have an educational and/or psychological component and were admitted to hospital for elective surgery. There had to be an experimental design with experiment and control groups in the same hospital. The analysis reported the positive effects of preoperative education on postoperative pain and satisfaction.

A meta analysis of 191 studies has demonstrated increased patient education and use of cognitive behavioral interventions result in improved surgical patients' outcomes less self reported pain, less anxiety, fewer complications and shorter hospital stays (Devine, 1992). This analysis included studies where at least four subjects in each groups in the same hospital for surgery. The interventions were health care information, teaching of skills and psychological support. The limitations of the analysis were many of the studies were from unpublished United States dissertations, it does not detail individual interventions and it was not clear how long the patients were followed up after discharge and therefore the extent of the benefits or attenuated over time is not known.

Previous studies show that giving information preoperatively can minimize patients pain and anxiety postoperatively (Davies, 1988, Richardson et al., 1994). Callaghan et al. (1998) measured 30 Chinese male patients satisfaction with information, demand for analgesia and anxiety following Transurethral Resection of the Prostate during a 3 month period. The 15 men allocated to the experimental group received a pamphlet and video. The 15 men allocated to the control group watched the video alone. The subjects were visited the day before surgery and administered the Chinese State-Trait Anxiety Inventory. The patients were revisited five days after surgery and administered a repeat Chinese State-Trait Anxiety Inventory, a patient satisfaction questionnaire developed by the researchers and requests for analgesia for the 5 days following surgery were recorded. The results suggested that giving specific information reduces patient's anxiety and increases their satisfaction but has no effect on the amount of postoperative analgesia consumed. The limitations of this study were the patients satisfaction questionnaire was

not defined, the validity and reliability of the instruments was not reported, the results were not demonstrated, the sample size was small and the study could not be generalized to the whole population.

It must also be noted that contradictory research findings have also been established. A meta-analysis of 20 published studies over the past 20 years reported mixed results regarding the impact of preoperative education on a variety of patient outcomes. It focused on studies with experimental design, considered the types of educational intervention employed and the impact on patient's outcomes. The measures included length of hospital stay as well as anxiety, pain and satisfaction. The limitations included the design of the studies were not reviewed and the influence of the severity of the illness was not reported (Shuldham, 1999).

Pain management practices of adult surgical patients (8% cardiothoracic) were review and studied at two time point in a tertiary hospital in United States . Data was collected from 15 hospitals including 330 adults at time one and data collected from 373 adults two years later. Two instruments were used for the study: The Patient Survey Form and the Chart Data Form. The Patient Survey form designed to obtain patients recall of preoperative information, report of pain and satisfaction with pain management. The responses were in fixed format on Likert scales. The Chart Data Form collected demographic data, documented pain rating scores and the use of pain management interventions. The study reported significant increases in the number of patients being taught how to use a pain scale but no significant improvement were noted in pain rating scores or patient's satisfaction with pain management. Limitations included data was collected only for the first 20 hours after surgery and researchers were dependent on the hospitals to collect the data, thus less control was given to the researchers on the number of sites and the sample size.

Many studies have demonstrated the beneficial impact that preoperative instructions have on the postoperative outcomes for general surgical patients but few studies have focused specifically on cardiac surgical patients. Studies investigating the effects of preoperative

education for cardiac surgical patients have reported positive and negative outcomes in relation to the impact on postoperative patient outcomes.

A recent study consisting of 100 patients undergoing elective cardiac surgery in a Turkish hospital setting evaluated the effects of preoperative education on anxiety levels (Asilioglu and Celik, 2004). Of the 100 participants 50 were allocated to the intervention group and 50 were allocated to the control group. Patients in the intervention group received structured education according to a patient education booklet by the researchers. Patients in the control group were instructed about routine surgical procedures regarding cardiac surgery by the nurse. The anxiety levels were measure for both groups on the third day after surgery using the Self-Evaluation Questionnaire for the State-Trait Anxiety Inventory. The patients were selected for the groups by matching according to personal details. Although no statistical differences were found in state and trait anxiety scores among patients from both groups, patients in the intervention group had lower average scores than the control group. This study did not measure the patient's anxiety scores preoperatively as a baseline measurement and emergency cases were excluded from the study.

Recker (1994) collected data from a convenience sample of 111 adult patients undergoing elective cardiac surgery. The first part of an instrument designed by Grady et al. (1988) was used to collect data for this study was. This included an evaluation of preoperative teaching. The preoperative questionnaire has eight closed-ended questions focusing on patients evaluations of explanations of routine procedures such as deep breathing. Responses were converted to a 10-point Likert scale. Grady et al. (19880confirmed content validity and reliability was established of the instrument. The control patients received standard and family about routine procedures by a clinical nurse the night before surgery and a tour of the intensive care unit was included. The experimental group received preadmission preoperative instructions by a cardiac patients services specialist nurse as well as receiving a patient's education booklet The experimental groups also received the standard preoperative instructions the night before surgery. The cardiac surgical patients reported they believed that all preoperative cardiac surgical information

was important and made no difference in the perceived adequacy of the information. Limitations of this study were many the research used a single institution, nonrandom sampling procedures, 56% of the participants did not complete the study for various reasons, small sample size, patients who were emergency admission for cardiac surgery were excluded and standardized teaching plans were not included, different nurses covered the preoperative instructions which could be a potential source of bias.

A convenient sample of 50 adult coronary artery bypass patients, 25 assigned to experimental group to receive a preadmission education and 25 assigned to the control group were investigated by Rice et al. (1992) to evaluate the impact of a preadmission self instruction booklet sent 6 to 10 days prior to admission for surgery. The booklet was also used to teach patients in the control group about practical exercises performed postoperatively. The Mood Adjective Checklist was used to measure mood by a Likert 4-point scale. Preoperative performance was assessed using an Exercise checklist with nurses assessing if participants performed the exercises effectively. Total analgesia consumed was averaged for the patient's daily doses for the first three postoperative days and length of stay was recorded. Patient's performance of exercises was assessed preoperatively and patient's moods were assessed day 5 postoperatively. Patients in the experimental group performed more of the exercise behaviours, and required less teaching time following hospital admission. Postoperatively the both study groups reported high positive mood scores and did not differ from the other in terms of mood scores. No differences were found between the two groups in terms of length of stay, use of analgesia and postoperative physical activity. This study has a number of limitations including nonprobability sampling, small sample size, lack of actual measurement using for patient activities indicating potential for bias, and lack of reported reliability and validity of the instruments used.

Watt-Watson and Stevens (1998) evaluated a preadmission educational booklet on pain management outcomes for 45 coronary bypass graft surgery adult patients. Patients were randomly assigned to one of three groups at the preadmission clinic 2 to 7 days before surgery. The patients in the first group (control) received standard care including generic

hospital booklets and video on pain control, the second group received standard care as well as a pain management booklet and the third group received standard care as well as a pain management booklet and interview. The interviews were conducted at the preadmission clinic on the third and seventh day post surgery. Patient outcomes were measured using McGill Pain Questionnaire-Short Form for pain intensity scores and the American Pain Society Patient Outcome Questionnaire for satisfaction with pain management. Patients consumed inadequate analgesia and reported moderate pain scores. Patients receiving the pain management booklet requested and received more adequate analgesia. Limitations were data was collected from a single institution; small sample size and patients were only followed-up for the first 5 days post surgery.

A randomized controlled trial was conducted by Shuldham et al. (2002) of 356 adult cardiac surgical patients with 188 in the experimental group that received the intervention and 168 in the control group. The independent variable measured was the preoperative education and the dependent outcomes measures were postoperative pain, anxiety, depression and wellbeing in the first 6 months after surgery. The intervention that 188 patients received was a day of preadmission preoperative education by a multidisciplinary team of health professionals as well as receiving education on admission and throughout their hospital stay. The control group received education on admission and throughout their hospital stay. Measurement was conducted a multiple time points on entry to study, before randomization, 3 days post surgery, 6 weeks after surgery, 3 months after surgery and at 6 months. A variety of instruments was used: the SF-36 Health Status Questionnaire, the Hospital Anxiety and Depression Scale, the General Well-Being Questionnaire and a pain measurement tool. The SF-36 Health Status Questionnaire was used to measure patient's characteristics. The Hospital Anxiety and Depression Scale measured anxiety and depression and a Visual Analogue Scale measured pain intensity. There were no significant differences between the groups in the patient's outcomes of anxiety, pain, depression and wellbeing at three days and six months after cardiac surgery. There was however a significant difference in length of hospital stays with the experimental group having the longer stay. The Hospital Anxiety and Depression Scale, the General Well-Being Questionnaires were not defined and

reliability and validity were not reported. The limitations of the study were many patients did not want to travel to the hospital at later time points to continue the study and medical advances occurred during the four years the study took to complete. These results challenge the generally accepted beliefs that preoperative education benefits postoperative patient's outcomes.

In summary, many studies suggest that preoperative education for general surgical patients is beneficial. Recent findings among objective and subjective measures for preoperative education for cardiac surgical patients have mixed results. These include positive results in regards to objective measures such as length of stay as well as subjective measures such as satisfaction with pain management, anxiety and performance of exercise. However other studies investigating the effects of preoperative education for cardiac surgical patients have not reported statistical significant differences in regards to postoperative pain, consumption of analgesia, use of Patient Controlled Analgesia and length of stay. Generally recent studies investigate one form of education with another; this does not prove that preoperative education fails to benefit the cardiac surgical patient.

2.4.1. Acute Pain Service

This research investigated the impact of a preoperative pain management education program by clinical specialist nurse-led Acute Pain Service (APS) for cardiac surgical patients on postoperative pain outcomes measuring postoperative pain levels, consumption of analgesia postoperatively, preoperative and postoperative anxiety levels, postoperative satisfaction with pain management, failed attempts and deliveries on Patient Controlled Analgesia (PCA) postoperatively and length of hospital stay.

Acute Pain Service programs are available in many large hospitals around the world. The main focus of this section is to discuss Acute Pain Service (APS) programs generally and specifically the APS program where the research was conducted.

Definition of Acute Pain Service

In this research an APS is defined as a multidisciplinary team with specific staff and resources to provide a framework in which postoperative pain can be managed more effectively and in which staff and patients can be provided with up to date education regarding pain and its management (Harmer & Davies, 1998; The Royal College of Surgeons of England and the College of Anesthetists (RCSCA) (1990).

History of Acute Pain Service

Ready et al (1988) was the first to describe the concept of APS. In 1990 The Royal College of Surgeons of England and the College of Anesthetists (RCSCA) recognized the problem of unrelieved postoperative pain and jointly published the "Report of the Working Party on Pain after Surgery'. Central to the report was the recommendation that all major hospitals should establish an Acute Pain Service. Since this time the problem of acute pain has been addressed by a number of professional bodies including The Agency for HealthCare Policy and Research (AHCPR) in 1992, The International Association for the Study of Pain (IASP) in 1992, the American Pain Society, the American Society of Anesthesiologist (ASA) in 1995, the Australian and New Zealand College of Anesthetists (ANZCA) and The Australian Council on Healthcare Standards (ACHCS). Since the report by the Royal College of Surgeons & College of Anesthetists working party on pain after surgery (1990), the number of APS in the UK has dramatically increased.

Acute Pain Service Characteristics

The development of an acute pain service including anesthesiologists, surgeons and nurses can promote consistent standards of safe and effective care and should be used as a framework to individualize treatment. The concept of skilled pain specialists collaborating to provide improved post operative analgesia within the framework of an organized APS appears to be universally applicable (Rawall, 1999). APS models have been described from the US, UK, Germany, Australia, New Zealand, Switzerland and Sweden. An Acute Pain Service, multidisciplinary team approach with specific staff and

resources have been devised based on the concept that postoperative pain relief can be improved and managed more effectively by providing regular in-service training to health care professionals on optimal use of systemic analgesia, use of regular self reported pain rating tools and evaluation of pain relief interventions. The APS also provides patients with up-to-date preoperative and postoperative education regarding pain and its management.

APS has improved safety and efficiency of postoperative pain control achieved by addressing many of the misconceptions about pain control and analgesia (Frenette, 1999). APS has lead to an increased awareness of good pain management (MacKintosh and Bowles, 1997). Members of medical staff are willing to listen to advice and assessments provided by APS nurse and prescribe accordingly (MacKintosh and Bowles, 1997).

Purpose of Education by APS

The educational methods used by the APS are presented in this section. APS focuses on the subjective outcomes of postoperative pain, recovery, psychological well being and satisfaction with care provided.

Education is one of the most significant nonpharmacological strategies a nurse can use to alleviate patients acute post operative pain. Preoperative patient education decreases the patients fear of the unknown, thereby reducing his or her anxiety and assisting with the control of pain (Jurf and Nirschl, 1993). Preoperative information and education in combination with Patient Controlled Analgesia (PCA) can offer supplementation to pain management techniques by reducing anxiety and improving cognitive control .

APS programs provide education preoperatively and postoperatively to surgical patients about the use of advanced forms of analgesia such as PCA's, epidural and administration of multimodal drug therapies (Bardiau et al., 1999, MacKintosh and Bowles, 1997, Sartain and Barry, 1999). Preoperative education about PCA's is very important as

patients need to understand how to use the machine in order to optimize the use of analgesia (Timmons and Bower, 1993).

APS programs provide guidelines, protocols and standing orders for healthcare professionals on the safe use of advanced methods of analgesia (Bardiau et al., 1999, MacKintosh and Bowles, 1997, Miakowski et al., 1999, Sartain and Barry, 1999).
In theory for an APS program to be effective in educating adult surgical patients about pain management the principles of Adult Learning Theory must be adhered to.

2.4.2. Adult Learning Theory

Education is defined as initiated by one person and designed to effect changes in knowledge, skills and attitudes of the individual. Adult education is a cognitive process influenced by a variety of elements such as prior learning, learner attitudes and beliefs about the source, content, topic and mode of presentation as well as the state of the learner. The Acute Pain Service personalized patient education program for cardiac surgical patients in conjunction with the principles of Adult Learning Theory recognizes the internal motivation that exists with cardiac surgical adult learners. The effective use of the principles of Adult Learning Theory to guide the APS program would affect changes in knowledge of pain relief techniques; improve skills and attitudes that are necessary to meet the cardiac patients need for improved quality of life and reduction of postoperative pain.

Principles of Adult Learning Theory

Adult Learning Theory principles are grounded in theories that stem from many disciples including education and psychology (Palazzo, 2001). Knowles (1980) defined four basic assumptions of adult learners included in *The Modern Principles of Adult Learning*.

The theories of adult learning must be considered when scheduling preoperative teaching. Knowles (1980) theory takes into account the premise that adults need to be self directed and have a rich reservoir of experience as well as the desire to apply new knowledge and

skills immediately. Adult learners also need learning experiences to coincide with problems or developmental tasks. An event such as cardiac surgery affects an adult's readiness to learn. The implications for practice, in relation to addressing readiness to learn and establishing a climate conducive to adult learning, are to design learning experiences of a problem and to attend to the psychological atmosphere. Delaying preoperative teaching until the day of admission has the potential to heighten anxiety. Highly anxious patients have decreased ability to learn (Recker, 1994). According to Knowles (1980) adults need to know why they need to learn something before undertaking to learn it. Thus it would be appropriate to educate cardiac surgical adults to understand why theory needs to learn about pain management techniques than just presenting the bare facts on pain management.

Adults are self directed

Knowles (1980) theory takes into account that adults learners are responsible for making independent and informed decisions and resent others making them for them (Palazzo, 2001). Patients are increasing self directedness but at different rates for different people and at different dimensions of life (Knowles, 1980). Adult learners take initiative for their own learning. Self directed learning involves a change in attitude and behaviour which benefits the person. According to Knowles (1990), adult learners have a concept of being responsible for their own decisions and resent others telling them. Information for cardiac surgical patients should take this principle into account and analgesia, visual analogue and PCA devices should be presented in a manner that takes this principle into account. According to Mirka (1994) the more the cardiac patient is involved in the planning of their own learning, the more likely it is that the goal of adult learning will be attained. Empowering the cardiac patient in this way could foster the development of self-directed learning skills that would be more useful to the patient. The APS education model for cardiac surgical patients focuses on the physical aspects of diseases and pain and education providers decided how much information, what information was relevant and how much detail they would provide. Interventions that support the concept of self-directed care and a greater sense of control include Patient Controlled Analgesia (PCA)

and preoperative individual education (Shade, 1992, Tighe et al., 1998). Providing adult learners with information pamphlets or booklets reported increased satisfaction and reduce anxiety (Callaghan et al., 1998, Derham, 1991). Strategies that apply the concept of adults are self directed are interactive internet sites, preoperative Intensive Care visits, self-directed booklets and videotapes can be developed to meet cardiac surgical patient's needs and increase participation in health education activities.

Adults have many and varied experiences

Patients previous experiences influence not only adults perceptions of events but the utilization of specific coping resources and problem solving skills (Mirka, 1994). All adults have a great deal of life experience. Thus it is important to ascertain the perception of the cardiac patient's previous experiences with acute illness situations, pain experiences, history of problems with pain and their available resources. This information can be helpful to the health care professional caring for the patient and for the Acute Pain Service nurse to identify a deficit in learning needs. Ignoring previous experiences or rejecting patients perceptions may be a potential barrier to identify individual learning needs of the adult and ultimately may be interpreted as a rejection by the learner. Experiences also shape adults beliefs, attitudes and values influencing the learning process. Walmsley et al. (1992) examined the effect that previous pain experiences had on the expectations of postoperative pain. The study involved 101 patients aged between 55 to 87 years old. The authors found two variables that correlated significantly with pain expected postoperatively: a single item from the General Attitude Questionnaire that is pain is expected after surgery even with medication and the ratings of past pain experienced. The results of this study suggest that a proportion of the expectation of pain may be accounted for by asking patient about their prior pain history.

Acute Pain Service education programs according to the principle that adults have many varied life experiences and need to incorporate relevant information geared to the cardiac patient. Group leaders need to invite comments, discussion and participation of individuals by involving small groups. This encourages involvement of family members,

sharing of personal stories and exchange of information, opportunity for questions and creates a positive conducive learning environment.

Adults become ready to learn when they experience the need to know

Using a descriptive survey, Watts and Brooks (1997) examined the preoperative information which patients described they needed to know prior to admission to intensive care where they were admitted following elective surgery. The majority of the 69 participants stated preoperative information about the management of pain and likely source of pain is of value. According to Knowles (1990) adults are ready to learn if the information can be applied to real life situations. Adults need to feel that learning has immediate utility and focuses on issues directly concerning them. Adult learners need to expect performance improvement as a result of their learning and need to anticipate how they will use the information. Adult cardiac surgical patients need to understand why pain management is important to them to before they are willing to learn (Palazzo, 2001). Cardiac surgical patients are usually quite eager to learn because they have an intense need to know changes that may improve their quality of life (Palazzo, 2001).

Specialist pain nurses provide information about pain management that is likely to pertain to a real life situations and applies directly to the cardiac surgical patients, for example PCA's, self-reporting of pain, splinting of wounds or other pain relief measures specific to their critical illness (Palazzo, 2001). Patients need to understand why they need the information prior to surgery and to be informed about sensations they are likely to experience and information about side effects and analgesics (Palazzo, 2001). Watts and Brooks (1997) identified that critical care patients want simple information relevant to management and likely site of pain.

Adults are life, task or problem centred and motivated by internal self esteem, recognition of better quality of life.

Knowles (1990) identifies that the orientation of the adult learner is problem centred. Specifically the author states that adults are motivated to devote energy to learn something to the extent that they perceive will help them perform tasks or special skills to deal with real life situations (Knowles, 1990). Motivation is at the core of why adults behave as they do (Campbell, 1999). The main influences on motivation and learning are within the participants themselves (Campbell, 1999). Motivation depends on multiple factors both personal and situational (Campbell, 1999). Therefore the task of APS education programs is to frame information regarding pain management so that the cardiac patient can recognize it as useful and applicable to their unique perspective and real life situation. For cardiac surgical patients it has been recognized that the internal motivation exists to improve quality of life (Mirka, 1994)and reduce pain after surgery (Recker, 1994). However as demonstrated through the review of the study hospital APS (see section below) internal motivation has not been utilized in conjunction with the other principles of adult learning in personalizing patient education program.

In summary, the application of all the adult learning principles to the preoperative APS would be more useful in addressing the learning needs of cardiac surgical patients than the existing preoperative program whose content is not reflecting the patient's pain management needs.

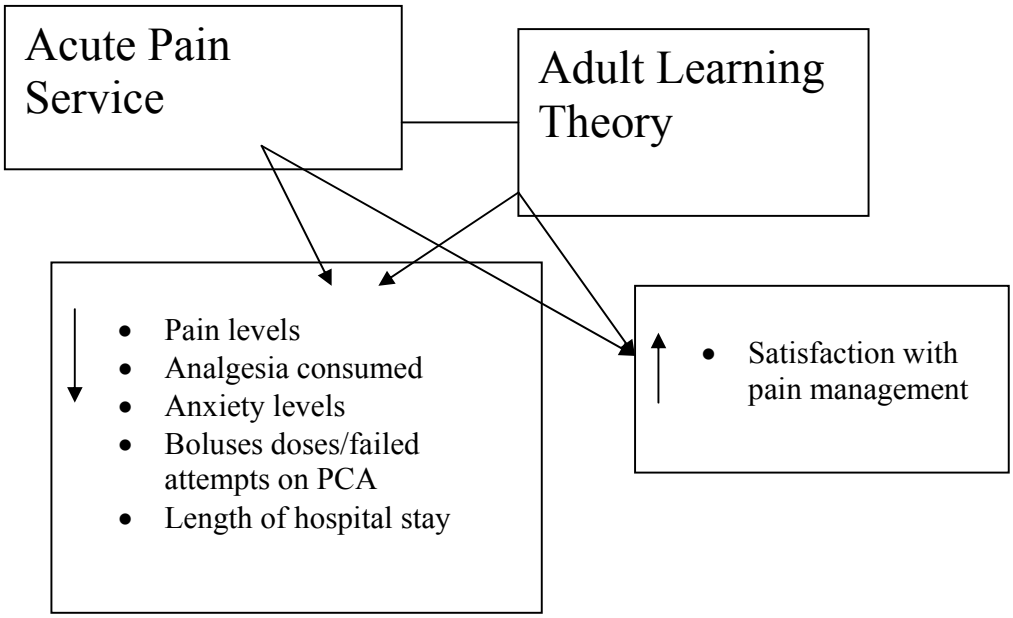

Figure 2.1 Proposed relationship patterns of independent variables and dependent variables being investigated in this study

2.4.3. Acute Pain Service at study hospital

The aims of the nurse-led APS at the study hospital are to teach patients about the importance of relieving pain, methods of treating pain, regular use of analgesia, pain assessments and education about PCA's. The APS at the hospital involved in this research has four major elements; Preoperative group pain management education, post operative individualized pain management education, supervision and liaison with Anesthetist, and health care professional education.

Preoperative education session

The aim of the study hospital's Acute Pain Service is to reduce the cardiac surgical patient pain experience and improve patient outcomes. The pre operative APS education sessions aim to teach patients about pain management techniques such as Patient Controlled Analgesia (PCA), other multimodal analgesia and the use of assessment tools such as pain scores. The structured formal education session provides information about

the Patient Control Analgesia device, pain assessment rating scales and techniques on prevention and reduction of pain.

Approximately 60 to 70% of cardiac surgical patients admitted to the hospital where the research was conducted for surgery are sent written pamphlets with their admission letter describing the PCA device as a method offered by the hospital for pain relief and booklets entitled “What to expect after open heart surgery”. In addition PCA pamphlets, education booklets along with other education resource materials are readily available in the wards.

Cardiac surgical patients are invited to attend the preadmission clinic usually two to four weeks prior to admission. The purpose of the preadmission clinic is to reduce preoperative length of stay and decrease hospital costs. Diagnostic testing such as radiographic tests, electrocardiography and pathological tests are performed at the preadmission clinic.

The Acute Pain Service (APS) is attached to the preadmission clinic. The APS specialist nurse at the hospital provides a short (10 to 15 minute) in length pre operative structured educational sessions in the mid afternoon to a large group of patients and family members (12 to 30 people) after a full day of diagnostic tests. The APS nurse decides what information the patients will receive.

During the Acute Pain Service session the APS specialist nurse instructs cardiac surgical patients and family members using short structured lectures on pain management techniques, reassurances about pain experiences, use of Patient Controlled Analgesia (PCA) including side effects, demonstration of the PCA button, use of Numerical Rating Scales (NRS) or Verbal Descriptor Scales (VDS) for assessment of the patient's pain, and use of provision of regular analgesia supplied by nurses.

Approximately 30 to 40 % of cardiac surgical patients are do not attend the preadmission clinic due to a variety of reasons such as distance needed to travel to the hospital,

Surgeons preference not to utilize APS, private patients, changes to the surgical waiting list or the limited time between the diagnosis of coronary artery disease and the requirement for surgery. These patients are currently not seen by the APS nurse. These patients receive individual preoperatively informal information about the surgical procedures from multiple health care professionals from nurses in the ward, physiotherapist, surgeons, registrars and anaesthetists.

Postoperative APS care

For the first three days post surgery the APS clinical nurse individually reviews and evaluates each cardiac surgery patient without complications from surgery in the form of daily pain rounds.

The APS clinical nurse performs history checks and resets the PCA's, demonstrates the use of PCA button, assesses pain intensity, answers any questions, evaluates pain management needs of individual patients and suggests alternative pain relief measures with nurses caring for the patient.

2.5. Conclusion

The literature reviews studies related to postoperative pain and pain management. The definitions used to guide this research are pain is an 'unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage' (Merskey and Bogduk, 1994 p 210) and 'whatever the experiencing person says it is existing whenever the experiencing person says it does' (McCaffery, 1968 p 95).

The cardiac surgical patient has three major elements to their postoperative pain experience. The surgical procedure produces physical stimulation of pain. The psychological responses are produced once the pain impulses reach the brain (Heffline, 1990) and are influenced by how a person perceives and interprets the pain (Carr, 2001). The subjective nature of pain is due to the patients past experiences and expectations of

pain (McCaffery and Beebe, 1989). The subjective nature of pain influences how the individual interprets and expresses their pain. Each unique person interprets and expresses their pain differently due to the multidimensional complex nature of pain (McCaffery and Beebe, 1989).

Pain management by healthcare professionals involves three stages, assessment, pain relief interventions (pharmacological and nonpharmacological) and evaluation of pain relief interventions. Recent advances in medical technology have provided new improved methods of delivering analgesia such as PCA and epidural injections. However, cardiac surgical patients continue to report moderate to severe amounts of postoperative pain (Watt-Watson and Stevens, 1998). A patient suffering is unacceptable and unethical (Timmons and Bower, 1993).

In theory nurses can employ nonpharmacological interventions to supplement traditional analgesia therapy (McCaffery and Beebe, 1989). Nurses spend more time with patients in pain than do other healthcare professionals (McCaffery and Beebe, 1989). Preoperative education on postoperative pain management for surgical patients can address the psychological components of pain such as reducing anxiety and improving cognitive control and address the subjective nature of pain by suggesting the patients is the best person to assess and provide effective pain management techniques (McCaffery and Beebe, 1989).

Reports investigating APS programs for general surgical patients have produced positive results in reducing patient's postoperative pain levels, length of hospital stay, analgesia consumed, bolus doses and failed attempts on Patient Controlled Analgesia device and increasing satisfaction with pain management (Bardiau et al., 1999, Harmer and Davies, 1998, Mackintosh and Bowles, 1997, Tighe et al., 1998). Studies have also reported positive outcomes for cardiac surgical patients receiving preoperative education on reducing length of hospital stay, moods scores, anxiety levels, improved knowledge and increased performance of postoperative exercises (Asilioglu and Celik, 2004, Brooks and Brunn, 1995, Cupples, 1991, Devine, 1992, Recker, 1994).

However, studies investigating preoperative pain management programs for cardiac surgical patients have reported mixed results. Some studies have not shown the significant differences in regards to postoperative pain levels, satisfaction with pain management or length of hospital stay (Rice, 1992, Shuldham, 2002, Watt-Watson et al., 2000).

For an APS program to be effective in educating adult learners about pain management the principles of Acute Learning Theory need to be applied. The principles of adult learners are; adults are self directed, have many varied experiences, are ready to learn when they have a need to know and are problem, life or task centred with internal motivation.

The aim of this study was to determine if the APS program provided at the study hospital would have the benefits reported for general surgical patients. This aim has been addressed by testing the research question. Is the study hospital APS effective in reducing pain levels, analgesia consumed, anxiety levels, bolus doses and failed attempts on PCA device and length of hospital stay and increasing satisfaction for cardiac surgical patients? The methods used to address the research questions and hypotheses are discussed in the next chapter.

Chapter 3-Methodology

Chapter Three-Methodology

3.1. Introduction

An overview of the methodology used to conduct this research is provided in this chapter. Justification for the research, the research design, instruments used, data collection processes and data analysis are also presented in this chapter.

This research was conducted in order to investigate the impact of a formal nurse-led preoperative pain management education program provided by the Acute Pain Service (APS) for cardiac surgical patients in a tertiary hospital setting. High pain levels continue to be a problem after surgery and many patients have high expectations they will experience pain (Puntillo and Weiss, 1994, Tsang and Brush, 1999, Ward and Gordon, 1994).

The Acute Pain Service (APS) being investigated in this research provides preoperative pain management education for approximately 60 - 70% of cardiac surgical patient's as part of the pre admission clinic at the hospital where the research was conducted. This research has provided the first investigation into the APS education program. Based on this study the service provider from the hospital can make evidence based decisions to improve the education provided by the APS. Other benefits of this study are potentially to inform and provide evidence to improve other small group preoperative pain management education programs.

3.2. Research Design

This research is a quasi-experimental, single blind, controlled clinical trial with multiple measures. This set out to test the null hypotheses that compared an experimental group that received an education intervention with a control group that received usual care regarding preoperative education. Ethical approval for the proposal was obtained from the hospital and university research ethics committees.

Cardiac surgical patients in the study were unable to be randomized as preadmission patient education by APS in the study hospital was already randomly offered to 60 to 70% of cardiac surgical patients. Cardiac surgical patients are randomized to attend APS by several situational factors such as distance needed to travel to the hospital, Surgeons preference to utilize APS. Cardiac surgical patients who do not attend APS are private patients excluded from APS, changes to the surgical waiting list or the limited time between the diagnosis of coronary artery disease and the requirement for surgery.

The pilot study consisting of 40 cardiac surgical patients set out to demonstrate a statistical reduction in subjective outcome measures (analgesia consumed, ratios of failed attempts with doses delivered on PCA and lengths of hospital stay) and objective outcome measures (pain and anxiety) and a statistical increase in objective measures (satisfaction). Data collected from the pilot study was used as power calculation and improve necessary changes in the study proper.

Data was collected from 20 participants in the experimental group that attended pain management education by APS, a 10 to 20 minute preadmission group discussion by an APS clinical nurse specialist, 2 to 4 weeks prior to admission to the study hospital for surgery usually the sessions were held mid-afternoon during the day long preadmission clinic. Patients were also sent a generic hospital booklet and pain management education pamphlet as part of the admission procedures. Data was collected from 20 cardiac surgical control group participants who had the individual usual, routine care which included pain management education on admission by Registrar, Surgeons, physiotherapist, nurses and anesthetist and throughout their stay by APS nurses and members of the multidisciplinary team. Pain management education pamphlets are readily available for all patients on the ward.

Measurement was conducted for both groups on entry to the study the night prior to surgery to remove possible biases. At this time each patient was given an information sheet to review and a consent form to sign. Confidentiality was assured. Patients were re-interviewed 4 to 5 days following the operation to allow time for patients to settle into

ward and concentration to return and prior to discharge. On average cardiac surgical patients are discharged 5 to 6 days following operation at the study hospital. Participant's data was also collected following discharge. A variety of instruments was used: the Demographic Data Form designed by the researcher, the State-Anxiety Questionnaire derived from the State-Trait Anxiety Inventory (STAI) (Spielberger; 1983), the American Pain Society In-patient Outcome Questionnaire, the study hospital designed Patient Controlled Analgesia (PCA) Observation Chart, Theatre Report, Medication Chart and pain measure assessment tools (visual analogue scale (VAS) & numerical rating score (NRS). Analysis was done using parametric and nonparametric statistics.

The 40 patients in the pilot study informed the main study and the pilot study data was included in the statistical analysis of the main study. This study did not in any way change the routine procedures of the clinical setting. The homogeneity of the sample was maintained by only including cardiac surgical patients in this research.

3.3. Target population and samples

3.3.1 Sample

The pilot sample consisted of 40 patients, 20 cardiac surgical patients who received the intervention and 20 patients who did not attended the Acute Pain Service (APS) education. A pilot study was used to guide the study proper.

A total of 90 patients were invited to participate in the study (40 from the pilot study). Two patients declined the invitation to participate, 2 had preoperative complications, 2 had surgery cancelled due to emergency cases, 2 had postoperative complications and 2 did not receive PCA therapy for pain relief. Ten patients were excluded from the study proper. The final sample size in the experimental group was 51 cardiac surgical patients who attended APS and in the control group were 29 cardiac surgical patients who did not attend APS education, 40 of which were used for the pilot study. This is consistent with

the study hospital's average 60 - 70% of patients who regularly receive the APS education program.

3.3.2. Inclusion Criteria

Cardiac surgical patients were invited to participate in this research if they met the following criteria:

- Patients who were about to undergo open heart surgery,
- Patients planning to use Patient Controlled Analgesia for post operative pain management,
- Aged 18 years or more,
- Able to read and converse in English,
- Able to comprehend and complete the research, and
- Able to consent on their own behalf.

3.3.3. Exclusion Criteria

The patients who were excluded from this research were those who;

- Had post operative complications and extended stays in intensive care,
- Had previous open heart surgery and were familiar with procedures,
- Were health care professionals and were familiar with PCA devices, and
- Had psychological or intellectual disabilities.

3.3.4. Recruitment of participants

Both groups of participants were recruited the night before surgery. The investigator provided an information sheet (Appendix E) and consent form (Appendix F) to potential participants to review. The study was explained to the potential participant and written consent was obtained.

The pilot study consisted of forty consecutive cardiac surgical patients that were approached by the investigator. Twenty cardiac surgical patients had attended preoperative APS and twenty cardiac surgical patients had not attended preoperative

APS. Subjective and objective measurements were collected by the instruments and analyzed.

Eighty-eight cardiac surgical patients consented to participate in this research and two cardiac surgical patients declined the invitation to participate. Of the 88 who agreed to participate, two had pre operative complications and their surgery was cancelled, two had post operative complications and could not complete this study and two did not receive PCA therapy post operatively. This resulted in a final sample of 80 participants.

3.3.5. Instruments

The validity and reliability of the four instruments used in this study to collect data are presented in this section.

Many instruments were used in this study to investigate and compare the impact of pre operative education for cardiac surgical patients on post operative pain;

1. Demographic Data Form (Appendix A),
2. State-Anxiety Questionnaire (Appendix B),
3. American Pain Society Inpatient Outcome Questionnaire (Appendix C),
4. Patient Controlled Analgesia Observation Chart (Appendix D),
5. Theatre Report,
6. Medication Chart.

The first instrument used in this study was the *Demographic Data Form*. This instrument was designed by the research team to collect the participant's general characteristics such as age, gender, nationality, education and income.

The second instrument used in this study was the *State Anxiety Questionnaire.* The State-Anxiety Questionnaire derived from the State-Trait Anxiety Inventory (STAI) Spielberger (1983) is a 20-item self report scale that assesses an individual's perception of an associated stress. Anxiety refers to at least two related, yet different constructs; they are A-State and A-Trait anxiety. A-State-anxiety (S-anxiety) relates to how a person feels

right now on a 4-point scale of increasing intensity and is used to assess the momentary or situational anxiety, this may vary in intensity and fluctuate over time. A-Trait anxiety is how a person generally feels. The State-Anxiety Questionnaire requests that subjects indicate 'how they feel at that moment' on a 4-point scale' of increasing intensity anchored by terms 'not at all' to 'very much so'. Each item in the State-Anxiety Questionnaire is given a weighted score of 1 to 4. To obtain scores for the State-Anxiety Questionnaire, the weighted scores for the 20 items were added. Possible scores range from a minimum of 20 to a maximum of 80 (Spielberger, 1983). Higher scores indicate higher levels of the anxiety. State-Anxiety (Spielberger, 1983) points calculated from the statements are defined as 0 to 19 'no anxiety', 20-39 points 'mild anxiety', 40-59 points 'moderate anxiety', 60-79 'severe anxiety and 80 points 'panic'. The aim of the questionnaire is to provide a weighted score on "how the person feels right now" (Calvin and Lane, 1999). Reliability has been established with overall mean alpha coefficients as 0.83 to 0.92 for the State-Anxiety scale (Spielberger, 1983). The State-Anxiety Questionnaire was completed preoperatively and postoperatively to establish participant's anxiety levels.

The reliability of the STAI, in terms of both stability and internal consistency (Spielberger, 1983) has been evaluated for test-retest correlations and alpha coefficients using the KuderRichardson formula. Test-retest correlation for the S-anxiety scale were relatively low, ranging from 0.16 to 0.54, indicating A-State is appropriately reflects current situational factors as expected for a measure of assessing changes in anxiety resulting from situational stress (Spielberger, 1983). The overall mean alpha coefficient has been established as 0.83 to 0.92 for the S-Anxiety scale (Spielberger, 1983). Assessment of the validity of the STAI through concurrent divergent and construct validity has been supported (Spielberger, 1983). The State-Anxiety scale has been demonstrated to be a valid instrument for measuring anxiety about stressful experimental procedures and unavoidable real-life situations such as imminent surgery, dental treatment or school tests (Calvin and Lane, 1999). Concurrent validity for the STAI has been documented by comparing the S-Anxiety scale with other anxiety inventories such as Taylor Manifest Anxiety Scale, the Zuckerman Affect Adjective Checklist and the

IPAT Anxiety scale (Cupples, 1991). Calvin and Lane (1999) have established a coefficient alpha for their study sample as 0.90 using the State-Anxiety scale to measure real life stressors such as imminent surgery.

The preoperative measurement data generated from State-Anxiety Questionnaire and the pain rating scales were used in this study to statistically control for the effect of preoperative anxiety on postoperative measures of anxiety and pain on the 4 or 5 day postoperatively.

The State-Anxiety Questionnaire has been rigorously examined and used as a measure to assess preoperative and postoperative anxiety for surgical patients by many studies (Calvin and Lane, 1999, Asilioglu and Celik, 2004, Callaghan et al., 1998, Schwartz-Barcott et al., 1994, Kain et al., 2000).

A recent study comparing the relationship between preoperative anxiety and uncertainty for STAI (Spielberger, 1983) for 106 orthopaedic surgical adult patients reported no statistically significant differences among 3adult developmental stages, gender or acuity levels by the State-anxiety questions (Calvin and Lane, 1999).

Another study evaluated the effects of preoperative teaching methods for 100 adult cardiac surgical patients using STAI (Spielberger, 1983)for measuring postoperative anxiety levels (Asilioglu and Celik, 2004). Kain et al (2000) evaluated whether psychological variables such as preoperative state trait anxiety can serve as a predictor for the postoperative pain response. The sample included 53 women undergoing elective hysterectomy surgery. Anxiety using STAI (Spielberger, 1983) were assessed at multiple time points. Path analysis demonstrated both direct and indirect effects of preoperative state anxiety on postoperative pain such that high levels of preoperative state anxiety predicts higher levels of postoperative state-anxiety also preoperative state anxiety is a significant positive predictor of immediate postoperative pain (Beta = 0.30) which in turn is a positive predictor of pain in the wards (Beta = 0.54).

The third instrument used in this study was the *American Pain Society In-Patient Outcome Questionnaire* (1995). This questionnaire was developed by the American Pain Society Quality of Care Committee (1992) to improve treatment outcomes for patients with acute and cancer pain. The original American Pain Society Patient Outcome Questionnaire has 15 items to be filled out by patients or adapted to interview questions. The items or questions may be selected or modified to suit the needs of the particular clinical settings, patient population or the intention of the survey. Alternatively items may be added if initial data suggest a need such as was confirmed by the current research pilot study. The main study included 10 questions (questions 6 to 16) devised by the research team that address specific satisfaction with pain management issues. Item 15 of the American Pain Society Patient Outcome Questionnaire related to Outpatients only and were not included in this study. The revised American Pain Society In-Patient Outcome Questionnaire is used in this study to measure pain intensity and the patients' satisfaction with their pain management. The items in this Questionnaire address both satisfaction with pain management and pain levels.

The items (questions 2 to 4) assessing pain intensity were adapted from the Brief Pain Questionnaire (Daut et al., 1983). This instrument is widely used for assessing pain and its effects on patients moods and functions and has been shown to be reliable and valid in English, Spanish and other languages (Daut et al., 1983, Daut and Cleeland, 1982, Serlin et al., 1995). The items addressing satisfaction (questions 6 to 8) are constructed as suggested by Ware et al (1983) who provided extensive evidence for the validity and reported an internal consistency for the interference scale (alpha rating= 0.92) (Ware and Hays, 1988, Ware et al., 1983).

Question 5 has been added from the Brief Pain Inventory (Daut et al., 1983) to examine whether patients pain is severe enough to interfere with sleep, walking and other functions. This question was included to address the problem that most patients report satisfaction even with reported high levels of pain. The items comprising this question have been shown to be internally consistent and valid (Serlin et al., 1995, Daut and Cleeland, 1982, Daut et al., 1983). An alternative explanation for high satisfaction scores

is patients with high levels of pain were still satisfied with the care provided by the staff therefore question 13 was added to separately address satisfaction with the overall pain treatments and questions 14 and 15 on satisfaction with the responses of the nurse and the doctors. Because studies have shown that patients in pain may be reluctant to ask for medication (Ward et al., 1993, Donovan et al., 1987) questions 17 and 21 were added to the Brief Pain Inventory. The items in question 22 were taken from the Barriers Questionnaire, a 27 item instrument that has internal consistency, excellent test-retest reliability , and content and construct validity (Ward et al., 1993). The subset of Barriers Questionnaire items included in the current consistence (alpha = 0.72) and test-retest reliability (r = 0.85) during a 1 week interval. Prior investigations using this instrument demonstrated an internal consistency of Cronbach's alpha rating from 0.72 to 0.81 (Bostrum et al., 1997, Calvin et al., 1999).

Watt-Watson et al (2000) measured pain intensity, satisfaction with pain management, interference with activities and concerns with seeking help for 45 Coronary Artery Bypass Graft surgical patients who received a preoperative pain management education program. The Cronbach's alpha was 0.71 and 0.85 for the questions derived from the American Pain Society Inpatient Outcome Questionnaire, indicating good to very good internal consistency for these measures. Several studies into acute postoperative and cancer pain have reported using the American Pain Society Patient Outcome Questionnaire (Viejo et al., 1999, Ward and Gordon, 1994, Ward and Gordon, 1996, Dawson et al., 2002). Questions 1 to 5 and 17 to 22 were summed to calculate a total American Pain Society In-Patient Outcome score for the pilot study. Additional questions 6 to 16 related to satisfaction with cares provided, were required to further investigate other possible reasons for patients reporting high levels of satisfaction and were added to the main study. These questions were summed and a satisfaction with pain management score calculated.

The fourth instrument used in this study was the *Patient Controlled Analgesia* (*PCA*) *Observation Chart*. Patient Controlled Analgesia therapy is provided to most cardiac surgical patients at the study hospital as part of their routine care. The anesthetist orders

the specific narcotic medication, the bolus doses, the maximum hourly dosage, dosage of analgesia per hour (background) and the lockout time period for each patient provided with PCA onto page 1 of the PCA Observation Chart.

The patients pain levels and PCA information is assessed 2 to 4 hourly by the nurse caring for the patient. In the initial postoperative period whilst patient have endotracheal tubes and are unable to verbalize their pain levels the nurse assesses the patients pain levels by asking the patient to indicate by nonverbal response if they have pain. The nurse initiates the PCA device by depressing the button if the patients indicate they have pain. The patient's nonverbal information is documented onto PCA Observation Chart. At the same time the total number of doses of analgesia and number of failed attempts is assessed and recorded onto the PCA Observation Chart. The reliability of the instrument has been established with Pearson product moment-correlation between the pain intensity scores and the number of failed attempts for the first 24 hours ($r = 0.74$, $p < 0.000$). Once patients have their endotracheal tubes removed. The nurse caring for the patient is able to verbally ask patients to self report their pain intensity using the Numerical Rating Scale (NRS). The NRS allows the patient to identifying a number between '0 to 10' with verbal endpoints that reflects the patient's current level of pain at regular time points. The number 0 represents no pain and 10 the worst possible pain. The 11-point numerical rating scale (NRS) has been established as both reliable and valid compared with other types of pain measurement instruments (Jensen et al*.,* 1986). Construct validity of the NRS has been established using factor analysis (Jensen et al., 1986). Ohnhaus and Adler, (1975) and Woodforde and Merskey, (1972) found strong correlations ($r = 0.81$ to 0.87, $p = 0.01$ to 0.001) and Puntillo and Weiss, (1994) also established strong correlations between visual analogue scale (VAS) and NRS ($r = 0.84$ to 0.94; $p < 0.001$). One way to increase the validity of the assessments of average pain is to increase the number of assessments (Chronbach, 1970). Increasing the number of assessments would control for and thereby reduce the effects of other non-related factors that might contribute to the pain report. Patients are taught how to use the NRS are part of the acute pain service education program.

Nurses assess pain intensity and check the demands and deliveries stored on the pumps as history data every 2 to 4 hours in order to establish if the patient is receiving effective pain management. The number of failed attempts is determined by the number of times the patient pushes the demand button attached to the PCA device to self administer analgesia but still within the lockout time. The lockout time (usually 5 minutes) is prescribed by the anesthetist after surgery to prevent patients from overdosing on narcotic analgesia. Deliveries are the number of times the patient pushes the demand button to successfully self administer prescribed doses of analgesia outside of the lockout time. This information was stored in the central processor of the PCA device as history data. This data was collected for the study after patients were discharged from the hospital.

The nurse documents the pain intensity using NRS, the number of deliveries of analgesia by the PCA, the number of failed attempts on the PCA by the patient and the total amount of opioid analgesia consumed by the patient. This data were recorded on the patient's PCA observation chart. This data was collected for the study after patients were discharged from hospital.

Total amount of *analgesia* consumed by each patient' in the study hospital is recorded as an objective measure in total milligrams in their *medication chart* and *theatre report* as part of routine postoperative care. This data were collected by the researcher after patients were discharged to ensure all necessary data was retrieved.

3.4. Procedures for data collection

This study was undertaken at a tertiary hospital. The hospital provides a pre admission clinic for a large percentage of elective surgical patients. The main purpose of the clinic is to conduct diagnostic testing, provide information to patients and reduce the length of preoperative hospital stays.

3.4.1 Pilot

A pilot study was conducted to determine the sample size and identify any potential problems with the instruments. The sample for the pilot was 20 cardiac surgical patients who attended the Acute Pain Service education program and 20 cardiac surgical patients who did not receive the Acute Pain Service education program. The pilot and research proper used the same methodology.

The pilot study consisted of forty consecutive cardiac surgical patients that were approached by the investigator. The pilot study data collected was used for power calculation to determine the sample size and improve necessary changes in the study proper. The 40 patients in the pilot study data were included in the statistical analysis of the study proper. The data from the pilot study necessitated changes. These were including a baseline American Pain Society Inpatient Outcome Questionnaire. The preoperative measurement included a Visual Analogue Scale generated from American Pain Society Inpatient Outcome Questionnaire were used in the study proper to statistically control for the effect of preoperative scores on postoperative measures of American Pain Society Inpatient Outcome Questionnaire scores and pain levels by Visual Analogue Scale on the 4 or 5 day postoperatively.

The results of the pilot study were used to inform whether or not any changes to questions or adjustments might have needed to be made to the study prior the research proper. The main study had additional satisfaction questions added in order to address patient expectations of pain. The 11 items were summed to calculate a total American Pain Society In-Patient Outcome score for the pilot study. Additional questions related to satisfaction with cares provided, was required to further investigate other possible reasons for patients reporting high levels of satisfaction were added to the study proper these questions were summed and a satisfaction with pain management score calculated.

3.4.2. Main Study
Step 1 Preoperative

Potential participants who met the inclusion criteria were approached by the researcher the night before surgery in the Cardiac ward prior to any pre-operative medications being administered. The researcher described the study to potential participants and provided an information sheet to explain the study and for the patient to refer to. The researcher asks the patients to read the information sheet, providing any answers to questions, and then invited the patients to participate in the study. If the patient agreed to participate a written consent was obtained.

The participants who gave consent and meet the inclusion criteria were then asked to complete the *Demographic Data Form,* the *State-Anxiety Questionnaire* and a revised version of the *American Pain Society In-Patient Outcome Questionnaire*. This interview took approximately 5 to 10 minutes.

Step 2 Postoperative

Patients who continued to meet the inclusion criteria were revisited while in hospital on day 4 or 5 post operatively by the researcher. If patients wanted to continue to participate in the study they were asked by the investigator to complete the second post operative 20 question *State-Anxiety Questionnaire* and the 22 questions from the *American Pain Society In-Patient Outcome Questionnaire* including the additional satisfaction questions. The second interview took approximately 10 to 15 minutes to complete.

The fourth or fifth day post operatively was chosen by the investigator because the effects of the narcotic analgesia were likely to be reduced, patients were given time to settle into the routine of the cardiac wards, were willing to answer questions and was just prior to their discharge.

Step 3 Post discharge data collection

During surgery medications administered to the cardiac surgical patient's are recorded on *Theatre Report* chart by the anesthetist. Post operative medications given to cardiac surgical patient by health care professionals are documented on the *Medication Chart*. The documentation of Patient Controlled Analgesia (PCA) failed demands and deliveries are recorded on the *Patient Controlled Analgesia Observation Chart* and by nurses in the Cardiac Surgical Intensive Care Units or the Cardiac Wards. These charts also provided a record of all medications administered to the patient. All medical data were collected by the investigator from patients medical records after consenting patients were discharged. Ethical approval and consent to access medical histories was granted by the hospital and the Head of Medical Records. Charts were accessed in order to collect data related to the study.

3.5. Data analysis

3.5.1. Scientific Hypotheses

The hypotheses being tested in this study are:

Cardiac surgical patients who attended structured pre-operative pain management education by a clinical specialist nurse from the Acute Pain Service (APS) will;

1. ***Report less average post-operative pain scores*** than cardiac surgery patients who did not attend the pre operative APS education program,
2. ***Consume less average post operative analgesia*** than cardiac surgical patients who did not attend the pre operative APS education program,
3. ***Report less average pre and postoperative anxiety scores*** than cardiac surgical patients who did not attend the pre operative APS education program,
4. ***Report higher average satisfaction scores regarding post operative pain management***, than cardiac surgical patients who did not attend the pre operative APS education program,
5. ***Make fewer ratios of self administered boluses and failed attempts on the Patient Controlled Analgesia device postoperatively*** than cardiac surgical patients who did not attend the pre operative APS education program, and

6. ***Have shorter average length of hospital stay*** than cardiac surgical patients who did not attend the pre operative APS education program.

In order to investigate the hypotheses being tested in this study the following data analysis were undertaken. All data were numerically coded and all calculations checked for consistency visually and electronically using SPSS computer software package.

Independent Variables

The independent variables in this study were the Acute Pain Service (APS) education program and Adult Learning Theory. The participants who attended the preoperative pain management education program were allocated to the intervention group. The participants who did not attend the pre operative APS education program were allocated to the control group. The potential confounding variables of age, gender, nationality, education and income were collected using the Demographic Data Form.

Dependent Variables

There are several dependent variables in this study including;

1. Pain intensity levels,
2. Amount and types of analgesia consumed,
3. Preoperative and Postoperative anxiety Scores,
4. American Pain Society In-Patient Outcome Scores postoperatively indicating satisfaction with pain management,
5. Deliveries of opioid analgesia and failed attempts on the PCA, and
6. Length of hospital stay.

The dependent variables were measured in a variety of ways.

1. Pain levels were measured using a self report numerical rating score (NRS) and the visual analogue scale (VAS). The patient's NRS pain intensity scores were

measured several times per day and recorded on the Patient Controlled Analgesia (PCA) Observation Chart and pain intensity VAS were assessed on the fourth or fifth day post operatively at the second interview by the investigator using the American Pain Society In-patient Outcome Questionnaire. The data were collected and entered into SPSS. The average pain level recorded on each participants PCA observation chart for post operative days 0, 1, 2 and average pain levels for day 4 or 5 were calculated for each patient. The higher the pain levels the higher the patient's pain intensity. Once the average pain level of each day was calculated the one way analysis of variance (ANOVA) was applied. This data were collected after patients were discharged.

2. Total analgesia consumed for each day was calculated for each participant. One way ANOVA was applied to the four different types of analgesics consumed by patients in order to detect any differences in the total amount of analgesia consumed between the two groups.

3. Anxiety levels were measured using the State-anxiety questionnaire from the State-Trait Anxiety Inventory (Spielberger, 1983). The State-Anxiety questionnaire was administered pre and post operatively. The State-anxiety items are a weighted score of 1 - 4. Scores varied from a minimum of 20 to a maximum of 80. The higher scores indicate higher levels of anxiety. Two anxiety scores were calculated for each participant. The preoperative State-Anxiety score was used in the analysis because the post operative s-anxiety reflected how the patient was feeling preoperatively. Once the threat of surgery had been removed the patient's anxiety levels had decreased therefore the preoperative s-anxiety was used in the final analysis. The preoperative State-Anxiety scores had t-test applied. The results indicated the level of anxiety and ensured bias-within group errors did not influence the results. In this way it is possible to determine whether the independent variable is indeed having an effect on the dependent variable.

4. Post operative satisfaction with pain management was measured using the American Pain Society In-patient Outcome Questionnaire and additional Satisfaction Questions. The In-Patient Outcome Questionnaires questions were summed and a score calculated. The satisfaction scores were calculated, the higher the score the greater the patients satisfaction.
   The aim of the American Pain Society In-patient Outcome questionnaire is to assess for satisfaction with post operative pain management. Each item of the questionnaire is based on subsections. Question 5 of the In-Patient Outcome Questionnaire refers to interference caused by pain. Question 22 is related to patient's attitudes to pain medications (A to E). Sub-scale mean scores for each sub-scale were calculated and then mean scores for the American Pain Society In-patient Outcome Questionnaire and the satisfaction questions were used in the analysis. The American Pain Society In-patient outcome questionnaire and satisfaction scores are single measures for each participant. T-testing was used to detect any differences in means for the patients who attended the APS education compared with patients who did not attend APS.

5. The total number of deliveries and failed attempts on the PCA were collected from participant's medical records and entered into SPSS. A ratio of failed attempts versus deliveries of opioids was calculated. This was used to gauge if there was a correlation between the pain intensity levels of the participant and the usage of the PCA device.

6. The length of hospital stay for each patient was collected and entered into the SPSS package.

The participant's average pain levels, total analgesia, average preoperative anxiety levels, average in-patient outcome score and average satisfaction scores, ratio of failed attempts and deliveries on PCA and average length of stay were analyzed. The frequencies of each dependent variable were calculated and compared for both groups of cardiac surgical patients from the study using the statistical package (SPSS).

The analyzed data were then presented in contingency tables showing the central tendency of all the data collected for both groups.

3.6. Ethical considerations

This research assessed the impact of the preoperative APS education program on cardiac surgical patients pain levels, analgesia consumed, anxiety levels, satisfaction with pain management, bolus doses/failed attempts on PCA and length of hospital stay. There was no withholding of care or education. All participants received at least routine care.
All cardiac surgical patients between February 2003 and July 2003 were invited to participate in the research. This research did not in any way interfere with normal or routine care. The participants were assured of confidentiality and/or anonymity. All potential participants were informed about the purpose and procedures of the research including data storage and use. All participants were advised of their right to exercise voluntary choice to participate without influence, coercion or inducement. Ethical approval was granted by Queensland University of Technology and The Prince Charles Hospital. Documents are stored in accordance with the NHMRC guidelines.

3.7. Conclusion

This study utilized a quasi-experimental, single blind, controlled clinical trial with multiple measures research design. This set out to test the null hypotheses that compare the impact of preoperative education APS for cardiac surgical patients with cardiac surgical patients who received usual care regarding preoperative education on multiple pain outcomes. The target population was therefore cardiac surgical patients. This study consisted of a pilot study followed by the main study. Apart from additional satisfaction questions added to the main study both studies used the same four major instruments and study design. All instruments used were reported to be valid and reliable. Measurements were conducted at three time points, the night prior to surgery, the four/fifth day following surgery and following patient discharge from hospital. Patients were randomly selected to attend the APS program and cardiac surgical patients were consecutively

recruited after admission to the study hospital. The final sample size consisted of 80 participants (59 in intervention group and 21 in the control group).

The justification for this research was based on recent published reports into APS for general surgical patients establishing positive outcomes related to pain management from education. Previous to this research the impact of the APS on the pain experiences of cardiac surgical patients at the study hospital had not been established. Based on this study, the APS service provider from the hospital involved in this study can make evidence based decisions to improve the pain management. The next chapter reports the findings and analysis of this studies result.

The main study involved a total of 80 patients. Cardiac surgical patients from both groups were recruited the night before surgery. There were main four instruments used to investigate the impact of the preoperative APS program. The data collected from these instruments were collected in three phases, the first phase was preoperative visit by investigator, the second phase was the post operative visit by investigator and the third phase was the post discharge data collection from the health care records. The data were analyzed using SPSS software package. The ethical considerations for the study were discussed.

Chapter 4-Analysis of Results

Chapter Four-Analysis of Results

4.1. Introduction

In order to address the hypotheses, a range of data collection and analysis techniques were completed. This chapter describes the hypotheses addressed and the data analysis used to establish the research findings.

Six hypotheses were addressed in this study.
The six hypotheses are:
Cardiac surgical patients who attended preoperative pain management education by a clinical specialist nurse from the Acute Pain Service (APS) will:

1. ***Report less average post-operative pain scores*** than cardiac surgery patients who did not attend the pre operative APS education program.
2. ***Consume less average post operative analgesia*** than cardiac surgical patients who did not attend the pre operative APS education program.
3. ***Report less average pre and postoperative anxiety scores*** than cardiac surgical patients who did not attend the pre operative APS education program.
4. ***Report higher average satisfaction regarding post operative pain management,*** than cardiac surgical patients who did not attend the pre operative APS education program.
5. ***Make fewer ratios of self administered boluses and failed attempts on the Patient Controlled Analgesia device postoperatively*** than cardiac surgical patients who did not attend the pre operative APS education program.
6. ***Have shorter average length of hospital stay*** than cardiac surgical patients who did not attend the pre operative APS education program.

The hypotheses were addressed using the following data collection procedures. All consenting patients from both groups were interviewed preoperatively the night before surgery and on the fourth or fifth day postoperatively by the investigator. Data were also collected from medical records by the investigator after participants were discharged

from the hospital. All the data were entered and analyzed using SPSS. Statistical analyses of the data were performed using t-tests and ANOVA.

4.2. Demographic data

In order to investigate the question 'Do cardiac surgical patients who attended the Acute Pain Service (APS) education have the same general demographic characteristics as the cardiac surgical patients who did not attend the APS education program?' the *Demographic Data Form* was completed.

4.2.1. Characteristics

The data collected using the *Demographic Data Form* was analyzed to calculate the general characteristics of the participants in both groups these included: age, gender, nationality, education completed and yearly income earnings of the participants. The results are presented in the following tables:

Table 4.1 Gender of Participants

Gender

group			Frequency	Percent	Valid Percent	Cumulative Percent
intervention	Valid	Male	33	64.7	64.7	64.7
		Female	18	35.3	35.3	100.0
		Total	51	100.0	100.0	
control	Valid	Male	26	89.7	89.7	89.7
		Female	3	10.3	10.3	100.0
		Total	29	100.0	100.0	

Table 4.1 indicates the gender distribution of cardiac surgical patients who attended APS was different compared with cardiac surgical patients who did not attend APS and were therefore considered as factors in the statistical analysis. The results indicate more females in the intervention group when compared with the control group.

Table 4.2 Age of Participants

Age

group			Frequency	Percent	Valid Percent	Cumulative Percent
intervention	Valid	18 - 30 years	2	3.9	3.9	3.9
		41 - 50 years	11	21.6	21.6	25.5
		51 - 60 years	16	31.4	31.4	56.9
		=< 61 years	22	43.1	43.1	100.0
		Total	51	100.0	100.0	
control	Valid	18 - 30 years	1	3.4	3.4	3.4
		'31 - 40 years	2	6.9	6.9	10.3
		41 - 50 years	5	17.2	17.2	27.6
		51 - 60 years	16	55.2	55.2	82.8
		=< 61 years	5	17.2	17.2	100.0
		Total	29	100.0	100.0	

Table 4.2 indicates the age of cardiac surgical patients who attended APS were similar compared with cardiac surgical patients who did not attend APS.

Table 4.3 Income levels of Participants

Income

group			Frequency	Percent	Valid Percent	Cumulative Percent
intervention	Valid	lower	38	74.5	77.6	77.6
		medium	5	9.8	10.2	87.8
		high	6	11.8	12.2	100.0
		Total	49	96.1	100.0	
	Missing	-1	2	3.9		
	Total		51	100.0		
control	Valid	lower	23	79.3	79.3	79.3
		medium	5	17.2	17.2	96.6
		high	1	3.4	3.4	100.0
		Total	29	100.0	100.0	

The income level of low was determined by participants yearly income of 0 to $25 000. The medium level was determined by participants yearly incomes of $25 001 to $45 000. The high level was determined by participants yearly incomes > $45 000. Table 4.3

indicates that income levels of cardiac surgical patients who attended APS were similar compared with cardiac surgical patients who did not attend APS.

Table 4.4 Education completed by Participants

Education

group			Frequency	Percent	Valid Percent	Cumulative Percent
intervention	Valid	primary	7	13.7	14.3	14.3
		secondary	25	49.0	51.0	65.3
		teritary	17	33.3	34.7	100.0
		Total	49	96.1	100.0	
	Missing	99	2	3.9		
	Total		51	100.0		
control	Valid	secondary	22	75.9	81.5	81.5
		teritary	5	17.2	18.5	100.0
		Total	27	93.1	100.0	
	Missing	99	2	6.9		
	Total		29	100.0		

Table 4.4 indicates completed education for cardiac surgical patients who attended APS was different compared with cardiac surgical patients who did not attend APS and were therefore considered as factors in the statistical analysis.

Table 4.5 Nationality of Participants

Nationality

group			Frequency	Percent	Valid Percent	Cumulative Percent
intervention	Valid	Australia	36	70.6	70.6	70.6
		New Zealand	2	3.9	3.9	74.5
		Asia	2	3.9	3.9	78.4
		Europe/Continent	2	3.9	3.9	82.4
		UK	8	15.7	15.7	98.0
		other	1	2.0	2.0	100.0
		Total	51	100.0	100.0	
control	Valid	Australia	20	69.0	69.0	69.0
		New Zealand	2	6.9	6.9	75.9
		Asia	1	3.4	3.4	79.3
		Europe/Continent	1	3.4	3.4	82.8
		UK	5	17.2	17.2	100.0
		Total	29	100.0	100.0	

Table 4.5 indicates the countries of birth for cardiac surgical patients who attended APS were similar compared with cardiac surgical patients who did not attend APS.

The demographic results indicated that the general characteristics of cardiac surgical patients were not equally distributed between the cardiac surgical patients who attended the APS and the cardiac surgical patients who did not attend the APS. Of the participants who attended APS 10% were females and 17% had completed tertiary education compared with 35% of female cardiac surgical patients who did not attend APS and 33% of patients who had completed tertiary education. This suggested that gender and completed education were potential confounders and required consideration in the final analysis. However, both gender and education were both categorical variables and did not meet statistical assumptions to be able to adjust for in the final analysis. Gender and education levels were statistical analyzed using factor analyses. The result indicated gender and education had not statistically impacted on the intervention attending APS education.

4.3. Pain levels

In order to investigate the hypothesis 'Cardiac surgical patients who attended pre operative pain management education by a clinical specialist nurse from the APS will report ***less average postoperative pain scores*** than cardiac surgical patients who did not attend the pre operative APS education program' participants from both groups were requested to self report their pain intensity using visual analogue scale (VAS) and numerical rating scale (NRS). The NRS scores are routinely assessed every 2 to 4 hours while the patients are using PCA for analgesia. Participants were interviewed on day 4 or 5 following surgery, during this interview participants were asked to report pain levels using VAS. Data was entered into SPSS and average pain levels for time 1, the day of surgery (Day 0), time 2, the day after surgery (Day 1), time 3, the second day after surgery (Day 2) and time 4, the 4 or 5 day following surgery were calculated.

Participant's pain scores for time 1, time 2, time 3, and time 4, analyzed using One-Way ANOVA with gender and education considered as factors.

The repeated pain levels data were collected and entered into SPSS. Pain scores were calculated for each patient. Average pain levels for time 1, time 2, time 3 and time 4 were statistical analyzed to generate mean, median and standard deviations for both groups.

Data were analyzed to test for the assumption of homogeneity and it was established. The statistical test used to detect any mean difference between two groups using repeated measures data is the one way analysis of variances (ANOVA). The mean differences between the two groups were statistical analyzed using One-Way ANOVA. This research did not have equal distributions of gender or education between the two groups. Gender and education levels were measured as categorical variables and required consideration in the final analysis however the characteristics did not meet the statistical assumptions to be able to consider them as covariates. This has been corrected by adjusting gender and education completed as factors in ANOVA. The design of factor analysis includes assessing all combinations of the levels of each factor that is gender has two levels of measurement male and female. Education completed has three levels of measurement meeting the statistical assumption to be able to use Tukey's post hoc test (Appendix H & L) to ensure accuracy of the results. The patients' pain levels were analyzed to establish any relationships between the two groups as well as any significance across time.
The average pain levels for cardiac surgical patients from both groups for the day of surgery (Day 0), the day after surgery (Day 1), the second day after surgery (Day 2) and the fourth or fifth day after surgery (Day 5) are presented in the following tables and graphs.

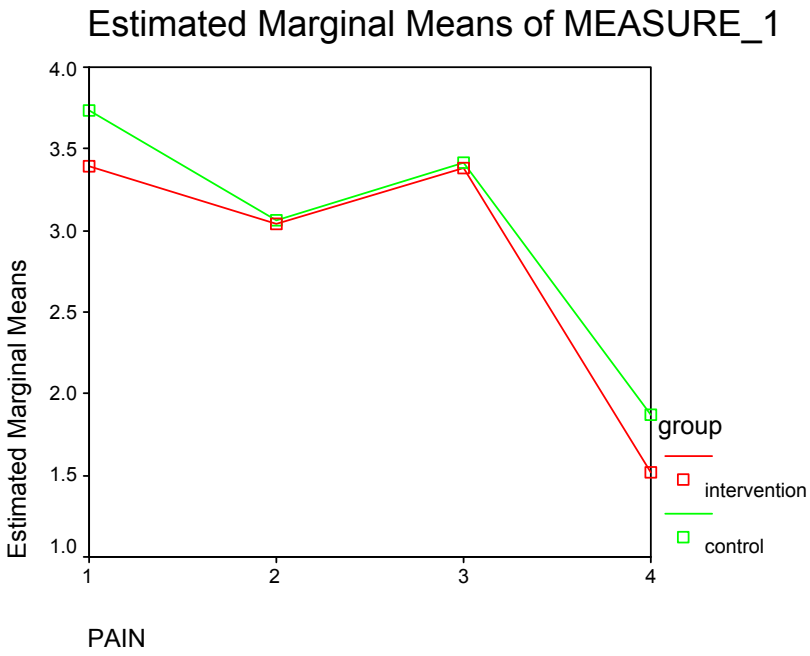

Figure 4.1 Average pain levels for cardiac surgical patients from both groups

Figure 4.1 indicates average pain scores for time 1, Day 0, time 2, Day 1, time 3, Day 2 and time 4, Day 4 or 5 for cardiac surgical patients who attended APS (intervention) were similar when compared with cardiac surgical patients who did not attend APS (control).

Table 4.7 Average postoperative pain levels

Statistics

group			PAINLEVELDay0	PAINLEVELDay1	PAINLEVELDay2	PAINLEVELDay5
intervention	N	Valid	31	40	40	45
		Missing	20	11	11	6
	Mean		3.423	3.026	3.142	1.389
	Median		3.800	2.950	3.350	1.000
	Std. Deviation		1.9370	1.8333	1.8193	1.5333
	Minimum		.0	.0	.3	.0
	Maximum		6.0	7.5	8.5	7.0
control	N	Valid	18	24	24	25
		Missing	11	5	5	4
	Mean		3.778	3.025	2.996	1.480
	Median		4.150	3.000	2.650	1.000
	Std. Deviation		1.6696	1.1685	1.6174	1.1590
	Minimum		.0	.9	.6	.0
	Maximum		6.0	6.0	6.0	4.0

Table 4.6 indicates the average pain scores for the day of surgery (Day 0), the day after surgery (Day 1), the second day after surgery (Day 2) and the fifth day after surgery (Day 5) were similar for cardiac surgical patients who attend APS compared with cardiac surgical patients who did not attend APS.

Table 4.7 One-way ANOVA pain levels with gender as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PAINLEVELDay0	Between Groups	.874	1	.874	.256	.615
	Within Groups	160.508	47	3.415		
	Total	161.382	48			
PAINLEVELDay1	Between Groups	7.521	1	7.521	3.009	.088
	Within Groups	154.959	62	2.499		
	Total	162.480	63			
PAINLEVELDay2	Between Groups	1.221	1	1.221	.402	.528
	Within Groups	188.349	62	3.038		
	Total	189.570	63			
PAINLEVELDay5	Between Groups	.019	1	.019	.009	.923
	Within Groups	135.799	68	1.997		
	Total	135.818	69			

Table 4.7 indicates that average pain scores using gender for factor analysis had no statistical significant differences between cardiac surgical patients who attended preoperative APS compared with cardiac surgical patients who did not attend APS.

Table 4.8 One-way ANOVA pain levels with gender as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PAINLEVELDay0	Between Groups	1.970	2	.985	.288	.751
	Within Groups	150.356	44	3.417		
	Total	152.326	46			
PAINLEVELDay1	Between Groups	12.504	2	6.252	2.646	.080
	Within Groups	137.063	58	2.363		
	Total	149.567	60			
PAINLEVELDay2	Between Groups	5.632	2	2.816	.934	.399
	Within Groups	174.941	58	3.016		
	Total	180.573	60			
PAINLEVELDay5	Between Groups	2.853	2	1.426	.913	.406
	Within Groups	98.394	63	1.562		
	Total	101.246	65			

Table 4.8 indicates that average pain scores using completed education had no statistical significant differences between cardiac surgical patients who attended APS compared with cardiac surgical patients who did not attend APS.

The results indicate that there were no average differences in pain intensity scores for the two groups being investigated. The ANOVA results indicated no statistical significant differences between the two groups in regards to pain intensity using gender and completed education for factor analysis. Therefore, the hypothesis "Cardiac surgical patients who attended preoperative pain management education by clinical specialist nurse from the APS will report less average post operative pain scores than cardiac surgical patients who did not attend the preoperative APS education program " cannot be supported.

4.4. Analgesia

In order to investigate the hypothesis "Cardiac surgical patients who attended the pre operative pain management education by clinical specialist nurse from the APS will ***consume less average postoperative analgesia*** than cardiac surgical patients who did not attend the preoperative APS education program" the amount of analgesia each participant received was collected by the investigator (documented in the *Theatre report,* the *medication sheet* and the *PCA observation chart*) after the patients were discharged from hospital.

The data were collected and entered into SPSS. This data were analyzed to generate the mean, median and standard deviation for cardiac surgical patients who attended APS and cardiac surgical patients who did not attend APS in this study. The average analgesia consumed by each participant for each day after surgery was calculated. The mean difference between the two groups was calculated and compared using the ANOVA "F" statistic. The two groups did not have equal distributions of gender or education. Gender and education levels were measured as categorical variables and required consideration in the final analysis however the characteristics of gender education completed did not meet

the statistical assumptions to be able to consider them as covariates. This has been corrected by adjusting gender and education completed as factors in ANOVA. The design of factor analysis includes assessing all combinations of the levels of each factor that is gender has two levels of measurement male and female. Education completed has three levels of measurement meeting the statistical assumption to be able to use Tukey's post hoc test (Appendix H & L) to ensure accuracy of the results.

This study measured Morphine by milligrams, Fentanyl was measured by micrograms and Paracetamol and Tramadol was measured in grams. The average analgesia (Fentanyl, Morphine, Panadol and Tramadol) consumed by cardiac surgical patients in both groups for the day of surgery (Day 0, the day after surgery (Day 1), the second day after surgery (Day 2) and the fourth of fifth day after surgery (Day 5) are presented in the following tables. Please see appendix (Appendix G, I, J, K) attached for presentation of further ANOVA, factor analysis and post hoc results regarding analgesia consumed.

Table 4.9 Average Opioid consumed

Statistics

group			FENTANYLDay0	FENTANYLDay1	FENTANYLDay2	MORHINEDay0	MORPHINEDay1	MORPHINEDay2
intervention	N	Valid	42	51	41	42	51	41
		Missing	9	0	10	9	0	10
	Mean		1562.29	261.73	108.46	11.121	11.090	6.122
	Median		1500.00	.00	.00	7.000	.000	.000
	Std. Deviation		701.798	526.942	213.691	12.8784	17.7709	10.4048
	Range		2500	2494	980	41.9	57.5	48.0
	Minimum		500	-1	0	.0	-1.0	.0
	Maximum		3000	2493	980	41.9	56.5	48.0
control	N	Valid	23	29	24	23	29	24
		Missing	6	0	5	6	0	5
	Mean		1547.83	352.86	175.21	14.730	13.652	5.667
	Median		1620.00	.00	.00	6.400	.000	.000
	Std. Deviation		731.176	517.188	246.001	22.3890	19.3551	8.1596
	Range		2673	1826	710	99.0	57.0	25.0
	Minimum		500	-1	0	.0	-1.0	.0
	Maximum		3173	1825	710	99.0	56.0	25.0

Table 4.9 indicates the average micrograms of Fentanyl and average milligrams of Morphine consumed by cardiac surgical patients who attended APS were similar

compared with the amount of Fentanyl and Morphine consumed by cardiac surgical patients who did not attend APS.

Table 4.10 One-way ANOVA Fentanyl consumed with education as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
FENTANYLDay0	Between Groups	969357.2	2	484678.597	.935	.398
	Within Groups	30571713	59	518164.627		
	Total	31541070	61			
FENTANYLDay1	Between Groups	228658.7	2	114329.350	.398	.673
	Within Groups	20981388	73	287416.278		
	Total	21210047	75			
FENTANYLDay2	Between Groups	38519.989	2	19259.995	.354	.703
	Within Groups	3210018	59	54407.088		
	Total	3248538	61			

Table 4.10 indicates average Fentanyl consumed using education completed for factor analysis had no statistical significant differences between cardiac surgical patients who attended preoperative APS compared with cardiac surgical patients who did not attend APS.

Table 4.11 One-way ANOVA Morphine consumed with education as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
MORHINEDay0	Between Groups	28.177	2	14.088	.048	.953
	Within Groups	17438.114	59	295.561		
	Total	17466.291	61			
MORPHINEDay1	Between Groups	340.542	2	170.271	.524	.594
	Within Groups	23708.166	73	324.769		
	Total	24048.708	75			
MORPHINEDay2	Between Groups	113.741	2	56.871	.598	.553
	Within Groups	5609.242	59	95.072		
	Total	5722.984	61			

Table 4.11 indicates average Morphine consumed using education completed for factor analysis had no statistical significant differences between cardiac surgical patients who attended preoperative APS compared with cardiac surgical patients who did not attend APS.

Table 4.12 Average Panadol (paracetamol) and Tramadol consumed

Statistics

group			panadol day 0	panadol day 1	panadol day 2	panadol day 5	tramadol day 1	tramadol day 2	tramadol day 5
intervention	N	Valid	42	42	42	39	42	42	36
		Missing	9	9	9	12	9	9	15
	Mean		1.21	3.74	3.67	3.28	2.38	125.00	101.39
	Median		1.00	4.00	4.00	4.00	.00	150.00	100.00
	Std. Deviation		.682	.497	.570	.972	15.430	59.725	74.149
	Minimum		0	2	2	1	0	0	0
	Maximum		2	4	4	4	100	300	300
control	N	Valid	24	24	24	22	24	24	20
		Missing	5	5	5	7	5	5	9
	Mean		1.50	3.63	3.71	2.91	4.17	133.33	67.50
	Median		1.00	4.00	4.00	3.00	.00	150.00	25.00
	Std. Deviation		.722	.647	.464	1.269	14.116	65.386	84.721
	Minimum		0	2	3	1	0	0	0
	Maximum		3	4	4	4	50	250	250

Table 4.12 indicates the average grams of Panadol (paracetamol) and Tramadol consumed by cardiac surgical patients who attended APS were similar when compared with cardiac surgical patients who did not attend APS.

Table 4.13 One-way Panadol consumed with gender as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
panadol day 0	Between Groups	.153	2	.076	.148	.863
	Within Groups	31.117	60	.519		
	Total	31.270	62			
panadol day 1	Between Groups	.612	2	.306	.984	.380
	Within Groups	18.658	60	.311		
	Total	19.270	62			
panadol day 2	Between Groups	.243	2	.122	.515	.600
	Within Groups	14.169	60	.236		
	Total	14.413	62			
panadol day 5	Between Groups	1.707	2	.854	.727	.488
	Within Groups	64.569	55	1.174		
	Total	66.276	57			

Table 4.13 indicates average Panadol (paracetamol) consumed using education completed for factor analysis had no statistical significant differences between cardiac surgical

patients who attended preoperative APS when compared with cardiac surgical patients who did not attend APS.

Table 4.14 One-way ANOVA Tramadol consumed with education as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
tramadol day 1	Between Groups	236.740	2	118.370	.597	.554
	Within Groups	11906.117	60	198.435		
	Total	12142.857	62			
tramadol day 2	Between Groups	15915.577	2	7957.789	2.291	.110
	Within Groups	208449.5	60	3474.158		
	Total	224365.1	62			
tramadol day 5	Between Groups	792.453	2	396.226	.059	.943
	Within Groups	336000.0	50	6720.000		
	Total	336792.5	52			

Table 4.14 indicates average Tramadol consumed using education completed for factor analysis had no statistical significant differences between cardiac surgical patients who attended preoperative APS when compared with cardiac surgical patients who did not attend APS.

The results indicate there is no average difference between the two groups in the average amounts of micrograms of Fentanyl, milligrams of Morphine or grams of Panadol (paracetamol) and Tramadol consumed. The ANOVA results indicate that there are no statistically significant differences between the two groups. Therefore the hypothesis that cardiac surgical patients who attended structured pre-operative by clinical specialist nurse from the clinical Acute Pain Service will consume less average postoperative analgesia than cardiac surgical patients who did not attend the preoperative APS education program cannot be supported.

4.5. Anxiety

In order to investigate the hypothesis "Cardiac surgical patients who attended structured pre operative pain management education by a clinical specialist nurse from the Acute Pain Service will report ***less average pre and postoperative anxiety scores*** than cardiac surgical patients who do not attend the preoperative APS education program" the State-Anxiety (S-Anxiety) Questionnaire was used. This study addressed S-anxiety questions because they pertain to how a person 'feels right now'. The State anxiety questions have been used effectively for other studies. This study used repeated measures of the participant's state anxiety to calculate an anxiety score pre and post operatively. The participant's anxiety scores were used for the statistical analysis.

The repeated anxiety data were collected and entered into SPSS. The anxiety scores were calculated for each participant. This data were statistically analyzed to generate preoperative and postoperative mean, median and standard deviation for each of the two groups in this study. The mean difference between the two group anxiety scores were calculated and compared using the t-test statistic. The average preoperative and postoperative anxiety levels for cardiac surgical patients from both groups and statistical t-test are presented in the following tables.

Table 4.15 Average preoperative and postoperative anxiety scores for Participants

Statistics

group			ANXIETY PREOPERATIVE	ANXIETY POSOPERATIVE
intervention	N	Valid	49	51
		Missing	2	0
	Mean		28.92	22.61
	Median		24.00	20.00
	Std. Deviation		11.719	5.389
	Minimum		20	20
	Maximum		70	47
control	N	Valid	29	29
		Missing	0	0
	Mean		26.76	22.41
	Median		26.00	20.00
	Std. Deviation		8.475	5.060
	Minimum		20	20
	Maximum		60	42

Table 4.15 indicates that average preoperative anxiety scores were slightly elevated and preoperative and postoperative anxiety scores for cardiac surgical patients who attended APS were similar compared to cardiac surgical patients who did not attend APS.

Table 4.16 T-test preoperative anxiety scores

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ANXIETY1	Equal variances assumed	3.789	.055	.866	76	.389	2.16	2.493	-2.805	7.124
	Equal variances not assumed			.940	72.824	.350	2.16	2.298	-2.420	6.739

Table 4.16 indicates no statistical significant differences in regards to preoperative anxiety scores for cardiac surgical patients who attended APS compared with cardiac surgical patients who did not attend APS.

There was no difference found in preoperative anxiety scores for the two groups. The Levene's test for equal distribution of preoperative anxiety indicates normality. The t-test indicated no statistical significance differences in preoperative anxiety scores of the two groups. Therefore, the hypothesis that cardiac surgical patients who attended structured pre-operative by clinical specialist nurse from the clinical Acute Pain Service will report less average anxiety scores pre and postoperatively than cardiac surgical patients who did not attend the preoperative APS education program cannot be supported.

4.6. Satisfaction

In order to investigate the hypothesis "Cardiac surgical patients who attended preoperative pain management by a clinical specialist nurse from the Acute Pain Service will report ***higher average satisfaction regarding postoperative pain management*** than cardiac surgical patients who did not attend the preoperative Acute Pain Service education program" the patients completed the *American Pain Society Inpatient Outcome Questionnaire* these questions addressed the pain levels and patients satisfaction with pain management.

The data were collected during the postoperative interview with the researcher. Inpatient Outcome Questionnaire and satisfaction scores were generated for each patient. The data were entered into SPSS. The data were statistically analyzed to generate the mean, median and standard deviation for each of the two groups in this study. This was used to calculate the average satisfaction score for each participant post operatively. The mean differences between the two groups were calculated using the t-test statistic. The average American Pain Society Inpatient Outcome Questionnaire score, satisfaction score and t-test result for cardiac surgical patients from both groups are presented in the following tables. The minimum score possible for the American Pain Society Inpatient Outcome Questionnaire score is 27 and the maximum score possible is 89. Lower scores indicate higher satisfaction levels.

Table 4.17 Average American Pain Society Inpatient Outcome scores and satisfaction scores for participants

Statistics

group			INPATIENT OUTCOME	SATISFACTION
intervention	N	Valid	26	22
		Missing	25	29
	Mean		50.10	40.59
	Median		47.25	42.00
	Std. Deviation		15.135	2.702
	Minimum		30	33
	Maximum		89	42
control	N	Valid	16	17
		Missing	13	12
	Mean		50.88	38.94
	Median		48.50	40.00
	Std. Deviation		9.335	3.960
	Minimum		35	27
	Maximum		68	42

Table 4.17 indicates average American Pain Society Inpatient Outcome scores and satisfaction scores for cardiac surgical patients were similar when compared to cardiac surgical patient that did not attend APS.

Table 4.18 T-test In-patient Outcome scores and satisfaction scores

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SATISFACTION	Equal variances assumed	1.637	.209	1.546	37	.131	1.65	1.067	-.513	3.812
	Equal variances not assumed			1.473	26.926	.152	1.65	1.120	-.649	3.948
OUTPATIENT SCORE	Equal variances assumed	2.457	.125	-.185	40	.854	-.78	4.214	-9.295	7.737
	Equal variances not assumed			-.206	39.992	.838	-.78	3.776	-8.410	6.853

Table 4.18 indicates no statistical significant differences for cardiac surgical patients who attended APS when compared to cardiac surgical patients who did not attend APS.

There was no difference found in average Inpatient Outcome scores and satisfaction scores for the two groups. The t-test indicated no statistical significance difference in regards to Inpatient Outcome Score and satisfaction scores of the two groups.

Therefore the hypothesis "Cardiac surgical patients who attended preoperative pain management by clinical specialist nurse from the APS will report higher average satisfaction regarding postoperative pain management than cardiac surgical patients who did not attend preoperative APS education program" cannot be supported.

4.7. Bolus doses and failed attempts on PCA

In order to address the hypothesis "Cardiac surgical patients who attended pre operative pain management by clinical nurse specialist from the Acute Pain Service will ***make fewer ratios of self administered boluses and failed attempts on Patient Controlled Analgesia device postoperatively*** than cardiac surgical patients who do not attend the pre operative Acute Pain Service education program" the data were recorded and collected from the *PCA observation chart* for each participant.

The patients routinely have PCA observation charts competed every 2 to 4 hours by the registered nurse. The number of failed attempts on the PCA and the self administered boluses were collected and documented. This data were collected from the PCA device. The investigator collected data from the PCA observation charts. The data were entered into SPSS and then analyzed. The ratio of failed attempts versus self administered bolus doses were calculated for each participant and then the 2 group in the study. This data were statistically analyzed to generate the mean, median and standard deviation. The statistic t-test was then used to calculate a relationship between the two groups. The ratio of self administered boluses and failed attempts on PCA device for cardiac surgical patients from both groups and t-test results are presented in the following tables.

Table 4.19 Average ratios of bolus deliveries of analgesia and failed attempts on PCA device for Participants

Statistics

PCADEMANDS/D

intervention	N	Valid	51
		Missing	0
	Mean		.9463
	Median		1.1455
	Std. Deviation		.88995
	Minimum		-1.00
	Maximum		2.07
control	N	Valid	29
		Missing	0
	Mean		.9867
	Median		1.2174
	Std. Deviation		1.01263
	Minimum		-1.00
	Maximum		3.05

Table 4.19 indicates average ratios of self administered boluses and failed attempts on PCA device for cardiac surgical patients who attended APS when compared with cardiac surgical patients who did not attend APS.

Table 4.20 T-test ratios of bolus doses of analgesia and failed attempts on PCA

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PCADEMANDS/D	Equal variances assumed	.224	.637	-.185	78	.853	-.0403	.21765	-.47365	.39297
	Equal variances not assumed			-.179	52.342	.859	-.0403	.22559	-.49294	.41226

Table 4.20 indicates no statistical significant differences in average ratios of self administered boluses and failed attempts on PCA for cardiac surgical patients who attended APS compared with cardiac surgical patients who did not attend APS.

There were no average differences in regards to average ratios of failed attempts and self administered boluses for cardiac surgical patient who attended APS compared with

cardiac surgical patients who did not attend APS. There were no statistical significant difference in ratios of failed attempts and self administered boluses on PCA for cardiac surgical patients who attended APS compared with cardiac surgical patient who did not attend APS. The t-test results indicated no statistical significant difference between the two groups in regards to PCA failed attempts and deliveries. Therefore the hypothesis "Cardiac surgical patients who attended structured preoperative pain management education by clinical specialist nurse from the APS will make fewer average ratios of self administered boluses and failed attempts on PCA postoperatively than cardiac surgical patients who do not attend the preoperative APS education" cannot be supported.

4.8. Length of Stay

In order to address the hypothesis "Cardiac surgical patients who attended structured pre operative pain management by clinical specialist nurse from the Acute Pain Service will ***have shorter average length of hospital stay*** than cardiac surgical patients who did not attend the pre operative Acute Pain Service education" the charts were audited. The data were collected and entered into SPSS.

The length of hospital stay for each participant was collected and entered into SPSS. The average length of hospital stay for both groups was statistical analyzed to generate mean, median and standard deviation. This data were analyzed using t-test. The average length of hospital stay and t-tests for cardiac surgical patients from both groups is presented in the following tables.

Table 4.21 Average length of hospital stay for Participants

Statistics

lengthofstay

intervention	N	Valid	41
		Missing	10
	Mean		6.83
	Median		7.00
	Std. Deviation		1.702
	Minimum		4
	Maximum		11
control	N	Valid	24
		Missing	5
	Mean		6.67
	Median		6.50
	Std. Deviation		1.880
	Minimum		3
	Maximum		10

Table 4.21 indicates average length of hospital stay were similar for cardiac surgical patients who attended APS compared with cardiac surgical patients who did not attend APS.

Table 4.22 T-test length of hospital stay

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
lengthofstay	Equal variances assumed	.299	.586	.358	63	.722	.16	.455	-.746	1.071
	Equal variances not assumed			.348	44.457	.729	.16	.467	-.778	1.103

Table 4.22 indicates no statistically significant differences for cardiac surgical patients who attended APS compared with cardiac surgical patients who did not attend APS.

There were no differences in average length of stay for cardiac surgical patients who attended APS compared with cardiac surgical patients who did not attend APS. The t-test results indicated no statistical significant differences between the two groups in regards to length of stay. Therefore the hypothesis “Cardiac surgical patients who attended

structured preoperative pain management by clinical specialist nurse from APS will have shorter average length of hospital stay than cardiac surgical patients who do not attend the preoperative APS education" cannot be supported.

4.9. Conclusion

It was hypothesized that:
Cardiac surgical patients who attended structured preoperative pain management education by a clinical specialist nurse from the APS will

- Report less average postoperative pain levels,
- Use less average analgesia consumption,
- Report less average anxiety levels,
- Report higher average Inpatient Outcome scores and satisfaction scores,
- Make fewer average ratios of self administered boluses and failed attempts on PCA
- Have shorter average length of hospital stay

than cardiac surgical patients who do not attend the preoperative APS education program.

The findings of this study indicated there were no average differences or no statistical significant differences in regards to any of the hypotheses. Therefore the hypotheses could not be supported and the null hypotheses were accepted. These findings indicated that the APS education program at the study hospital does not have the desired impact on pain levels, analgesia consumed, anxiety levels, satisfaction with pain management, bolus doses of analgesia and failed attempts on PCA and length of hospital stay. The APS program as it stands does positively impact on the pain outcomes of cardiac surgical patients at the study hospital. The following chapter addresses these findings, limitations of this study and discusses possible recommendations and future research regarding APS for cardiac surgical patients.

Chapter Five-Discussion

Chapter 5-Discussion

5.1. Introduction

The results presented in Chapter 4 will be discussed in relation to the literature and outcomes of this research. Each research question and hypothesis will be discussed and the implications for theory, policy and practice analyzed. The conclusion and recommendations for future research are also presented.

Overall, the results of this study do not support previous findings (Tighe et al., 1998, Miakowski et al., 1999, Sartain and Barry, 1999) that the APS education program will reduce average postoperative pain levels, reduce consumption of average analgesia, reduce average anxiety scores, increase satisfaction scores, reduce ratios of self-administered boluses and failed attempts on the PCA device and have shorter length of hospital stay in relation to postoperative surgery.

5.2. Research Questions and Hypotheses

5.2.1. Research Questions

The general characteristics of the cardiac surgical patients who attended the Acute Pain Service (APS) education program were similar to the cardiac surgical patients who did not attend the APS education with regard to age, income and nationality. However, the results of this study also indicated that the number of males and females and the number of patients who had completed tertiary education were not equally distributed among the two groups and were potential confounders. However, statistical tests suggest that characteristics gender and completed education had not acted as compounding factors. Statistical factor analysis and Tukey's post hoc test indicated education (Appendix H & L) completed did not impact on the independent variables. Therefore, it has been concluded that the research findings resulted from factors other than gender and education level achieved.

The characteristics of the participants who did not attend the APS education session may well indicate issues that need further research. The non-attenders were older, less educated and male. This may indicate a number of things one of which is the poor suitability of large group education sessions for older, less educated men.

The Royal College of Surgeons recommended the implementation of Acute Pain Services in all hospital in order to better manage patient's postoperative pain. However, the outcomes have not always reflected positive expectations. Three key issues have identified that may well further diminish the positive effects of APS education on this group of patients. The issues are;

- Patients expectations of pain after surgery
- Patients preoperative anxiety
- Patients readiness-to-learn.

The APS that was the focus of this research does not achieve the positive outcomes expected. Patient's expectations and past experiences of pain are not being incorporated into their preoperative Acute Pain Service education program. Several factors reduce the likelihood that an APS program will have the desired effect on this sample of people. Patients expect surgery to result in pain therefore they do not expect APS education to reduce their pain, this increases the likelihood of patients reporting high levels of satisfaction regardless of pain experienced. This study has found that patient's expectations of pain are an important factor in mediating how a patient responds to pain after surgery. Cardiac surgery is a life-threatening event and causes enormous amounts of stress and anxiety. Readiness-to-learn also affects the adult learner's ability to take in educational material. The quality of the education program provided also impacts on patients learning to manage pain. Patient's expectations of pain will be addressed under pain levels. Anxiety, readiness-to-learn and quality of education will be addressed later in this section.

5.2.2. Pain levels

It was hypothesized that "Cardiac surgical patients who attended preoperative pain management education program by clinical specialists nurse from the APS will report ***less average post operative pain scores*** than cardiac surgical patients who did not attend the APS education program. This study reported no statistically significant differences between the patients who had attended the APS education program and the patients who did not. Patients who attended the APS education program did not report less average post operatively pain levels. Therefore, the hypothesis cannot be supported and null hypothesis accepted. The key factors affecting pain intensity for cardiac surgical patients include patient's expectations of pain, anxiety levels and the quality of the education (Walmsley et al., 1992).

EXPECTATIONS

The null hypotheses were retained in relation to pain levels due to several factors. A key factor affecting pain scores are patient's expectations (Walmsley et al., 1992). Patient expectations and values about pain management may influence patient's pain experiences. Patients expect to have pain after surgery (Walmsley, et al., 1992). The results of this study suggest that the participant's expectations of pain may account for the findings in reported pain levels. When participants were asked "Was the level of pain you experienced what you expected?" most responded that the level of pain was the same as they expected. This may have been exacerbated by previous experiences or what they have heard by others (Carr, 2001). Patient's expectations of pain are developed in relation to prior experiences of pain, the observation of others in pain, attitudes towards effectiveness of pain medication and the information they receive (Walmsley, et al., 1992).

The experiences of cardiac surgical patients suggest that pain is still being inadequately managed after surgery and lack of information about what to expect following surgery

continues to be a contributor (Carr, 2001). Interviews with 20 patients recovery from Coronary Artery Bypass Graft surgery identified a number of unmet needs regarding pain information they received by standardized education programs (Moore, 1994). Ignoring previous experiences or rejecting patient perceptions may be a barrier to identifying learning needs and ultimately maybe interpreted as a rejection by the person (Knowles, 1980).

Patient's previous experiences influence not only their perceptions of pain but also their expectations of pain. It is therefore important to ascertain each person's perceptions and situation and his/her available coping resources. This information can be useful for the healthcare professional working with patients to identify learning needs. Gathering information regarding patient's prior experiences with pain could assist APS nurses in providing them with appropriate information about the probable level of discomfort to be expected and the pain management strategies used.

ASSUMPTIONS

Not all patients can or will report pain. Some patients who are in pain may deny pain or refuse pain relief (McCaffery & Beebe, 1989). Patients may have assumptions that pain is to be endured and everything possible is already being done to relieve pain (Cullen et al., 2001). Many patients are reluctant to report postoperative pain (Hancock, 1996). Some patients believe that an admission of pain is a sign of weakness as well as the inevitable consequence of surgery (Cullen et al., 2001). A patient's assumptions may be based on previous experiences. Many health care professionals continue to provide inadequate information about the effect of analgesia (Carr, 2001).

Adult learners enter into any education experience with a set of assumptions and expectations about their upcoming experiences and about the learning experience. Each learner enters the situation with personal and cultural characteristics, psychological type, learning styles, developmental stage, values, attitudes, beliefs and social norms (Mirka, 1994). Assumptions are usually based on past experiences including formal schooling

and exposure to any other adult learning environment. Characteristics such as age, gender, cultural background and inability to communicate play a role in the experiencing of pain and may have impact on the patient's expectations of pain (Cullen et al., 2001). More than 70% of participants in this study are aged over 50 years old.

5.2.3. Analgesia consumed

It was hypothesized that "Cardiac surgical patients who attended preoperative pain management education program by clinical specialist nurse from the Acute Pain Service (APS) education program will ***consume less average postoperative analgesia*** than cardiac surgical patients who did not attend the preoperative APS education program. There were no statistically significant differences between the patients who attended the APS education and the patients who did not. Therefore the hypothesis cannot be supported and null hypothesis accepted.

The expectation that less analgesia will be consumed by patients who have attended preoperative APS is not universal and not reflected in this research. Participant's reluctance to request analgesia for pain relief continues. The participant who attended APS did not request more or less analgesia.

The null hypothesis may have been retained due to the needs of the patients in regards to pain management differed from what the clinical nurse specialist from the APS felt was important for the patient to learn. The current preoperative APS pain management program does not provide adequate information regarding analgesia. Participants expected to feel a certain amount of pain and were unlikely to seek the maximized effectiveness of pain relief. Understanding the individual patient's beliefs about the effectiveness of pain medication following surgery could assist the APS nurse to make each patient aware of effect pain management strategies. In summary, this reinforces the need to match preoperative pain education with each patients attribute.

5.2.4. Anxiety

It was hypothesized "Cardiac surgical patients who attended structure preoperative pain management education program by clinical nurse specialist from the Acute Pain Service (APS) education program will ***report less average pre and postoperative anxiety scores*** than cardiac surgical patients who did not attend the preoperative APS education program. There were no statistically significant differences between the patients who attended the APS education and the patients who did not. Therefore, the hypothesis cannot be supported and the null hypothesis accepted.

The findings of this research suggest elective cardiac surgical patients have slightly more preoperative anxiety scores than cardiac surgical patients who are emergency admissions. This may be due to the fact that they are informed they require surgery several weeks before it can be performed and they have time to dwell on their fears. Participants from both groups when asked by the investigator during the State-Anxiety Questionnaire 'Are you worried?' responded they were worried about the surgery.

The null hypothesis related to anxiety may have been retained due to factors such as very little learning takes place when patients are anxious (Redman, 1988, Ferguson, 1992). This may be due to the difficulty comprehending the information. Cardiac surgical patients have high levels of anxiety (Tsang and Brush, 1999). CABG surgery has a high degree of physiological threat posed by the nature of surgery . This is due to the high level of anxiety associated with cardiac surgery and potentially no preoperative education can significantly reduce this anxiety (Anderson, 1987, Cupples, 1991). The anxiety of trying to survive the impending surgery may impede the patients learning.

The current APS at the focus of this research does not recognize the unique needs of this population of adult learners. Critical analysis of contemporary education programs, such as APS strengths the argument that these education programs fail to address the high anxiety of these patients. No significant increase in knowledge was found following in-

hospital cardiac teaching program. The authors explained these results by hypothesizing about the effects of stress on learning.

The APS program at the hospital concentrates on increasing patient's knowledge and assumes that this will produce favourable pain outcomes. One potential solution to this problem of providing effective preoperative teaching for cardiac surgical patients would be to conduct an initial preoperative teaching session before admission and then reinforce this information after patients are admitted. The findings of this study suggest that the individual's anxiety levels are not considered when implementing the preoperative APS program. Anxiety measures may be counteracted by patients receiving continuous pain education by health care professionals and APS nurses post-operatively.

5.2.5 Satisfaction

It was hypothesized that "Cardiac surgical patients who attended structured preoperative pain management education by clinical specialist nurse from the APS will ***report higher average satisfaction scores regarding post operative pain management*** than cardiac surgical patients who did not attend the preoperative pain management APS education. There were no statistically significant differences in regards to American Pain Society Inpatient Outcome scores or satisfaction scores between the patients who attended the APS education and the patients who did not. Therefore the hypothesis cannot be supported and the null hypothesis was retained.

The majority of patients from this research reported satisfaction with pain education received before surgery, pain management materials used, Patient Controlled Analgesia, analgesia administered and postoperative pain management by medical staff and nurses. Patients expected to feel a certain amount of pain and were unlikely to seek the maximize effectiveness of pain relief (Walmsley et al., 1992). Studies into APS education program revealed patient satisfaction was high before and after the introduction of the APS and was an unreliable indicator of pain relief (Sartain and Barry, 1999). Patients are commonly satisfied when they believe health care professionals want to relieve pain (Sartain and Barry, 1999). Despite cardiac surgical patient reporting moderate pain

intensity 96% expressed satisfaction with cares (Meehan et al., 1995, Sartain and Barry, 1999).

Hawkins & Price (1993) investigated the use of preoperative pain management videotape and reported 90% of patients were satisfied with pain control however patients experienced moderate levels of pain. Patients report satisfaction even when they are in pain (Ward & Gordon, 1996). Studies have reported measuring satisfaction with pain management is not a reliable outcome to determine effective pain management and pain relief (Sartain & Barry, 1999; Viejo et al., 1999; Ward & Gordon, 1996). This may be due to level of pain they experience is acceptable to them and any reductions in pain is satisfactory and what they expect (Ward & Gordon, 1996). Dawson et al. (2002) concluded that the pattern of pain relief, not the pain intensity that is the critical determinant of the patients' satisfaction with how their pain is managed.

The findings of this study reported average patient satisfaction scores and American Pain Society Inpatient Outcome scores were relatively low indicating high satisfaction with pain management. These findings are consistent with other studies. Despite moderate-severe reports of pain patients were generally satisfied with pain relief (Sartain and Barry, 1999, Dawson et al., 2002, Meehan et al., 1995, Viejo et al., 1999). It can be concluded that patient satisfaction is not a reliable and valid way to establish the effectiveness of APS education.

5.2.6. Bolus administered/failed attempts on PCA

It was hypothesized that "Cardiac surgical patients who attended structured preoperative pain management education by clinical specialist nurse from the Acute Pain Service (APS) education program will ***make equal ratios of self administered and failed attempts on the Patient Controlled Analgesia (PCA) device post operatively*** than cardiac surgical patients who did not attend the APS education program. The results of this study indicated no difference in ratios of self-administered and failed attempts on the PCA device post operatively by cardiac surgical patients who attended the APS education program compared with cardiac surgical patients who did not attend the APS education

program. Therefore the hypothesis cannot be supported and the null hypothesis was accepted.

PCA use in the immediate postoperative period may be impractical for cardiac surgical patients due patients suffering from disorientation, confusion and loss of memory following anaesthesia and cardiopulmonary bypass (Hancock, 1996). These findings suggest that psychological factors can, and do, influence the use of PCA. Patients are not assessed preoperative to ensure they have the ability to use a PCA. There is a need to perform individualized preoperative clinical assessment to identify patients who can use the PCA effectively (Koh and Thomas, 1994). Successful use of PCA depends of psychological variables such as locus of control, coping styles, levels of anxiety which can influence the patient's ability to press the button (Koh and Thomas, 1994).

The APS preoperative education program did not affect the cardiac surgical patient's ability to effectively use PCA. This confirms the findings in other studies. Structured preoperative PCA education by acute pain team did not affect patient's use of PCA or pain outcomes (Lam, et al., 2001). The combination of expecting pain and high anxiety levels diminish a patient's ability to learn.

5.2.7. Length of hospital stay

It was hypothesized "Cardiac surgical patients who attended structured preoperative pain management education program by clinical specialist nurse from the Acute Pain Service (APS) education program will ***have shorter average length of hospital stays*** than cardiac surgical patients who did not attend the preoperative APS education. The results of this study indicated no difference in length of hospital stays by cardiac surgical patients who attended the APS education program compared with cardiac surgical patients who did not attend the APS education program. Therefore the hypothesis cannot be supported.

These findings suggest the APS does not reduce patient's length of hospital stay. Studies investigating the length of hospital stay for postoperative patients have mixed results. Other studies have reported cardiac surgical patients who attended preadmission

education had no differences in length of hospital stay compared with cardiac surgical patients who attended postadmission education (Shuldham, 1999). Cardiac surgical patients who attended full day of preadmission education had longer length of hospital stay compared with cardiac surgical patients who received education on admission (Shuldham et al., 2002). Based on the inadequacies to the APS education program already presented these results are not surprising.

5.3. Acute Pain Service and Adult Learning Theory

Two key factors impact on the outcomes of an APS education program; the patient's readiness to learn and the quality of the education program. Readiness-to-learn indicates that adults are ready to learn if the information can be applied to real-life situations (Palazzo, 2001). Adults need to feel that learning has immediate utility. Adults need to feel that learning focuses on issues that directly concern them. Adults need to anticipate how they will use their learning and adults need to expect performance improvement to result from their learning (Boulmetis, 1999).

The readiness-to-learn of cardiac surgical patients preoperatively is severely limited by the stress of the impending surgery, patient's misconceptions of postoperative pain after surgery, the physical effects of coronary heart disease, medications, reduced attention and loss of focus (Mirka, 1994). The learning process may also be affected by psychosocial variables such as cognitive styles, sociocultural background, personality, attitudes, values and beliefs (Palazzo, 2001). Patients may have previous negative experiences with learning. Many cardiac surgical patients have an intense need to know and readiness-to-learn because they are highly motivated. Two concepts are considered as possible reasons affecting the cardiac surgical patient's readiness-to-learn. The anxiety levels are too high for patients to be able to comprehend the information about pain management or the information may be to complex for patients to understand. The cardiac surgical patient's expectations of what the pain experience is going to be may prevent patient's ability to relieve pain effectively.

First the anxiety levels are elevated and patients may not to be able to comprehend the information about pain management or the information may be to complex for patients to understand. The preoperative APS education program for cardiac surgical patients did not significantly reduce the anxiety levels of the participants. Patients may be more receptive to learn about pain management after the threat of surgery is removed.

Although patients expect to experience pain the APS education program does not alter the patient's expectations or beliefs about pain. The levels of pain patients experienced are acceptable to the patient.

The current APS program does not assess the readiness-to-learn needs of cardiac surgical patients prior to the intervention or adequately address these needs. The preoperative hospital program may not facilitate the patient's readiness-to-learn. In order to foster readiness to learn for cardiac surgical patients the APS program should include simulations of real life situations that encourage anticipatory coping and problem solving.

Adult learners need to know why they need to learn something before they are willing to learn it. Patients need to know more than the basic principles of pain management to facilitate effective treatment of pain and understanding why to perform certain tasks. The APS program should help cardiac surgical patients understand certain tasks and behaviours such as splinting of chest with pillows, utilization of PCA and requests for analgesia to possible reduce pain intensity, improve satisfaction and reduce their length of hospital stay would be a more logical approach to fostering behaviour changes than presenting facts on PCA.

A person's readiness-to-learn relates to tasks facing them in their life, need to know and the value they place on the learning and of these relevant tasks. An adult's readiness to learn also depends on the developmental or transition point of the individual. There are two implications to the readiness-to-learn; firstly curriculums should be organized according to the real life concerns (Mirka, 1994). Real life tasks should be considered by the APS nurse but may be difficult to cover due to time restraints. Secondly, the

implementation of a program based on the Adult Learning Theory principles that take into consideration of the special needs of the adult learner, to help make sense of the information from their perspective would be more effective than the present APS program. Previous studies have revealed patients ranked learning how to prevent Myocardial Infarction higher than the learning of the pathophysiology of heart disease (Mirka, 1994). The findings from this research emphasis the need for APS program to be flexible, unstructured and more open to the dynamic learning needs of the individual cardiac surgical patient.

If the APS program aims to change the attitudes and behaviours of cardiac surgical patients with regard to pain management the APS nurse must be prepared to adapt the education program to address what the patient feels is important. When considering the learning needs of the patient education programs must incorporate the rest of the principles of adult learning theory including self directedness of adults, role of previous experiences and the motivation of the adult learner.

According to Knowles (1980), adult's learners have a concept of being responsible for their own decisions and resent others forcing their will on them. Information for cardiac surgical patients dealing with medication, PCA and pain management techniques should be presented in a manner that takes these principles into consideration. The more the adult learner is involved in planning their own learning, the more likely it is that this goal will be obtained. Individual one-on-one preoperative APS could assist cardiac surgical patient to formulate pain relief goals. Empowering the patient in this way could foster the development of self-directed learning skills that would be more useful to the patient in the long term, than information presented in the traditional manner.

Past experiences shape the way individuals understand the world around them, the assumptions they make, the beliefs they hold and the knowledge they may have for example the individuals personal beliefs about analgesia consumption may lead to dependence or side effects such as hallucinations or they may loose control when taking medications and is very difficult to alter. Previous negative learning experiences and past

experience with postoperative pain may prejudice the learner. Patients have low expectations of pain free cardiac surgical experience. Patients have expectations of what cardiac surgery entails and may see pain relief as a low priority. Patients' previous experiences and expectations of pain have been described earlier in this section. Learning styles are influenced by intelligence, personality, age, developmental level and formal education (Campbell, 1999).

Learning styles and abilities change throughout life. Adult learning relies on information that is appropriate to what is known at a given time i.e. it is developmentally paced. Attitudes about pain relief are derived from beliefs and past experiences, are powerful influences on human behaviours and learning. As adults get older life experiences increase and older patients may have low expectations of relieving pain or realize that the experience of acute postoperative pain will only be short lived. The majority (>70%) of participants in this study are aged over 50 years and have many past experiences with hospitals, pain, stress and previous illness.

Adults prefer problem centred or performance learning. Knowles (1980) states that adults are motivated to devote energy to learn something to the extent that they perceive that it will help them perform a task or deal with problems that they are confronted with in real life situations. When adults need and desire what they are learning they are highly motivated.

The cardiac surgical patient's expectations of what the pain experience is going to be may impede the patient's ability to relieve pain effectively. The stress and anxiety of living through cardiac surgery may reduce the patient's motivation on pain management. Therefore the task of healthcare professional is to frame information so that patients can recognize its usefulness and applicable to his/her unique perspective and real life situation (Mirka, 1994).

Motivation of adult learners is different because it is generated from internal factors rather than external sources, for example anxiety, personality, locus of control and

psychological aspects. However, as demonstrated by the findings in this research, internal motivation has not been utilized in conjunction with other principles of Adult Learning Theory in personalizing patient education programs. This should be reflected in the aims or objectives of the APS program.

APS nurse educators need to be attuned to the needs of the individuals and develop learning programs that are relevant to these concerns. Older adults are vulnerable to fatigue and distraction when the learning is uninteresting. Use of breaks, smaller work groups and energizers also reduces fatigue of adult learners. Introduction of unfamiliar pain relief information such as Patient Controlled Analgesia with more generalized familiar information such as splinting with pillows reduces adult learner's fears and increases motivation to learn. The APS nurse educator needs to provide stimulation of cardiac surgical patients by utilizing a variety of presentation styles, methods of instruction and types of learning materials. This increases motivation, interest in pain relief techniques and allows for individual learning styles. This may be achieved by individual preoperative visits to assess and address these needs.

5.4. Clinical Implications

These results challenge some of the generally accepted beliefs about preoperative pain management for cardiac surgical patients. Three key issues need to be addressed when planning preoperative APS education for cardiac surgical patients:

1. High anxiety levels. Cardiac surgical patients have high levels of anxiety due to the threat posed by the nature of the surgery and potentially no preoperative education program can be affective unless their anxiety levels are significantly reduced.

2. Expectations of pain relief are low. Cardiac surgical patient expect pain post-operatively. Effective education utilizing principles of Adult Learning Theory is needed in order to bring about any changes in patient's attitudes and beliefs about pain relief.

3. Readiness-to-learn. Cardiac surgical patients have an intense need to know about surgical procedures but may not rate pain relief as that important. Adults need to feel that the learning has immediate utility and focuses on issues directly related to them. APS programs should include simulations of real life situations that improve patient's knowledge of pain management.

4. The implementation of the APS education should take into consideration the special needs of cardiac surgical patients and help patients alleviate their fears about surgical procedures in order to educate and assist patients with techniques used to relieve pain.

5.5. Recommendations

The APS which was the focus of this research is not currently meeting the needs of individual cardiac surgical patients therefore it is necessary to explore alternatives to the current education program. Practical constraints such as lack of time and finances need to be considered. Patient characteristics and educational factors reduce the effectiveness of the current APS education program. Patients expect to have pain, have high levels of anxiety, and may not be ready to learn. The education program does not reflect individual participants educational needs, is offered in a large group environment and the content of the program is teacher focused.

One recommendation is to discontinue the preoperative APS group education program. Recommendations to improve the existing APS pain management program are:

1. Reducing preadmission class sizes to smaller groups. Studies have shown size considerations are important smaller groups of 6 or less are more productive (Imel, 1999).

2. Introducing APS sessions earlier in the day incorporating short breaks in the APS or provided APS education over two days as fatigue reduces the patient's ability to comprehend the complex information.

3. The APS could use a range of other resources such as discussions with recovering cardiac surgical patients, videotapes, slides or games to keep patients interested and motivated.

4. APS group learning can be used effectively in combination with individualized learning. One-on-one preoperative visits by the clinical nurse specialist from the APS may provide an opportunity for patients to formulate individual pain management plans, discuss personal interests, myths and beliefs about pain and may be a catalyst for further learning and behavioural changes. Some adults need to test their learning as they go along, rather than receive background theory and general information (Boulmetis, 1999). Individual discussions with patients could introduce concepts of pain management and introducing cardiac surgical patient how they might apply the information along with individualized visits by APS before surgery. Individual teaching could provide; direct eye contact, asking patients questions, feedback and evaluation of what the patients expect and understand about pain management, formulation of pain goals, needs assessment and demonstration of the PCA device. Previous experiences, values and attitudes could be explored. Individual preoperative visits by APS that incorporates effective use of the principles of Adult Learning Theory may have the positive impact on postoperative pain management that is desired.

5.6. Future research

This study analyzed preoperative education on postoperative pain outcomes other studies are needed to evaluate preoperative measures. Future research could examine ongoing programs of education or utilizing principles of Adult Learning Theory for APS and further support of patients. Other areas of research could be to provide alternative resources such as CDROM, videotapes, discussions with other patients, booklets specifically to pain management, smaller groups or INTERNET. Future research is needed in order to assist in the appropriate development of APS education for cardiac surgical patients. Preoperative education programs studies that take into account the

severity of the diseases as rated by angiography, length of time on cardiopulmonary bypass, number of grafts or intraoperative blood loss may be helpful.
One question that needs addressing is whether or not introducing the APS team preoperatively followed by one-on-one teaching postoperative improves pain management. A second question that needs addressing is whether or not brief one-on-one preoperative education is practical and or effective.

5.7. Limitations

The APS which was the focus of this research is not currently meeting the needs of individual cardiac surgical patients therefore it is necessary to explore alternatives to the current education program. Practical constraints such as lack of time and finances need to be considered. Patient characteristics and educational factors reduce the effectiveness of the current APS education program. Patients expect to have pain, have high levels of anxiety, and may not be ready to learn. The education program does not reflect individual participants educational needs, is offered in a large group environment and the content of the program is teacher focused.

Possible reasons for non-significant results are patient's expectations and experiences of pain are not being adequately addressed in the preoperative Acute Pain Service education program. This APS program does not assess individual patient expectations, assumptions, beliefs or previous experiences prior to the intervention. It is difficult to determine if the information presented in the APS program is perceived by the patients as relevant to his/her perspective, applicable to their life situation or instrumental in facilitating behaviours for effective pain management.

This study cannot be generalized to the whole population. The lack of statistical significant differences in all of these outcomes may be related to the small numbers in the control group or the small number of female participants and the large standard deviations is some of the dependent variables. Case control studies investigating only females may eliminate this. Confounding was minimized by the study hospital randomizing the selection of patients to both groups. There are many reasons why this

study might fail to find a significant difference between the two groups. The first is that there are no significant differences on the outcomes chosen between the both groups. This study compared one form of education with another and not any education. This research does not prove that education fails in fact the cardiac surgical patient in this study had lower anxiety scores than reported in previous findings. The sample size was not large enough to detect differences. Pain assessment by self reported numerical rating scales were only assessed and documented for the first 2 days following surgery at the study hospital. This may not have been long enough to detect reduced pain scores as patients are mechanically ventilated for the first 12 to 24 hours after surgery and verbal communication is limited. Pain is a very subjective experience and many factor effect the way a patient expresses pain. The interval between the APS education and surgery (usually 2 to 4 weeks) could not be controlled for and may have been too long. Cardiac patients who received APS were predetermined by the study hospital and could not be controlled for in the study. Staff were unaware which patients were assigned to which group. Data was collected and inputted, blind to patient's assigned group. Education was provided the same nurse ensuring consistency of the information however, the control group received informal education by multidisciplinary team who may have allowed time for answering specific questions.

5.8. Conclusion

In summary there are a number of variables that impact on the learning process of cardiac surgical patients, the expectation that they will have pain after surgery, the important role that anxiety and stress play in the process of learning and the quality of the education program. The effectiveness of the by the APS program methods used in teaching pain management to cardiac surgical patients. The application of all of the above Adult Learning Theory principles for the unique needs of cardiac surgical patients would be more useful in addressing pain management than the existing study hospital's APS program. The current APS programs content is determined by expert healthcare professional's perception of needs. The APS program reflects the underlying principles of the biomedical model and underpinnings of the academic rationalism. The presence of

the biomedical theories and principles may explain the inability of APS to address and meet the needs of cardiac surgical patient's postoperative pain experiences.

The use of the biomedical model of delivering pain management education is not useful in explaining complex and interactive physical, emotional, social and spiritual demands of adult learners in regards to pain and its management. Specifically the theory that increased knowledge will provide compliance is linear and does not consider psychosocial and subjective issues that play a role in the individual's pain experiences. The APS program is teacher centred and contains content determined by experts. The patient is expected to learn information that the nurse provides.

It is clear that the APS program discussed in this study provides patients with knowledge based on the practice of medicine and currently is ineffective and makes no attempts to frame this information in the context of the expectation of pain, patient's high anxiety, readiness-to-learn, self-directedness of adults, patient's life experience or motivation of adult learners. An approach that incorporates the learning needs of the patients and uses these as a guide to personalize the preoperative APS education program has provided the framework for this study. The APS program should be a service available to those who chose it rather than a part of routine preoperative program.

High pain levels continue to be a common problem after surgery and are anticipated by many patients as virtually unavoidable consequences of surgery (Acute pain Management, 1992a, Puntillo & Weiss, 1994, Tsang & Brush, 1999). Pain remains one of the most serious problems in health care (Royal College of Surgeons, 1990). To allow patients to experience moderate to severe pain is unethical (Chung & Lui, 2003, Morris, 1991) .

Pain is a complex phenomenon and is affected by physiological, psychosocial and subjective factors. Pain perceptions are individual and are affected by psychological profile, sociocultural background, motivation, and age and anxiety levels of patients (Ferguson, 1992).

Health care professionals provide pain management by assessment of pain intensity, pharmacological and nonpharmacological interventions and evaluations. This study investigated nonpharmalogical intervention of preoperative education by APS provided for cardiac surgical patients. Some studies have reported reduce pain levels and safe use of analgesia by providing APS for surgical patients (Bardiau et al., 1999; Harmer and Davies, 1998, Miakowski et al., 1999, Mackintosh and Bowles, 1997, Sartain and Barry; 1999, Tighe et al., 1998). Other studies have criticized the use of preoperative education for surgical patients (Devine et al., 1999, Hawkins and Price, 1993, Shuldham et al., 2002, Watt-Watson and Stevens, 1998).

The aim of this research was to compare the pain experiences of cardiac surgical patients who attended a preoperative pain management education program provided by clinical specialist nurse-led Acute Pain Service compare with cardiac surgical patients who did not attend an APS program. In order to address the aims the following hypotheses were addressed: Cardiac surgical patients who attended the preoperative pain management education program by clinical APS specialties nurse will:

- Report less average pain scores,
- Consume less average postoperative analgesia,
- Report less average pre and postoperative anxiety scores,
- Report high average satisfaction regarding postoperative pain management
- Make fewer ratios of self administered boluses and failed attempts on the PCA device postoperatively
- Have shorter average length of hospital stay

than cardiac surgical patients who do not attend APS.

The findings of this study indicated there were no statistically significant differences in regards to all of the hypotheses. Therefore, the hypotheses cannot be supported and the null hypotheses have been accepted. This research has provided the first investigation into the APS education program. Based on this study the service provider from the study hospital can make evidence based decisions regarding the delivery of preoperative

education provided by the acute pain service for cardiac surgical patients. Other providers of small group education programs or introduction of APS programs for surgical patients or intensive care patients may benefit from the findings and recommendations of this study. For the wider population of patients about to undergo cardiac or general surgery at other centres and where such a program is not available then a cautious approach should be adopted.

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Appendix A

DEMOGRAPHIC DATA FORM

PLEASE TICK THE APPROPRIATE ANSWER

1.What is your age?

1	18 – 30	
2	31 – 40	
3	41 -50	
4	51- 60	
5	61 <	

2. What is your gender?

1	Male	
2	Female	

3.Tick final year of school?

	Grade	Completed		Grade	Completed		Grade	Completed
1.	Did not start		7.	6		13.	12	
2.	1		8.	7		14.	TAFE	
3.	2		9.	8		15.	Trade	
4.	3		10.	9		16.	University	
5.	4		11.	10				
6.	5		12.	11				

4. Do you speak another language at home?

1.	Yes	
2.	No	
3.	If yes what other language?	

5. Where were you Born?

1.	Australia	
2.	New Zealand	
3.	Asia	
4.	Europe/Continent	
5.	United Kingdom	
6.	Africa	
7.	North America	
8.	South America	
9.	Islands of South Pacific	
10.	other	

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6. If you were not born in Australia, how long have you lived in Australia?

1.	0 to 5 years	
2.	6 to 10 years	
3.	11 to 15 years	
4.	16 to 20 years	
5.	21 to 25 years	
6.	26 to 30 years	
7.	31 and more	

7. What is your yearly income?

1.	0 to $15 000	
2.	$15 001 to $25 000	
3.	$25 001 to $35 000	
4.	$35 001 to $45 000	
5.	More than $45 001	

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Appendix B

STATE-ANXIETY QUESTIONNAIRE

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate value to the right of the statement to indicate how you feel *right now*, that is, *at this moment.* There is no right or wrong answers. Give the answer which seems to describe your present feelings best.

	Not at all	somewhat	moderately	very much
1. I feel calm……..	1	2	3	4
2. I feel secure……	1	2	3	4
3. I am tense……	1	2	3	4
4. I feel strained……	1	2	3	4
5. I feel at ease…….	1	2	3	4
6. I feel upset……	1	2	3	4
7. I am presently worrying over misfortunes	1	2	3	4
8. I feel satisfied……	1	2	3	4
9. I feel frightened……	1	2	3	4
10.I feel comfortable……	1	2	3	4
11.I feel self-confident……	1	2	3	4
12.I feel nervous…….	1	2	3	4
13.I am jittery…….	1	2	3	4
14.I feel indecisive……..	1	2	3	4
15.I am relaxed……	1	2	3	4
18.I feel confused……	1	2	3	4
16.I feel content……..	1	2	3	4
17.I am worried……..	1	2	3	4
19. I feel steady……..	1	2	3	4
20.I feel pleasant……	1	2	3	4

Appendix C

THE INPATIENT OUTCOME QUESTIONNAIRE

1) Have you experienced any pain in the past 24 hours?

1. Yes □ 2. No □

2) On this scale, how much discomfort or pain are you having right now?

0 1 2 3 4 5 6 7 8 9 10
no pain worst possible pain

3) Please describes the worst pain you have had in the last 24 hours.

0 1 2 3 4 5 6 7 8 9 10
no pain worst possible pain

4) Please describes the average level of pain you have had in the past 24 hours.

0 1 2 3 4 5 6 7 8 9 10
no pain worst possible pain

5) Please describes how, during the past 24 hours, that pain has interfered with your

A. General Activity
0 1 2 3 4 5 6 7 8 9 10
does not interfere completely interferes

B. Mood
0 1 2 3 4 5 6 7 8 9 10
does not interfere completely interferes

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C. Walking Ability

0 1 2 3 4 5 6 7 8 9 10

does not interfere completely interferes

D. Relations with other people

0 1 2 3 4 5 6 7 8 9 10

does not interfere completely interferes

E. Sleep

0 1 2 3 4 5 6 7 8 9 10

does not interfere completely interferes

F. Other activities that are needed to recover from illness (eg. coughing, deep breathing, triflow)

0 1 2 3 4 5 6 7 8 9 10

does not interfere completely interferes

6) Have you been satisfied with your pain education before surgery?

1.	Very dissatisfied		4.	Slightly satisfied	
2.	Dissatisfied		5.	Satisfied	
3.	Slightly dissatisfied		6.	Very satisfied	

8) Have you been satisfied with the pain information you have been given eg. Brochures?

1.	Very dissatisfied		4.	Slightly satisfied	
2.	Dissatisfied		5.	Satisfied	
3.	Slightly dissatisfied		6.	Very satisfied	

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9) Have you been satisfied with the PCA?

1.	Very dissatisfied		4.	Slightly satisfied	
2.	Dissatisfied		5.	Satisfied	
3.	Slightly dissatisfied		6.	Very satisfied	

10) Have you been satisfied with oral pain tablets?

1.	Very dissatisfied		4.	Slightly satisfied	
2.	Dissatisfied		5.	Satisfied	
3.	Slightly dissatisfied		6.	Very satisfied	

11) Was the level of pain you experienced what you expected?

1.	Lot less	
2.	Little less	
3.	same	
4.	Little more	
5.	Lot more	

12) What advice about pain control would you give another person having your operation?

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13) How satisfied or dissatisfied were you with your pain treatment overall.

1.	Very dissatisfied		4.	Slightly satisfied	
2.	Dissatisfied		5.	Satisfied	
3.	Slightly dissatisfied		6.	Very satisfied	

14) How satisfied were you with the way your nurses treated your pain.

1.	Very dissatisfied		4.	Slightly satisfied	
2.	Dissatisfied		5.	Satisfied	
3.	Slightly dissatisfied		6.	Very satisfied	

15) How satisfied were you with the way your doctors treated your pain.

1.	Very dissatisfied		4.	Slightly satisfied	
2.	Dissatisfied		5.	Satisfied	
3.	Slightly dissatisfied		6.	Very satisfied	

16) If you were not satisfied with the way your nurses or doctors treated pain, please explain why.

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17) What was the longest time you had to wait to get pain medication?

1.	15 minutes or less	
2.	15 to 30 minutes	
3.	30 to 60 minutes	
4.	More than one hour	
5.	Never asked for pain medication	

18) Was there a time that the medication you were given for pain didn't help and you asked for something more or different to relieve the pain?

1. Yes □ 2. No □

19) If you answered "yes", how long did it take before your doctor or nurses changed your treatment to a stronger or different medication and gave it to you?

1.	1 hour or less	
2.	1 to 2 hours	
3.	2 to 4 hours	
4.	4 to 8 hours	
5.	8 to 24 hours	
6.	More than 24 hours	

20) If you still have pain, would you like a stronger dose of pain medication?

1. Yes □ 2. No □

If you answer no, please indicate why?

21) Early in your care, did your doctor or nurses discuss with you that we consider treatment of pain very important, and did they ask you to be sure to tell them when you have pain?

1.	doctor	
2.	nurse	
3.	No one	
4.	both	

22) Please respond to the next seven items by circling the number (0, 1, 2, 3, 4 or 5)

A. Pain medicine cannot really control pain.
0 1 2 3 4 5
do not agree at all agree very much

B. People get addicted to pain medicine very easily.
0 1 2 3 4 5
do not agree at all agree very much

C. Good patients avoid talking about pain
0 1 2 3 4 5
do not agree at all agree very much

D. It is easier to put up with pain than with the side effects that come from pain medicine.
0 1 2 3 4 5
do not agree at all agree very much

E. Pain medicine should be "saved" in case the pain gets much worse.
0 1 2 3 4 5
do not agree at all agree very much

Appendix D

PCA
OBSERVATION CHART

Patient Identification Label

Name: ....
Ur № ....
DOB: ....
Sex: ....

PAIN SCORE	SEDATION SCORE
0 (no pain)--------------------10(worst pain imaginable) at rest (R) and on movement (M)	0 none 1 mild, occassional drowsy, easy to rouse 2 moderate, frequently drowsy, easy to rouse 3 severe, somnolent, diffcult to rouse S normal sleep, easy to rouse

(a)Record deliveries and demands with routine postoperative obs, then at least 2-4hrly.
Intensive care units **only**, nurse controlled analgesia note as NCA and sign in signature section.
(b)Record background/continuous infusion. When ceased sign on the order form 'change to programme details'. **Check programme with 2 RN's.**
(c)Record 24 hr total of opioid ie.scroll through history to '*shift' mgs and record this amount since the shift reset. Reset "shift" on PCA **ONLY ONCE A DAY AT 0800HRS** AND RECORD. This will rezero del/dem and patient total.

EXAMPLE
PRESS
HISTORY

TIME IS 08:00 FRI, JAN 4,99	PCA MODE PCA ONLY	CONCENTRATION 1MG/ML	PCA DOSE 2MGS	PCA LOCKOUT 5 MINUTES	4HOUR LIMIT? NO	TOTAL AMT 100MGS	HIGH SENSITIVITY ALARM ON

➡

SHIFT CLEARED 8:00 JAN 5,99	*PCA DEL 9 *PCA DEM 11	*PCA 18MGS *LOADING 2MGS	*SHIFT 20MGS

(ONLY AT 08OOHRS) (RECORD WITH OBS) (RECORD)

Date/ time	Sedation score	Resp Rate	SaO2	Pain at rest	Score move/ cough	PCA del	dem	PCA infusion rate /back ground	TOTAL 24hr total / 'reset' 0800hrs	NCA ICU only Nr sign	Comments (eg pain relief given/action taken, PCA reset, etc)
eg. 5/10 0800	0	16	95%	2/10	5/10	15	18	0.3mgs/hr	37.2mgs		(ie 37.2mgs in 24 hrs
-------	-------	-----	------	------	-----	0	0	ceased	----------	------	PCA reset

Appendix E

Information Sheet for Cardiac Surgical Patients

Study Title

The impact of structured pre operative education by the Acute Pain Service at the Pre admission clinic for elective open heart surgical patients' measuring pain levels, anxiety, satisfaction, number of self administered bolus doses, the number of failed attempts on Patient Controlled Analgesia (PCA) and analgesia consumption.

Principal Researchers

Masters student Snezana Stolic, at Queensland University of Technology and Registered nurse at The Prince Charles Hospital

Supervisor Dr. Judy Wollin, School of Nursing, Queensland University of Technology

Study Information

We are conducting a study at The Prince Charles Hospital to look at the extent to which education of pain management meets the needs of people going for open heart surgery. The outcomes of the two-part study will be to recommend improved education programs for future open heart surgical patients. The benefits of this study to you are the personal satisfaction of helping in this project.

The FIRST part of our study will be when you are admitted to the hospital for your surgery the researcher will sit down and ask you a few questions about personal details, your attitude to pain management and your stress levels.

The aim of this part of the study is to explore and describe your attitudes to pain management and your stress levels before surgery.

The SECOND part of the study will be on your 3 or 4 day after surgery at a time of convenience to you, when the researcher will revisit and ask you a few more questions regarding your satisfaction with your pain management, your stress levels and personal details.

At this time we will be looking at the extent to which the two different existing education programs meet the needs of open heart surgical patients.

The findings of the study should lead to improvements in the education program for open heart patients' pain management.

We are asking that you might take part in the study. Information that you would be able to contribute would be most valuable to the project and kept confidential.

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What Does the Study Involve?

If you agree to participate, you will be invited to take part in two individual surveys with a research nurse, as well as providing some brief, background details about your situation. The first survey will take place at a time convenient to you before surgery when you are admitted to hospital. The survey interview will last between 5 to 10 minutes, you will be asked to give written consent to the study. In addition, the research nurse will follow-up with a second survey on your third or fourth day after your heart surgery asking the stress level questions with additional questions regarding your satisfaction with your pain management after surgery. Information about how much medication you have received will also be recorded from your medical records.

On the questionnaire any personal or identifying information will be removed. Paper copies will be stored in a locked filing cabinet in the Principal Researcher's office at the University, as will any computer diskettes used during the study. You will be given a code number, and this will be known only to the Principal Researchers and the interviewer. Five years after findings are first published, all paper copies of study data will be shredded and computer files deleted in accordance with national guidelines. In published findings or findings presented at conferences, all identifying information will have been removed.

Possible Risks

The main risk to you from taking part in the study would be that you might become upset when remembering the difficult times you have experienced. If this should occur at any time during the interview, the interview would be ceased immediately. You would be given the option of continuing after a short break, continuing on another occasion, or withdrawing from the study. You are free to withdraw from the study at any time during the study. If you should decided to withdraw, this will in no way effect any relationship you have with any health care provider.

The Time and Cost Involved

The first interview would take about five minutes of your time and the second interview will be about ten minute's at the most convenient time to you. There are no costs involved for you.

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Potential Benefits of the Study
The study is aimed at recommending ways of meeting educational needs to manage pain after open heart surgery, such as your own in a better or more complete way. You may obtain personal satisfaction from having input into such a study.

You're Right to Refuse to Take Part
Of course, you are free to refuse this invitation, and such a refusal will have no negative effects for you. You may also elect to withdraw at any time during the project, without providing a reason. If you decide to withdraw from the study you can also request that any information that has been collected about you be destroyed and not used in the study.

Questions
Any questions concerning the project, which is entitled "The impact of structured pre-operative education by Acute Pain Service (APS) clinical nurse specialist at the Pre admission clinic for elective open heart surgical patients' measuring, pain levels, anxiety, satisfaction, number of self administered bolus doses, the number of failed attempts on Patient Controlled Analgesia (PCA) and analgesia consumption" can be directed to Masters Student Snez Stolic, the lead investigator on this project. Snez Stolic is in the School of Nursing 07 3864 3882 and Prince Charles Hospital on 07 3350 8671 or on 0402 427961. Dr. Judy Wollin is the supervisor and can be contacted at Queensland University of Technology on 07 3864 3885. If you have any concerns in relation to the ethical conduct of this project you may contact the Secretary, University Human Research Ethics Committee on 3864 2902 or the research Co-ordinator of The Prince Charles Hospital on 3350 8500.

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Appendix F

Participant Consent Form

The Prince Charles Hospital

STANDARD CONSENT FORM FOR RESEARCH PROJECTS

Ethics Committee Protocol No: EC2258

Title of Research Project:

The effect of pre operative education by nurse-led Acute Pain Service on open heart surgical patient's pain levels, anxiety, satisfaction, the number of self administer bolus doses, the number of failed attempts on Patient Controlled Analgesia and analgesia consumption.....

Name of researcher:

.....Snezana.Stolic.....

I agree to participate in the above named project and in so doing acknowledge that:

1. I have read the attached Patient Information Sheet outlining the nature and purpose of the project and the extent of my involvement, and have had these details explained to me. I have had the opportunity to ask further questions and am satisfied that I understand.

2. I have been informed as to the nature and extent of any risk to my health or well-being.

3. I am aware that, although the project is directed to the expansion of medical knowledge generally, it may not result in any direct benefit to me.

4. I have been informed that my refusal to consent to participate in the study will not affect in any way the quality of treatment provided to me.

5. I have been informed that I may withdraw from the project at my request at any time and that this decision will not affect in any way the quality of treatment.

6. I have been advised that the District Manager, on recommendation from The Prince Charles Hospital Human Research Ethics Committee and the Hospital authorities, has given approval for this project to proceed.

7. I am aware that I may request further information about the project as it proceeds.

8. I am aware that my GP may be informed that I am taking part in the project.

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I understand that, in respect of any information including audiovisual records obtained during the course of the project, confidentiality will be maintained to the same extent as for my Hospital medical records and that, in the event of any results of the project being published, I will not be identified in any way.
I agree that, if necessary, my medical records (in respect of my involvement in this project) may be inspected by a Research Assessor who may be external to but approved by the Hospital, provided that the Assessor does not identify me or the Hospital's medical records in any way to a third party.

DATE……..

PATIENT' NAME: .....….(Signature).....

NAME OF WITNESS: .....…...(Signature).....

NAME OF INVESTIGATOR :……(Signature……..

Appendix G
Table of results

One-way ANOVA Fentanyl with gender as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
FENTANYLDay0	Between Groups	969357.2	2	484678.597	.935	.398
	Within Groups	30571713	59	518164.627		
	Total	31541070	61			
FENTANYLDay1	Between Groups	228658.7	2	114329.350	.398	.673
	Within Groups	20981388	73	287416.278		
	Total	21210047	75			
FENTANYLDay2	Between Groups	38519.989	2	19259.995	.354	.703
	Within Groups	3210018	59	54407.088		
	Total	3248538	61			

Appendix H

Tukey's post hoc analysis Fentanyl and education levels

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
FENTANYLDay0	primary	secondary	387.36	297.350	.399	-327.55	1102.26
		teritary	241.65	318.269	.729	-523.55	1006.84
	secondary	primary	-387.36	297.350	.399	-1102.26	327.55
		teritary	-145.71	204.121	.756	-636.47	345.05
	teritary	primary	-241.65	318.269	.729	-1006.84	523.55
		secondary	145.71	204.121	.756	-345.05	636.47
FENTANYLDay1	primary	secondary	-90.56	217.197	.909	-610.19	429.07
		teritary	-185.74	232.645	.705	-742.33	370.85
	secondary	primary	90.56	217.197	.909	-429.07	610.19
		teritary	-95.18	138.490	.772	-426.51	236.15
	teritary	primary	185.74	232.645	.705	-370.85	742.33
		secondary	95.18	138.490	.772	-236.15	426.51
FENTANYLDay2	primary	secondary	-40.74	96.140	.906	-271.88	190.41
		teritary	-81.70	103.899	.713	-331.50	168.10
	secondary	primary	40.74	96.140	.906	-190.41	271.88
		teritary	-40.96	67.030	.815	-202.12	120.20
	teritary	primary	81.70	103.899	.713	-168.10	331.50
		secondary	40.96	67.030	.815	-120.20	202.12

Appendix I

One way ANOVA Morphine with gender as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
MORHINEDay0	Between Groups	830.447	1	830.447	3.043	.086
	Within Groups	17191.083	63	272.874		
	Total	18021.530	64			
MORPHINEDay1	Between Groups	632.753	1	632.753	1.915	.170
	Within Groups	25768.049	78	330.360		
	Total	26400.802	79			
MORPHINEDay2	Between Groups	194.373	1	194.373	2.160	.147
	Within Groups	5670.489	63	90.008		
	Total	5864.862	64			

Appendix J

One way ANOVA Panadol with gender as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
panadol day 0	Between Groups	.153	2	.076	.148	.863
	Within Groups	31.117	60	.519		
	Total	31.270	62			
panadol day 1	Between Groups	.612	2	.306	.984	.380
	Within Groups	18.658	60	.311		
	Total	19.270	62			
panadol day 2	Between Groups	.243	2	.122	.515	.600
	Within Groups	14.169	60	.236		
	Total	14.413	62			
panadol day 5	Between Groups	1.707	2	.854	.727	.488
	Within Groups	64.569	55	1.174		
	Total	66.276	57			

Appendix K

One-way ANOVA Tramadol with gender as factor

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
tramadol day 1	Between Groups	4.242	1	4.242	.019	.891
	Within Groups	14389.698	64	224.839		
	Total	14393.939	65			
tramadol day 2	Between Groups	29574.511	1	29574.511	8.760	.004
	Within Groups	216069.4	64	3376.085		
	Total	245643.9	65			
tramadol day 5	Between Groups	740.703	1	740.703	.117	.734
	Within Groups	342830.7	54	6348.717		
	Total	343571.4	55			

Appendix L

Tukey post hoc analysis for Tramadol and education

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
tramadol day 1	primary	secondary	-1.35	5.806	.971	-15.30	12.60
		teritary	-5.26	6.228	.677	-20.23	9.70
	secondary	primary	1.35	5.806	.971	-12.60	15.30
		teritary	-3.91	3.976	.590	-13.47	5.64
	teritary	primary	5.26	6.228	.677	-9.70	20.23
		secondary	3.91	3.976	.590	-5.64	13.47
tramadol day 2	primary	secondary	-17.57	24.294	.751	-75.95	40.82
		teritary	-47.37	26.061	.173	-110.00	15.26
	secondary	primary	17.57	24.294	.751	-40.82	75.95
		teritary	-29.80	16.636	.181	-69.78	10.18
	teritary	primary	47.37	26.061	.173	-15.26	110.00
		secondary	29.80	16.636	.181	-10.18	69.78
tramadol day 5	primary	secondary	12.50	36.469	.937	-75.59	100.59
		teritary	10.00	39.598	.965	-85.65	105.65
	secondary	primary	-12.50	36.469	.937	-100.59	75.59
		teritary	-2.50	25.652	.995	-64.46	59.46
	teritary	primary	-10.00	39.598	.965	-105.65	85.65
		secondary	2.50	25.652	.995	-59.46	64.46