EFFECTS OF PAIN MANAGEMENT COMBINED WITH COMPLEMENTARY CARE PROGRAM ON ACUTE PAIN AND PHYSIOLOGICAL RESPONSES IN PATIENTS WITH CARDIAC SURGERY

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ผลของโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ

นางสาวผกามาศ แก้วนันทวัฒน์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาพยาบาลศาสตรดุษฎีบัณฑิต
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Thesis Title	EFFECTS OF PAIN MANAGEMENT COMBINED WITH COMPLEMENTARY CARE PROGRAM ON ACUTE PAIN AND PHYSIOLOGICAL RESPONSES IN PATIENTS WITH CARDIAC SURGERY
By	Miss Pakamas Keawnantawat
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ผกามาศ แก้วนันทวัฒน์ : ผลของโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ (EFFECTS OF PAIN MANAGEMENT COMBINED WITH COMPLEMENTARY CARE PROGRAM ON ACUTE PAIN AND PHYSIOLOGICAL RESPONSES IN PATIENTS WITH CARDIAC SURGERY) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร. สุรีพร ธนศิลป์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: ผศ. ดร. สุนิดา ปรีชาวงษ์, 235 หน้า.

การวิจัยครั้งมีเพื่อศึกษาประสิทธิผลของโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานนี้ มีพื้นฐานมาจากแนวคิดการจัดการอาการที่ผสมผสานระหว่างวิธีการทางชีวภาพทางการแพทย์ การใช้ผู้เชี่ยวชาญและกลวิธีในการดูแลตนเอง กลุ่มตัวอย่างเป็นผู้ป่วยที่เข้ารับการผ่าตัดหัวใจจำนวน 70 คน ณ โรงพยาบาลรามาธิบดี ผู้ป่วยในกลุ่มควบคุมได้รับการดูแลตามปกติ ผู้ป่วยในกลุ่มทดลองได้รับการดูแลตามปกติร่วมกับโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสาน ซึ่งจะเริ่มตั้งแต่ครั้งแรกที่หอผู้ป่วยศัลยกรรมในวันเตรียมผ่าตัด และติดตามไปจนถึงวันที่สามภายหลังการผ่าตัด เนื้อหาของโปรแกรม ประกอบไปด้วย 3 ส่วน กล่าวคือ การปรับประสบการณ์ความปวดแบบเฉียบพลัน, กลยุทธ์การจัดการความปวดแบบเฉียบพลัน และการประเมินผลลัพธ์การจัดการความปวดแบบเฉียบพลัน เครื่องมือที่ใช้ในการเก็บรวบรวมข้อมูล ได้แก่ Bedside patient monitoring และ แบบประเมินความปวด Brief pain inventory ฉบับดัดแปลงที่แปลเป็นภาษาไทย ใช้ประเมินความปวดใน 2 มิติ; มิติด้านความรุนแรงของความปวดและมิติด้านการรบกวนของความปวด เครื่องมือได้ผ่านการตรวจสอบความเที่ยงโดยสัมประสิทธ์อัลฟาครอนบาค มีค่าเท่ากับ 0.76 - 0.85 การวิเคราะห์ข้อมูลใช้สถิติ Repeated measure MANOVA และ Repeated measure ANOVA

ผลการศึกษาพบว่าภายหลังการการเข้าร่วมโปรแกรม ผู้ป่วยในกลุ่มทดลองมีค่าเฉลี่ยความปวดต่ำกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ($p < .05$) โดยคะแนนเฉลี่ยความปวดของผู้ป่วยผ่าตัดหัวใจในกลุ่มทดลองลดลงอย่างเป็นลำดับ ตั้งแต่วันที่ 1, 2 และ 3 หลังผ่าตัดอย่างมีนัยสำคัญทางสถิติ ($p < .05$) นอกจากนี้ ยังพบว่า ผู้ป่วยในกลุ่มทดลองมีค่าเฉลี่ยปริมาณออกซิเจนในเลือดสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติเช่นกัน($p < .05$) ดังนั้นจึงควรมีการนำโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานไปใช้ร่วมกับการดูแลความปวดแบบเฉียบพลังภายหลังการหลังผ่าตัดหัวใจ

สาขาวิชา พยาบาลศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2558 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

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KEYWORDS: PAIN MANAGEMENT / COMPLEMENTARY CARE / ACUTE PAIN / PHYSIOLOGICAL RESPONSES / PATIENTS WITH CARDIAC SURGERY / SYMPTOM MANAGEMENT MODEL

PAKAMAS KEAWNANTAWAT: EFFECTS OF PAIN MANAGEMENT COMBINED WITH COMPLEMENTARY CARE PROGRAM ON ACUTE PAIN AND PHYSIOLOGICAL RESPONSES IN PATIENTS WITH CARDIAC SURGERY. ADVISOR: ASSOC. PROF. SUREEPORN THANASILP, Ph.D., CO-ADVISOR: ASST. PROF. SUNIDA PREECHAWONG, Ph.D., 235 pp.

The aim of this study was to examine effect of the pain management combined with complementary care program (PCP) on acute pain and physiological responses in patients with cardiac surgery. The PCP program based on the Symptom management model (Dodd, 2001) and implemented at Ramathibodi hospital, Bangkok, Thailand. Seventy cardiac surgery participants were studied with matched pairs and random assignment to the intervention or control group. The intervention consisted of acute pain experience adjustment, acute pain management strategies, and evaluation of acute pain management. Testing was conducted at post-operative day 1, 2, and 3 on both an experimental and a control groups. Data was analyzed by repeated measures MANOVA and repeated measure ANOVA

The results indicated that the participants in the experimental group had lower mean pain score ($p < .05$) and that were also significantly decreased during post-operative day 1, 2, and 3, respectively ($p < .05$). Regard to physiological responses, the experimental group had higher mean oxygen saturation ($p < .05$). These results suggest that implementing this program at cardiac centers would result in better control of acute pain after cardiac surgery.

Field of Study: Nursing Science
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Student's Signature .....
Advisor's Signature .....
Co-Advisor's Signature .....

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CHAPTER I
INTRODUCTION

Background and Significance of Study

Acute pain is the most common symptom occurs after cardiac surgery (Forster, 2003; Utriyaprasit & Moore, 2005). Once patients need to do early ambulation activities, patients who tend to catastrophize pain avoid movement and it causes major respiratory complications (Forsythe, Dunbar, Hennigar, Sullivan, & Gross, 2008). Standard care to manage acute pain following cardiac surgery is to follow the WHO 3-steps pain ladder with a multi-modal treatment (Thai Association for the Study of Pain; TASP, 2011). It suggests assessment pain as "The 5th vital sign" by The American Pain Society (Max et al., 1995); The Joint Commission on Accreditation of Healthcare Organization, 2001). Despite the available knowledge exists, patients following cardiac surgery still have acute pain and reported as poorly controlled; under-estimated, under-medicated, and under-relieved (Lahtinen, Kokki, & Hynynen, 2006; Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004; Toleb, 2001; Yorke & Wallis, 2004). These reflect that proper pain control needs to be reconsidered and the further strategies should be indicated.

Acute pain amongst persons with cardiac surgery is a short-lived subjective unpleasant feeling during early postoperative period at sternotomy wound. Theoretically, pain is resulted from a neural activity which is moderated by a gating mechanism that opens to allow nerve impulses to reach the brain or closes to decrease impulse transmission, depended on the extent to which gate is open. Consequently, the pain expressed through patient's perception and physiologic responses.

Patient's perception explicated as level of pain intensity and its interference of patients daily function. It is reported as subjective information from acute pain after cardiac surgery. Patients perceived pain scores as high level; over 5/10 during the first 24-72 hours after surgery relieved (Lahtinen, Kokki, & Hynynen, 2006; Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004; Toleb, 2001; Yorke & Wallis, 2004). Nevertheless, acute pain also impacts to daily activities, 78% of patients complained of intensive pain from coughing, and 62% felt severe pain while moving (Lahtinen, Kokki, & Hynynen, 2006). In Thailand, Phattawee (1998) found that a worst pain occurs in first 3 days which positive correlated with coughing and deep breathing ($r = .34$, $p < .01$).

On the other hands, as the objective information, physiological responses of pain illuminated with work reaction of sympathetic nervous system including heart rate, blood pressure, respiration rate and oxygen saturation. Pain increases the secretion of cortisol, cathecholamines, epinephrine and non-epinephrine and other stress hormones (Ashburn & Ready, 2001).Therefore, it produces deleterious effects by activating the autonomic nervous system resulting in tachycardia, and increased blood pressure (Ashburn & Ready, 2001; Watt-Watson, & Stevens, 1998). Respiratory responses, unrelieved pain can result in a patient limiting the movement of the thoracic and abdominal muscles in a bid to reduce pain which may cause some degree of respiratory dysfunction with secretions and sputum being retained because of a reluctance to cough. Atelectasis and pneumonia may follow (Macintyre & Ready, 2001).

Although the standard guideline has been proposed as aforementioned, managing postoperative acute pain is still problematic. A multi-modal treatment approach that includes pharmacological and non-pharmacological interventions is recommended to improve the effectiveness of pain relief after surgery, to reduce of the dose of drug and its side effects (TASP, 2011). Specifically, following WHO-3-step-ladder of pain management, cardiac surgery is defined as the severe pain operation so that medicine provides 1) strong opioid e.g.Morphine via epidural local analgesia/major peripheral nerve or plexus block/injection (IV/PCA), 2) Paracetamol and 3) NSAIDS. However, in real practice not all cardiac surgery patients that receive opioid continuously perfusion as PCA and also each hospital/cardiac surgeon has their own protocol which definitely depended on patients conditions so that makes the difficulty in generalizing the standard guideline. Moreover, pain medicine can have unwanted side effects mainly sedation, nausea, vomiting, pruritis, constipation (Elvir, 2010; Harris, 2008).Thus, again, non-pharmacological interventions are emphasized as adjuvant which includes physical, cognitive and behavioral pain relief (Craven & Hirnle, 2003). A number of sources indicate that combination of strategies may provide the most effectiveness (Banks, 2007).

From this reason, nurses who spend 24 hours with patients should provide the effective pain management during patients perform early ambulation activities in order to prevent pulmonary complications. The proper pain control might need to reconsider about manipulating manageable pain factors. Firstly, as acute pain arises at sternotomy and the gate control delivers pain signal to the brain, physical factors as performing activities (early ambulating, deep breathing and coughing exercises and incentive spirometer) increase pain level by disturbing the incision wound that

increase the pain impulse to the brain. Anyhow, patients cannot skip those activities as it is certain to do, so the correct skills must be endorsed. Secondly, individual factor, patient's perception is found to be influenced with pain level as that pain naturally percept by the responsible brain area following the spinal cord, it was explained that they feel reluctant to voluntarily ask for analgesia and to report their pain (Kuperberg & Grubbs, 1997; Manias, 2005; Watt-Watson et al., 2004). These reflect that adjusting patient's perception of acute pain is essential. Thirdly, psychological factor, anxiety can exacerbate pain by changes the neurotransmitters (Forster, 2003; Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004), thus reducing anxiety should limit pain level as well.

Concerning about naturalistic of acute pain, as pain is simply explained as it arises from gate control level and control by the brain central system, from systematic review that does not show the effective interventions in managing pain (Crowe et al., 2008). It might be hypothesized that acute pain while patients perform early ambulation activities is short-lived. The existing interventions performed while patients rest in bed and did not continuously conduct through first 3 days that intensity of pain is the on top (Jongjareonkumchok, 2005; Kamkhieo, 2008; Kasetlaksami, 2008; Kittisup, 1994). Also, previous studies mainly intervened with brain activity whereas the modulation of impulses from spinal cord is still lacked.

For this reason, decreasing pain sensory impulse needed to be done together with pain medication. Cold therapy is another kind of pain relief intervention that causes physiologic change mainly on neurological response that has direct effect on the gate mechanism in obstruct the pain sensory (Algafly & George, 2007). It has been used effectively in number of studies (Chaittapiwat, 2003; Dawan, 2007; Koc,

Tez, Yoldaş, Dizen, & Göçmen, 2006) including in cardiac surgery Chailler (2010). However, this study has limitation in methodology and participants had no chest tube which opposite to evidence that it is one of pain physical factor. Thus, providing cold therapy during performing early ambulation activities at day 1, 2, 3 when the chest tubes still persist might yield the best benefit.

Thus, the nursing conceptualize that recognizes the importance of patient's perception to symptom and establish a strategy that involves patients self management strategies to yield the desired outcome should match and the symptom management model (SMM) (Dodd et al., 2001) seems to be most fit. The SMM has been applied to many symptoms (Kotta, 2004; Pila, 2010; Punpho, 2007). In cardiac surgery, SMM has been used effectively in few studies (Bunkong, 2009; Miller, 2005) but never used for managing acute pain follow cardiac surgery. This comprehensive nursing program belongs to the SMM will shape the patient's perception about acute pain and skill to perform early ambulation activities correctly will manipulate the central pain control while the physical non-pharmacologic pain management will obstruct pain impulse that arrives from spinal cord so that acute pain would completely be lessened. Moreover, as aforementioned that acute pain after cardiac surgery had high level during the first 3 days after surgery, the effective intervention should continuously provide through this phase and as well as with the repeated evaluation of pain and its responses in order to yield the successful post-operative pain management.

Problem statement

Despite a frequency of pain management has been explored but cardiac surgery patients still experience substantial pain in a reality. Acute pain after cardiac surgery expressed through patients' perception i.e. the intensity of pain and its impact

to daily function and also the physiological responses to pain. Result from systematic review does not indicate strong evidence of the effectiveness of nursing interventions in reducing or relieving post-operative pain. Most of the previous interventions rarely focused on factors that contribute to pain. Therefore, comprehensive and patients-centered perspectives are essential factors in providing effective nursing intervention. In response to this requisites, a nursing intervention program to enhance the patient's abilities in managing symptom should be conducted

Research questions

Were there any differences of acute pain and physiological responses between the participants who received the pain management combined with complementary care program (PCP) and the participants in the control group during postoperative day 1, 2 and 3?

Research objective

To examine effect of the pain management combined with complementary care program (PCP) on acute pain and physiological responses amongst persons with cardiac surgery during postoperative day 1, 2 and 3

Research hypotheses

1. Acute pain and physiological responses amongst persons with cardiac surgery improved after receiving the pain management combined with complementary care program (PCP) during postoperative day 1, 2 and 3 i.e.

- Acute pain level gradually decreased during this period of time
- Heart rate, respiration rate and blood pressure decreased while oxygen saturation progressively increased during this period of time

2. Acute pain and physiological responses amongst persons with cardiac surgery in experimental group were better than control group during postoperative day 1, 2 and 3 i.e.

- The participants in the experimental group had lower pain level than those in the control group during this period of time
- The participants in the experimental group had slower heart rate, slower respiration rate and lower blood pressure than those in the control group during this period of time
- The participants in the experimental group had higher oxygen saturation than those in the control group during this period of time

Rational

Based on the Gate control theory (Melzack & Wall, 1996), pain results from a pattern of neural activity by pain impulses are moderated by a gating mechanism at spinal cord that opens to allow nerve impulses to reach the brain or close to decrease impulse transmission. The large-fiber inputs tend to close the gate, whereas small-fiber inputs generally open it, and the gate is influenced by descending controls from the brain. The activity is initiated when nerve impulses conveying painful information arrive from the periphery via the ascending pathways of the spinal cord. The sensory input is modulated at successive synapses throughout and projected from the spinal cord to the brain areas responsible for pain experience and response.

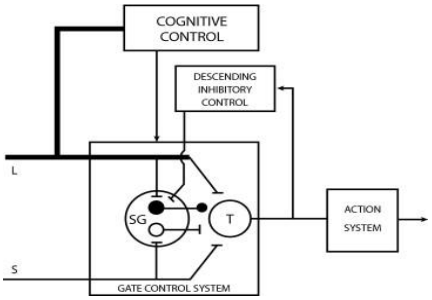

Figure 1 The Gate control theory (Melzack & Wall, 1996)

Briefly, acute pain after cardiac surgery arises from median sternal cutting wound which causes tissue damaged and produces nerve impulses from gate at spinal cord area up to reach the central brain control. It results to the perception of pain which can be measured directly from each patients as the subjective information whereas the physiological responses of pain is way to measure pain indirectly to gather the objective data as sign of acute pain symptom.

From these reason, efficient management of acute pain following cardiac surgery should focus on both decreasing pain perception and its physiological responses. In response to these challenges, the nursing conceptualize that recognizes the importance of patient's perception establish strategies based on the multimodal strategies should match and the symptom management model (SMM) (Dodd et al., 2001) seemed to be most fit. The SMM is a way to control symptom and its experiences that aims to guide selection or designing management strategies that based on understanding the symptom, approaches the symptom based on the understanding of symptom. Ideally, patient must accept the importance of symptom as the gold standard in managing symptom based patient focused. It hypothesizes that the effectiveness of intervention must involve the interaction among symptom experience, symptom management and symptom outcome.

Traditionally, the gold standard of acute post pain management for cardiac surgery is to follow WHO 3-step-ladder. However, as stated earlier that to improve pain control, combination of pharmacological and non-pharmacological approach is recommended. Thereupon, the content of this study was simultaneously provided with pharmacologic and non-phamacologic pain management called “the complementary care” which National Center for Complementary and Integrative Health (NCCIH; 2016) suggests to use with the evidences in order achieve the safety and effectiveness. The SMM underpinned this study named the pain management combined with complementary care program (PCP).

The PCP aimed to assess and manage acute pain and physiological responses, to promote patients knowledge, encourage self-care skill regard to managing pain, and to monitor patient pain response to intervention through 3 dimensions.

Firstly, **symptom experience,** it is dynamic, involving the interaction of the patient’s perception of a symptom, his/her evaluation of the meaning of a symptom, and the patient’s response to a symptom. Acute pain perception came once patients felt suddenly pain along the sternal wound during performing early ambulation activities which requires a conscious, cognitive interpretation of information gathered to this situation. The patients then evaluated their acute pain including intensity, location, and frequency and its impact. The response to acute pain belonged to the person which can be different in each person. If patients evaluated that acute pain is more severe once perform activities, then they might avoid to perform these activities by take breathe inappropriately, omit to early ambulate which result in poor recovery outcomes.

To this study, this dimension called **"Acute pain experience adjustment"**. It aimed to adjust with the individual factors that was the patient's perception about pain was adjusted by sufficient knowledge. Nurses enhanced the specific information (from literature reviews and standard guideline) included; generally information about cardiac surgery, preoperative preparation and patient's roles, naturalistic of acute pain after cardiac surgery, acute pain evaluations, acute pain management (multimodal strategies), the significance of effective pain management, and significance of performing early ambulation activities.

Secondly, **symptom management strategies**, these strategies helped patients in ease acute pain symptom experiences through nurse professional, biomedical, and self-care strategies in order to manipulate with the factors that intensify pain. This process for this study called **"Acute pain management strategies"** which included:

1. Biomedical strategies: pharmacologic intervention with pain medication was sufficiently provided by nurse as prescribed followed by patient's experiences subjectively.

2. Professional strategies: nurse was a key person of this step using complementary care as non-pharmacological pain interventions to pain including:

a) Cold therapy; it is one kind of pain relief intervention that has been used effectively; it is perhaps the simplest and oldest modality in the treatment of acute soft-tissue injuries (Bleakley, McDonough, & MacAuley, 2006). Briefly, belongs to the gate control theory, applying 20 minutes frozen gel pack on the periphery pathways will stimulates large pain fiber nerve conduction so that the transmission of small pain fiber is reduced and the gate will close and results in decreasing pain(Algafly & George, 2007).

b) Promoted the comfort positioning by helping patients to splint the incision site with hugging hands or pillow when coughing and moving improves pain control (El-Ansary, Waddington, & Adams, 2007).

3. Self-care strategies; patients used self-ability and gained confidence they can carry out a prescribed symptom management strategy by doing the skill correctly; doing the skill consistently; and having the ability to evaluate whether the prescribed activity was effective. Those skills were:

a) Relaxation techniques with diaphragmatic breathing exercises to prevent the collapse of alveolar and to produce the body's natural relaxation response which also results in decreasing the anxiety that has effect to pain (Lai, 2004; McCubbin et al., 1996) by adjusting the ability of right perception before stat teaching/demonstrating others skills. The incentive spirometer was used together this step in order to decreases pleural pressure, promoting lung expansion and better gas exchange (Restrepo et al., 2011).

b) Effective coughing to produce the sputum and increase lung expansion (Middleton & Middleton, 2002).

Lastly, **symptom outcome**, outcomes emerged from symptom management strategies as well as from the symptom experience. The outcome dimension focused on eight indicators which include (1) symptom status, (2) functional status, (3) emotional status, (4) cost, (5) morbidity and co-morbidity, (6) mortality, (7) quality of life, and (8) self-care. Outcome of this study was acute pain that was evaluated determining the effect of the PCP as a symptom status. This process of this study called "**Evaluation of acute pain management**" which included:

1. Evaluation of acute pain: it composed of

1) Perception of acute pain: the measuring of the pain intensity and the interference of pain that impacts with personal daily function. They were measured by a patient self-report named modified Brief Pain Inventory (BPI) (Watt-Watson, Stevens, Garfinkel, Streiner, & Gallop, 2001).
2) Physiological responses, it was the measure of the sympathetic nervous system that reacts to the pain including heart rate, blood pressure, respiration rate and oxygen saturation. It was recorded by the researcher on vital signs sheet from the automatic bedside monitoring
3) 2. Evaluation of the process of acute pain management strategies was evaluated e.g. problems, limitations of each skill. The flaw, misunderstanding were reconsidered and adjusted appropriately until program terminated.

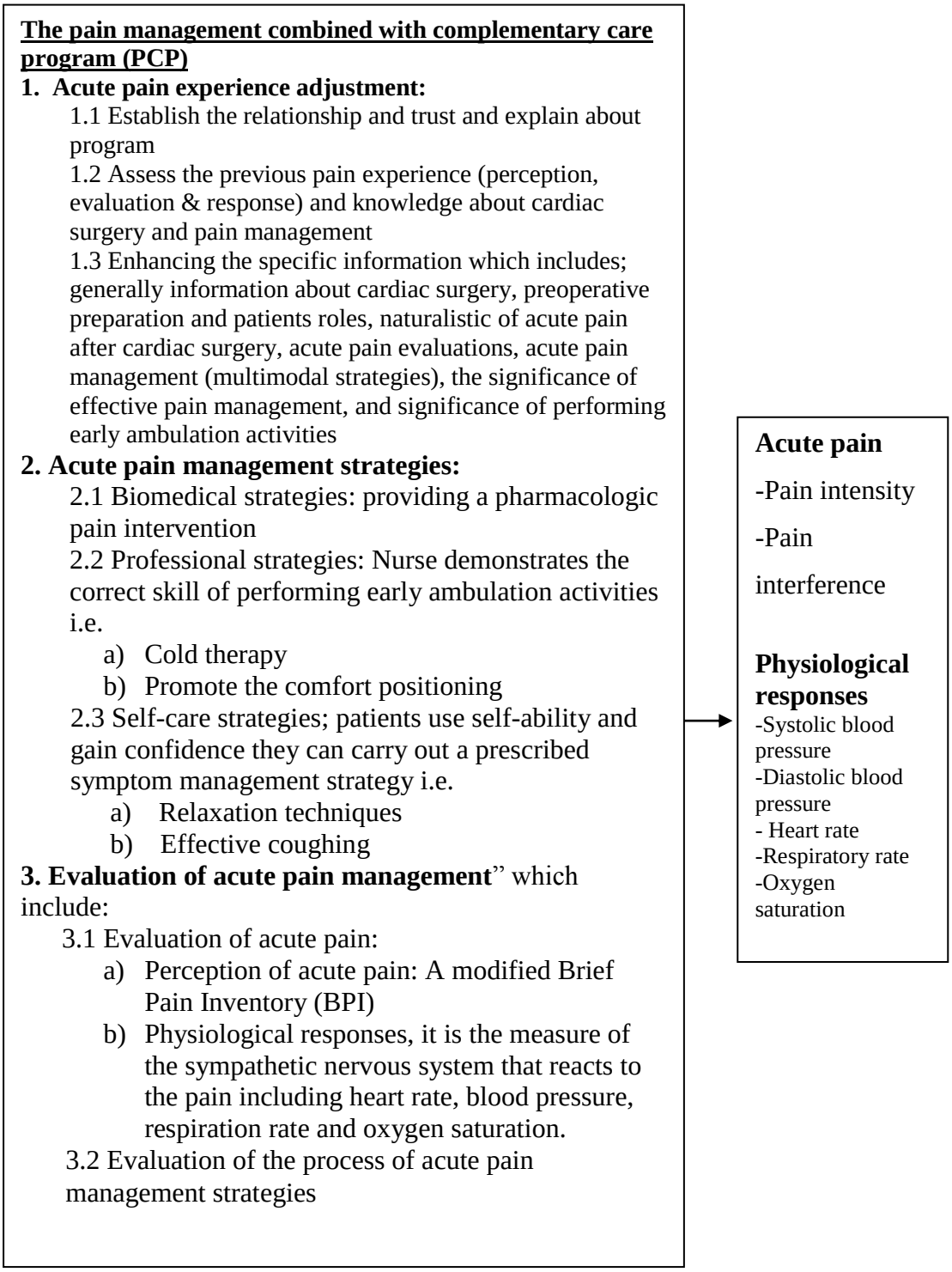
The pain management combined with complementary care program (PCP)
1. Acute pain experience adjustment:
1.1 Establish the relationship and trust and explain about program
1.2 Assess the previous pain experience (perception, evaluation & response) and knowledge about cardiac surgery and pain management
1.3 Enhancing the specific information which includes; generally information about cardiac surgery, preoperative preparation and patients roles, naturalistic of acute pain after cardiac surgery, acute pain evaluations, acute pain management (multimodal strategies), the significance of effective pain management, and significance of performing early ambulation activities
2. Acute pain management strategies:
2.1 Biomedical strategies: providing a pharmacologic pain intervention
2.2 Professional strategies: Nurse demonstrates the correct skill of performing early ambulation activities i.e.
a) Cold therapy
b) Promote the comfort positioning
2.3 Self-care strategies; patients use self-ability and gain confidence they can carry out a prescribed symptom management strategy i.e.
a) Relaxation techniques
b) Effective coughing
3. Evaluation of acute pain management" which include:
3.1 Evaluation of acute pain:
a) Perception of acute pain: A modified Brief Pain Inventory (BPI)
b) Physiological responses, it is the measure of the sympathetic nervous system that reacts to the pain including heart rate, blood pressure, respiration rate and oxygen saturation.
3.2 Evaluation of the process of acute pain management strategies
Acute pain
-Pain intensity
-Pain interference
Physiological responses
-Systolic blood pressure
-Diastolic blood pressure
- Heart rate
-Respiratory rate
-Oxygen saturation

Figure 2:

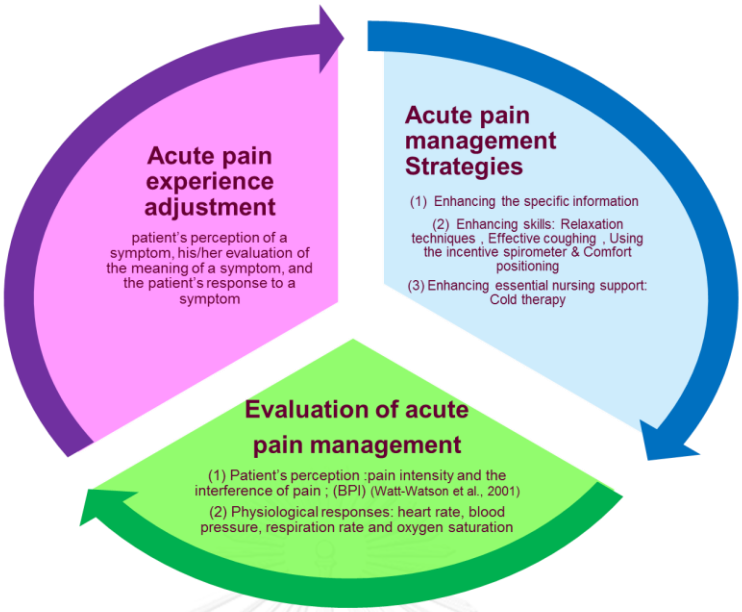

Figure 3 Components of PCP

Scope of the Study

This quasi experimental study aimed to examine the effect of PCP on acute pain and physiological responses amongst patients undergone an elective cardiac surgery. It started from surgical ward until postoperative day 1, 2 and 3 at Ramathibodi hospital. The control group received the conventional care whereas the experimental group received the PCP and the conventional care.

- An independent variable was PCP
- Dependent variables were acute pain and physiological responses

Operational Definition

Patients with cardiac surgery were patients who undergone an elective cardiac surgery at Ramathibodi hospital and first participated to the program at the surgical ward on admission day, and on postoperative period day 1, 2, and 3 at intensive and/or surgical ward

Acute pain defined as a short-lived subjective unpleasant feeling during postoperative day 1, 2 and 3 that immediately occurred during performing activities at sternotomy and intercostals catheters at chest wound area. It was measured with the patient perception through the intensity and interference of pain. Pain intensity referred to the degree of pain severity level whereas pain interference was the degree to which pain impacts with personal daily function. They were measured by a patient self-report named modified Brief Pain Inventory (BPI) (Watt-Watson, Stevens, Garfinkel, Streiner, & Gallop, 2001).

Physiological responses referred to work reaction of sympathetic nervous system as the objective response from pain including heart rate, blood pressure, respiration rate and oxygen saturation. They were recorded by the researcher on vital signs sheet every 8 hour from the automatic bedside monitoring.

- Heart rate can measure as how many times a minute that our arteries expand because of the increase in blood pressure originated by our heartbeat.

- Blood pressure referred to two numbers in millimeters of mercury including when the heart is contracting (systole) and relaxing (diastole).

- Respiratory rate was the number of breaths per minute or the number of movements indicative of inspiration and expiration per unit time.

- Oxygen saturation defined as the ratio of oxyhemoglobin to the total concentration of hemoglobin present in the blood.

Conventional care referred to all routine nursing activities provided for cardiac surgery patients in order to manage acute pain including offering the information, the body position change, recording vital signs and pain evaluation,

administrating pain medication as prescribed, assess its effectiveness, and report if the protocol did not achieve desired outcomes or forms side effects.

The pain management combined with complementary care program (PCP) was a nursing intervention to manage acute pain and physiological responses among cardiac surgery patients on postoperative day1, 2, 3. The PCP was based on SMM model which comprised of 3 components: 1) Acute pain experience adjustment, 2) Acute pain management strategies, and 3) Evaluation of acute pain management

Expected benefits

1. To the health care system: since cardiac surgery consumes a lot of healthcare cost. Poorly managed pain results in the financial burden including complication, generates unnecessary partial or total disability and associated costs with consequent health care costs and reflecting poor quality of care

2. To the nursing science: this study would provide additional knowledge to fulfill nursing practice in cardiac surgery caring to develop a clinical practice guideline/protocol and might be used to other kinds of major surgery

3. To the nurse profession: the non-pharmacological management could be easily, timely and safely promote benefits to patients as our authority

Summary, the data gained from this study would present a few of benefit of a nursing intervention to improve acute pain control of persons with cardiac surgery. In addition, findings generated from this study would serve in the existing nursing knowledge for cardiac center as a mechanism for further improvement of outcome and quality of care.

CHAPTER II
LITERATURE REVIEW

The review of theoretical and empirical literature, which was organized into ten major parts, is to examine the following areas:

1. Persons with cardiac surgery
2. Acute pain among persons with cardiac surgery
3. Factors related acute pain among persons with cardiac surgery
4. Nursing role in managing acute pain after cardiac surgery
5. Physiological responses
6. Existing intervention studies for managing acute pain after cardiac surgery in Thailand
7. Complementary care
8. Cold therapy
9. The symptom management model
10. The Pain Management Combined with Complementary Care Program (PCP)

Persons with cardiac surgery

Cardiac surgery (heart surgery) is procedure used to correct problems with the heart if other treatments can't be used including:

1. Coronary Artery Bypass Graft surgery (CABG) is a myocardial revascularization procedure to prevent a myocardial infarction in patients with severe blockages of the coronary arteries when other methods cannot be used (Eagle et al., 2004).

2. Valvular heart repair/replacement: when heart valves are severely malformed or destroyed, they may need to be repair/replaced with a biological valve (made of animal or human tissue) or a mechanical valve (made from materials such as plastic, carbon, or metal)(Texas Heart Institute Heart Information Center: THI, 2013).

3. Aneurysm Repair: An aneurysm occurs when the wall of a blood vessel or the heart becomes weakened. An aneurysm can be repaired before it bursts. Surgery involves replacing the weakened section with a patch (called a graft) (THI, 2013).

4. Transmyocardial Laser Revascularization (TMLR): is a procedure that uses lasers to make channels in the heart muscle, it is only done as a laser in patients who have many CABG operations and cannot have another bypass operation(THI, 2013)..

5. Heart Transplantation: it can be traced to many heart problems when medicines, mechanical devices, and other therapies cannot help (THI, 2013).

Since performing cardiac surgery is a major operation so that results in patient experiences in every stage of treatment as follow:

1. Preoperative period: they present with weaken heart function resulting limited of engaging the daily activities. Since cardiac surgery is a major surgery, the feeling that it is life-threatening cause patients to become frightened.

2. Intraoperative period: Anesthesia involvement, the administration of medications, Cardiopulmonary bypass running and performing the surgical procedure are circumstances that they have to deal with.

3. Critical care period: All patients usually stay at the Intensive Care Unit for 1-3 days. The patient will begin to regain consciousness approximately 2 hours afterward. Patients who have no complications will begin preparations for weaning from the respirator. At this stage, feeling pain comes at the incision site from

breathing patterns. Moreover, respiratory catheter, ventilator, routine nursing activities, numerous catheters, and environment in ICU are factors that stimulate the patient's senses and cause in patients' suffering.

4. Postoperative period: they usually spend this period average 4.3 days in hospital (Cardiac Care network, 2007). The experiences for this phase are early ambulating, performing deep breathing and coughing exercise and encouraging carrying out self care behaviors during and after hospitalization.

In sum, cardiac surgery is a major surgery that extremely causes the changes in various systems in the body. Patients have to face with many specific situations starts from preoperation until recovery period that influence their health status and needs dynamic process strategies to manage or prevent the undesired outcomes

Acute pain among persons with cardiac surgery

Definition of pain

Pain is a universal phenomenon by Descartes in the 17th century was the first philosopher who proposed theory of pain and several attempts were later on flourished to find a new theory (Melzack, 1993). Pain can be defined in many different ways as follows;

McCaffery (1968) defines pain as, "Pain is whatever the experiencing person say it is, existing whenever the experiencing person say it does". This classical description of pain makes the client and the expert aware of his or her own pain (McCaffery & Paasero, 1994).

Jean & Melzack (1992) describes pain as, "a highly personal and variable subjective that is influenced by cultural learning, the meaning of situation in which it occurs, attention anxiety, and a host of other cognition and psychological variables".

This definition describes variable that have an effect on pain and especially on psychological variables.

The definition of pain which is widely used and accepted by most pain specialists was proposed by The IASP (1994) as “pain is unpleasant sensory and emotional experience associated with actual and potential tissue damage”.

The IASP definition relates to all types of pain which describes pain as a multiple component, pain literally composed of 3 dimensions by Melzack and Casey (1968) including: “sensory-discriminative” (sense of the intensity, location, quality and duration of the pain), “affective-motivational” (unpleasantness and urge to escape the unpleasantness), and “cognitive-evaluative” (cognitions such as appraisal, cultural values, distraction and hypnotic suggestion).

From concept analyses of nursing scholars (Mahon, 1994; Montes-Sandoval, 1999; Cheng, Foster, & Huang, 2003) could summarize pain as an unpleasant personal experience that originated from noxious stimuli and actual or potential tissue being damaged which has different multi-dimensional responses and uniquely influenced by personal, environmental, and socio-cultural issues.

Acute pain

Typically, pain can be characterized by the duration to be acute and chronic pain. Acute pain is defined as pain of recent onset that ends or is anticipated to end during a period of days to weeks (Portenoy & Kanner, 1996) or less than 3 months (Conn, 2005). Specifically, characteristics of acute pain include the following: it is usually short-lived, pain of varying intensity, initially severe then subsiding as healing takes place; nervous system is usually intact; reasons for pain can be pinpointed caused of known origin by trauma, surgery, acute medical conditions or a

physiological process; responds well to conventional analgesia e.g. opioids, local anesthetics, etc; psychological problems such as depression are short lived if present (Pain community center, Cardiff University).

In summary from above explanations, acute pain amongst persons with cardiac surgery then was defined in this study as a short-lived subjective unpleasant feeling during to be 1) the subjective experience and response to unpleasant sensory that immediately occurred at known origin which came from sternotomy and intercostals catheters at chest wound area during performing activities, it has limited duration within 3 months after surgery.

Pain Mechanisms

Naturally, pain sensations travel along 4 main components based on The Gate control theory mechanism (Melzack & Wall, 1996) which illustrate as figure:

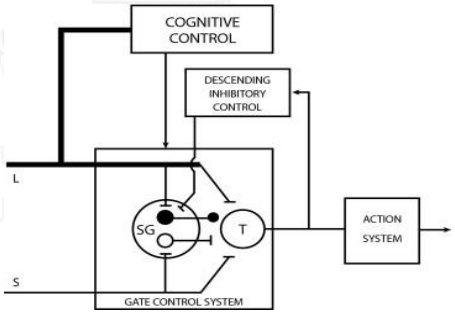

Figure 4 The Gate control theory
(Melzack & Wall, 1996)

1. Spinal gate mechanism**:** Spinal gate mechanism includes large-diameter A-delta fibers, small-diameter C-delta fiber, substantia gelatinosa (SG), and transmission cell (T-cell). The SG cells can inhibit or facilitate pain impulses that are transmitted to the T-cell. The impulses from A delta fibers when pass through SG, SG cell's activity will be activated and T-cell's activity will be inhibited. There are no pain impulses to the brain, it is so-called 'the gate is closed". In opposition, the impulses from C delta

fibers when pass through SG, SG cell's activity will be inhibited and T cell's activity will be activated. The pain impulses ascend to the brain, called 'the gate is opened'.

2. The central control system: it is activated by afferent from the selective brain process (dorsal horn), which transmit information about the noxious stimulus to the thalamus. The system may be subdivided into three components:*1)Sensory-discriminative component* establishes precisely the characteristic, intensity, and location of pain sensation. *2) Affective-motivate component* causes the emotional stimulus and interprets to discomfort and pain distress and 3) *Cognitive-evaluative component* acts as the cortical processes by analyzing, perceiving, recognizing pain experience, into conscious and unconscious action.

3. Central biasing system: The descending control influences may be exerted through the reticular projections and cortical projections. The brain stem reticular formation exerts a powerful inhibitory control over information projected by spinal gate. This reticular inhibitory projection is also influenced by somatic input and the visual and auditory system. The part of cortical projections is fibers from the cortex, particularly the frontal cortex which subserves cognitive processes such as past experience, project to the reticular formation, and influences the gate control system.

4. Action system: It response after perception includes the sympathetic or parasympathetic nervous systems, verbal or movement expressions, differential coping and solving problems, or behavioral expressions to avoiding pain.

Summary, pain is resulted from a neural activity. The pain impulses are moderated by a gating mechanism that opens to allow nerve impulses to reach the brain or close to decrease impulse transmission, depended on the extent to which gate

is open and suggests that large-fiber inputs tend to close the gate, whereas small-fiber inputs open it, and the gate is influenced by descending controls from the brain

Incidences of acute pain among persons with cardiac surgery

Acute pain in cardiac surgery is usually occurred within 24-72 hours (postoperative day 1 – day 3) (Toleb, 2001). Cardiac surgery patients reported acute pain as most severe on post-operative day 1, 2 & 3 during early ambulation especially for deep breathing and coughing activities. Deep breathing scored pain as high as 5.3 on postoperative day one and 4.4 on postoperative day two (Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004). Lahtinen, Kokki, and Hynynen (2006) found that coughing caused the worst pain in 78% of the 213 patients after cardiac surgery. Similarly, Yorke and Wallis (2004) reported that 95% of the 102 patients reported coughing as the most painful activity post cardiac surgery. The location was greatest intensity at the sternal, substernal, and parasternal regions (Gélinas, 2007; Toleb, 2001). Patients responses as tender (70.6%), sharp (58.8%), aching (56.9%) and the most frequently term to describe the affective component was tiring/exhausting (86.7%)(Yorke & Wallis, 2004).

In Thailand, Phattawee (1998) studied the severity of acute pain among 100 post sternotomy patients during post-operative day 1, 2 and 3 , the result showed that the pain level were 6.80 (±2.387), 6.62 (±2.167) and 5.76 (±2.179), respectively. This study also indicated a positive significant correlation of worst pain and coughing and deep breathing at the first three day period ($r = .34$, $p < .01$). Consistently, a recent study showed that of 40 Thai cardiac surgery patients, pain scores during using intensive sporometer and coughing on postoperative day 1 – day 3 were statistical higher than at rest; during using intensive spirometer pain scores were mild to

moderate (3.40-4.82) whereas were moderate to severe during coughing (5.32-7.05)(Srikaew, Khuwatsamrit, Mongkong, & Chaiyaroj, 2013).

The impacts of acute pain to persons with cardiac surgery

Significantly, at the post-operative period, patients have to perform early ambulation activities as early as possible; the movement of the rib cage during activities may prevent patients from achieving maximum lung volumes which conversely creates pulmonary complications because of feeling pain (Edelen & Perlow, 2002; Westerdahl et al., 2005). Uncontrolled pain during perform early ambulation results in prolonging ICU hours, extended cost/length of stay, increased morbidity/mortality rates, and poor recovery outcome (Fortner, Okon, & Portenoy, 2002; Scott et al, 2001). Puntillo and Weiss (1994) reported that patients with higher pain scores on three consecutive days following cardiac surgery had significantly more atelectasis than patients having less pain. Normally, the pulmonary complications will occur in 1-3 postoperative days (Middleton & Middleton, 2002; Richard, 2005, Wongyai, 2009). It can also have negative psychological effects e.g. anxiety, fear, and mood irritability because the hypothalamus is contributed from pain to increase anxiety and can hider postoperative recovery (McCaffery & Pasero, 1994). Briefly, acute pain during early ambulation results in both psychological and physiological responses that need to be appropriately managed to ease complications especially for respiratory complication that could causes in burdensome, costly and hamper the recovery.

Existing instruments in measuring pain

Self-report method: it is considered the “gold standard” and the most valid approach in evaluating pain (O'Rourke, 2004). The tools are as follows:

Unidimensional pain scales: they were developed to assess the severity of the pain and allows for comparison of changes following intervention, it is rather more than is achievable or desirable in most clinical contexts. Thus, in clinical setting, for acute pain management, unidimensional pain intensity scores are mainly used and were scaled in many styles as explained below:

Lines: this type consists of a straight line that represents the continuity of pain with numbers or descriptions or both on the line. The patient indicates the severity of their pain by choosing or ticking a mark on the line that is close to their feelings with the help of numbers or descriptions accompanying the line.

a) Visual Analog Scale for Pain (VAS Pain): it is the first type of pain measure, a continuous scale on straight line of 10 centimeters in length with descriptions at both ends. At the 0 end, the description is 'no pain' while, on the opposite end is, 'pain as bad as it could possibly be'. The patient is asked to mark their pain intensity that can measure in centimeters or in millimeters (Jensen & Karoly, 1994).

There is much evidence supporting the validity of VASs for pain intensity with positive relations to other self-report measures of pain intensity. Jensen and Karoly (1994) indicated that VASs are more sensitive to treatment effects than other measures and the scores of VASs appear to have the quality of ratio data. VAS is very helpful for the critically ill patients. However, it remains some disadvantage in cognitively impaired patients, elderly persons or persons on high doses of opioid analgesic (Jensen, Karoly, & Braver, 1986). Good and colleagues (1999) examined concurrent validity correlation between VAS and NRS with a strong (r=0.92).

Aragon, Farris, & Byers (2002) had tested reliability of VAS in post CABG patients, the result shown good test – retest reliability (r=0.88)

b) The numerical pain scale (NRS): It refers to all the possible combinations of pain rating scales that use numbers, whether they are verbally or graphically presented and whether they contain word descriptors or not. NRSs do not require paper or pencil, one simply asked patients to verbally state his or her pain intensity (Jensen, Karoly, & Braver, 1986; McCaffery & Pasero, 1999). The validity of the 0 to 10 NRS has been well proved and it is easy to score.

Researchers recommend that NRS is proper to measuring intensity of pain in elderly s than other measures of pain (Bulechek & McCloskey, 1999; McCaffery & Pasero, 1999; Puntillo & Weiss, 1994).

c) Simple Descriptive Scale (SDS): it is a horizontal straight line with number of 0 to 5 marked evenly above the line and descriptions for each number. The descriptions are no pain, mild pain, moderate pain, severe pain, very severe pain, and worst possible pain, respectively (McCaffery & Pasero, 1999).

Graphic Rating Scale (GRS): it is also a horizontal straight line with the descriptions below the line as follows: no pain, little pain, medium pain, largepain, and pain as bad as it could possibly be.

Color: some developers constructed pain measures with the use of color e.g. white represents ‘no pain’, red as ‘moderate pain’, and black as ‘pain as bad as it could possibly be’. With this measure, the patient picks the color that corresponds most closely to their feelings. One example of this type of measures is Stewart pain-color scale. The scale is a strip of connected colors from white, yellow, orange, red, purple and black with the descriptions at both ends.

2) Multiple-dimension pain reporting: There are a number of multidimensional pain assessments which is somewhat different in approach and style.

a) The McGill Pain Questionnaire (MPQ) (Melzack, 1987), it is the most widely used tool since it provides estimates of all dimensions of pain and is often considered to be the gold standard of the pain measurement tools. The originally version is time consuming so the Short Form- MPQ (SF-MPQ) has been more used practically (Melzack, 1987). SF-MPQ composed of 3 parts: 1) the Pain Rating Index (PRI) which includes 15 descriptors that describe the sensory (11 items) and affective (4 items) dimensions of pain, 2) VAS and 3) the Present Pain Intensity (PPI). The SF-MPQ takes 2–5 minutes to complete and no training is required to score and interpret the SF-MPQ other than the ability of the interviewer to define each word (Melzack, 1987).The SF-MPQ correlates highly with the MPQ (Caraceni et al., 2002). It has been translated into the following several languages including Thailand (Kitisomprayoonkul, Klaphajone, & Kovindha, 2006). The Thai version of SFMPQ (Th-SFMPQ) has good psychometric properties (Cronbach's value 0.78 and inter-rater validity value 0.7) (Kitisomprayoonkul, Klaphajone, & Kovindha, 2006).

b) Memorial Pain Assessment Card (MPAC) (Fishman et al., 1987), it is a validated tool that consists of 3 VAS to measure pain intensity, pain relief and mood, and a set of 8 pain severity descriptors to further characterize pain intensity, all printed on one card. It is currently only available in English and Spanish. Designed initially for use in the assessment of very ill in patients suffering from pain of malignant origin, the MPAC is now used in a variety of pain settings. The mood scale is significantly correlated with measures of global psychological distress, depression

and anxiety, is considered to be a brief measure of global distress. This measurement tool has the advantage that it takes very little time to administer. However, the card should be folded so that only one scale is presented to the patient at a time.

c) Brief Pain Inventory(BPI) (Cleeland, 1991), it is used to determine whether the pain limits the ability or function of the daily tasks that she or he wishes to perform. BPI was developed to include items that reported the severity of pain and the interference of pain with daily function. The pain severity subscale delivers through 4 items in regard to the variability of pain over time by asking patients to rate their pain now, worst, least, and average pain during the last 24 hours. On the other hands, the pain interference subscale composes of 7 questions that ask how pain interferes with 7 daily activities.

It has also been translated and validated in several languages include Chinese (Wang, Mendoza, Gao, & Cleeland, 1996), French (Larue, Colleau, Brasseur, & Cleeland, 1995), German (Radbruch et al., 1999), Hindi (Saxena, Mendoza, & Cleeland, 1999), Japanese (Uki, Mendoza, Cleeland, Nakamura, & Takeda, 1998), Vietnamese (Cleeland, Ladinsky, Serlin, & Thuy, 1989) and Thailand (Chaudakshetrin, 2009) and proved to be valid and reliable across translations. The Thai version of BPI (BPI-T) has a good psychometric properties (Cronbach's value 0.88 and 0.89 for the intensity and the interference scale respectively) (Chaudakshetrin, 2009). Its disadvantages are that it is a lengthy form to complete and it is unsuitable for those with cognitive impairment.

Particularly, amongst the cardiac surgery patients, the BPI has been used and modified differently in the context of acute (Watt-Watson et al., 2004), sub-acute (Mendoza et al., 2004)and chronic phase (Gjeilo, Stenseth, Wahba, Lydersen, &

Klepstad, 2007). Some activities from the original version of the pain interference dimension does not fit to the cardiac surgery populations and have been modified called a modified version of the Interference Subscale of the Brief Pain Inventory(BPI-I)(Watt-Watson et al., 2004). It was generated to measure interference with 6 activities because of pain within post-operative day 1-5. Two items from the original version relating to work and enjoyment of life were not considered relevant and additional item about coughing and deep breathing were included as suggested in the American Pain Society Patient Outcome Questionnaire (1995). For the psychometric testing, it has internal consistency 0.71 for CABG sample (Watt-Watson, Stevens, Garfinkel, Streiner, & Gallop, 2001).

d) The West Haven-Yale Multidimensional Pain Inventory (WHYMPI), it was developed from a cognitive behavioral viewpoint composed of 61 items (12 subscales) across three domains including the impact of pain on the patients' lives, the responses of others to the patients' communications of pain, and the extent to which patients participate in common daily activities (Kerns, Turk, & Rudy, 1985). Although it is multidimensional, this is only related to the patient's subjective pain experience (sensory dimension). Clinically, the time consuming to the test is 31 to 60 minutes without cutoff scores. It has been translated into several languages including Spanish, German, Dutch, Swedish and Italian. For the psychometric properties among Chronic Musculoskeletal Pain**;** Internal Consistency was between 0.66-0.86 among each subscales and construct validity (convergent validity) of the WHYMPI showed significantly correlate with several pain and mood tools (Andreu et al., 2006). It is useful to gain the patient's view of the sensitive to change following treatment.

e) The Multiperspective Multidimensional Pain Assessment Protocol (MMPAP) (Rucker & Metzler, 1995). It is a combination of physical examinations by physicians and self-report by the patient with pain. The MMPAP was designed to be of value for assessing applicants for disability pensions, and has been shown to successfully predict employment status (Rucker & Metzler, 1995). The major domains assessed by the MMPAP are pain dimensions, medical information, mental health status, social support networks, functional limitations and abilities and rehabilitation potential.

In summary, acute pain after cardiac surgery in this study was measured directly from each patients as the subjective information using the modified Brief Pain Inventory (BPI) (Watt-Watson, Stevens, Garfinkel, Streiner, & Gallop, 2001) as it has been used among cardiac surgery patients in the context of acute pain (Watt-Watson et al., 2004). It provided information of pain multi-dimensionally i.e. pain intensity and pain interference to daily activities. Moreover, the objective data of pain was also gathered by measuring the physiological responses of pain.

Factors related acute pain among persons with cardiac surgery

The factors related acute pain among persons with cardiac surgery could be divided into 4 types including physiological factors, psychological factors, individual factors and environmental factors. The details were explained as following:

1. Physiological factors: influenced by

1) Performing postoperative rehabilitation activities including early ambulating, deep breathing and coughing exercises and incentive spirometer which are encouraged after surgery at least once hourly while the patient is awake (El-Ansary, Waddington, & Adams, 2007; Fanning, 2004).

2) Anesthesia administration causes total relaxation muscles (Heye, 1991)

3) Positioning in operative room, patients placed in a frog-legged position which lead to muscle aches from the pulling and stretching of relaxed muscles and ligaments (Oates, 1993)

4) Median sternotomy incision is made through subcutaneous tissue, bone, periosteum and muscle which may lead to injury of tiny blood vessels or various nerve plexuses (Oates, 1993)

5) Instrumentation, the sternal retractor may lead to fractured ribs, dislocation or separation of the costochondral junction, costochondritis, and dislocation of the articulation between the ribs and spine posteriorly (Cogan, 2010)

6) Harvesting of the bypass graft (only in CABG surgery) usually taken from the sphenoid veins, radial artery or the internal mammary artery. The use of the internal mammary artery requires the surgical dissection of the artery from anterior chest wall and use of electrocautery to control bleeding of the small vessel interrupted by the incisions. It related with the study of Eisenberg and colleagues (2001) who found that CABG patients most reported with left side chest wall pain often because the left internal mammary artery is most frequently used.

7) The chest tubes, all patients required these tubes postoperative period the removal process can result in intense, yet transient, acute pain and is described as being one of the worst memories of the patient's perioperative experience (Gift, Bolgiano, & Cunningham, 1991).

8) The ICU procedures, for example cannulations, inserting endotracheal and chest tubes, and surgical incisions, stimulate the pain perception of patients. Heart surgery patients feel severe pain during the aspiration of the endotracheal tube and

removal of the chest tubes, especially the pleural ones (Ferguson, Gilroy, & Puntillo, 1997)

9) Postoperative complications such a fractures ribs or costal cartilages, infection of bony and visceral structure, nerve injury and bleeding requiring the reoperation may contribute to post operative pain (Oates, 1993)

10) Duration of surgery also increases the level pain experiences (Heye, 1991).

2. Psychological factor: it is related to anxiety that can exacerbate pain by initiate a sequence of physiological changes , the neurotransmitters can produce a generalized arousal the body, including increase heart rate, blood pressure, and muscle tension provoke vasoconstriction and visceral disturbances, and release pain producing substance (Well-Federman et al., 1995; Forster, 2003; Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004). Nelson (1998) found a direct relationship of anxiety with pain in CABG patients($r = 0.235\text{-}0.492$; $P < 0.001$), researcher explained that pain perception increases when anxiety is high and patients are attentive to the pain and contributing to the continuity of the cycle of pain.

3. Individual factors: gender, age, pain threshold, past experience and knowledge have been found to influence intensity of pain by females found their overall pain experience to be less acceptable than did males and elderly patients received less morphine and were refused pain killers more often than younger patients(York & Wallis, 2004). Pain threshold may be defined as the point at which an increasing intensity of stimuli is felt as painful (McCaffery & Pasero, 1999). Previous pain experience leads to alterations in pain-signal processing that may be reversible or permanent (Franck, Greenberg, & Stevens, 2000). While a client who has no experience with pain may have an impaired ability to cope with pain. Furthermore, it

has been found that patient's knowledge is important in pain management as well. Kuperberg & Grubbs (1997) found that patients fear of unrelieved pain and may inadvertently contribute to being undermedicated, because they may be reluctant to voluntarily ask for analgesic whereas number of sources stated that patients also worry about drug dependency and adverse effects (Kuperberg & Grubbs, 1997; Swarm, Karanikolas, & Kalauokalani, 2001).

4.Environment factors: it increase pain by perception of the constant light & noise may proceed to sleeplessness, perceptual limitations and various of nursing activities can increase patients' pain (Aslan, Badir, Arli, & Cakmakci, 2009).

In conclusion, there are a number of factors affecting cardiac surgery patients perception and responses to pain during early ambulation. Therefore, nurses should consider all factors affecting pain to accurately assess and should appropriate pain therapies. However, the type of surgery, gender and age are unmanageable factors but they might be the confounding factors to the study so it needs to be manipulated. To reduce this confound, the participants were matched on the sampling assignment using these three variables as criteria. Moreover, since past experience in pain has effect on pain perception thus patients who have had prior surgery were excluded. Analgesic has effect on pain so it was controlled effect in data analysis process.

Nursing role in managing acute pain after cardiac surgery

Standard care to manage acute pain following cardiac surgery is to follow the WHO-3-step-ladder with a multi-modal treatment (The Thai Association for the Study of Pain, 2011). Nurses use their roles managing pain from two types of intervention including pharmacologic interventions and non-pharmacologic interventions**.**

Pharmacologic interventions

Nurses must maintain the analgesia, assess its effectiveness, and report if the intervention does not achieve desired outcomes or forms side effects. Traditionally, the pharmacologic interventions regimens include Opioids, Acetaminophen, NSAID (Cogan, 2010). Sometiemes adjuvants are included e.g. corticosteroids, antihistamine, benzodiazepines tricyclic antidepressant, local anesthetics (Craven & Hirnle, 2003).

Nowadays, patient to self-administer analgesics has been proposed in several postoperative analgesic regimens. Patient controlled analgesia (PCA) is now routinely used in postoperative setting (Carr, Miaskowski, Dedrick, & Williams, 1998). PCA devices are programmable by the healthcare provider to deliver a specific amount of medication upon each request by the patient. It may be applied via intravenous, subcutaneous, epidural or intrathecal routes (Crews, 2000). Commonly, PCA devices are applied to deliver intravenous opioids after operations although PCA has also been used following trauma or to treat cancer pain (Lehmann, 1999) and to deliver non-opioids such as non-steroidal anti-inflammatory drugs (Cepeda, Delgado, Ponce, Cruz, & Carr, 1996) or local anesthetics (DeKock, Lavandhomme, & Scholtes, 1994). A previous systematic review (Ballantyne et al., 1993; Walder, Schafer, Henzi, & Tramer, 2001) still has the controversy in finding the effectiveness of PCA compare to the conventional postoperative analgesia. The findings only described the strong patient preference for PCA over conventional analgesia i.e. the self-autonomy (Ferrante, Ostheimer, & Covino, 1990; Kiecolt-Glaser, Page, Marucha, MacCallum, & Glaser, 1998).

Non-pharmacologic interventions

This intervention includes physical pain relief, cognitive pain relief and behavioral pain relief (Craven & Hirnle, 2003).

- Physical pain relief intervention includes: 1) Cutaneous stimulation to relief both acute and chronic pain such as cold therapy, pressure, massage and vibration into the areas that can be used include the skin over near the pain site 2)Positioning for client who spend many times on bed by changing their position.

- Cognitive pain relief techniques are 1) Anticipatory guidance by providing information about pain and promoting the client's expression 2) Distraction is useful when they are going to the period of intense/sharp pain such as chest drain removal by using something the client enjoy such as music 3) Guide imagery is the way to relief the pain by leads patient to focuses on a pleasant, relaxed mental image.

- Behavioral therapy program are 1) Relaxation techniques, it is used for promoting mental and physical freedom from tension and stress 2) Meditation by encourage client to focus on a single thought or sound to decrease perception.

Existing intervention studies for managing acute pain after cardiac surgery in Thailand

There have been reported of the pain management literatures after cardiac surgery in Thailand as following:

– Music therapy: Kittisup (1994) used 2 group experimental study to examine the effect of music on pain and anxiety on the first 48 hours after open heart surgery among 40 patients. The western and Thai classical music were given on the experimental group while the control group received the routine care. The finding shown that pain and anxiety within 48 hours in the experimental group was lower than

the control did ($p < .05$). Also, Kamkhieo (2008) had conducted the two groups quasi-experimental study to examine the effect of music on pain relief in 40 cardiac surgery patients who had undergone cardiac surgery within the previous 24 hours. The experimental group participants listened to their choice of music while those in control group received routine nursing care. The result not shows the pain level different between groups ($p > .05$).

– Progressive muscle relaxation: Jongjareonkumchok (2005) used a one group pre-test and post-test quasi-experimental design to examined the effect of progressive muscle relaxation treatment after extubation on postoperative pain and anxiety 30 CABG patients and found that the mean post-intervention scores for both the pain and anxiety scores were significantly lower than the pre-intervention scores ($p< .05$). This group requested fewer analgesic drugs than the group that did not receive the treatment.

– Combine therapy: Rattanamanee (2006) conducted the two groups quasi study to compare the effect of preparatory information combine with music listening and routine care on pain level in 40 post open heart surgery patients(each group consisted of 20 patients), the experimental group received preparatory information before surgery 1 week and listening to music before surgery 1 day and during sitting, chest tube removal and physical therapy. The result shown that after operation, the mean of pain level during sitting and chest drain removal of the experimental group was significant lower than those in control group ($P< .05$). Another study was from Kasetlaksami (2008) that used three groups quasi-experimental design to compared the effect of preoperative information, preoperative information combined with foot reflexology with aromatherapy, and conventional

nursing care on unpleasant symptoms in 45 post opened-heart surgery patients on the 1st, 2nd, and 3rd day after surgery. It was found that the mean of unpleasant symptoms score were statistical different among groups in everyday ($p < .05$). By the mean of unpleasant symptoms score in the group receiving preoperative information combined with foot reflexology with aromatherapy was the lowest while it was the highest in the control group.

Summary from the review of existing knowledge, there are some problems to generalize them to this current study because 1) the number of effective intervention that can reduce pain in coughing and deep breathing exercise is still limited. 2) previous studies did not continuously conducted through post operative day 1, 2, 3 that patients face with most severe pain during this stage. 3) these studies have weakness in research methodology e.g. lack of control group, small sample size. 4) concerning on naturalistic of acute pain regard to the gate mechanism that pain evolves from spinal cord and brain system, previous studies mainly intervening with central control in brain e.g. affective-motivate and cognitive-evaluative component whereas the modulation of nerve impulses from gate has rarely been manipulated. Thus, it could lead to the problem that the effective intervention in decreasing acute pain during chest physical therapy is fairly approved and still be required.

Complementary care

The concept of Complementary and Alternative Medicine (CAM) was first released in December 2008 by the National Center for Complementary and Alternative Medicine (NCCAM) and the National Center for Health Statistics. Since many people use health care approaches developed outside of mainstream Western, or conventional, medicine for specific conditions or overall well-being. Hence, CAM is a

group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medicine. There are three kinds of CAM including:

1) Complementary medicine is using non-conventional medicine together with conventional medicine

2) Alternative medicine is using non-conventional medicine in place of conventional medicine

3) Integrative medicine is using non-conventional medicine as a part of conventional medicine

Generally, CAM is divided into two subgroups: natural products or mind and body practices

1) Natural Products: this group includes a variety of products, such as herbs (also known as botanicals), vitamins and minerals, and probiotics. They are widely marketed, readily available to consumers, and often sold as dietary supplements

2) Mind and Body Practices: include a large and diverse group of procedures or techniques administered or taught by a trained practitioner or teacher. For example Acupuncture, Massage therapy, Meditation, Movement therapies, Relaxation techniques, Spinal manipulation, Tai chi and Qi gong, yoga, Healing touch and hypnotherapy.

3) Other Complementary Health Approaches: some approaches may not neatly fit into either of these groups. For example, the practices of traditional healers, Ayurvedic medicine, traditional Chinese medicine, homeopathy, and naturopathy.

To use complementary methods as Non-pharmacological pain management, Meditation, progressive relaxation, dreaming, rhythmic respiration, biofeedback,

therapeutic touching, transcutaneous electrical nerve stimulation (TENS), hypnosis, musical therapy, acupressure including cold-hot treatments have been used. However, these techniques may have disadvantage/disadvantage differently. For this reason, clinical feasibility abilities and preferences of the patient regarding the use of non-pharmacological methods should be taken into consideration.

Cold therapy

It could be categorized as Mind and Body Practices from Complementary and Alternative Medicine (CAM). It is the application of cold modalities that have temperature range between 0 ^{0}C to 18.33 ^{0}C to treat the tissue trauma in acute or sub-acute phase and decrease pain from exercise or activities of rehabilitations after orthopedic surgery (Starkey, 1999). The magnitude of therapeutic depends on the temperature of modality, the duration of treatment and the surface area that must be decreased to 13.88 ^{0}C to gain therapeutic benefit in optimal decreasing the local blood flow and to 14.44 ^{0}C for analgesic result (Starkey, 1999).

Indications for cold therapy

It can be used in acute injury or inflammation, or chronic pain, first degree burns, post-surgical pain and edema, conjunction with rehabilitation exercises, spasticity accompanying central nervous system disorders, acute or chronic muscle spasm and neuralgia (Starkey, 1999).

Contraindications

Contraindications are cardiac or respiratory involvements, uncovered open wounds circulatory insufficiency, cold allergy, anesthetic skin, advanced diabetes, Raynuald's phenomena and rheumatoid arthritis (Starkey, 1999).

Mechanism of cold therapy

1) Cellular responses: when normal tissues are injured, a hypoxic environment is created and needs physiological responses to increase the cellular metabolic rate preserving a normal cellular oxygenation. Cold helps in decreasing the cellular metabolic rate and chemical substances.

2) Vascular and fluid dynamic response: applying cold therapy induces vasoconstriction due to the body compensates to preserve core heat by triggering a sympathetic response instructing the superficial cutaneous vessel to constrict. Thus, the hematoma or swelling is consequently decreased because delaying blood and tissues molecular motion in the injured area.

3) Inflammatory response: applying cold therapy inhabits bradykinin, prostaglandin, and histamine at the point of tissue damages which can decrease cellular oxygen demands from reducing the metabolism.

4) Neurological response: cold therapy slows nerve conduction which is the A-delta fibers and the C fibers. Once the cold apply, the small diameter myelinated never fibers, the A-delta fibers and gamma motor neurons are first changed and the large diameter myelinated nerve fibers called the alpha are then slow their conduction. Lastly, the C fibers which are the small diameter unmyelinated never fibers will be the last one that respond to cold therapy and results in decreasing pain.

Complications of cold therapy

Frostbite occurs when skin is exposed to cold below 0 ^{0}C for longer than 30 minutes. Patient will experience itching and progress to pain, numbness and loss of function.

The uses of cold therapy

It has been used to decrease both post-surgical and medically associated pain In Thailand, it commonly uses a reusable cold pack gel pack as it is inexpensive, easily purchasable and convenient in application. However, the use of cold therapy in cardiac surgery was only shown in a study by Chailler (2010) demonstrated that there were the effectiveness of frozen gel pack application on to the sternal incision dressing before performing deep breathing and coughing exercises in CABG patients. Unfortunately, this study has limitation in generalization due to small sample size, participant mostly were men and it was conducted when patients free from chest tube but in real practice and empirical review, chest tube is one of physical factor that contribute pain which should be provide an appropriate pain management since it still exists with patients. Hence, the use of cold therapy might be benefit

Physiological responses

According to gate control mechanism that pain resulted from a neural activity. The pain impulses are moderated by a gating mechanism that opens to allow nerve impulses to reach the brain or close to decrease impulse transmission, depended on the extent to which gate is open. Pain expressed by patient's perception and body responses as action system: The action system responses after perception which beginning with the sympathetic or parasympathetic nervous systems. Hence, managing pain should also concern in both type of consequences of pain i.e. patient's perception and as physiological responses that related to each other as dynamic system.

Physiological responses is the work reaction of sympathetic nervous system including heart rate, blood pressure, respiration rate and oxygen saturation. These

vital signs are essential as delays in initiating appropriate treatment can detrimentally affect the patient's outcome (Chalfin et al, 2007). The explanation as follow:

Heart rate

Definition

The American Heart Association defines the heart rate (or pulse) as the number of times that the heart beats per minute (Go et al., 2013).

The pulse rate is the number of times that people can feel a pulse wave passing a point in one minute. Since a pulse wave occurs whenever the heart beats, the pulse rate equals the heartbeat rate. (U.S. Army Medical Department Center and school)

In summary for this study, heart rate is the palpable rhythmic expansion of an artery produced by the increased volume of blood pushed into the vessel by the contraction and relaxation of the heart that use to measure as how many times a minute that our arteries expand because of the increase in blood pressure originated by the heartbeat.

Mechanism of the heart rate (Klabunde, 2016)

Heart rate is normally determined by the pacemaker activity of the sinoatrial node (SA node) located in the posterior wall of the right atrium. The SA node exhibits automaticity that is determined by spontaneous changes in Ca^{++}, Na^{+}, and K^{+} conductances. This intrinsic automaticity, if left unmodified by neurohumoral factors, exhibits a spontaneous firing rate of 100-115 beats/min. This intrinsic firing rate decreases with age.Heart rate is decreased below the intrinsic rate primarily by activation of the vagus nerve innervating the SA node. Normally, at rest, there is significant vagal tone on the SA node so that the resting heart rate is between 60 and 80 beats/min. This vagal influence can be demonstrated by administration of atropine,

a muscarinic receptor antagonist, which leads to a 20-40 beats/min increase in heart rate depending upon the initial level of vagal tone. For heart rate to increase above the intrinsic rate, there is both a withdrawal of vagal tone and an activation of sympathetic nerves innervating the SA node. This reciprocal change in sympathetic and parasympathetic activity permits heart rate to increase during exercise. Heart rate is also modified by circulating catecholamines acting via β_1-adrenoceptors located on SA nodal cells. Heart rate is also modified by changes in circulating thyroxin (thyrotoxicosis causes tachycardia) and by changes in body core temperature (hyperthermia increases heart rate). SA nodal dysfunction can lead to sinus bradycardia, sinus tachycardia, or sick-sinus syndrome.

Artery expansion. The sudden rush of blood increases the volume of blood in the arteries. In order to accept this increased volume, the arteries expand. As the arteries quickly contract, blood is forced from the arteries, through the capillaries, and into the veins.

Pulse. In addition to the expansion of the arteries, a "wave" travels through the arteries. This wave is the pulse. All arteries have a pulse, but the pulse is easier to feel (palpate) when the artery is near the surface of the body.

Measuring of heart rate

The purpose of measuring pulse is to establish the patient's baseline pulse rate and to assess the pulse rate after special procedures, medications, or disease processes that affect heart functioning. Normally there are two simple ways to measure heart rate including (West, 2012):

Manual Method

Pulse is palpated by applying moderate pressure with the sensitive pads located on the tips of the three middle fingers. There are several sites on the body where a pulse is normally taken. All arteries have a pulse, but it is easier to palpate the pulse at certain locations. The three most common sites are the radial, carotid, and brachial.

Monitor Method

A heart rate monitor or ECG/EEG can be used to get a more accurate heart rate measurement. Using a heart rate monitor is also useful to record heart rate changes over short time periods, where the heart rate may be changing. Many heart rate monitors are able to record the heart rate values to be reviewed later or downloaded to a computer.

Classification of the heart rate

Normal heart rate varies from person to person and is normally 60 to 100 times a minute, heart rates that are outside the normal range are classified as tachycardia or bradycardia. (U.S. Army Medical Department Center and school)

(a) Tachycardia is when the patient's pulse rate is over 100 beats per minute. Often, tachycardia is only temporary that can be caused by exercise, pain, strong emotion, excessive heat, fever, bleeding, or shock. Constant tachycardia could be a sign of certain diseases and heart problems.

(b) Bradycardia means that patient has pulse rate below 60 beats per minute. Bradycardia can be sign of certain diseases and heart problems. Certain medicines, such as Digitalis, can result in bradycardia.

Factors affecting heart rate (Dewit, 2014)

Pulse rate can vary depending on many factors as following

1. Age: pulse varies inversely with age. As age increases, the pulse rate gradually decreases.

2. Body built and size: tall, slender people may have a slower pulse rate than short, stout people.

3. Blood pressure: when the blood pressure rises, it causes a decrease in the pulse rate and when the blood pressure is lower, the pulse rate increase this is because the heart is attempting to increase the cardiac output.

4. Medications: stimulants increase heart rate e.g. epinephrine while depressants decrease heart rate e.g. digitalis.

5. Emotional states: strong emotional states such as anxiety, fear, excitement, and anger, temporarily increase the pulse rate.

6. Blood loss: excessive blood loss increases heart rate as the body tries to meet the tissue oxygen demands.

7. Physical activity: physical activity, such as jogging and swimming, increases the pulse rate temporarily in order to meet the circulatory needs.

8 Metabolism: increased body metabolism, such as occurs during pregnancy, increases the pulse rate.

9. Body temperature: fever increases the pulse rate. The pulse rate increase 7-1- beat per minute for each degree of temperature increase

10. Pain: pain increase the pulse rate

Blood pressure

Definition

Blood pressure (BP) is a measurement of the pressure or force exerted by the blood on the walls of the arteries in which it is contained (Dewit, 2014).

Blood pressure (BP) refers to the pressure exerted by blood against the arterial wall. It is influenced by cardiac output, peripheral vascular resistance, blood volume and viscosity and vessel wall elasticity (Fetzer, 2006).

Blood pressure refers to the force (pressure) with which the blood presses against the walls of the blood vessel. All blood vessels-large or small, artery or vein--have blood pressure. Blood pressure is normally measured in millimeters of mercury (mm Hg). "Millimeters of mercury" is a standard unit for measuring pressure. It refers to how high a force (pressure) would cause a column of mercury (chemical symbol Hg) to rise in a tube. (U.S. Army Medical Department Center and school)

Conclusively, this study, blood pressure refers two numbers in millimeters of mercury including when the heart is contracting (systole) and relaxing (diastole) which the average of two properly measured are undertaken.

Measurement of blood pressure

There are two types of BP measurement including direct and indirect measurement as follows (Lee, 2003):

1. Direct measurement: it is the criterion standard measurement of blood pressure. The direct measurement consisted of the use of an intra-arterial catheter to archive the data. However, this method is not common in clinical setting since it is invasive procedure that not able to apply to general populations of asymptomatic individuals or for the hypertension screening.

2. Indirect measurement: This method involves collapsing the artery with an external cuff, providing an inexpensive and easily reproducible way to measure blood pressure. The manual cuff and sphygmomanometer or with an automated oscillometric device are used in this method. The manual method requires auscultation of the blood pressure, whereas the automated system depends on oscillometric devices. Usually the auscultatoric measurement is preferred to use in the hospital where the oscillometric one is generally used in home care setting.

Classification of the blood pressure

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (Chobanian et al., 2003) provides a classification of BP for adults 18 years and older. The classification is based on the average of two or more properly measured, seated, BP readings on each of two or more office visits. The normal blood pressure as <120/80 mmHg. And has introduced a new classification that includes the term "prehypertension" for those with BPs ranging from 120–139 mmHg systolic and/or 80–89 mmHg diastolic.

The most common condition that causes an abnormal blood pressure reading is hypertension. Hypertension, or high blood pressure, results from excessive pressure on thewalls of the arteries. Hypertension is determined by a sustained systolic blood pressure reading of 140 mm Hg or greater, or a sustained diastolic reading of 90 mm Hg or greater.

Factors affecting blood pressure

Blood pressure does not remain at a constant value. Numerous factors may affect it throughout the course of the day including (U.S. Army Medical Department Center and school)

1) Condition of Cardiovascular System

If a patient's heart is not pumping blood with enough force, the blood pressure will be low. This will decrease the rate that blood is circulated throughout the body. Slow blood circulation may result in certain parts of the body (especially the brain) not receiving enough oxygen since oxygen is carried by the blood.

If a patient's heart is pumping with too much force, the blood pressure will be high. If an artery has a weak spot, the force of the systolic pressure may be enough to rupture the artery and allow blood to escape.

If a patient's arteries loose part of their elasticity, such as in patients who have arteriosclerosis (hardening of the arteries), the patient's blood pressure will be higher, since the artery walls stretch less and cannot relieve as much pressure.

2) Age: as age increases, the blood pressure gradually increases. As an individual gets older, there is a loss of elasticity in the walls of the blood vessels, causing this increase in pressure to occur.

3) Gender: after puberty, men tend to have higher blood pressure than women of the same age but after menopause, women usually have a higher blood pressure than men of the same age.

4) Physical Fitness: people who are physically fit tend to have more normal blood pressure than people who are "out of shape."

5) Obesity: people who are very overweight usually have higher blood pressure than they would if their weight were closer to their ideal weight.

6) Pain: pain is a type of body defense that lets the brain knows that something is wrong. The brain may respond to pain by increasing the rate and strength of

heartbeats. The increased rate increases the amount of oxygen available to the muscles for producing energy. It also results in an increased blood pressure.

7) Emotion: strong emotional states, such as fear, worry, excitement, and similar emotions can result in a higher blood pressure. The brain may react to these emotions in basically the same way that it reacts to pain.

8) Gravity: if a person is standing, the blood pressure of the arteries in the lower part of the body will be greater than the pressure in the upper part of the body.

9) Exercise: physical activity temporarily increases the blood pressure because the heart beats faster in order to supply additional oxygen to the muscles.

10) Disease: almost any disorder that affects the arteries or the renal system will result in a higher blood pressure. Diseases that weaken the heart will usually result in a lower blood pressure.

11) Drugs: drugs designed to strengthen the actions of the heart, such as digitalis, will cause blood pressure to rise. Vasoconstrictors will also cause the blood pressure to rise. Vasodilators will decrease blood pressure.

12) Eating: blood pressure is usually elevated while he is eating and for a while after he finishes the meal.

13) Bleeding: serious bleeding reduces the amount of blood in the body's circulatory system and thus reduces blood pressure.

14) Diurnal variations: fluctuations in an individual’s blood pressure are normal during the course of a day. When one awakens, the blood pressure is lower as a result of decreased metabolism and physical activity during sleep. As metabolism and activity increase during the day, the blood pressure rises.

15) Body position: the blood pressure of a patient who is in a lying or standing position is usually different from that measured when the patient is sitting.

16) Other factors: other factors that may increase the blood pressure include caffeine, smoking, and bladder distention.

Respiration

Definition

Respiration is the exchange of oxygen and carbondioxide in the lungs and tissues and is initiated by the act of breathing. (Dewit, 2014)

Mechanism of respiration

Each respiration is divided into two phases: inhalation and exhalation. During inhalation, or inspiration, the diaphragm descends and the lungs expand, causing air containing oxygen to move from the atmosphere into the lungs. Exhalation, or expiration, involves the removal of carbon dioxide from the body. The diaphragm ascends, and the lungs return to their original state so that air containing carbon dioxide is expelled. One complete respiration is composed of one inhalation and one exhalation. (West, 2012)

Control of respiration

The medulla oblongata is the control center for involuntary respiration. A buildup of carbon dioxide in the blood sends a message to the medulla, which triggers respiration to occur automatically. To a certain extent, respiration is also under voluntary control. An individual can control respiration during activities such as singing, laughing, talking, eating, and crying. Voluntary respiration is ultimately under the control of the medulla oblongata. The breath can be held for only a certain

length of time, after which carbon dioxide begins to build up in the body, resulting in a stimulus to the medulla that causes respiration to occur involuntarily(West, 2012).

Control of ventilation

Ventilation is caused by two muscle systems which are the diaphragm and the intercostal muscles. (U.S. Army Medical Department Center and school)

The diaphragm is a large dome-shaped muscle that separates the chest cavity from the abdominal cavity. When the diaphragm contracts, the muscle flattens somewhat and "lowers the floor" of the chest cavity. When the muscle relaxes, it returns to its normal (dome) shape. The diaphragm is responsible for most of the air movement during breathing. The diaphragm is a skeletal muscle that is under involuntary control of the part of the brain that controls breathing.

On the other hands, Intercostal Muscles are the muscles that connect one rib to another rib. When the muscles contract, the ribs are pulled up and out. This action causes the entire rib cage to move up and out that causes the circumference of the chest to increase.

Measuring of respiration rate (West, 2012)

Because an individual can control thier respiration, they may change their respiratory rate unintentionally if they are aware that they are being measured. The respiratory rate of a normal healthy adult ranges from 12 to 20 respirations per minute referred as eupnea. An abnormal increase in the respiratory rate of more than 20 respirations per minute is referred to as tachypnea. An abnormal decrease in the respiratory rate of less than 12 respirations per minute is known as bradypnea.

The rhythm and depth should be noted when measuring respiration. Respiratory depth is generally described as normal, deep, or shallow and is

determined by observing the amount of movement of the chest. For normal respirations, the depth of each respiration in a resting state is approximately the same. Deep respirations are those in which a large volume of air is inhaled and exhaled, whereas shallow respirations involve the exchange of a small volume of air. Hyperpnea is an abnormal increase in the rate and depth of respirations. A patient with hyperpnea exhibits a very deep, rapid, and labored respiration. Hyperpnea occurs normally with exercise and abnormally with pain and fever. It also can occur with any condition in which the supply of oxygen is inadequate, such as heart disease and lung disease.

Hyperventilation is an abnormally fast and deep type of breathing that is usually associated with acute anxiety conditions, such as panic attacks. An individual who is hyperventilating is “overbreathing,” which usually causes dizziness and weakness.

Hypopnea is a condition in which a patient’s respiration exhibits an abnormal decrease in rate and depth. The depth is approximately half that of normal respiration. Hypopnea often occurs in individuals with sleep disorders.

In summary, in this study, respiration rate means the number of breaths per minute or the number of movements indicative of inspiration and expiration per unit time and to classify the pattern as eupnoea, tachypnoea, bradypnoea or hypopnoea.

Factors affecting respiration rate

Many of factors affecting the heart rate also affecting the respiration rate because the heart and lungs are closely connect in providing oxygen to sustain life. Although the rate and depth of respiration are controlled by the respiratory control in the brain , they are easily influenced by emotions(strong emotional states temporarily

increase the respiratory rate), pain, degree of activity(physical activity increases the respiratory rate temporarily), age(as age increases, the respiratory rate decreases), fever(patient with a fever has an increased respiratory rate), drugs, and disease conditions such as head injury or any increase intra cranial pressure depresses the respiratory center and results in shallow and /or slow breathing (Dewit, 2014; West, 2012).

Oxygen saturation

Definition

Oxygen saturation is an indicator of the percentage of hemoglobin saturated with oxygen at the time of the measurement. (Saunders, 2001).

Oxygen saturation is defined as the oxygen content expressed as a percentage of the oxygen capacity (Kamat, 2002).

Hence, this current study defines oxygen saturation as represents the percentage of hemoglobin that is saturated with oxygen.

Measuring of oxygen saturation (West, 2012)

A pulse oximeter is the device used to measure and display the oxygen saturation. It also measures the patient's pulse rate in beats per minute. The pulse oximetry reading represents the percentage of hemoglobin that is saturated (filled) with oxygen. Each molecule of hemoglobin can carry four oxygen molecules. If 100 molecules of hemoglobin were fully saturated with oxygen, they would be carrying 400 molecules of oxygen, and the oxygen saturation reading would be 100%. If these same 100 molecules of hemoglobin were carrying only 360ould be 90%. The more hemoglobin that is saturated with oxygen, the higher the oxygen saturation of the blood.

Classification of oxygen saturation

The oxygen saturation level of most healthy individuals is 95% to 99%. Because the air we breathe is only 21% saturated with oxygen, it is unusual for an individual's hemoglobin to be fully or 100% saturated with oxygen. Patients on supplemental oxygen sometimes have a reading of 100%, however.

An oxygen saturation level of less than 95% typically results in an inadequate amount of oxygen reaching the tissues of the body, although patients with chronic pulmonary disease are sometimes able to tolerate lower saturation levels. Respiratory failure, resulting in tissue damage, usually occurs when the oxygen saturation decreases to a level between 85% and 90%. Cyanosis typically appears when an individual's oxygen saturation reaches a level of 75%, and an oxygen saturation of less than 70% is life-threatening. A decrease in the oxygen saturation of the blood (less than 95%) is known as hypoxemia. Hypoxemia can lead to a more serious condition known as hypoxia. Hypoxia is defined as a reduction in the oxygen supply to the tissues of the body, and if not treated, it can lead to tissue damage and death. The first symptoms of hypoxia include headache, mental confusion, nausea, dizziness, shortness of breath, and tachycardia. The tissues most sensitive to hypoxia are the brain, heart, pulmonary vessels, and liver.

Factors affecting oxygen saturation

Conditions that can affect the SpO2 measurements include conditions resulting in poor blood flow to the vascular bed as following: hemoglobin level, peripheral vascular disease, vasoconstrictor medications, severe hypotension, perfusion mismatch and hypothermia (Schulz & Grimes, 2002).

Regarding the factors affecting all physiological responses, there are multiple factors that involve mutually through all parameter which are emotional states and pain. Thus, nurse should use the independent model to consider all modifiable factors. In summary, all these physiological responses were measured with the automatic bedside monitoring since they were continuously recorded throughout the period of study that participants stay in intensive care unit.

Symptom management model (SMM)

The SMM of Dodd and colleagues (2001) assumes that the symptom management is a dynamic process. It is modified by individual outcomes and the influences of the nursing domains. It is a way to manage symptom and intervention strategies might be initiated before an individual experiences the symptom. Symptom management is a strategy that patients use through biomedical, professional and self-care ways for managing symptom occurrence with a goal to avert or delay a negative outcome. There are three domains of nursing profession which are related to SMM including (1) person, (2) health and illness, and (3) environment as described follows:

1) Person domain. It consists of demography, psychology, and physiology of a person which are intrinsic to the way an individual views and responds to the symptom experience. Developmental variables include the level of development or maturation of an individual. When the model is used, person variables may be expanded or contracted depending on the symptom(s) and the population of interest.

2) Health and illness domain unique to the health or illness state of an individual and includes risk factors, injuries, or disabilities. This domain has direct and indirect effects on model. In addition, the model allows to assess factors that influence perception, evaluation and response of individual at risk for symptoms

3) Environment domain. It refers to the aggregate of conditions or the context within which a symptom occurs; that is, it includes physical, social and cultural variables. The physical environment may encompass home, work and hospital. The social environment includes one's social support network and interpersonal relationships. Cultural aspects of the environment are those beliefs, values and practices that are unique to one's identified ethnic, racial, or religious group.

These three domains are contextual variables which influences all three essential dimensions of the SMM including (1) symptom experiences, (2) symptom management strategies, and (3) symptom outcomes.

1) Symptom experience. It includes an individual's perception of a symptom, evaluation of the meaning of a symptom and response to a symptom. Perception of symptoms refers to whether an individual notices a change from the way he or she usually feels or behaves. People evaluate symptoms by making judgments about the severity, cause, treatability and the effect on their lives. Responses to symptoms include physiological, psychological, socio-cultural and behavioral components.

There are bi-directional relationships among the components of the symptom experience dimension. If an individual believes that the symptom has ominous significance, the perception of intensity maybe heightened. In the revised model, these processes are conceived to be iterative and may occur simultaneously.

2) Symptom management strategy. The goal of symptom management is to avert or delay a negative outcome through biomedical, professional and self-care strategies. Management begins with assessment of the symptom experience from the individual's perspective. Assessment is followed by identifying the focus for

intervention strategies. The intervention strategies may be targeted at one or more components to achieve one or more desired outcomes.

The symptom management strategy includes the specifications of what (the nature of the strategy), when, where, why, how much (intervention dose), to whom (recipient of intervention) and how (delivered). Researchers consider these questions as they design, develop and prescribe symptom management strategies. The specifications should greatly aid in replications of intervention studies. The nature of the intervention depends on the state of the science for the particular symptom. Additionally, in the evolution of the research on symptom management strategies, developers of the model have moved from targeting only the individual (`to whom' in the model) to including family members and `experienced' former patients as recipients of the intervention.

3) Symptom outcome. Outcomes emerge from symptom management strategies as well as from the symptom experience. In the revised model the outcomes dimension focuses on eight factors which include (1) symptom status, (2) functional status, (3) emotional status, (4) cost, (5) morbidity and co-morbidity, (6) mortality, (7) quality of life, and (8) self-care. There are no arrows indicating directionality between the multidimensional indicators and symptom status which means that all outcomes may be related to each other as well as to symptom status.

Adherence in the revised model to indicates the relationship between symptom management strategies and symptom outcomes, it is a critical factor that affects the outcome of the intervention and is under the control of the patient or family member who is the target of the intervention. Adherence (i.e. whether the intended recipient of

the strategy actually receives or uses the strategy prescribed) and intervention integrity present a potentially more challenging issue.

The Pain Management Combined with Complementary Care Program (PCP)

PCP is a nursing intervention to manage acute pain and physiological responses among cardiac surgery patients on postoperative day1, 2, 3. The PCP is based on SMM model and the content based on the clinical guideline for management of acute postoperative pain (TASP, 2011) and intensive literature reviews.

The PCP program was developed based on the SMM (Dodd et al., 2001) and the literature reviewed. Acute pain following cardiac surgery limits patients to perform early ambulation activities and causes the major respiratory complication. The most severe acute pain occurs during the first three days after surgery at sternotomy wound area during deep breathing and coughing. Existing interventions provided does not indicate the effectiveness. Thus, proper pain control during the first 3 days remains the needs to be manipulated properly. The PCP aimed to assess and manage acute pain and physiological responses, promoted patients knowledge, encouraged self-care skills in regard to manage pain, to educate patient and to monitor patient pain response to intervention. The PCP intervened with the naturalistic of acute pain and physiological responses with integration of complementary therapy with traditional care, it worked through 3 dimensions i.e. symptom experience, symptom management strategies and symptom outcome. It presumed that persons with cardiac surgery who receive the PCP would have lower acute pain and physiological responses than those who receive conventional care. Beside, persons with cardiac surgery who received the PCP would have lower acute pain and physiological responses than before participation in the program.

Summary

From the above, it can be concluded that ineffective acute pain management after cardiac surgery is the major problem which leads to poor post-operative outcomes i.e. pulmonary complications, increase cost and length of stay and leads to development of chronic pain. Therefore, the comprehensive pain management should be established in cardiac surgery center. To date, in Thailand, the existing evidence presents that there is no compatible intervention fulfilling this gap.

The SMM is the way to manage such symptom based on the perception of the individual experiencing the symptom. It concerns that the effectiveness of management strategy must be related with the interaction with symptom experiences, symptom management strategies, and symptom outcomes. Thus, it congruent with the way to manage pain follows its naturalistic within the cognitive central process in brain that patient will use determines pain before the response or action system. If the intervention helps patients in adjust their perception to pain appropriately, then the patients will have suitable symptom outcomes.

CHAPTER III
RESEARCH METHODOLOGY

This chapter discusses the research methodology selected for this study including research design, setting, population and sampling, instrumentation, protection of the rights of human participants, data collection, threats to internal validity, and data analysis procedure.

Research design

The study was quasi-experimental, repeated-measure design (Burns & Grove, 2009)(Figure 5). The design was used to examine the effect of the pain management combined with complementary care program (PCP) on acute pain and physiological responses amongst persons with cardiac surgery who have attended an elective cardiac surgery at Ramathibodi hospital, the tertiary hospital, Bangkok. The outcomes were acute pain level and physiological responses. The participants in the experimental group received both the PCP (which was conducted by a nurse researcher) and usual care while the participants in the control group received only usual care.

	Post-operative Day 1		**Post-operative Day 2**		**Post-operative Day 3**	
	10 am	2 pm	10 am	2 pm	10 am	2 pm
Exp.	x O_1 x O_2 O_3	O_4 x O_5	O_6 x O_7 O_8	O_9 x O_{10}	O_{11} x O_{12} O_{13}	O_{14} x O_{15}
Con.	O_{16} O_{17} O_{18}	O_{19} O_{20}	O_{21} O_{22} O_{23}	O_{24} O_{25}	O_{26} O_{27} O_{28}	O_{29} O_{30}

Figure 5 Research design

Remarks:

O_3, O_8, O_{13} = Acute pain in the experimental group on postoperative day 1, 2, and 3

O_1, O_2, O_4, O_5, O_6, O_7, O_9, O_{10}, O_{11}, O_{12}, O_{14}, O_{15} = Physiological responses in the experimental group on postoperative day 1, 2, and 3

O_{18}, O_{23}, O_{28} = Acute pain in the control group on postoperative day 1, 2, and 3

O_{16}, O_{17}, O_{19}, O_{20}, O_{21}, O_{22}, O_{24}, O_{25}, O_{26}, O_{27}, O_{29}, O_{30} = Physiological responses in the control group on postoperative day 1, 2, and 3

x = The pain management combined with complementary care program (PCP)

Exp. = The experimental group

Con = The control group

Setting

This study was conducted at cardiovasculartthoracic (CVT) unit, Ramathibodi hospital, Bangkok.

Population and Sample

Population

The population of this study was cardiac surgery patients aged above 18 years who had undergone an elective cardiac surgery.

Sample

The sample for this study was cardiac surgery patients aged above 18 years who had undergone an elective cardiac surgery at CVT unit, Ramathibodi hospital, Bangkok.

Sample selection

Convenience sampling was used to recruit participants based on their eligibility. The researcher first reviewed operative schedule, medical records and interviewed both cardiac surgery patients and family caregivers to determine whether the participants were eligible. Prospective participants fulfilling all of the following criteria were invited to participate in this study.

Inclusion criteria

1) Age above 18 years at the time of the initial screening
2) Good consciousness (well cooperate to time, place and person)
3) Able to read, write, and understand Thai language
4) No history of alcoholism, use hypnotic/tranquilizer/sedative drug, neurological pathology/deficit
5) Never been diagnosed with Raynaud's disease/cryoglobulinemia/cold hemoglobinuria

The participants were matched in pairs according to their gender, age (different less than 5 years), and type of operation. These dyads aimed to control for bias to the study. The descriptions for match paired were as follows:

1. Gender: was found to be an influent factor related intensity of pain. Females found their overall pain experience to be less acceptable than did males (Yorke & Wallis, 2004).

2. Age: it was found that elderly patients received less morphine and were refused pain killers more often than younger patients (Yorke & Wallis, 2004). Therefore, every recruited subject was matched to a subject of comparable age (different less than 5 years)

3. Type of operation: Since the use of the internal mammary artery (only in CABG surgery) to be the bypass graft requires the surgical dissection of the artery from anterior chest wall and use of electrocautery to control bleeding of the interrupted small vessel causes more pain. It related with the study of Eisenberg, Pultorak, Pud, and Bar-El (2001) which found that CABG patients most reported with left side chest wall pain often because the left internal mammary artery is most frequently used. Hence, type of operation was also used to match the participants in both the experimental and the control groups into 6 categories: Coronary Artery Bypass Graft (CABG), valvular surgery, aneurysm surgery, combined surgery, congenital heart surgery and miscellaneous surgery.

The results showed that there were twenty-one male and fourteen female matched pairs. Twelve pairs had CABG, ten pairs had valvular surgery, seven pairs had aneurysm surgery, four pairs had combined surgery, one pair with congenital surgery and last one pair went to miscellaneous operation. For the age, each single pair had different age not over 5 years (Table 1).

Table 1 Matched pair characteristic between groups

Experimental group			Control group		
Sex	**AGE**	**OPERATION**	**Sex**	**AGE**	**OPERATION**
F1	68	Valve	F1	66	Valve
F2	55	Valve	F2	56	Valve
M3	47	CABG	M3	51	CABG
M4	54	CABG	M4	54	CABG
M5	67	CABG	M5	64	CABG
M6	65	CABG	M6	60	CABG
F7	22	Congenital	F7	18	Congenital
M8	71	Combined	M8	68	Combined
M9	39	CABG	M9	41	CABG
F10	66	Miscellaneous	F10	62	Miscellaneous
M11	55	Valve	M11	55	Valve
M12	73	Valve	M12	71	Valve
M13	47	CABG	M13	49	CABG
M14	73	Valve	M14	78	Valve
M15	60	Combined	M15	62	Combined
M16	67	CABG	M16	65	CABG
F17	40	Congenital	F17	45	Congenital
M18	56	CABG	M18	59	CABG
F19	52	Valve	F19	55	Valve
M20	60	CABG	M20	60	CABG

Experimental group			Control group		
Sex	**AGE**	**OPERATION**	**Sex**	**AGE**	**OPERATION**
M22	45	Valve	M22	40	Valve
F23	42	Aneurysm	F23	44	Aneurysm
M24	45	Valve	M24	50	Valve
M25	36	Combined	M25	37	Combined
M26	24	Valve	M26	23	Valve
F27	45	CABG	F27	49	CABG
M28	58	CABG	M28	56	CABG
F29	76	CABG	F29	76	CABG
F30	56	Aneurysm	F30	56	Aneurysm
F31	66	Aneurysm	F31	63	Aneurysm
M32	48	Aneurysm	M32	49	Aneurysm
F33	66	Aneurysm	F33	65	Aneurysm
F34	68	Valve	F34	69	Valve
M35	31	Aneurysm	M35	35	Aneurysm

Table 1 (cont.): Matched pair characteristic between groups

Sample size

Based on a power analysis and effect size determinations using G*Power version 3.1.9.2. Since most nursing studies cannot expect effect sizes in excess of 0.50 (Polit & Beck, 2006). This study aimed to detect differences of pain intensity, pain interference, heart rate, SBP, DBP, RR and Sat O_2 (7 variables) between two groups. To yield 80% power and with the .05 level of significant for repeated measure MANOVA, the total 62 participants required for overall study (actual power =0.807).

Concerning about 10% of attrition rate, at least 68 patients were required for each group. However, that study finally collected data with 35 participants each group.

Sampling procedure

Convenience sampling was used to select participants following the inclusion criteria. Researcher reviewed the medication record of participant based on inclusion criteria. When patients whose characteristics met the inclusion criteria were selected, the researcher used a draw technique to match pairs. The first 40 participants were allocated to the experimental group but three of them refused to complete the study. The researcher selected other participants and matched their characteristics until the total number in this group were obtained. Another 40 participants were allocated to the control group and were matched in pairs with those from the experimental group. Two participants in this group refused and researcher selected other eligible participants. The sampling procedures outlined in Figure 6.

Sample attrition

During the study, five participants in the experimental group dropped out (two delayed extubation, one had hemodynamic unstable, one turned delirium and another one died). Five participants in the control group also did not complete the study because three delayed extubation, one had hemodynamic unstable and one participants went to re-operation. Finally, the final experimental and the control groups each contained 35 participants and were equally distributed to either of the two clinics (Figure 6).

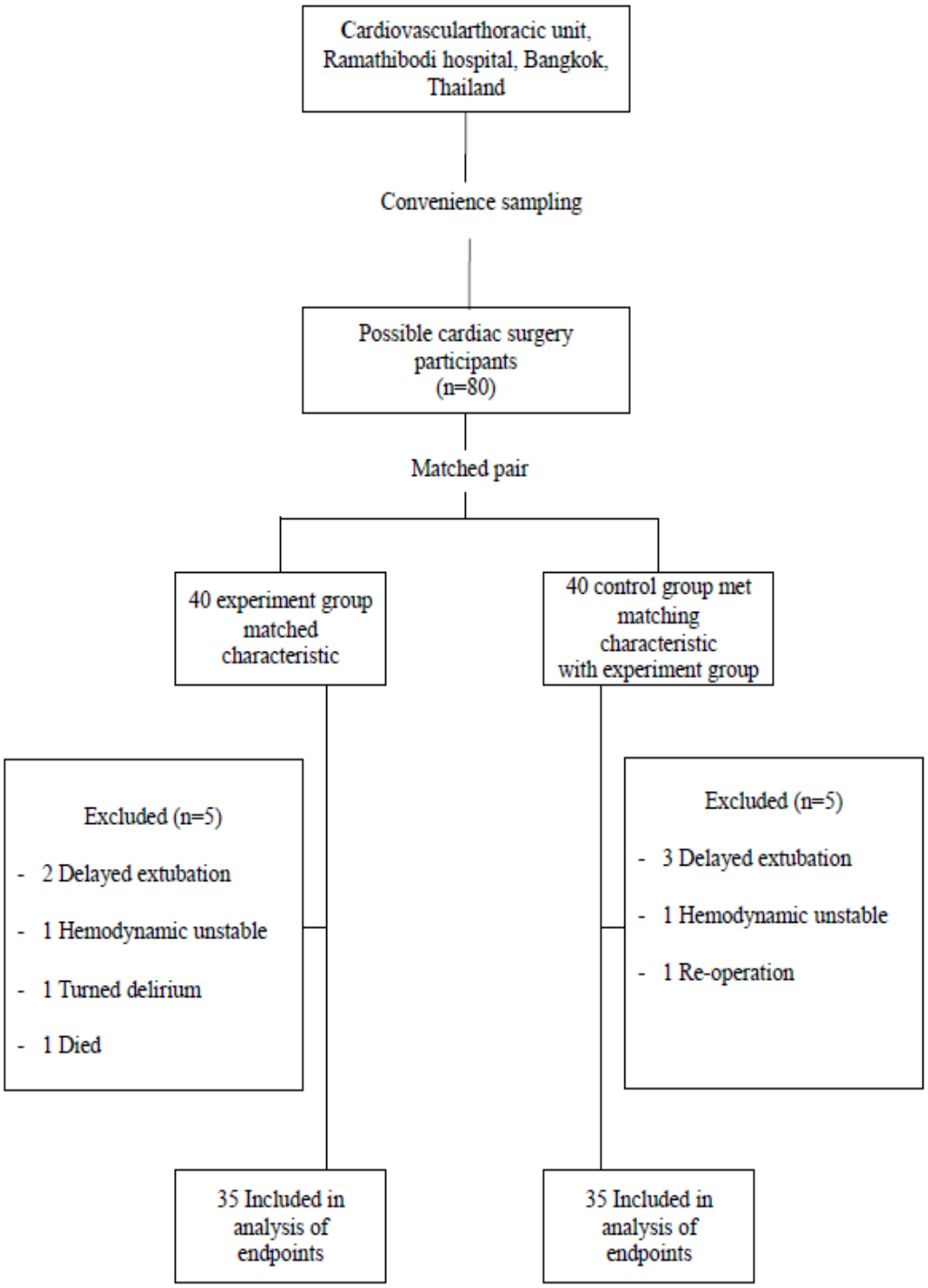

Figure 6 Flow Diagram of the sampling procedure

Research Instruments

There were three types of instrument used in this study: (1) data collection instruments, (2) intervention instruments, and (3) instruments for validity check. The content validity of the instruments was examined by five experts from various institutions including (1) A nursing faculty member who has long experience in cardiac surgery and experiences in instrument development, (2) A nurse instructor who experts in pain management, (3) An advanced practitioner nurse who experts in pain management, and (4) An anestheologist who experts in acute pain management and works in acute pain clinic and (5) An adult cardiac surgeon (See Appendix A).

1. Data collection instruments

Instruments for data collection consisted of (1) demographic data sheet, (2) a Thai version of a modified version of Brief Pain Inventory (BPI-T) and (3) bedside patients monitoring.

Demographic data sheet

Demographic data sheet consisted of two part: (1) a section for demographic data of the cardiac surgery patients included age, gender, marital status, level of education, income, current occupation, types of the payment and medical data i.e. type of cardiac surgery, length of stay in ICU, length of endotracheal tube intubation, length of intercostal chest drainage(ICD), length of hospi(tal stay, number of ICD, and number and locations of surgery wound; and (2) a section for pain management information including use of analgesic drug prior to admission, current postoperative analgesia(continuous and pro re nata; prn. as needed) (See Appendix B).

1.2 A Thai version of a modified Brief Pain Inventory (BPI-T)

The BPI-T, a self-report questionnaire was used to measure acute pain level of cardiac surgery patients. It consisted of 2 subscales cover 10 items including 4 items of intensity subscale and 6 items of interference subscale. For the intensity subscale, participants were asked to rate their pain of 4 times point: (1) pain at least during the last 24 hours, (2) pain at worst during the last 24 hours, (3) average pain during the last 24 hours and (4) pain right now. Scores were presented as NRS with 0 = no pain and 10 = pain as bad as you can imagine. It was categorized to be mild pain, moderate pain and severe pain when a worst pain scored of 1 - 3, 4 - 6, and 7 – 10, respectively. A pain severity index was calculated by adding the scores on the pain severity items.

The interference subscale were examined by participants rating "How pain had interfered your life in past 24 hours?" with (1) general activities, (2) sleep, (3) mood, (4) walking, (5) deep breathing and coughing and (6) relations with others. Scores were bounded by 0 = does not interfere and 10 = completely interferes (10). A pain interference index was calculated by mean score of the 6 pain interference item. The researcher was allowed to use and translate this questionnaire from the developers (See figure 7).

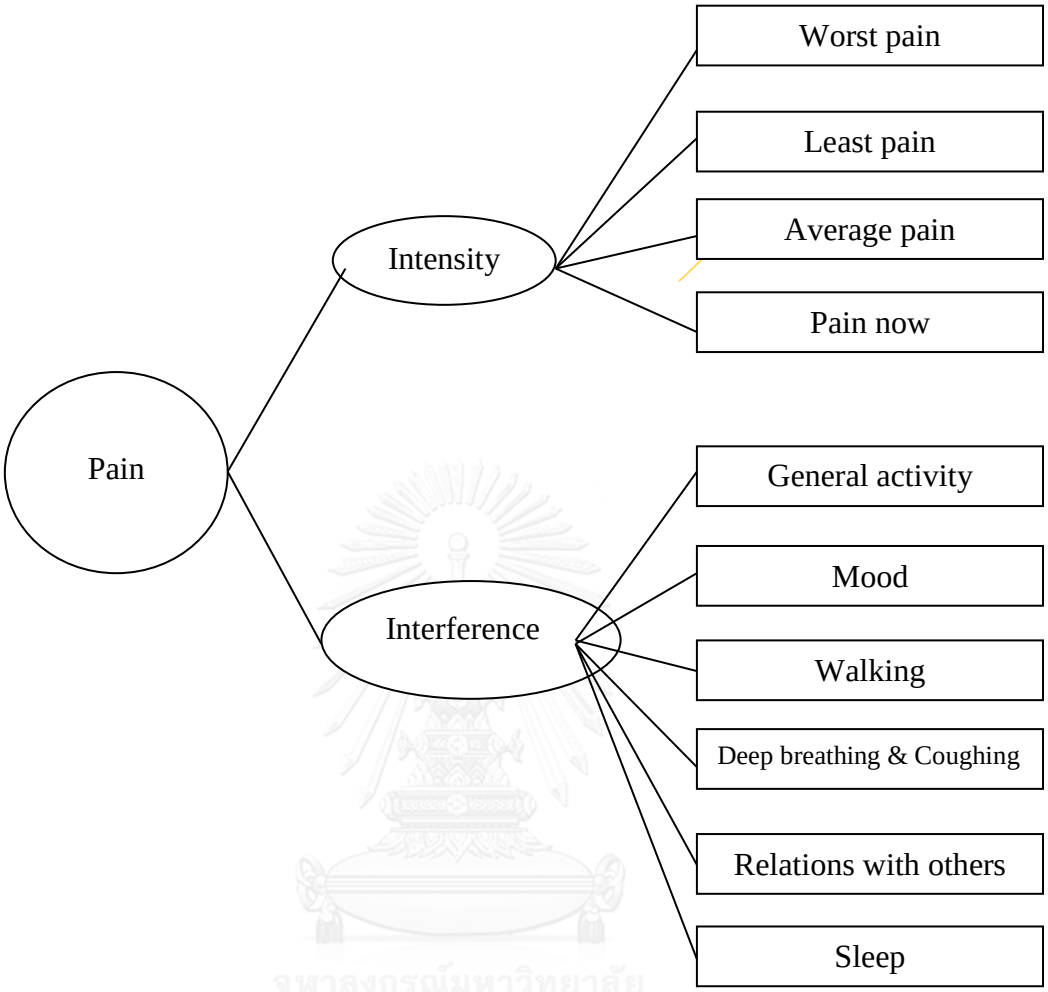

Figure 7 Measurement model of modified BPI

Originally, Brief Pain Inventory (BPI) was designed in English and used to estimate a cancer pain by Cleeland and colleagues since 1989 with the long form (Cleeland, 2009). Later, BPI has been shown to be an appropriate measure of pain caused by wide range of clinical conditions and has been translated into several languages. To this study that focused on acute pain during the first 72 hours post-operative, a modified version of BPI from Watt-Watson and colleagues was chosen since it is considerably relevant to the context of immediate post-operative care. With some items modification, the psychometric testing of this modified version shown

acceptable internal consistency at 0.71 for CABG sample (Watt-Watson, Stevens, Garfinkel, Streiner, & Gallop, 2001). However, this modified version of BPI has never been used in Thai context. In order to use this assessment for non-English-speakers, questionnaire was undergone a standardized process of translation and psychometric properties testing in order to maintain equivalent meanings between two different languagees prior to administration.

Translation process was done following the Brislin's (1970) model of translation (Jones, Lee, Phillips, Zhang, & Jaceldo, 2001). After asking the permission from the developers (See Appendix N), the translation process was begun with a forward translation from the source language (English) into the target language (Thai) by the first bilingual expert. After that, the translated version (Thai) was reviewed by another Thai bilingual reviewer before performing a blinded backward translation from the translated version (Thai) to the source language (English) by a second bilingual expert. The comparison of both versions was done to ensure linguistic and conceptual equivalence before sending the back-translated version to the developer to obtain her opinions. Without any requirements for modification from the developer's suggestion, a first draft of a BPI-T was ready examining validity and reliability.

Content Validity Index (CVI) was evaluated with the content validity index for items (I-CVI) and the content validity index for scales (S-CVI) through the opinion of the content experts. All versions of the translation were collected and discussed by the previous 5 committees. Based on the feedback from the experts, each item on both subscales have high relevance between two versions as result quantified

the acceptable value with the I-CVI 1.0. Regard to S-CVI (Average), with the score 1.0 in both subscales, it indicates the appropriateness of the scale.

Psychometric properties of this BPI-T were done with construct validity, convergent validity and internal consistency testing with 132 cardiac surgery patients during the first 72 hours after surgery from 4 cardiac centers in Bangkok. Confirmatory Factor Analysis did confirm the two-factor structure high loadings on pain intensity and pain interference consistent with the original BPI (RMSEA=0.08, CFI=0.95, x2=39.00, df= 27, X2/df =1.44, P = 0.06). Results also indicated acceptable internal consistency with Cronbach's alpha coefficients between 0.76 and 0.85. The association between the BPI-T and the NRS supported the convergent validity with the Pearson's Correlations Coefficient between 0.35 - 0.70. Final version of a Thai version of a modified Brief Pain Inventory (BPI-T) shown in appendix C.

Philips IntelliVue (M8005A)

Philips IntelliVue (M8005A), a bedside patients monitoring was used to obtain data of physiological responses including heart rate, systolic arterial blood pressure, diastolic arterial blood pressure, respiration rate and oxygen saturation. It was a real time monitor with 15" (405 x 360 x 170 mm.) color LCD display and 10 kg of weight (Philips Medical Systems Nederland, 2006). (See appendix D).

This device complied with the American National Standard for Electronic or Automated Sphygmomanometers and the possibility errors was minimized in compliance with ISO14971:2000.The accuracy of each parameter were as follows (1) Respiration Rate: at 0 to 120 rpm ±1 rpm & at 120 to 170 rpm ±2 rpm (2) SpO2= ±2 % or 1 bpm (3) Pulse Rate = ±1 % Full Range (4) Blood pressure: ±4 % of reading or ±4 mmHg (±0.5 kPa). Sensitivity is 5 μV/V/mmHg (37.5 μV/V/kPa)

with adjustment range: ±10 %. The Philips-qualified service professionals responded to this tasks every 6 months by Xovic Co., Ltd., Thailand as indicated by the monitor's maintenance schedule. The process of standard calibrations was generally including testing and maintenance of monitor, multi measurement module and battery.

Precision is similar to reliability and is supported by careful and proper use of the equipment (Rodrigues, 2007). Thus, prior to initiating patient monitoring, nurse prepared the transducers to be leveled at the appropriate position that is the midchest position in the midaxillary of the patient in the supine position. The initial step nurse exposed the transducer to atmospheric pressure by opening the adjacent stopcock to air, pressing the zero pressure buttons on the monitor, and thus establishing the zero pressure reference value.

2. Intervention instruments

It included conventional care and the Pain Management Combined with Complementary Care Program as following:

2.1 Conventional care: all cardiac surgery patients received the pamphlet about cardiac surgery, providing knowledge, preoperative assessments and preoperative preparation individually by nurses, physician, and health care provider

2.2 The Pain Management Combined with Complementary Care Program (PCP): It is a nursing intervention to manage acute pain and physiological responses among cardiac surgery patients on postoperative day1, 2, 3. The PCP is based on the symptom management model (SMM) (Dodd et al., 2001) and the content based on the clinical guideline for management of acute postoperative pain (Thai Association for the Study of Pain, 2011) and intensive literature reviews.

The researcher described the PCP program in three topics (1) the program development, (2) the program trial, and (3) the program modification as follow:

(1) PCP program development

The PCP program was developed based on the SMM (Dodd et al., 2001) as described in the Chapter 2. Based on the literature reviewed, acute pain following cardiac surgery limits patients to perform early ambulation activities and causes the major respiratory complication. The most severe acute pain occurs during the first three days after surgery at sternotomy wound area during deep breathing and coughing. Existing interventions provided does not indicate the effectiveness. Thus, proper pain control during the first 3 days remains the needs to be manipulated properly. The PCP aimed to assess and manage acute pain and physiological responses, promoted patients knowledge, encouraged self-care skills in regard to manage pain, to educate patient and to monitor patient pain response to intervention. The PCP intervened with the naturalistic of acute pain and physiological responses with integration of complementary therapy with traditional care, it worked through 3 dimensions i.e. symptom experience, symptom management strategies and symptom outcome. It presumed that persons with cardiac surgery who receive the PCP would have lower acute pain and physiological responses than those who receive conventional care. Beside, persons with cardiac surgery who received the PCP would have lower acute pain and physiological responses than before participation in the program.

(2) The PCP program trial

The manual and booklet were reviewed by five experts for content validity. The manual was revised according to the recommendation of these five experts.

Because the feasibility of the program is important, a pilot study was conducted on five patients who had similar characteristics to the participants in the study. The objectives for conducting the field testing were to: 1) determine the feasibility of the proposed study, 2) identify the problems with implementation of the PCP program, and 3) examine the validity and reliability of the research instruments. The results indicated that the appropriate timing to initiate program should be start at the day of admission. Participants mentioned that if the PCP starts at outpatient clinic, it was too far before coming to admission so that they could not remember or perform those skills they had to do. This was congruent with characteristics of participants since the majority was older adults. They also preferred cold therapy since it took only short time to administrate and could see the effectiveness and some of them reported the comfort feeling at chest wall. In addition, cardiac surgery patients' family said that they were willing to support patients for any possible ways that made patients go home quicker, less complications and less pain. Finally, the PCP program was found to be appropriate for all cardiac surgery patients and their family.

(3) The PCP program modification

The experts and the results of practice sessions suggested that the researcher should modify the protocol of the program by combining some sessions together and start program at the day of admission; remove the complicated content such as technical terms or drug names e.g. NSAIDs; and illustrate more pictures

regarding the skill training sessions. As a result of these recommendations, the researcher modified the content of the program and initiated the program at the day of admission by combining the 1st and 2nd together. Finally, the PCP comprised of 4 instruments as followed:

2.2.1 The pain management combined with complementary care program (PCP): A Nurse Manual

The Manual for the PCP was developed by the researcher applying the SMM model and the content based on the clinical guideline for management of acute postoperative pain (Thai Association for the Study of Pain, 2011) and intensive literature reviews. This was developed to use as a guideline for intervention implementation. The detail of PCP protocol describes goals, contents, activities, and evaluations processes.

The manual included the goals of each session, materials, and content written in an education plan, for cardiac surgery patients training. The strategies to facilitate symptom-management skills among cardiac surgery patients and detailed guidelines for nurse to provide the PCP program were also included. At the daily meeting for monitoring and evaluating acute pain between the participants and the researcher was discussed (See Appendix E).

2.2.2 The pain management combined with complementary care program (PCP): Booklet

The booklet was developed by the researcher entitled "Acute pain management after your cardiac surgery" and provide to participants during the intervention sessions. The following topics were covered: cardiac surgery, preoperative preparation and patient's roles, naturalistic of acute pain after cardiac surgery, acute pain evaluations, acute pain management (multimodal strategies), the

significance of effective pain management, and significance of performing early ambulation activities (See Appendix F).

2.2.3 A digital thermometer

Oakton Digital Pocket Thermometer was used to measure the temperature of the cold modality. It is a 31/2 digit, 0.3" high LCD display with probe dimensions 4.3" x 0.14" x 1.8" diameter. Temperatute Range is between -10 to 200 Degrees Celsius. Accuracy is +/-1 Degrees Celsius, Battery Type 1.5 V Silver Oxide, Resolution 0.1 Degrees to 199.9 Degrees Celsius. It includes plastic protective sleeve with pocket clip for easy transportation and storage Pocket sized thermometer recalls minimum and maximum temperature with a button press (Oakton Instruments, 2016) (See Appendix H).

2.2.4 Reusable gel pack

3 M reusable gel pack, size 10 x 26.5 cm. was used as the cold source. It is manufactured of a soft, natural drug-free way, non-toxic, biodegradable gel held in a flexible plastic contour. The gel packs were kept in the freezer before the temperature was low enough to be suitable for use. The gel packs were applied over the surgical dressing covering the sternal incision (3M, 2016) (See Appendix G).

The temperature of gel pack was tested using the same digital thermometer (Oakton digital thermometer) as instrumentation in every time of before cold therapy session starts. The probe of digital thermometer was inserted into the rolled gel pack to measure its temperature to yield the required therapeutic level. This process was done under the recommendations from Customer Service Department, 3M Co., LTD., Bangkok, Thailand.

3. Instruments for validity check

There were two instruments for monitoring the intervention in this study: (1) The acute pain management's knowledge questionnaire and (2) the acute pain management behavior self-report form.

3.1 The acute pain management's knowledge questionnaire

This instrument was used for the assessment and evaluation of acute pain management's knowledge for cardiac surgery patients. It was developed by the researcher based on literature review and the items were created which covered the most important content. The test addressed the understanding of the key management content and including: cardiac surgery, preoperative preparation and patient's roles, naturalistic of acute pain after cardiac surgery, acute pain evaluations, acute pain management (multimodal strategies), the significance of effective pain management, and significance of performing early ambulation activities. The test was administered immediately after 1st meeting session. It consisted of 20 items with a dichotomous answer for choosing; "correct or incorrect" (correct = 1 point, incorrect = 0 point). The level for passing was established at 80% of total score in post-test. The higher score meant the participants have more knowledge and more understanding about cardiac surgery and acute pain after cardiac surgery than lower score. If any participant could not reach this level, he/she was allowed them to ask and review his/her knowledge again until they well understood (See Appendix I).

This questionnaire was evaluated by five experts. The recommendations were that the use of confusing sentences and negative questions should be reconsidered. After correction, result from implementation phases found that the participants had

the average of the knowledge's score at 90 %, maximum 100%, minimum 80% (See Appendix I).

3.2 The acute pain management behavior self-report form

The self-report for acute pain management behavior form was developed by the researcher for the participants in the experimental group, to monitor and record the achievement of their goals through symptom management behaviors. The participants were instructed to monitor their daily acute pain management during the period of study. It was used to evaluate how patients can carry out a prescribed symptom management strategy by doing the skill consistently. Participants were asked to rate how often they perform the skill they had been trained. The possible answers were "not at all" to "regularly". This questionnaire was evaluated by five experts (as previously described). The suggestion of experts was about the difficulty of the response scales, rather it should make it the easiest and most convenient and practical way for participants that might be lay persons or of had low education. Following these modifications, rating scale descriptors were modified to be: "1= not at all," "2= rarely," 3= moderately," "4= quite often," and "5=regularly." This tool was used at the 3rd, 4th and 5th session. The goal was that patients rate their acute pain management behavior score above 4 in all skill (quite often: above 80%) (See Appendix J).

Following these modifications, the researcher tested the instrument in five older cardiac surgery patients. The results from implementing the program showed that patients understand the tool and was easy for rating the score. (See Appendix J).

Experimental Procedure

This section was divided into 3 phases including preparation, implementation, and evaluation. Details of these procedures are described below:

1. Preparation Phase

1.1 Instrument preparation

The manual of the PCP, materials for this program, and an instrument were developed by the researcher and with content validity established by five experts.

Researcher preparation

The researcher served as an informant, consultant, and facilitator for this study.

Field research preparation

The researcher informed the director of hospital, and collaborated with the staff nurses of cardiovasculartho racic surgery unit. The objectives, procedures, and the approximate length of time for data collection were described. In addition, the researcher also requested and prepared the area for the educating participants.

2. Implementation phase

2.1 Procedures in the control group

The participants in the control group completed the demographic data at the day of admission. They received the conventional care with the preoperative assessments and preparation with leaflet about cardiac surgery by nurses, physician, and other health care providers. At postoperative period, nursing activities to manage acute pain including offering the information, the body position change, recording vital signs and pain evaluation, administrating pain medication as prescribed, assess

its effectiveness, and report if the protocol does not achieve desired outcomes or forms side effects. These participants completed the BPI-T during postoperative day 1,2,3 same as those form experimental group as well as the measure of physiological responses.

2.2 Procedures in the experimental group(See appendix K)

The researcher provided the PCP program to the participants in the experimental group. This program was conducted in five sessions as follows:

1st Session: "The preparation for operation" (surgery ward: 20 minutes).

Part 1: The main purpose of the session was to establish the relationship participants and researcher, to access acute pain experience and knowledge, to enhance participants' understanding, to explain the way to assess acute pain, the significance of being sufficiently managed pain, and the significance of performing early ambulation activities.

Nursing activities:

1) The researcher introduced herself and established the relationship.

2) The researcher explained about the purpose of the PCP and the knowledge was delivered through a booklet, "Acute pain management after your cardiac surgery".

3) The researcher educated the participants following the contents in booklet regarding general information about cardiac surgery, preoperative preparation and patient's roles, naturalistic of acute pain after cardiac surgery, acute pain evaluations, acute pain management (multimodal strategies), the significance of

effective pain management, and significance of performing early ambulation activities.

Evaluation phase

The acute pain management's knowledge was used to gain score above 80%. The pretest score showed that there were only 54 % of participants that had 80% of the knowledge pretest score but after completing the education session, the posttest knowledge score reached the acceptable criteria for 100% of participants (See Appendix I).

Part 2: Aimed to promote the use of symptom management strategies (15 minutes).

Nursing activities: The researcher demonstrated each skill for acute pain management

1) Relaxation techniques with diaphragmatic breathing exercises using the incentive spirometer (Detail provided in appendix E)

2) Effective coughing to produce the sputum and increase lung expansion (Detail provided in appendix E)

At the end of this session, all participants returned demonstration of each skill correctly after this session with some questions clarifying to make them more understood.

2nd Session: "The first cold therapy session": it was delivered on post operative day 1 at 10:00 am and 02:00 pm before the participants had to perform early ambulation activities (30 minutes). The main purpose of the session was to provide the complementary therapy as a non-pharmacologic management.

Nursing activities:

The participants were elevated to be upright position and the researcher informed them about the cold therapy. The physiologic parameters were measured whereas the skin sensitivity was also tested at the sternotomy wound area. The sterile gel pack that had temperature range between 0 ^{0}C to 18.33 ^{0}C from the freezer was applied over the dressing covering the sternal incision to yield the therapeutic level at 14.4 ◦C for 20 minutes. Target skin was re-evaluated every 10 minutes to maintain the analgesic range, to early detect the frostbite and to assess the satisfaction. After 20 minutes, gel pack was then removed and patients performed deep breathing exercise and coughing.

At the end of this session, acute pain was first measured with NRS this and physiological responses were also assessed. For the NRS result, it was not accounted to data analysis process, rather, it was a usual care all patients had in clinic. So there were only physiological responses measured pre and post cold therapy sessions (10 am and 2 pm) used in the data analysis process. The participants were also asked about the feeling from the first cold therapy session, the most frequently terms used were coolness and/or cold. But none of them reported pain, aching, itchy, and burning or frostbite after the session. The participants mentioned that cold therapy made they feel more comfortable to take a breath more smoothly.

3rd Session: "The second cold therapy session": it was delivered on post operative day 2 at 10:00 am and 02:00 pm before the participants had to perform early ambulation activities (30 minutes).

Nursing activities: The participants were asked about previous cold therapy session regard the comfort and satisfaction before the same procedures followed "The first cold therapy session" was done.

At the end of this session, acute pain was measured with BPI-T. The acute pain management behavior self-report form was also delivered at 10:00 hour to gain score above 4 by each skill. Although it was the first time measuring pain using the BPI-T, the participants clearly understood about how to report their pain with the 10 items questionnaire. They stated that they could recall from what they learnt from the 1st session of the program. About the acute pain management behavior self-report form, majority of them reported that they perform the skills quite often(score = 4) (57.1% for the deep breathing exercise and 42.9 % for the effective coughing).

4th Session: "The last cold therapy session": it was delivered on post operative day 3 at 10:00 am and 02:00 pm before the participants had to perform early ambulation activities (30 minutes).

Nursing activities: The participants were asked about previous cold therapy session regard to the comfort and satisfaction before the same procedures followed "The first cold therapy session" was done.

At the end of this session, the BPI-T was used as the second time collecting data regarding acute pain level where the acute pain management behavior self-report form was also used at the same time as yesterday (10.00 am). At this time, the number of patients performing skill quite often was increased to be 65.1% for both deep breathing exercise and effective coughing. Regarding the sensation from coldness, one participant said that he could even forget that he had ICD on his chest wall using the cold compression.

5th Session: "The program termination session": it was delivered on post operative day 4 at 10:00 am (20 minutes). This session aimed to see whether the PCP

successfully affected to patient's symptom status and the process of acute pain management strategies were appropriate.

Nursing activities: The participants were asked about previous cold therapy session regard to the comfort and satisfaction also the acute pain evaluation and the flaw and misunderstandings before the program termination.

At the end of this session, the BPI-T and the acute pain management behavior self-report form were used as the last time. Also, the process of PCP was discussed. This last session, majority of patient improved their frequency of performing skills to be often (score = 5) by 62.9 % of patients for the deep breathing exercise and 45.7 % of them for the effective coughing. Majority of participants stated that they would use a cold therapy again in future and none of them refused the cold therapy after the first session. Overall, the summary of research protocol illustrated as figure 8 below.

Session	**Timing**	**Place**	**PCP Program**	**Evaluation**
1st session: Admission: Part 1	20 minutes	Surgical ward	Individual education	The acute pain management's knowledge
Part 2	15 minutes	Surgical ward	Skill training	Participants returned demonstration of each skill correctly
2nd session	Post-operative day 1 (10:00 am and 02:00 pm):30 min	ICU	Cold therapy	-Physiological responses **(**before & after cold therapy session)
3rd session	Post-operative day 2 (10:00 am and 02:00 pm) : 30 minutes	ICU/ Surgical ward	Cold therapy	-BPI_T(1) -The acute pain management behavior self-report form(1) -Physiological responses**(**before & after cold therapy session)
4th session	Post-operative day 3 (10:00 am and 02:00 pm): 30 minutes	ICU/ Surgical ward	Cold therapy	-BPI_T(2) -The acute pain management behavior self-report form(2) -Physiological responses**(**before & after cold therapy session)
5th session	Post-operative day 3 (10:00 am) : 20 minutes	ICU/ Surgical ward	- Discussion -Program termination	-BPI_T(3) -The acute pain management behavior self-report form(3)

Figure 8 Summary of the intervention procedure

Data Collection Procedure

In this study, the time spent for implementation the program was one day before operation and three days after operation. The procedures for data collection was done when the permission for the data collection (IRB NO. MURA2015/60) obtained (See Appendix L). The researcher coordinated with cardiac surgeons, a nurse director and head nurses of related units in order to explain the objectives, the method and data collection procedures in the setting of the research and time schedule. After that, the convenience sampling was used to recruit eligible participants and when he/she decided to participate, the consent form was signed (See Appendix M). Participants were allocated either to the experiment or control groups and matched pair based on gender, age, and type of surgery. The demographic data was obtained by the researcher using the demographic data form prior to surgery. The participants in the control group received the conventional care, while the experimental group received the conventional care and PCP from researcher. Data was archived on postoperative day 1, 2, and 3 with a Thai version of a modified BPI for acute pain and from bedside monitor for physiological responses.

Ethical consideration

Under the permission of Ethical Committee on human rights at Faculty of medicine Ramathibodi hospital (IRB NO. MURA2015/60), cardiac surgery patients who met the inclusion criteria were informed about the aims of study, procedure, potential, risk/benefits, confidentiality, and right to withdraw anytime from the study without affecting on the services and their relationship with health care providers. Other information was also served as needed. Once the participants agreed to participate, a consent form was given.

This intervention presented no harm at all to the participants, and did not interrupt with the routine nursing care or medical care. It also made the effective nursing care to encourage cardiac surgery patients' symptom management behaviors. Then acute pain decreased in these participants. Throughout the study process, the researcher made attempt to avoid any possibilities of discomfort, interference, over excessive response burden on the participants. Confidentiality of data collection was ensured for both during and after data collection.

Data analysis

Data from questionnaires was entered in to a worksheet of Statistical Package for Social Sciences for Window (SPSS) version 21. The assigned study number was used for the data of each subject ensured the anonymity of the participants. Statistical analyses were performed with the SPSS with a significance level set < .05 as follows:

1. Descriptive statistics were used to describe characteristics of the participants and dependent variables with frequency, range, mean, standard deviation, and percentage

2. Independent t-test or Chi-square test were used to compare the demographic characteristics of the participants and dependent variables between the experiment and the control groups at baseline which were found to be non-statistical significance.

3. The repeated measures of MANOVA was used to determine the significant difference of mean score of acute pain i.e. intensity and interference while physiological responses were analyzed using the repeated measures of ANOVA during post-operative day1, 2 and 3 between experimental and control group.

Assumption testing

The repeated measures MANOVA and was used to determine if acute pain level and physiological responses improved across time and by group. The dependent variables were acute pain level which composed of two dimensions i.e. intensity and interference (measuring during day 1, 2, 3 post operation) and physiological responses including heart rate, blood pressure, respiration rate and oxygen saturation. The independent variable was group (experimental and control). The assumptions for the repeated measures MANOVA were tested before further analysis. The following assumptions were examined to ensure the validity of statistical calculations.

1. Normality distribution of dependent variables was tested. The dependent variables; acute pain level and physiological responses during post operative day 1,2,3 were accepted as a normal distribution with the test of One-Sample Kolmogorov-Smirnov Test (KS-test). Table 1 illustrated the non-significance of Asymp.Sig. (2-tailed) ($p > .05$) among all dependent variables which indicated to accept the null hypothesis that enables the study to detect normal distributions of the result except the oxygen saturation (Table 2).

Table 2 Test of normality distribution of dependent variables

Time	**Control group**			**Experimental group**		
	mean	**KS-test**	**Asymp .Sig. (2-tailed)**	**mean**	**KS-test**	**Asymp.Sig. (2-tailed)**
Pain Intensity						
Day 1	2.79	.61	.85	2.94	.69	.73
Day 2	3.57	.73	.66	1.97	.71	.69
Day 3	3.58	1.61	.20	1.07	.77	.59
Pain interference						
Day 1	2.65	.79	.58	2.21	.71	.69
Day 2	2.85	.75	.63	1.50	.98	.29
Day 3	2.80	.79	.55	.91	.74	.64
Heart rate						
Day 1	75.50	.13	.13	81.41	.11	.20
Day 2	84.15	.15	.20	79.45	.09	.20
Day 3	86.63	.14	.06	78.28	.13	.08
SBP						
Day 1	119.52	.09	.20	118.30	.10	.20
Day 2	127.77	.11	.20	122.55	.10	.20
Day 3	126.77	.14	.05	120.58	.06	.20
DBP						
Day 1	65.90	.06	.20	67.53	.07	.20
Day 2	67.98	.08	.20	64.41	.08	.20
Day 3	71.70	.15	.25	64.22	.10	.20
RR						
Day 1	25.17	.35	.20	21.98	.09	.20
Day 2	22.14	.10	.20	21.93	.12	.20
Day 3	23.18	.12	.20	21.75	.12	.20
Sat O_2						
Day 1	98.89	.17	.06	99.77	.49	.02
Day 2	98.82	.13	.13	99.90	.52	.02
Day 3	99.00	.12	.18	99.96	.52	.02

2. Independence. All assumptions regard to independence were met since acute pain levels and physiological responses were measured independently by each participant. In addition, participants rated their answers upon their own subjective perception at each present time.

3. Homogeneity of variance is required. Levene's test of equality of variance matrices that produced *p*-values of >.05 indicating no significant differences, in other words, there were equal levels across the between-subject factor of variance matrices is needed. However, the Levene's test in some points of time indicated an inequality of the variance-covariance matrices. Therefore, the interpretation of result from this parameter needed to be careful using appropriate post-hoc test. (Table 3).

Table 3 Homogeneity of variance testing (Levene's test)

Time	**Control (mean)**	**Exp (mean)**	**F-test**	**Asymp.Sig. (2-tailed)**
Pain Intensity				
Day 1	2.79	2.94	3.73	.058
Day 2	3.57	1.97	5.55	.021
Day 3	3.58	1.07	7.76	.007
Pain interference				
Day 1	2.65	2.21	.04	.493
Day 2	2.85	1.50	4.52	.037
Day 3	2.80	.91	9.77	.003
Heart rate				
Day 1	75.50	81.41	.42	.517
Day 2	84.15	79.45	.08	.771
Day 3	86.63	78.28	3.56	.063
SBP				
Day 1	119.52	118.30	2.14	.148
Day 2	127.77	122.55	5.47	.022
Day 3	126.77	120.58	.16.14	.000
DBP				
Day 1	65.90	67.53	.95	.332
Day 2	67.98	64.41	1.33	.252
Day 3	71.70	64.22	3.06	.084
RR				
Day 1	25.17	21.98	4.64	.035
Day 2	22.14	21.93	3.67	.059
Day 3	23.18	21.75	.25	.614
Sat O_2				
Day 1	98.89	99.77	4.17	.045
Day 2	98.82	99.90	16.60	.000
Day 3	99.00	99.96	48.45	.000

4. Compound symmetry was tested with Mauchly's test of sphericity, result indicating the non-met the assumption of compound symmetry ($\chi 2(2) = 27.216$, $p < .001$),Therefore, Greenhouse-Geisser estimates of sphericity ($\varepsilon = 0.75$) was further selected to adjust degree of freedom for estimating variances in the process of data analysis (Polit, 2010).

CHAPTER IV
RESEARCH RESULTS

This chapter presents the research findings which are divided into four parts:

Part 1: The descriptive analysis of the personal characteristics both groups

Part 2: The results of data analysis answering the hypotheses

Part 3: Descriptive information from cold therapy session

Part 4: The effect size of this study

Characteristics of the participants

In the control group, the mean age of the participants was 54.89 (±13.67) years. They mostly were male (60%), married (51%) and were Buddhism (83%). More than half of the participants had no surgical experience (57%). The majority of the participants in the control group were 94 % used the analgesia. Table 5 illustrated that one third of patients underwent isolated CABG-surgery (34%) where 29 % of the participants had isolated vulvular surgery. More than haft of participants had single wound (54%), two intercostal chest drainages (ICD) (77%) that retrained between 1-3 days (71%). Analgesic prescriptions were categorized according to the World Health Organization analgesic ladder. The results showed that strong opioids were most often prescribed to the majority of patients (71%) combining with multimodal analgesia. Equianalgesic conversion was used to transform between prescribed opioids to be the comparable unit based on the American Pain Society guideline and critical review papers. The result showed that participants were prescribed with opioids between 4.96-10.63 mg/day during post-operative day 1 -3.

Regarding the characteristic of participants in the experimental group, the participants had the mean age at 54.74 (±14.20) years. 60% of them were male and were married. Buddhism was majority of participants (83%). About half of the participants had surgical experience (51%) and 9% were using analgesia during period of study. 34% of the participants underwent isolated CABG-surgery where as 29 % of them had had isolated vulvular surgery. About half of the participants had one surgical wound (54%) with two ICD (66%) with the retention length between 1-3 days (51%). Strong opioids were most often prescribed (74%) with the daily dose of 4.7-9.33 mg/day combining with multimodal analgesia during post-operative day 1 - 3(Table 4).

Overall, data from Table 4 and table 5 did not show the significant difference between the control and experimental groups neither the characteristics at baseline nor physiological status (Age, t= 0.04, *p* =.96; Gender, p=1.00; Marital status, p= 0.59; Religion, p=1.00; Previous surgery, p= 0.47; Current analgesia usage, p=0.64; Type of surgery, p=.92; Analgesia type, p=0.79; Total Analgesia dose, p=0.58; Number of wound, p=0.58; Number of ICD, p=0.57 and Duration of ICD, p=0.23).

Table 4 Participant characteristics at baseline

Characteristics	**Control (n=35)**		**Experimental (n=35)**		χ^2	***df***	***p*-value**
	n	**%**	**n**	%			
Gender					.00	1	1.00
Male	21	60	21	60			
Female	14	40	14	40			
Status					7.43	3	.06
Married	18	51	21	60			
Single	14	40	8	23			
Widowed	1	3	6	17			
Divorced	2	6	0	0			
Religion					.00	2	1.00
Buddhism	29	83	29	83			
Muslim	4	11	4	11			
Christian	2	6	2	6			
Previous surgery					.51	1	.47
Never	20	57	17	49			
Experienced	15	43	18	51			
Current analgesia usage					.22	1	.64
No	33	94	32	91			
Yes	2	6	3	9			

*p < .05

Table 5 Physiological status among participants

Characteristics	**Control**		**Experimental**		***χ2***	***df***	***p*-value**
	n	**%**	**n**	**%**			
Type of surgery					1.46	5	.92
CABG	12	34	12	34			
Valve	10	29	10	29			
Aneurysm	6	17	6	17			
Combined	4	11	4	11			
Congenital	2	6	2	6			
Miscellaneous	1	3	1	3			
Analgesia(Type)					.07	1	.79
Opioid	25	71	26	74			
Multimodal	10	29	9	26			
Analgesia Dose (mg/day)	*(m, ± sd)*		*(m, ± sd)*				
Day 1	4.96	(±3.65)	4.7	(±4.08)	19.85	15	.18
Day 2	10.63	(±4.93)	9.33	(±5.87)	15.70	18	.61
Day 3	6.87	(±5.02)	5.94	(±4.91)	10.56	13	.65
Total	22.46	(±10.39)	19.97	(±10.92)	25.50	31	.75
Number of wound					1.03	2	.58
1 area	19	54	19	54			
2 areas	15	43	16	46			
3 areas	1	3	0	0			
Number of ICD					1.12	2	.57
1 tube	6	17	9	26			
2 tubes	27	77	23	66			
3 tubes	2	6	3	8			
Duration of ICD(days)					2.97	2	.23
1-3	25	71	18	51			
4-6	9	26	15	43			
>6	1	3	2	6			

*p < .05

The key variables of this study were pain and physiological. The results were reported as following

Pain

Pain intensity

Pain intensity was measured using the Thai version of a modified BPI. As presented in table 6, pain intensity of the control group was mild to moderate, mean = 2.79(±1.74), 3.58 (±1.51) and 3.59(±1.10) during post-operative day 1, 2, and 3, respectively. For the experimental group, the pain intensity was mild, mean =2.94 (±1.33) at day 1, 1.97 (±1.01) at day 2 and 1.08 (±0.64) at day 3, respectively (Figure 6).

Table 6 Descriptive analysis of pain intensity between the control and experimental group

Time points	**Control group**			**Experimental group**		
	mean	**SD**	**Level**	**mean**	**SD**	**Level**
Pain Intensity						
Day 1	2.79	1.74	mild	2.94	1.33	mild
Day 2	3.58	1.51	moderate	1.97	1.01	mild
Day 3	3.59	1.10	moderate	1.08	0.64	mild

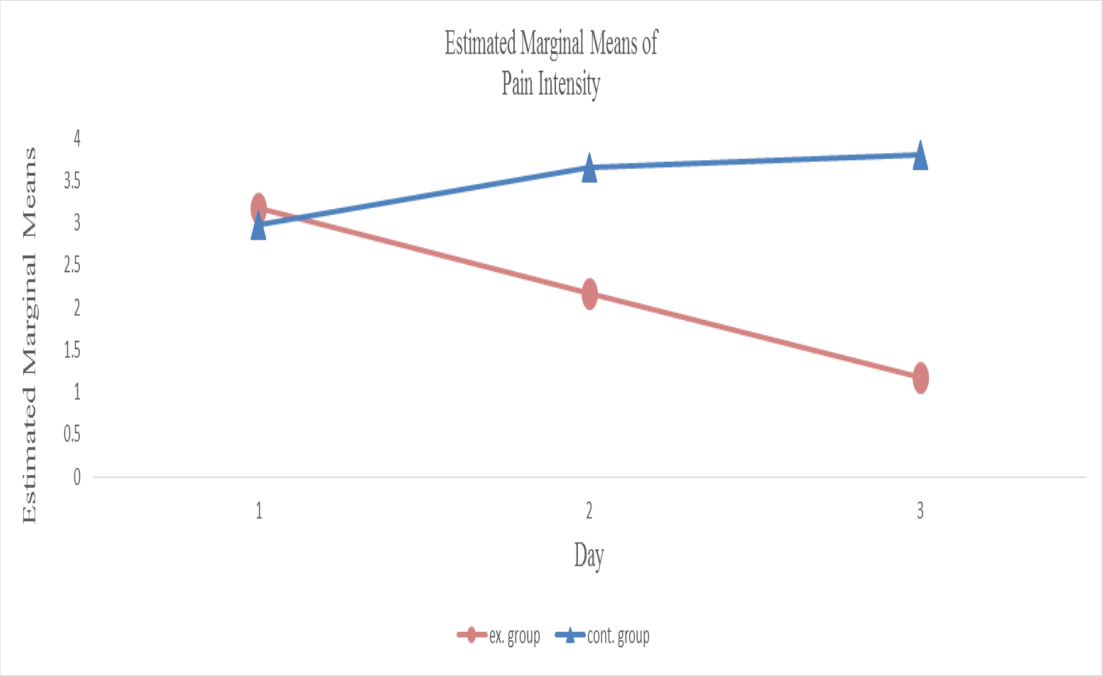

Figure 9 Mean pain intensity between the control and experimental group

In this study, the repeated measures MANOVA was used to answer the two hypotheses with a within-subjects factor of time (Day 1, 2, and 3) and a between-subject factor of group (experiment and control) to the pain (table 7).

Table 7 Repeated measures MANOVA of pain

Source of Variation	SS	df	MS	F	p-value
Between subjects					
Group	85.03	1	85.03	22.24	.00
Within group (error)	238.50	68	3.51		
Total	323.53	69	88.54		
Within group					
Time	22.52	1.50	15.02	39.77	.00
Group * Time	75.80	1.50	50.55	133.83	.00
Time x within group (error)	38.51	101.96	0.38		
Total	136.83	104.96	65.95		
Total	460.36	173.96	154.49		

To answer the first hypothesis if the cardiac surgery patients in the experimental group would have significant differences of pain intensity during day 1,2, 3 after operation, a repeated measures MANOVA analysis determining the main effect of time as within-subjects factor (Day 1, 2 and 3) was done. From table 7, the interaction effect of time and group on pain was presented (F (1.50, 101.96) = 133.83, $p < .05$) and as a result, this means that the difference between groups varies depending on the level of another effect (Hair, 2010; Polit, 2010).

Regarding the main effect of time, it was found that in at least one pair at the three time points as a within subject factor, F (1.50, 101.96) = 39.77, $p < .05$, the pain intensity was substantially changed from day 1 to day 3 after surgery. Pairwise comparison was further performed. At different time points, pain intensity were significantly different between any time point for experiment group ($p < .05$) but only significantly different between day 1 and day 2 to day 3 for those in the control group ($p < .05$) (Table 8).

Table 8 Post Hoc comparisons of pain intensity for each time point during post-operative day 1, 2 and 3 (Within group comparisons)

Time points to be Compared		Control group				Experimental group			
Time 1	Time 2	$\bar{x}$ dif.	SE	95% CI		$\bar{x}$ dif.	SE	95% CI	
				Lower	Upper			Lower	Upper
Day 1	Day 2	.79***	.12	-1.07	-.49	.97***	.12	.68	1.26
Day 1	Day 3	.57***	.18	-1.23	-.35	1.86***	.18	1.42	2.30
Day 2	Day 3	.01ns	.13	-.32	.31	.89***	.13	.57	1.21

Remark: ns $p > 0.05$
* $p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$

Table 7 revealed a main effects of group, F (1, 68) = 22.24, $p < .05$ which means that the pain intensity was affected by the effect of group. Post hoc comparisons confirmed that pain intensity of the participants in the experimental group was lower than the control group ($p < .05$ from day 2 to day 3 after operation) (Table 9).

Table 9 Post Hoc comparisons of pain intensity between both groups for each post-operative day (Between group comparisons of pain)

Time points	Control group	Experimental group	$\bar{x}$ dif	SE	95% CI	
					Lower	Upper
Day 1	2.79	2.94	.15ns	.371	-.89	.59
Day 2	3.57	1.97	1.60***	.307	.99	2.21
Day 3	3.58	1.07	2.51***	.215	2.07	2.93

Remark: ns $p > 0.05$
* $p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$

Pain interference

Regarding the pain interference, which was also measured by the Thai version of a modified BPI, table 10 illustrated that the average pain interference in the control group were 2.65 (±1.54), 2.85(±1.53) and 2.80(±1.39) for day 1, 2 and 3, respectively. In addition, the mean score of pain interference for participants in the experimental group during post-operative day 1, 2 and 3 were 2.21 (±1.31), 1.50 (±0.96) and 0.91 (±0.59), respectively (Figure 10).

Table 10 Descriptive analysis of pain interference between the control and experimental group at post-operative day 1, 2 and 3

Time points	**Control group**			**Experimental group**		
	mean	**SD**	**level**	**mean**	**SD**	**level**
Day 1	2.65	1.54	mild	2.21	1.31	mild
Day 2	2.85	1.53	mild	1.50	0.96	mild
Day 3	2.80	1.39	mild	0.91	0.59	mild

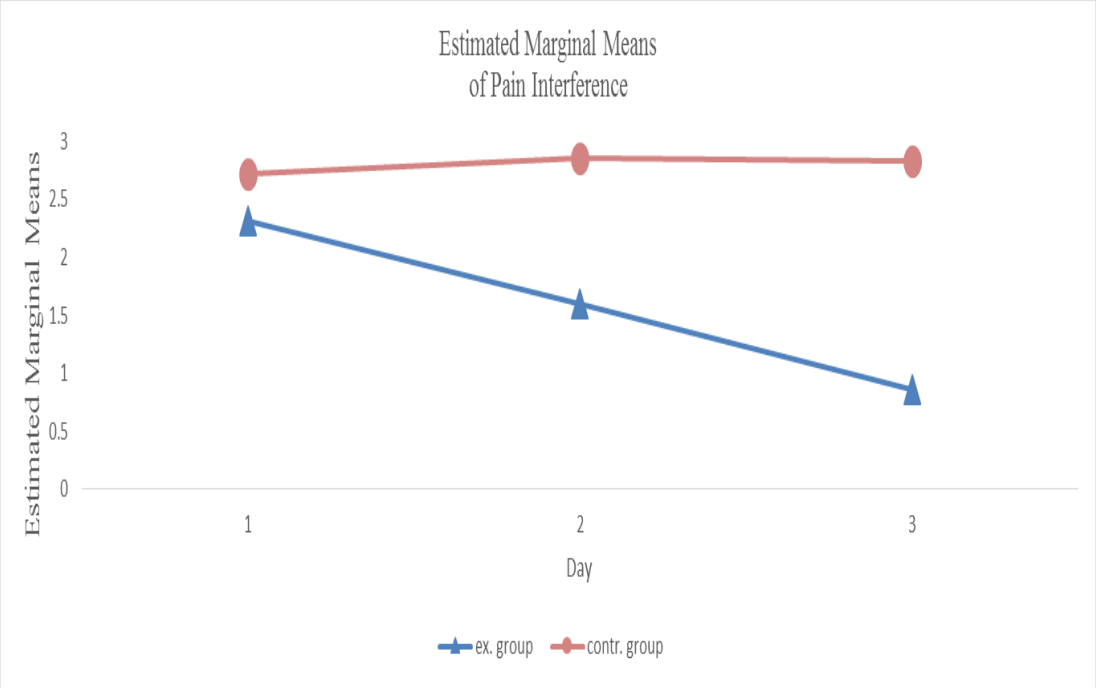

Figure 10 Mean pain interference between the control and experimental group

To answer the first hypothesis if the cardiac surgery patients in the experimental group would have significant differences of pain interference during day 1,2, 3 after operation, repeated measures MANOVA analysis determining the main effect of time as within-subjects factor (Day 1, 2 and 3) was done. Using the data provided on table 7 illustrated significant interaction effect of group and time on pain interference (F (1.50, 101.96) = 133.83, $p < .05$).

Regarding the main effect of time, it was found that in at least one pair at the three time points as a within subject factor, $F(1.50, 101.96) = 39.77$, $p < .05$, likewise, the pain interference was substantially changed from day 1 to day 3 after the surgery. Thus, pairwise comparison was further performed. At different time points, experiment group had significantly different of the pain interference at any time point

of the study ($p < .05$). There was only one time significant difference in mean pain interference between day 1 and 2 for the control group ($p < 0.05$) (Table 11).

Table 11 Post Hoc comparisons of pain interference for each time point during post-operative day 1, 2 and 3 (Within group comparisons)

Time points to be Compared		**Control group**				**Experimental group**			
Time 1	**Time 2**	**$\bar{x}$ dif.**	**SE**	**95% CI**		**$\bar{x}$ dif.**	**SE**	**95% CI**	
				Lower	**Upper**			**Lower**	**Upper**
Day 1	Day 2	.20**	.07	-.38	-.02	.71***	.07	.53	.89
Day 1	Day 3	.15ns	.11	-.41	.12	1.29***	.11	1.02	1.56
Day 2	Day 3	.05 ns	.06	-.10	.21	.71***	.06	.42	.74

Remark:
ns $p > 0.05$
* $p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$

According to table 7, the second hypothesis was tested and it revealed a main effects of group, F (1, 68) = 22.24, $p < .05$ which means that the pain interference was affected by the effect of group. After that, pairwise comparisons confirmed that patients in the experimental group had statistically significant lower of pain interference than those in the control group started from day 2 throughout day3 after operation ($p < .05$) (Table 12).

Table 12 Post Hoc comparisons of pain interference between both groups for each post-operative day (Between group comparisons)

Time points	Control group	Experimental group	$\bar{x}$ dif	SE	95% CI Lower	Upper
Day 1	2.65	2.21	.43^{ns}	.341	-.24	1.11
Day 2	2.85	1.50	1.35***	.306	.74	1.96
Day 3	2.80	.91	1.89***	.256	1.37	2.39

Remark: ns $p > 0.05$
* $p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$

In summary, the research hypotheses were supported that the pain intensity and pain interference level of participants were changed mainly caused by the PCP program, the time and the combination effect between the PCP and time of the study.

Physiological responses

Physiological responses in this study were included five parameters including heart rate, systolic blood pressure, diastolic blood pressure, respiration rate and oxygen saturation. All parameters were separately explained and illustrated between pre and post cold therapy sessions through post-operative day 1, 2 and 3 as followed:

Heart rate

Overall, from table 13, the mean score of heart rate from participants in the control group were relatively regular. Initially, the mean score was between 75.89(±16.75) to 74.94(±17.17) during post-operative day 1 and slightly increased to be 85.34(±14.16) at day 2 and maintained up to 88.37(±0.24) for day 3.

Similarly, the participants in the experimental group had regular heart rate. The mean score of heart rate were between 80.74(±17.33) to 81.83(±17.94) for post-operative day1. After that, they had slightly slower heart rate between 78.91(±3.51) to 80.00(±12.41) during day 2 and about 77.94(±0.35) to 78.57(±0.35) at day 3(See figure 11).

Table 13 Descriptive analysis of heart rate between the control and experiment group at post-operative day 1, 2 and 3

Time points		**Control group**		**Experimental group**	
		$\bar{x}$	SD	$\bar{x}$	SD
Day 1					
10 am	Pre	75.89	16.75	80.74	17.33
	Post	74.94	17.17	81.60	16.91
2 pm	Pre	75.83	17.40	81.83	17.94
	Post	75.37	15.81	81.49	16.05
Day 2					
10 am	Pre	85.34	14.16	79.29	14.16
	Post	83.34	12.40	79.60	12.97
2pm	Pre	84.40	13.88	80.00	12.41
	Post	83.54	12.50	78.91	3.51
Day 3					
10 am	Pre	85.74	0.77	78.37	2.67
	Post	85.03	1.97	78.26	2.26
2 pm	Pre	87.40	0.48	78.57	.35
	Post	88.37	0.24	77.94	.35

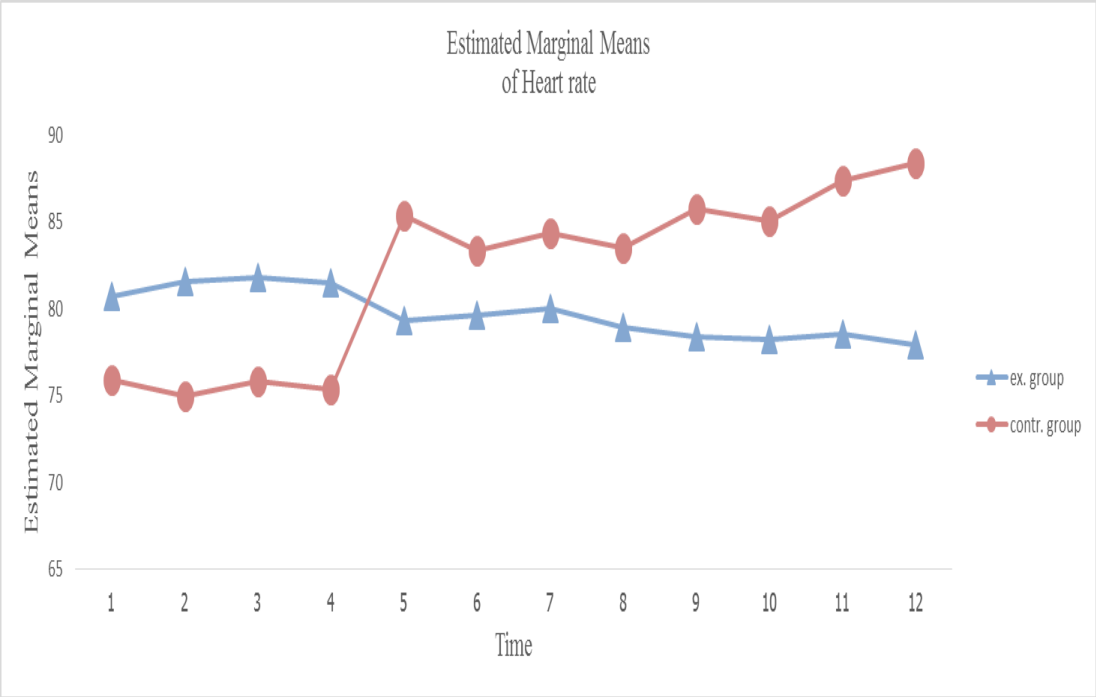

Figure 11 Mean heart rate between the control and experimental group

A repeated measures ANOVA analysis was done to answer two hypotheses of the study (Table 14). The effect of time to the difference of the heart rate within each group during day 1, 2, 3 after operation was examined answering the first hypothesis. In other words, to test the main effect of time as within-subjects factor (Day 1, 2 and 3). Table 14 illustrated a significant interaction effect of group by time to heart rate, $F(2.26, 153.78) = 7.71$, $p < .05$. However, the significant effect of time on heart rate was not found, $F(2.26, 153.78) = 2.69$, $p > .05$. This means that the heart rate did not statistically change from day 1 to day 3 after surgery for the participants in each group.

Moreover, to answer the second hypothesis examining the effect of group to heart rate as a between-subject factor of group analysis (experiment and control) (Table 14). Also, there was no effect of the group to heart rate, $F(1, 68) = 0.90$, $p > .05$ which mean that the mean score of the heart rate from participants in the experimental and control group were not different after receiving the intervention.

Table 14 Repeated Measures ANOVA of heart rate

Source of Variation	SS	df	MS	F	p
Between subjects					
Group	1192.85	1	1192.85	0.90	.35
Within group (error)	89797.66	68	968.43		
Within group					
Time	2761.75	2.26	1221.19	2.69	.06
Group * Time	7901.27	2.26	3493.79	7.71	.00
Time x within group (error)	69679.39	153.78	453.10		

In summary, there were no effect of time to the heart rate i.e. the heart rate of participants within the experimental group did not change during post-operative day 1, 2 and 3. Besides, the difference of heart rate was not found between participants in the experimental group and those in the control group during this period. The changes of heart rate were found only from the mutual effect between time and the program.

Systolic blood pressure (SBP)

According to table 15, initially, participants in the control group had mean SBP between 114.49 (±16.92) to 123.29 (±16.66). After that, their mean SBP slightly escalated (M= 123.83±14.81 to 131.00 ±13.82 and M=122.91 ±14.73 to 129.40±14.05, for day 2 and day 3, respectively)

For those in the experimental group, the mean SBP were about 117.00 (±10.41) to 119.54(±12.72) at post-operative day 1. During day 2 to day 3, the result showed that their mean SBP were approximately similar (M= 121.06±11.14 to 123.83 ± 10.16 and M= 119.26 ±9.25 to 122.46±9.38, for day 2 and day 3, respectively). (See Figure 12).

Table 15 Descriptive analysis of systolic blood pressure between the control and experiment group at post-operative day 1, 2 and 3

Time points		Control group		Experimental group	
		$\bar{x}$	SD	$\bar{x}$	SD
Day 1					
10 am	Pre	114.49	16.92	117.00	10.41
	Post	119.37	12.61	117.66	10.87
2 pm	Pre	121.23	14.32	119.54	12.72
	Post	123.29	16.66	118.97	11.54
Day 2					
10 am	Pre	123.83	14.81	121.06	11.14
	Post	126.91	13.58	122.97	10.92
2pm	Pre	129.37	14.21	122.37	9.42
	Post	131.00	13.82	123.83	10.16
Day 3					
10 am	Pre	122.91	14.73	119.26	9.25
	Post	125.69	14.25	120.29	8.34
2 pm	Pre	129.40	14.05	122.46	9.38
	Post	129.09	14.82	120.34	8.76

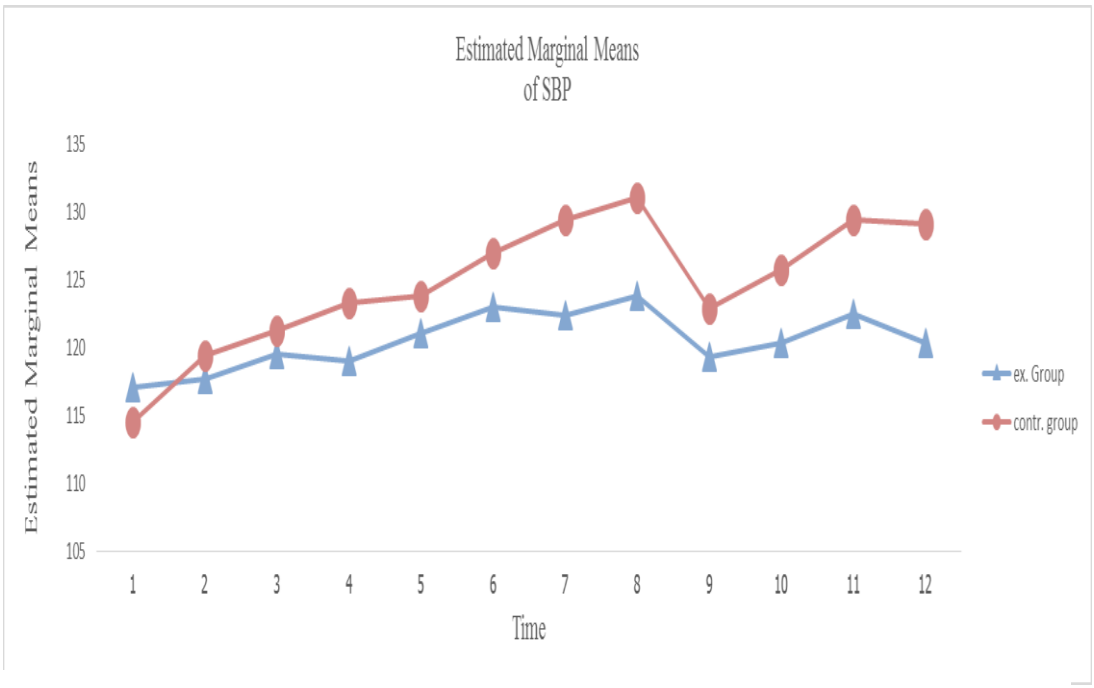

Figure 12 Mean systolic blood pressure between the control and experimental group

With the RM-ANOVA, the first hypothesis examining the difference of time to SBP within participants in each group during day 1, 2, 3 was done (Table 16). The result showed the effect of time on SBP during each time points as a within subject factor, F (3.22, 219.55) = 9.39, p <.05, in other words, the SBP were statistically different from day 1 to day 3 after surgery for the participants in each group.

However, the result of a second hypothesis testing did not show the effect of the group to SBP, $F(1, 68) = 3.88$, p >.05 (Table 16). This means that the mean score of the SBP from participants between two groups were not different after receiving the intervention. In other words, the change of SBP was only influenced by the time of measurement. Because of this present study aimed to examine the effect of PCP program on acute pain and physiological responses. Hence, the Post Hoc comparison of SBP at different time points was not considered as relevance to be tested.

Table 16 Repeated measures ANOVA of systolic blood pressure

Source of Variation	SS	df	MS	F	p
Between subjects					
Group	3759.20	1	3759.20	3.88	.05
Within group (error)	65853.51	68	65853.51		
Within group					
Time	8944.27	3.22	2770.17	9.39	.00
Group * Time	1872.95	3.22	580.08	1.96	.12
Time x within group(error)	64763.85	219.55	294.97		

Summary, even though there was the change of SBP during each time of measurement within the participants in each group, however, there was no effect of PCP to make the difference of SBP between experimental and control group.

Diastolic blood pressure (DBP)

The mean DBP score of the participants in the control group were between 64.91(±10.46) to 67.43(±10.86) at beginning (Table 17). Yet, the change was found. They were increasingly higher to be 66.77(±9.20) to 69.80(±8.97) for day 2 and were between 69.83(±10.20) to M= 73.23(±8.52) at day 3

Conversely, the experimental group's mean score of DBP gradually decreased for every day. At day 1, the mean score were between 66.80(±12.04) to 68.00(±10.49). After that, their mean DBP score were between 64.09(±10.40) to 64.83(±11.56) and to 63.74(±11.83) to 64.69(±11.83) for day 2 and day 3, respectively. (Figure 13).

Table 17 Descriptive analysis of diastolic blood pressure between the control and experiment group at post-operative day 1, 2 and 3

Time points		Control group		Experimental group	
		$\bar{x}$	SD	$\bar{x}$	SD
Day 1					
10 am	Pre	64.91	10.46	67.23	11.60
	Post	65.03	11.48	66.80	12.04
2 pm	Pre	66.26	9.18	68.11	12.49
	Post	67.43	10.86	68.00	10.49
Day 2					
10 am	Pre	66.77	9.20	64.09	10.40
	Post	67.23	9.66	64.29	10.22
2pm	Pre	68.14	8.68	64.46	10.82
	Post	69.80	8.97	64.83	11.56
Day 3					
10 am	Pre	71.37	10.27	64.29	10.91
	Post	69.83	10.20	64.17	11.84
2 pm	Pre	72.37	8.59	64.69	11.83
	Post	73.23	8.52	63.74	12.60

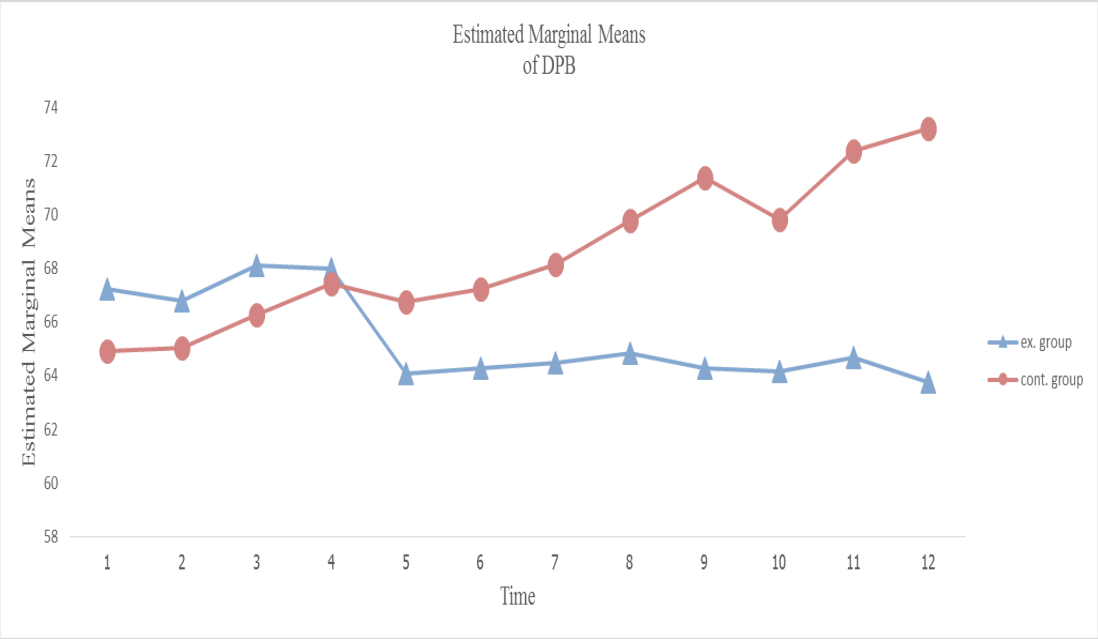

Figure 13 Mean Diastolic blood pressure between the control and experimental group

From table 18, the result from repeated measures ANOVA showed the hypotheses testing. The effect of time was examined answering the first hypothesis to see the difference of the DBP within the participants from each group during day 1, 2, 3 after operation. Whereas the effect of group to DBP was also examined illustrating the difference of DBP between the experiment and control group (The second hypothesis).

Neither the within group nor between group effect was found. There was only significant interaction effect of time and group on DBP shown, $F(2.986, 203.04) = 4.60$, $p < .05$, which means that the DBP did not change from day 1 to day 3 for the participants in each group. The effect of time was negative (F (2.986, 203.04) = 1.27, $p > .05$) as well as the effect of the group to DBP was not statistically significant, F (1, 68) = 3.09, $p > .05$. In other words, the mean score of the DBP from participants in the experimental and control group were not different after receiving the intervention.

However, only the interaction effect between time and group to DBP found (F (2.986, 203.04) = 4.60, $p < .05$. In this case, it means that the changes of DBP along the period of study was only caused by combination effect of intervention together with the effect time.

Table 18 Repeated measures ANOVA of diastolic blood pressure

Source of Variation	**SS**	**df**	**MS**	**F**	**p-value**
Between subjects					
Group	2071.14	1	2071.14	3.09	.08
Within group (error)	45553.64	68	669.90		
Within group					
Time	868.03	2.986	290.71	1.27	.28
Group * Time	3138.64	2.986	1051.15	4.60	.00
Time x within group(error)	46322.24	203.040	228.14		

In conclusion, similar to SBP, the participants within both experimental and control group did not have the difference level of DBP during the period of the study. Besides, the DBP were not different between these two groups after receiving the intervention. DBP was affected by the combination effect of intervention together with the effect time. No main effect from neither intervention nor time itself directly to DBP.

Respiration rate (RR)

Participants in the control group had normal respiration rate during the first 3 days after operation. At the first day, the mean RR was between 21. 94 (±3.06) to 23.40(±3.03). After that, it remained between 21.37 (± 2.60) to 22.43(±3.56) for day 2 and between 22.54(±3.95) to 23.26(±2.95) at day 3, respectively (Table 19).

Similarly, to those in the experimental group, the mean RR was consistent during these three days. At day 1, the mean RR were between 21.69(±3.26) to 22.51(±2.62). After that, it also remained between 21.89(±2.51) to 22.17(±2.67) at day 2 and between 21.43(±2.68) to 22.23(±3.2) at day 3, respectively (Figure 14).

Table 19 Descriptive analysis of respiration rate between the control and the experiment group at post-operative day 1, 2 and 3

Time points		**Control group**		**Experimental group**	
		$\bar{x}$	SD	$\bar{x}$	SD
Day 1					
10 am	Pre	21.94	3.06	21.94	2.54
	Post	23.40	3.03	21.69	3.26
2 pm	Pre	22.40	3.53	21.80	2.92
	Post	22.26	3.48	22.51	2.62
Day 2					
10 am	Pre	21.37	2.60	21.89	2.51
	Post	22.26	3.10	21.91	3.20
2pm	Pre	22.43	3.56	21.77	3.74
	Post	22.40	3.52	22.17	2.67
Day 3					
10 am	Pre	22.94	2.71	21.57	3.06
	Post	23.26	2.95	21.80	3.19
2 pm	Pre	23.03	3.70	22.23	3.20
	Post	22.54	3.95	21.43	2.68

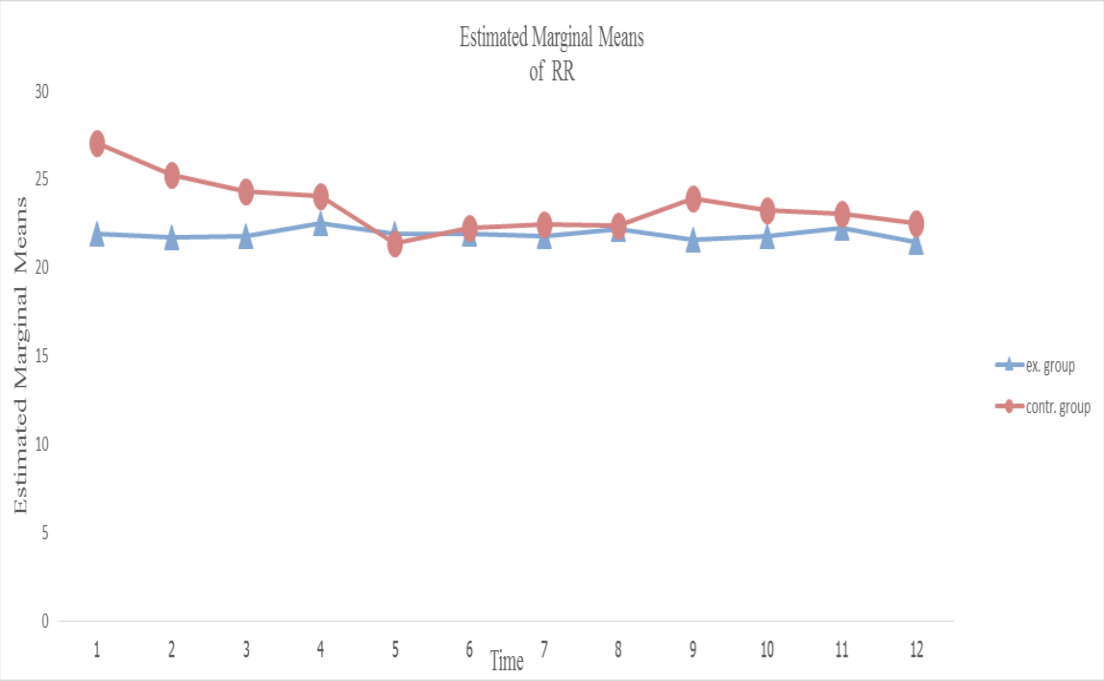

Figure 14 Mean respiration rate between the control and the experiment group

With the repeated measures ANOVA, the time was treated as a within-subject factor determining the change of RR within participants in each group of the study (the first hypothesis). The result from table 20 showed that time did not make the variation of RR; F (11, 748) = .695, p > .05. This means that the change of mean RR during time of study was not influenced by the time of measurement (Table 20). Similar to the negative interaction effect from time and group to RR found F (11, 748) = 1.01, p > .05.

After that, the second hypothesis was examined to see the effect of group to the mean RR between both groups. Data from Table 20 also revealed no main effect of group on RR between groups; F (1, 68) = 3.20, p > .05. It illustrated that RR between participants in the experimental and control group were not statistically different.

Table 20 Repeated measures ANOVA of respiration rate

Source of Variation	SS	df	MS	F	p-value
RR Between subjects					
Group	82.344	1	82.334	3.208	.08
Within group (error)	1745.610	68	25.671		
Within group					
Time	64.785	11	5.890	.695	.74
Group * Time	94.699	11	8.609	1.016	.43
Time x within group(error)	6337.933	748	8.473		

Hence, to respiration rate, there was no difference of respiration rate during post-operative day 1, 2 and 3 within participants from each group of the study. Also, the respiration rate of experimental group was not significantly different to those in the control group thoughout the entire period of study.

Oxygen saturation ($SatO_2$)

Participants in the control group had good oxygenation throughout the period of the study. The mean $SatO_2$ during post-operative day 1, 2 and 3 were between 98.84 (±1.46) to 99.20(± 1.07), 98.54(±1.17) to 99.17(±1.36) and 98.71(±1.31) to 99.23(± 1.06), respectively (Table21).

Even better, the participants in the experimental group had Sat O_2 up to 100%. Initially, the mean score of Sat O_2 were between 99.68(±0.75) to 99.83 (± 0.45) at day 1. After that, they had mean score of Sat O_2 between 99.86(± 0.60) to 100(±0.00) at day 2 and 99.94(±0.23) to 100(±0.00) at day 3, respectively (See figure 15).

Table 21 Descriptive analysis of oxygen saturation between the control and experiment group at post-operative day 1, 2 and 3

Time points		Control group		Experimental group	
		$\bar{x}$	SD	$\bar{x}$	SD
Day 1					
10 am	Pre	99.44	0.75	99.69	0.78
	Post	98.97	1.15	99.75	0.62
2 pm	Pre	98.84	0.88	99.81	0.53
	Post	99.03	1.03	99.81	0.47
Day 2					
10 am	Pre	99.19	1.42	99.84	0.62
	Post	98.66	1.15	99.87	0.42
2pm	Pre	98.91	0.96	99.87	0.42
	Post	98.66	1.28	100.00	0.00
Day 3					
10 am	Pre	99.25	1.01	99.97	0.17
	Post	98.75	1.32	100.00	0.00
2 pm	Pre	99.09	0.99	99.94	0.26
	Post	99.03	0.9	99.94	0.35

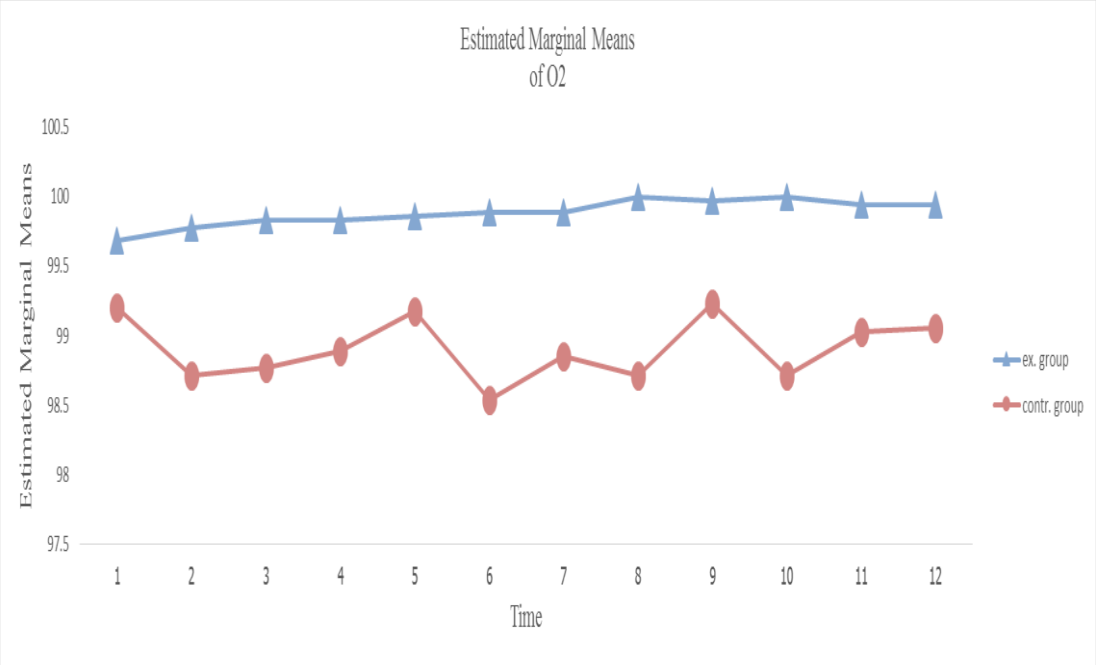

Figure 15 Mean oxygen saturation between the control and experiment group

Again, a repeated measures ANOVA analysis was performed determining the main effect of time as within-subjects factor (the first hypothesis). Data provided on Table 22 illustrated the significant interaction effect of time and group on $SatO_2$, F(6.691, 414.861) = .040, $p < .05$. And the main effect of time was not found, F (6.691, 414.861) = .020, $p > .05$.

In addition, the main effect of group on $SatO_2$ was found (F (1, 62) = 68.56, $p < .001$). However, the result only explain that the difference of Sat O_2 was from the interaction effect of time and PCP.

Table 22 Repeated measures ANOVA of oxygen saturation

Source of Variation	SS	df	MS	F	p-value
O2 Between subjects					
Group	151.408	1	151.408	68.56	.00
Within group (error)	136.904	62	2.208		
Within group					
Time	7.733	6.691	1.156	.020	.28
Group * Time	16.264	6.691	2.431	.040	.01
Time x within group (error)	387.753	414.861	.935		

Further analysis with Bonferroni 's procedure (Table 23). Data analysis illustrated that the oxygen saturation between both groups were every time different started from the post-test of the 10:00 am cold therapy session on post-operative day 1 until the end of the study ($p < .05$).

Table 23 Post Hoc comparisons of oxygen saturation between both groups for each post-operative day (Between group comparisons)

Time points		Control group	Experimental group	x̄ dif.	SE	95 % CI	
						Lower	Upper
Day 1							
10 am	Pre	99.44	99.69	.21^{ns}	.19	.04	.93
	Post	98.97	99.75	.78***	.26	.52	1.59
2 pm	Pre	98.84	99.81	.96***	.17	.70	1.41
	Post	99.03	99.81	.78***	.20	.53	1.35
Day 2							
10 am	Pre	99.19	99.84	.65***	.25	.18	1.18
	Post	98.66	99.87	1.21**	.20	.92	1.76
2 pm	Pre	98.91	99.87	.96***	.17	.68	1.37
	Post	98.66	100.00	1.34**	.21	.86	1.70
Day 3							
10 am	Pre	99.25	99.97	.71**	.18	.38	1.10
	Post	98.75	100.00	1.25**	.22	.84	1.73
2 pm	Pre	99.09	99.94	.84***	.18	.55	1.27
	Post	99.03	99.94	.90***	.17	.54	1.23

Remark: ns $p > 0.05$
* $p \leq 0.05$
** $p \leq 0.01$
*** $p \leq 0.001$

In summary, for the oxygen saturation, data analysis illustrated that patients in the experimental group had statistically significant higher of oxygen saturation than those in the control group started from day 1 to day3.

Overall for the whole study, during day 1, 2 and 3 after operation, cardiac surgery patients in the experimental group had significant differences of acute pain for both intensity an interference dimensions causing by the main effect of group, main

effect of time and the interaction effect between time and group. Regarding the physiological responses, the participants in the experimental group had significant differences of oxygen saturation from those in the control group throughout the period of the study that caused by the main effect from group itself and the interaction effect of group combined with time.

Descriptive data from cold therapy session

This session focuses on the patients' experiences of cold therapy, as it not only presents a physical modulation to relief pain but also a personal encounter involving their satisfaction of receiving a special therapeutic nursing care. The findings under four categories showed how cardiac surgery patients felt after the intervention. They included coolness or cold, reduction of pain, chest comfort and smooth breathing, and relaxation. Moreover, majority of participants stated that they would use a cold therapy again in future and none of them refused the cold therapy session.

There were clear examples of how participants had benefited from the cold therapy session (the codes by the end of each sentence referred to the ID number according to the matching pair table).

Coolness or cold

Not surprisingly, the words most frequently used from participants were coolness or cold. None of them reported pain, aching, itchy, unbearable, and burning and frostbite after the cold therapy session.

"*Excellent, I think it must be very helpful for people who are in pain because of the coolness it has served to your body, I didn't notice anything else …*" *(M3)*

"*Initially, I felt a little worried of how it feels because I wasn't sure …After that, it affected me positively for the rest of the day because of the coolness I got. It was really helpful….*" *(M8)*

"*Cold compression was very interesting; I could experience something new. It gave the coolness, not only at my chest wound, but also my whole body. It made me feel much better after the session compared to the day before….*" *(F10)*

"*I really like the feeling from this experience of coolness and I had no problem after all…." (F30)*

Reduction of pain

The participants reported that they were feeling better after the cold therapy session. They emphasized that reducing pain resulted from the cold compression, even in cases of severe pain. The coolness reduced the pain and, consequently, it reduced pain's interference.

"*It was very beneficial and I think it was very good to take my painful away even for a short period. I was feeling much better when I have to do for what I have to do after the cold session…" (M18)*

"With the cold therapy, I could do the activity much easier and it helped me somehow to manage my pain…." *(F27)*

"*When I got a cold therapy, I had a better status with my body especially for the pain around my chest. I could say that I became more sociable and friendly to my family when the pain decreased…." (F34)*

Chest comfort and smooth breathing

Many participants mentioned that coldness made the chest feels more comfortable and they could take a breath more smoothly. The temporary forgetfulness about having the foreign body (intercostal chest drainage) inside the chest wall was also reported. Some participants were surprised at the ease which the cold therapy produced.

"*I enjoyed the time that I received cold therapy, I felt more composed on my chest somehow, it's not easy to say to you but I felt easier to take a deep breath in some way….*" *(M25)*

"*I actually thought that I was already well prepared for the surgery. But not at all, I could still feel the difficulty to take a deep breath and to do a strong cough. But after receiving my cold therapy session in the day after, I felt that my condition was getting much better and I did very well my rehabilitation exercise if I could give myself scores. I will definitely have to use it again if I could choose I think….*" *(M6)*

"*I am not sure if I could give you answer correctly, but what I felt is that I could even forget that I had something inside my chest (the chest tubes) when you did apply me your cold compression. I think this is what I experienced; ….*" *(F17)*

Relaxation

Surprisingly, participants mentioned the relaxing effect of receiving cold therapy. As a result of cold modality, they experienced that the tension was reduced during and immediately after the session.

"*Really, it was very relaxing, it felt like you put the cloud inside your chest wall there you are about to float through the air. It was such a wonderful feeling ...*" *(M12)*

"*I felt so good; it helped me relax even it was just only 20 minutes. I totally forgot that I had the tension or stressful in the ICU...*" *(F21)*

Effect Size of the study

The researcher calculated the standardized difference between means (Cohen's d) to determine the effect size, or the magnitude of the treatment effect. This statistic can be used in within-subject designs. The effect size presents the ability to detect an association between a predictor and an outcome variable (Browner, Newman and Cummings, 1998). The effect size is calculated by the following formula:

$$\text{Effect Size} = \frac{\text{Experimental group mean} - \text{Control group mean}}{\text{Control group standard deviation}}$$

Cohen has suggested that *d*'s of 0.20, 0.50, and 0.80 represent small, medium, and large effect sizes, respectively (Cohen 1992). The effect size at post-operative day 1 was small for both intensity and interference subscale (0.10/0.29). After that, at day 2 and day 3, the effect size respectively large for both intensity (1.06/2.28) and interference (0.88/1.36)(Table below). This represents the acceptable treatment effect of the PCP in decreasing acute pain during day 1-3 after cardiac surgery.

Table 24 Effect size of the study

Pain	**Day1**	**Day2**	**Day3**
Intensity	0.01	1.06	2.28
Interference	0.29	0.88	1.36

Summary

In this study, a hypothesis testing was done using repeated measures MANOVA for both acute pain and physiological responses during post-operative day 1, 2 and 3. The analysis met assumptions underlying the statistical testing. The characteristics of the samples in the experimental and control groups were not significantly different. Intensity and interference of pain and physiological responses were significantly different according to the interaction effect from time and PCP supporting the hypotheses.

CHAPTER V
DISCUSSION, IMPLICATION AND RECOMMENDATION

This chapter presents a summary of the study and a discussion of the research findings. The study examined the effect of pain management combined with complementary care program (PCP) program applying the symptom management model on acute pain and physiological responses in persons with cardiac surgery during postoperative day 1, 2, 3. In addition, the limitations of the study, implications for nursing, and recommendations for future research are described.

Summary of the study

This study was a quasi-experimental design with a control group, aimed to evaluate the effect of pain management combined with complementary care program (PCP) program on acute pain and physiological responses in persons with cardiac surgery. Acute pain and physiological responses were examined from both an experimental and a control groups during postoperative day 1, 2, 3. The applying the symptom management model was the theoretical framework for this study.

Data collection was done at a cardiac surgery center, the Faculty of Medicine Ramathibodi Hospital, Bangkok, Thailand between November 2015 to February 2016. The study was conducted from the possible 80 cardiac surgery patients who met the inclusion criteria: age of 18 years or more, ability to extubate endotracheal tube within first 24 hours after surgery, no history of psychological disorder, did not have an emergency re-operation, had no cognitive impairments or severe post-operative complications. During the study, five participants in the experimental group dropped out (two delayed extubation, one had hemodynamic unstable, one turned delirium and

another one died). Also, five participants in the control group did not complete the study: three delayed extubation, one had hemodynamic unstable and one participant went to re-operation. Thus, the data were analyzed with 35 participants from experimental and 35 participants from the control groups.

Overall, the sample in this study was 70 patients having cardiac surgery. Sixty percent were male and the mean was 54 years (±13.83). More than half of them were married (55.7%). About one third completed bachelor degree (31.4%) were unemployed (34.3%) and had an average income less than 15,000 baht per month (40%).

Of 70 participants, 34.3% had Coronary Artery Bypass Graft (CABG) surgery, 30 % had valvular surgery, 18.6 % had aneurysm surgery, 11 % had combined surgery and the rest of them had congenital and miscellaneous surgery. Consistent to statistic data from the Society of Thoracic Surgeons of Thailand (2015) whose reported a higher percentage of CABG surgery than valvular surgery and aneurysm surgery respectively. All participants had a sternal incision and intercostal chest drainages that remained mostly for 3 days (40%). Opioid was mainly prescribed (73%) whereas some of participants had multimodal anesthesia. It is comparable to the WHO-3-steps-ladder of pain management which defines cardiac surgery as the severe pain operation so that medicine requires strong opioid e.g. Morphine (IV/PCA), Paracetamol and NSAIDS.

To prevent the influence of extraneous variables on the dependent variables, randomization was conducted. All possible distinguishing characteristics of the participants between both groups were equally compared. Statistical analysis showed similar demographic characteristics between the experiment and the control groups.

Particularly, the mean age of participants in the control group was 54.89(±13.67) years while those from the experimental group had mean age at 54.74(±14.20) years (t = 0.04, *p* =.96). Both group had majority of participants in male gender (60%) (*p* =1.00). One third of patients in the control group underwent isolated CABG-surgery (34%) where there were 29 % of the participants had isolated vulvular surgery. For the experimental group, 34% underwent isolated CABG-surgery where as 29 % of them had had isolated vulvular surgery. The significant difference was also not found for the type of surgery between the groups (*p* =.92).

The participants in the experimental group received the routine care and the PCP program whereas those in the control group received only the routine care from the health care professions. The PCP based on symptom management model (Dodd et al., 2001) which focused on three components: acute pain experience adjustment, acute pain management strategies and evaluation of acute pain management. Acute pain experience adjustment enhances participant's perception and knowledge about cardiac surgery and pain management through a booklet; "Acute pain management after cardiac surgery". The content in this booklet included the generally information about cardiac surgery, preoperative preparation and patients roles, naturalistic of acute pain after cardiac surgery, acute pain evaluations, acute pain management (multimodal strategies), the significance of effective pain management, and significance of performing early ambulation activities. After finishing the education session, the participants were asked to complete the questionnaire to make sure that they understand the contents and could apply knowledge after surgery. With the acute pain management strategies, the researcher demonstrated the correct skill of performing early ambulation including comfort positioning, relaxation techniques and

effective coughing combined with providing the cold therapy. The six sessions of cold therapy were done at post-operative day 1, 2 and 3 twice a day.

The participants in the control group received routine services by a staff nurse of the setting including offering the information, the body position change, recording vital signs and pain evaluation, administrating pain medication as prescribed, assess its effectiveness, and report if the protocol does not yield the effectiveness or patients have side effects from pain management protocols.

Daily meetings were held between participants and the researcher to discuss any identified patient problems, possible solutions, and coordination of required medical care. During each day, acute pain was daily evaluated using a modified Brief Pain Inventory (BPI) (Watt-Watson, Stevens, Garfinkel, Streiner, & Gallop, 2001) that measures pain intensity and pain interference. Simultaneously, physiological responses were recorded in terms of heart rate, blood pressure, respiration rate and oxygen saturation before and after each cold therapy sessions. The participants were also asked to rate their acute pain management behavior every day after surgery during the period of study to see how they can carry out a prescribed symptom management strategy by doing those skills consistently.

The results showed significant improvements in both pain intensity and interference in the experimental group explaining by the interaction effect between time and group and main effect of time and main effect of group ($p < .05$). The mean scores of pain intensity were lower than in the control group at day 2 and day 3 whereas the mean scores of pain interference were lower than in the control group from day 1 until day 3.The average pain intensity in the experimental group were 1.97 (±1.01) at day 2 and 1.07 (±0.64) at day 3, respectively. This was lower than in the

control group where the average intensity mean score were 3.57 (±1.51) at day 2 and 3.58 (±1.10) at day 3.

Regarding the pain interference, the participants in the experimental group had lower mean pain interference than the control group at everyday (M =2.21±1.31*;* M = 1.50±0.96 and M = 0.91±0.59) for day 1, 2 and 3 respectively). Conversely, the control groups' pain interference gradually increased for everyday (M =2.65±1.54; M = 2.85±1.53 and M = 2.80±1.39), for day 1, 2 and 3 respectively).

For physiological responses, data analysis showed the statistical difference of oxygen saturation between two groups. The significant interaction effects of PCP and time and main effect of PCP were found (p < .05). The participants in the experimental group had slightly higher blood oxygenation than those in the control group with the mean $SatO_2$ between 99.68(±0.75) to 100(±0.00) compared to the control group that had mean $SatO_2$ between 98.54(±1.17) to 99.23(± 1.06) during post-operative day 1, 2 and 3. However, for the heart rate, systolic blood pressure, diastolic blood pressure and respiration rate, there was no statistical difference between the two groups found.

Discussion

The discussion is described in the context of two hypotheses.

Hypothesis 1: Cardiac surgery patients in the experimental group would have significant differences of acute pain and physiological responses during day 1, 2, 3 after operation.

It was found that the changes in pain intensity and interference caused by interaction effect between time and group and main effect of time. This interaction effect from time and group of could be explained with naturalistic of acute pain after cardiac surgery. Congruent to the theoretical concept of acute pain which classifies

acute pain as pain of recent onset that ends or is anticipated to end during a period of days to weeks (Portenoy & Kanner, 1996) or less than 3 months (Conn, 2005). Specifically, it is usually short-lived, has vary intensity, initially severe and then subsiding as healing takes place (Pain community center, Cardiff University). In this case, it could mean that acute pain after cardiac surgery would gradually reduce from day by day after cardiac surgery.

However, with the positive finding from main effect of group that could support the effectiveness of PCP in decreasing acute pain during postoperative day 1 through day 3 even when the effect of time was also found. Reducing in pain could be explained by the following reasons.

1. Based on the symptom management model, it begins with assessment of the symptom experience from the individual's perspective, whether their symptoms affect their life or not. The participants in the experimental group were given with a preparatory information mentioned about the situations that the cardiac surgery patients had to experience about postoperative pain which were familiar with the expected situations that would occur with them. Furthermore, the given information based on the real experiences in the patients after surgery and focused on behavioral aspect. As a result, it helped the post cardiac surgery patients to understand the expected experience; to prepare themselves to confront with those situations appropriately, to accurately predict the upcoming situations and feelings; and create the knowledge plan when they have to face the situations after surgery.

In this case, researcher ensured the effectiveness of the PCP program in decreasing acute pain level throughout the duration of study for the participants in the experiment group with the validity check tools i.e. the acute pain management's

knowledge questionnaire. This validity check tool was used for the assessment and evaluation acute pain management knowledge. The result showed that participants met the standard criteria about 80% of the acute pain management's knowledge questionnaire that covered the significant knowledge and understanding about cardiac surgery and acute pain after cardiac surgery. Then, they can make decisions for managing their health behaviors, after receiving significant information.

2. The efficacious of PCP based on symptom management model encompassed three major symptom management strategies for managing the acute pain of cardiac patients including pharmacological management strategy, professional strategies, and self-care strategies.

2.1 Pharmacological management strategy: all participants usually recieved pharmacological management strategies for relieving pain including opioids and multimodal anesthesia according to the 3-steps ladder of WHO pain management after the cardiac surgery. Participants in the experimental group provided the reasons that they learnt from the knowledge about effective pain management and followed the suggestions according to the PCP program about being assertive for their pain control. For instance, they felt opened to tell health care team about their actual pain level, asked for pain medication, asked for further helps when their pain was unrelieved, etc. The findings support the fact that experience and interpretation of symptoms are the important sources of symptom management to encourage the patients for managing their symptoms. Likewise, the study about symptom management of patients waiting for CABG that they had pattern of taking medication depending on their past experience and followed the suggestions given by the physician (Bungkon, 2009).

2.2 Professional strategies: by this process, a nurse is a key person providing complementary care i.e. cold therapy. The participants from the experimental group stated that cold therapy made them feel more comfortable, relaxed, could decrease the pain level and made their chest feels more comfortable and could take a deep breath more smoothly. Adding complementary therapy methods together with prescribed pharmacological method provides better advantage in reducing pain than using only medication. According to the gate control theory, cutting sternal bone is a physical factor causing acute pain after cardiac surgery so that cold therapy manipulates with this naturalistic mechanism. Applying 20 minutes frozen gel pack on the periphery pathways will stimulates large pain fiber nerve conduction so that the transmission of small pain fiber is reduced and the gate will close and results in decreasing pain (Algafly & George, 2007).

This finding is similar to the previous study using cold modality in both post-surgical and medically associated pain including cardiac surgery patients whose found the effectiveness of frozen gel pack application on to the sternal incision dressing before performing deep breathing and coughing exercises (Chailler, 2010). However, since in real practice and empirical review, chest tube is one of physical factors contributing pain, this present study was then conducted when patients still had chest tubes which have also found the effectiveness of cold modality.

2.3 Self-care strategies: all participants in the experimental group were trained and practiced two skills i.e. relaxation techniques with diaphragmatic breathing exercise using incentive spirometer and effective coughing to produce the sputum and increase lung expansion. Once cardiac surgery patients were able to perform these skills correctly and consistently, they then could maintain their

skills managing pain themselves. These two skills could prevent the collapse of alveolar and could produce the body's natural relaxation response resulting in decreasing the anxiety that has effect to pain (McCubbin et al., 1996; Lai, 2004; NCCIH, 2016). Again, in this study, the validity check tool to ensure the effectiveness of the PCP on participant's acute pain management behaviors was used. The result from the acute pain management's behavior questionnaire reported that participants in the experimental group used these skills quite often for every day during the study (score above 4/5 on acute pain management behavior questionnaire). This could represent that the acute pain in the experimental group was decreased during the period of study because once patients perform these two skills, then the acute pain level was lessen. This result was consistent with a study that examined the effect of progressive muscle relaxation (Jongjareonkumchok, 2005) that could reduce pain scores for CABG patients.

Although the PCP has benefits in decreasing acute pain level for each participant within the experimental group during post-operative day 1, 2 and 3, however, the PCP did not show the effect on the change of physiological responses during this period. The explanation could be that this present study managed pain by manipulating with manageable factors of pain while there are several factors affecting the physiological responses that are not manipulable. The physiological responses is the work reaction of sympathetic nervous system; one type of involuntary nervous system that works automatically without any controls from individuals. For instance, the heart rate can be vary depending on age, body built and size, blood pressure, medications, emotional state, blood loss, physical activity, drinks, body temperature, etc. The blood pressure does not also remain at a constant value because of numerous

factors including the condition of cardiovascular system, age, gender, physical fitness, obesity, emotion, food, bleeding, etc. Regarding the respiration rate, although it is normally controlled by the respiratory center in the brain, they are also easily influenced by emotions, activity, age, fever, etc. Similarly, several conditions can also affect the oxygen saturation i.e. hemoglobin level, peripheral vascular disease, vasoconstrictor medications, severe hypotension, perfusion mismatch and hypothermia.

From above mentioned, it could summarize that PCP has effect on reducing acute pain for each participants in the experimental group during post-operative day 1, 2 and 3. Although the effect of PCP on physical responses within participants in the experimental group was not found, however, according to the naturalistic of pain mechanism that pain expressed through the patient's perception and body responses. Hence, managing pain should still concern in both types of consequences of pain i.e. patient's perception and physiological responses as they relate to each other as dynamic system.

Hypothesis 2: Cardiac surgery patients in the experimental group would have significant lower of acute pain and physiological responses than those in the control group during day 1, 2, 3 after operation.

The results from this study indicate the effectiveness of implementing the PCP on pain intensity, pain interference and oxygen saturation in patients with cardiac surgery. Since the acute pain level of participants in the experimental group improved successfully than the acute pain level from those in the control group. Despite there were only 54 % of participants that had 80% of the knowledge pretest score but after completing the education session, the posttest knowledge score reached the acceptable criteria for 100% of participants(See Appendix I). Moreover,

patients under the PCP program had better blood oxygenation. Consistently, they reported the use of deep breathing and effective coughing skills more often from day by day, the majority of patients rated the frequency of performing those skills as quite often for the first post-operative day and gradually increased to be regularly at day3 (See Appendix J).

Anyhow, since the interaction effects of time and group to pain intensity, pain interference and oxygen saturation were also found. Again, the possible reasons could be following the naturalistic of acute pain that should be improved from time to time. Regard to the oxygen saturation, since the acute pain level improved, patients could be potentially able to perform ambulation activities resulting the better oxygenation from the following days.

To explain the main effect of the group, the mechanism of the effectiveness of PCP may have been related to managing of acute pain experience, encouragement of patients to use acute pain management strategies and reinforcement their self-ability by daily post-operative visits. In the present study, the participants were provided with the education and skills needed to perform their behaviors through pre-operative period, in cooperation with providing a cold therapy. Concerning about naturalistic of acute pain, these methods might help reducing acute pain by manipulating manageable pain factors including individual factor, physical factor and psychological factor.

The individual factor, patient's perception is found to be influenced with pain level (Watt-Watson et al., 2004; Manias et al., 2005; Kuperberg & Grubbs, 1997) so that adjusting patient's perception of acute pain is crucial. Receiving the sufficient knowledge will shape patient's perception that can accept the occurrence of symptom

which is manageable individually so that they can respond correctly. Furthermore, performing post-operative activities i.e. early ambulating, deep breathing and coughing exercises and an incentive spirometer is needed even though it intensifies pain level unavoidably as physical factor. Having correct skills to perform those activities will help patients to support their sternum correctly and consistently so that the pain would not be worse. On top of that, cold therapy, a physical modality pain relief intervention would manipulate with nerve impulses to obstruct the pain sensory (Algafly & George, 2007). Lastly, since anxiety is a psychological factor of pain (Forster, 2003 & Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004), relaxation techniques could produce the body's natural response resulting in decreasing the anxiety that has effect to pain (McCubbin et al., 1996, Lai, 2004; NCCIH, 2016).

Comparing to the routine care that provides for the participants in the control group, this study contributes support for developing interventions using non-phamacological pain management which consistent with the previous studies such as music therapy (Kittisup, 1994 ; Kamkhieo, 2008), progressive muscle relaxation technique (Jongjareonkumchok, 2005) and foot reflexology combined with aromatherapy (Kasetlaksami , 2008). Our success in controlling acute pain is different from conventional care. Concerning on naturalistic of acute pain regard to the gate mechanism that pain evolves from spinal cord and brain system, routine care mainly intervenes with central control in brain e.g. affective-motivate and cognitive-evaluative component whereas the modulation of nerve impulses from gate has rarely been manipulated. Thus, it could lead to the problem that the effective intervention in decreasing acute pain during chest physical therapy is fairly approved and still be

required. Another difference between this present study and the routine care could be due to period of time this study employed. The routine interventions do not continuously provide through first 3 days that intensity of pain is on the top so that might not yield the effectiveness.

In summary, the research findings revealed that PCP gave the extensive implementation using pharmacology, non-pharmacology (complementary therapy) and self-care strategies to manage acute pain after cardiac surgery for adult patients. The findings of this study are in accordance with the Symptom Management Model (Dodd et al., 2001) which states that the symptom experiences, symptom management strategies, and symptoms outcomes are interrelated. The perception and evaluation of acute pain associated with some demographic and health-related data such as gender, age, and type of surgery. Both pharmacological and non-pharmacological management strategies (complementary therapy) were used and were demonstrated as effective for managing the symptom occurrences. In addition, the individual symptom management strategy was simultaneously used as a self-care strategy that also influenced the acute pain level after cardiac surgery for adult patients.

Limitation

This study are encouraged for implementation although there was a limitation of generalizability due to the setting. The effects of the intervention, however, could have also affected by the time changes when applying implementing the result. Another consideration is the duration of this intervention as it was conducted only during acute post-operative phase. While the PCP did show a good effect during three days of intervention, the results may plateau. The experimental group, however, continued to decrease their acute pain through three days and improved their blood

oxygenation. A longer duration of intervention may have improved control to even a smaller pain score and may have shown other benefits such as greater ability to have others recovery outcomes. Besides, because this study was conducted without the randomized selection, so that the risk of confounding factors could not be minimized and would affect the rigor of the study.

Implications

The findings of this study have implications for scientific knowledge, nursing practice, nursing education, and national health policy. In addition, recommendations for future research are presented.

Implications for scientific knowledge

The additional knowledge found from this study was that the non-pharmacological intervention of acute pain using cold modulation that normally used in others contexts. Providing cold therapy intervenes with gate mechanism that reduce the nerve impulse to the brain resulting in eliminating the pain perception from cardiac surgery patient at chest wound.

Implications for Nursing Practice

Although the PCP is not the principle pain management, rather it is proposed to integrative implement to clinical setting accompanying with the routine care. The nurses in cardiac surgery settings then can enhance the interpersonal relationship between nurse and patients while providing the program. Moreover, with this nursing strategy, APN/nurses may use it to tailor the patient's needs and concern their ability to self-manage their symptom effectively. The cardiac surgery patients are insisted to maintain their ability to perform skills after surgery in order to manage their pain

effectively. Besides, the cold therapy implementation is not only proposed to ease the pain, but also to help promoting patients comfort. The reason is that not only the neurological responses included, but also to reduce the cellular, vascular, inflammatory systems consequently decreasing the hematoma or swelling.

Implications for Nursing Education

Curriculum of pain management for cardiac surgery patients or surgical patients should be developed for training advanced nurse practitioners working in this area. The curriculum should encompass: the SMM to activate symptom management strategies; enhance their acute pain management knowledge following cardiac surgery; self-management skills and non-pharmacological therapy (complementary therapy) to decrease pain level, i.e. cold therapy, comfort positioning, relaxation technique and effective coughing. Finally, providing support and hands-on training for caregivers is essential to maintain their self-management skills as needed.

Implications for Health Care Policy

The nurse administrators can use the results of this study to create a policy for improving health care personnel and quality of nursing care. The nurse administrators may create a training program to promote the uses of this program to the surgical nurses to gain advanced knowledge about acute pain after cardiac surgery, its treatment and symptom management for providing nursing care to the patients in this group and improving their health status. The reason for implication the program at administrative or policy level is that since cardiac surgery is a major surgery that consumes high costs. Although the program could additionally reduce pain intensity at some level, but once again, pain is a subjective phenomenon and it has

interferences to daily activity that inhibit the ability performing ambulation that required. Promoting the use of this program could still be benefit to cardiac surgery patients in order to reduce the length of stay, promote proper recovery outcomes resulting in decrease the cost of care once the pain level reduced so they could perform rehabilitation in the certain time.

Recommendations for Future Research

1. As the results showed that the acute pain level decreased substantially in the first day and remained improvement until the last day of the program. Moreover, there was the effect to the improvement of the oxygenation. Therefore, it should utilize the components of this program in routine daily practice at cardiac center to maintain the effect of PCP in helping cardiac surgery patient to ease their pain and promote their comfort.

2. With a broader perspective, interventions can be designed to focus not only on acute pain management, but also other activities to improve the recovery outcomes of cardiac surgery procedure.

3. Further research should replicate the study in poorly pain controlled patients or study with a longer duration with long-term program evaluation in order to prevent the development of chronic post cardiac surgery pain.

4. Participants from several geographical areas are needed to increase generalizability of this study

Conclusion

The findings of this quasi-experimental design demonstrated that PCP decreases acute pain level and improves respiration rate and blood oxygenation

among Thai cardiac surgery patients. Furthermore, this study provides that collaborative work with patients and healthcare team can have a major effect on acute pain control after cardiac surgery. This potential benefit is particularly important given the magnitude of the care gap for cardiac surgery care in Thailand.

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APPENDICES

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Appendix A

List of Experts

List of experts

1 Professor Somchit Hanucharurnkul , Ph.D., RN., APN

Faculty of Medicine Ramathibodi hospital

Mahidol university

2 Associate Professor Ketsarin Utriyaprasit, Ph.D., RN.

Faculty of Nursing Mahidol university

3 Associate Professor Suchart Chaiyaroj, M.D.

Faculty of Medicine Ramathibodi hospital

Mahidol university

4 Assistant Professor Laksamee Chanvej, M.D.

Wattanosoth Hospital (Bangkok)

5 Miss Chiraphi Soonthornkul Na Cholburi,

Advanced Practitioner Nurse (Surgical Nursing),

Ramathibodi hospital

Appendix B

The Demographic data sheet

แบบบันทึกข้อมูลส่วนบุคคล

ส่วนที่ 1: ข้อมูลทั่วไป

Identification number……อายุ..... .ปี เบอร์โทรศัพท์.....

โรคประจำตัว..... ยาที่รับประทานประจำ.....

การวินิจฉัยโรคสำหรับการผ่าตัด……

วันแรกที่พบแพทย์ศัลยกรรมทรวงอก.....วันที่เข้านอนโรงพยาบาล.....

ชนิดการผ่าตัด.....วันที่ผ่าตัด.....

วันที่ถอดท่อช่วยหายใจ.....วันที่ถอดสายระบายทรวงอก.....

1. เพศ ( ) ชาย ( ) หญิง
2. สถานภาพสมรส ( ) โสด ( ) คู่ ( ) หม้าย ( ) หย่าร้าง ( ) แยกกัน
3. ศาสนา ( ) พุทธ ( ) คริสต์ ( ) อิสลาม ( ) อื่น ๆ.....

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10. แผลผ่าตัด .....ตำแหน่ง ( ) หน้าอก ( ) แขน .....ข้าง ( ) ขา.....ข้าง

ส่วนที่ 2: ข้อมูลด้านความปวด

1. ยาระงับปวดที่ใช้ประจำ ( ) ไม่มี ( ) มี ระบุ.....

2. ยาแก้ปวดที่ได้รับปัจจุบัน

หลังผ่าตัด / ประเภทยาแก้ปวด	**วันที่ 1** วันที่ ..... (เวลา: น.)	**วันที่ 2** วันที่ ..... (เวลา: น.)	**วันที่ 3** วันที่..... (เวลา: น.)
ยาแก้ปวด Continue (ชื่อ/ความเข้มข้น/ขนาด/ทางที่ให้/ความถี่)			
1……	……	……	……
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2……	……	……	……
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3……	……	……	……
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4……	……	……	……
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ยาแก้ปวด PRN (ชื่อ/ความเข้มข้น/ขนาด/ทางที่ให้/ความถี่)			
1……	……	……	……
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2……	……	……	……
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3……	……	……	……
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4……	……	……	……
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หมายเหตุ			

Appendix C

A Thai version of a modified version of Brief Pain Inventory (BPI-T) (Example)

แบบประเมินความปวดด้านระดับความรุนแรง (BPI) (คลีแลนด์, 1991)

1.กรุณาประเมินความปวดของคุณโดยวงกลมรอบตัวเลขหนึ่งตัว ที่บ่งบอกถึงความปวดที่มากที่สุดที่คุณมีในช่วง24 ชั่วโมงที่ผ่านมา ได้ดีที่สุด

0 1 2 3 4 5 6 7 8 9 10

ไม่ปวด ปวดมากเท่าที่คุณสามารถจินตนาการได้

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4. กรุณาประเมินความปวดของคุณโดยวงกลมรอบตัวเลขที่บ่งบอกว่าคุณปวดมากเพียงใดในขณะนี้

0 1 2 3 4 5 6 7 8 9 10

ไม่ปวด ปวดมากเท่าที่คุณสามารถจินตนาการได้

แบบประเมินความปวดด้านระดับการรบกวนฉบับดัดแปลง(BPI-I) (วัตต์-วัตสัน และคณะ, 2001)

วงกลมรอบตัวเลขที่อธิบายว่าในช่วง 24 ชั่วโมงที่ผ่านมาความปวดรบกวนคุณอย่างไรในเรื่อง

ก. กิจกรรมทั่วๆไป

0 1 2 3 4 5 6 7 8 9 10

ไม่รบกวนเลย รบกวนอย่างมาก

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ฉ. ความสัมพันธ์กับผู้อื่น

0 1 2 3 4 5 6 7 8 9 10

ไม่รบกวนเลย รบกวนอย่างมาก

Appendix D
A bedside patients monitoring

A bedside patients monitoring: Philips IntelliVue (M8005A)

(From

https://media.supplychain.nhs.uk/media/documents/n0889200/marketing/31990_n0889200.pdf)

Appendix E

The pain management combined with complementary care program (PCP): A Nurse Manual

(Example)

THE PAIN MANAGEMENT COMBINED WITH COMPLEMENTARY CARE

PROGRAM ON ACUTE PAIN AND PHYSIOLOGICAL RESPONSES

IN PATIENTS WITH CARDIAC SURGERY

โปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ

จัดทำโดย
นาวสาว ผกามาศ แก้วนันทวัฒน์ รหัสนิสิต 5477404436
นิสิตหลักสูตรพยาบาลศาสตร์ดุษฎีบัณฑิต สาขาวิชาพยาบาลศาสตร์
คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

อาจารย์ที่ปรึกษาหลัก รศ.ดร.สุรีพร ธนศิลป์
อาจารย์ที่ปรึกษาร่วม ผศ.ดร.สุนิดา ปรีชาวงษ์

คู่มือนี้เป็นส่วนหนึ่งของดุษฎีนิพนธ์ปริญญาพยาบาลศาสตร์ดุษฎีบัณฑิต

หลักการและเหตุผล

ผู้ป่วยหลังผ่าตัดหัวใจต้องเผชิญกับอาการหลายอย่าง จากการศึกษาพบว่าผู้ป่วยรายงานอาการ ได้แก่ อาการปวดบริเวณกระดูกหน้าอกและขา, อาการนอนไม่หลับ, อาการปวดบริเวณหัวไหล่,หลังและต้นคอ อาการเหนื่อยล้า อาการท้องผูกและอาการเบื่ออาหารตามลำดับ (Utriyaprasit & Moore, 2005) จะเห็นได้ว่า อาการปวดเป็นประสบการณ์ที่ผู้ป่วยหลังผ่าตัดหัวใจจะต้องพบมากที่สุด โดยอาการปวดที่เกิดขึ้นจะเป็นความปวดแบบเฉียบพลันอันเป็นประสบการณ์ส่วนตัวที่ตอบสนองต่อประสาทสัมผัสของเนื้อเยื่อที่ได้รับความเสียหายที่บริเวณแผลกระดูกหน้าอก พบว่า ระดับความปวดจะอยู่ในขั้นรุนแรงแล้วลดลงตามกระบวนการฟื้นหายและมีระยะเวลาจำกัด จากการศึกษาพบว่า อาการปวดแบบเฉียบพลันจะอยู่ในระดับมาก (คะแนนความปวดมากกว่าระดับ 5/10) ในช่วง 24-72 ชั่วโมงแรกหลังการผ่าตัด((Yorke & Wallis, 2004; Toleb, 2001; Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004; Lahtinen, Kokki, & Hynynen, 2006) และมีความสัมพันธ์กับการไอและหายใจลึก ๆ ซึ่งเป็นกิจกรรมที่ผู้ป่วยจะต้องปฏิบัติเพื่อป้องกันภาวะแทรกซ้อนในปอด (Phattawee, 1998; Srikaew, Khuwatsamrit, Mongkong, & Chaiyaroj, 2013)

เมื่อพิจารณาถึงปัจจัยที่มีผลต่อความปวด ได้แก่ ปัจจัยส่วนบุคคล, ปัจจัยทางร่างกาย รวมถึงปัจจัยด้านจิตใจ เนื่องจากกลไกการเกิดความปวดแบบเฉียบพลันหลังผ่าตัดหัวใจเกิดจากการที่เนื้อเยื่อได้รับบาดเจ็บบริเวณทรวงอก พบว่า ปัจจัยทางกายภาพ ได้แก่ การทำกิจกรรมที่ลุกนั่ง การทำกายบริหารทรวงอกจะสามารถกระตุ้นระดับความเจ็บปวดแก่ผู้ป่วยมากขึ้น (Black & Hawks, 2005, El-Ansary, Waddington, & Adams, 2007 & Fanning, 2004) ซึ่งกิจกรรมเหล่านี้ผู้ป่วยจะต้องปฏิบัติอย่างเคร่งครัดภายหลังการผ่าตัดอย่างหลีกเลี่ยงไม่ได้ เพื่อป้องกันการเกิดภาวะแทรกซ้อน นอกเหนือจากนั้น พบว่า ปัจจัยส่วนบุคคล ได้แก่ การรับรู้ของผู้ป่วยมีอิทธิพลสำคัญต่อการจัดการความเจ็บปวด (Watt-Watson et al., 2004; Manias, 2005; Kuperberg & Grubbs, 1997) โดยมีรายงานว่าผู้ป่วยที่มีคะแนนความปวดที่สูงขึ้นใน3วันแรกหลังผ่าตัดมีอัตราการเกิด Atelectasis อย่างมีนัยสำคัญ(Puntillo & Weiss, 1994) โดยผู้ที่มีความปวดจะหลีกเลี่ยงการขยับตัวและนำไปสู่ภาวะแทรกซ้อนหลังผ่าตัด และก่อให้เกิดความปวดแบบเรื้อรัง (Forsythe, Dunbar, Hennigar, Sullivan, & Gross, 2008) ดังนั้นการปรับการรับรู้ของผู้ป่วยเกี่ยวกับความปวดแบบเฉียบพลันเพื่อให้การจัดการความเจ็บปวดเป็นไปอย่างมีประสิทธิภาพจึงเป็นสิ่งจำเป็น นอกจากนั้นการจัดการด้านปัจจัยทางจิตวิทยา พบว่า ความวิตกกังวลสามารถเพิ่มระดับความรุนแรงของความเจ็บปวดจากการเปลี่ยนแปลงของสารสื่อประสาท (Forster, 2003 & Milgrom, Brooks, Qi, Bunnell, Wuestefeld, & Beckman, 2004) ดังนั้นเพื่อการจัดการความปวดอย่างครอบคลุม ผู้ป่วยควรได้รับการจัดการความวิตกกังวลด้วย

Appendix F

The pain management combined with complementary care program (PCP): Booklet

(Example)

ความปวดแบบเฉียบพลันกับการผ่าตัดหัวใจ

นาวสาว ผกามาศ แก้วนันทวัฒน์
นิสิตหลักสูตรพยาบาลศาสตร์ดุษฎีบัณฑิต
คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

คำนำ

ความปวดแบบเฉียบพลันภายหลังการผ่าตัดหัวใจเป็นประสบการณ์ที่เกิดขึ้นอย่างหลีกเลี่ยงไม่ได้ แต่สามารถจัดการได้อย่างมีประสิทธิภาพหากได้รับการเตรียมตัวอย่างดีตั้งแต่ระยะก่อนผ่าตัดไปจนถึงระยะหลังผ่าตัด นอกจากจะใช้วิธีการรักษาจากแพทย์แล้วตัวท่านเองก็เป็นปัจจัยสำคัญที่ทำให้การจัดการความปวดมีประสิทธิภาพมากยิ่งขึ้น ท่านสามารถใช้ความรู้และทักษะที่ได้เรียนรู้ไปในวันนี้ต่อการดูแลตนเองร่วมกับการรักษาของแพทย์ได้

คู่มือเรื่อง “**ความปวดแบบเฉียบพลันกับการผ่าตัดหัวใจ**” ฉบับนี้จึงจัดทำขึ้นเพื่อเตรียมความพร้อมของผู้ป่วยตั้งแต่ระยะก่อนผ่าตัดในเรื่องความปวดแบบเฉียบพลันเฉียบพลันหลังผ่าตัดหัวใจ, การประเมินความปวดเฉียบพลันหลังผ่าตัดหัวใจและการจัดการความปวดเฉียบพลันหลังผ่าตัดหัวใจ เพื่อช่วยให้ผู้ป่วยมีการรับรู้และมีความเข้าใจที่ถูกต้องและมีกำลังใจในการเผชิญและให้ความร่วมมือในการรักษาเป็นอย่างดี ในการจัดการความปวดอย่างมีประสิทธิภาพ ส่งเสริมการฟื้นหายและลดระยะเวลาหรือภาระค่าใช้จ่ายในการอยู่โรงพยาบาลได้

Appendix G
Reusable gel pack

3M reusable gel pack size 10 x 26.5 cm

Appendix H
A digital thermometer

A digital thermometer: **Oaktan 363 LOLLITEMP**

(From http://www.4oakton.com/)

Appendix I

The acute pain management's knowledge questionnaire And scores (Example)

แบบสอบถามหลังเข้าร่วมโปรแกรมการจัดการอาการปวดแบบเฉียบพลันหลังผ่าตัดหัวใจ

หมายเลข …… HN……...……

แบบสอบถามความรู้เกี่ยวกับจัดการอาการปวดแบบเฉียบพลันหลังผ่าตัดหัวใจ สร้างขึ้นเพื่อใช้กำกับติดตามประเมินความรู้ผู้ป่วยภายหลังได้รับคำแนะนำตามโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสาน

คำชี้แจง โปรดทำเครื่องหมาย √ ในช่องว่างที่ “ถูกต้อง” หรือ “ไม่ถูกต้อง” เพียงอย่างใดอย่างหนึ่งที่ตรงกับความคิดของท่านเกี่ยวกับการจัดการอาการปวดแบบเฉียบพลันหลังผ่าตัดหัวใจของท่านมากที่สุด จำนวนทั้งสิ้น 20 ข้อ โปรดทำทุกข้อ

ข้อที่	แบบทดสอบ	ถูกต้อง	ไม่ถูกต้อง
1.	การผ่าตัดหัวใจมิได้ถือเป็นการรักษาอาการของโรคหัวใจให้หายขาด แต่จะเป็นการรักษาเพื่อบรรเทาอาการและทำให้ผู้ป่วยมีคุณภาพชีวิตที่ดีขึ้น		
2.	ในระยะก่อนผ่าตัดหัวใจผู้ป่วยทุกรายมีความจำเป็นจะต้องได้รับการฝึกกายภาพบำบัด		
3.	……..		
4.	…… …… ……		
5.	…… …… ……..		
6.	…… …… …….		
7.	…… …… …….		

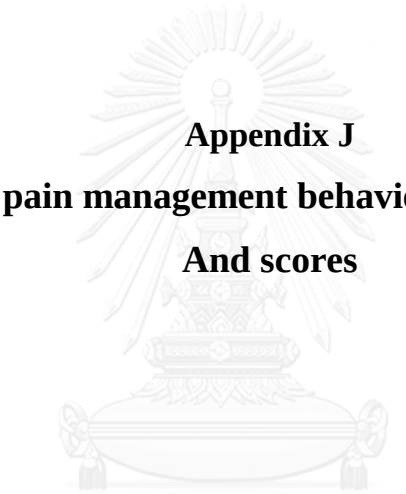
ข้อที่	แบบทดสอบ	ถูกต้อง	ไม่ถูกต้อง
8.	…… ……		
9.	…… …… ……		
10.	…… …… ……		
11.	…… …… ……		
12.	…… …… ……		
13.	…… …… ……		
14.	…… …… ……		
15.	…… …… ……		
16.	…… …… ……		
17.	…… ……		

ข้อที่	แบบทดสอบ	ถูกต้อง	ไม่ถูกต้อง
18.	…… …… ……..		
19.	…… …… …….		
20.	การเลือกวิธีจัดการความปวดที่เหมาะสมกับผู้ป่วยแต่ละราย เป็นบทบาทโดยตรงของผู้ป่วยร่วมกับแพทย์และพยาบาลเพื่อให้การจัดการความปวดแบบเฉียบพลันหลังผ่าตัดหัวใจมีประสิทธิภาพมากที่สุด		

ID	Pretest	Posttest
1	18	19
2	17	19
3	18	20
4	15	20
5	15	18
6	15	19
7	17	18
8	14	19
9	14	18
10	14	20
11	15	18
12	18	18
13	15	20
14	10	16
15	12	17
16	19	20
17	14	18
18	19	18

ID	Pretest	Posttest
19	13	16
20	10	16
21	15	16
22	16	16
23	17	19
24	15	20
25	19	18
26	14	18
27	16	18
28	18	20
29	12	18
30	15	17
31	17	19
32	18	18
33	16	18
34	15	17
35	14	20

Scores	Pretest	Posttest
Min-Max	10-19	16-20
Mean	15.20	18.36
SD	2.32	1.31



Appendix J

The acute pain management behavior self-report form

And scores

<u>แบบประเมินพฤติกรรมการจัดการความปวดแบบเฉียบพลันของผู้ป่วยหลังผ่าตัดหัวใจ</u>

แบบสอบถามนี้สร้างขึ้นเพื่อใช้กำกับติดตามประเมินพฤติกรรมผู้ป่วยภายหลังได้รับคำแนะนำตามโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสาน

คำชี้แจง โปรดทำเครื่องหมาย √ ในช่องว่าง เพียงอย่างใดอย่างหนึ่งที่ตรงกับพฤติกรรมการจัดการอาการปวดแบบเฉียบพลันหลังผ่าตัดหัวใจของท่านมากที่สุด โปรดทำทุกข้อ

หมายเหตุ	5	หมายถึง	ปฏิบัติสม่ำเสมอ(81-100%)
	4	หมายถึง	ปฏิบัติบ่อยครั้ง(61-80%)
	3	หมายถึง	ปฏิบัติบางครั้งบางคราว(41-60%)
	2	หมายถึง	ปฏิบัติน้อยครั้ง(21-40%)
	1	หมายถึง	ไม่เคยปฏิบัติเลย(0-20%)

หลังผ่าตัด	ความถี่ในการปฏิบัติกิจกรรม				
	5	4	3	2	1
<u>วันที่ 1:</u> การฝึกบริหารการหายใจการฝึกไออย่างมีประสิทธิภาพ					
<u>วันที่ 2:</u> การฝึกบริหารการหายใจการฝึกไออย่างมีประสิทธิภาพ					
<u>วันที่ 3:</u> การฝึกบริหารการหายใจการฝึกไออย่างมีประสิทธิภาพ					

	Frequency				
	5	4	3	2	1
Day 1: Deep breathing exercise	3 (8.6 %)	20 (57.1 %)	8 (22.9 %)	3 (8.6 %)	1 (2.9 %)
Effective coughing	3 (8.6 %)	15 (42.9 %)	12 (34.3 %)	3 (8.6 %)	2 (5.7 %)
Day 2: Deep breathing exercise	9 (25.7 %)	23 (65.7 %)	3 (8.6%)	-	-
Effective coughing	7 (20.0 %)	23 (65.7 %)	4 (11.4%)	2 (5.7 %)	-
Day 3: Deep breathing exercise	22 (62.9 %)	13 (37.1%)	-	-	-
Effective coughing	16 (45.7%)	18 (51.4 %)	1 (2.9 %)	-	-

Appendix K

Pictures of the pain management combined with complementary care program (PCP) activities

Skill training: Deep Breathing & Effective coughing

Cold therapy

Appendix L
Human Subjects Approval Document

คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล
๒๗๐ ถนนพระราม ๖ แขวงทุ่งพญาไท เขตราชเทวี กทม. ๑๐๔๐๐
โทร. (๐๒) ๒๐๑-๑๐๐๐

Faculty of Medicine Ramathibodi Hospital, Mahidol University.
270 Rama VI Road, Ratchathewi, Bangkok 10400, Thailand
Tel. (662) 201-1000

เอกสารรับรองโดยคณะกรรมการจริยธรรมการวิจัยในคน
คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี
มหาวิทยาลัยมหิดล

เลขที่ ๒๕๕๘/๖๐๔

ชื่อโครงการ EC_590015	โปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ
เลขที่โครงการ/รหัส	ID ๑๐ – ๕๘ – ๑๕ ว
ชื่อหัวหน้าโครงการ	นาวสาวผกามาศ แก้วนันทวัฒน์
สถานที่ศึกษา	คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ขอรับรองว่าโครงการดังกล่าวข้างต้นได้ผ่านการพิจารณาเห็นชอบโดยสอดคล้องกับแนวปฏิญญาเฮลซิงกิ จากคณะกรรมการจริยธรรมการวิจัยในคน คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี

ลงนาม .....
ประธานกรรมการจริยธรรมการวิจัยในคน (ศาสตราจารย์ นายแพทย์พัฒน์ มหาโชคเลิศวัฒนา)

วันที่รับรอง ๖ พฤศจิกายน ๒๕๕๘
ระยะเวลาในการศึกษา ๑ ปี

คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล
๒๗๐ ถนนพระราม ๖ แขวงทุ่งพญาไท เขตราชเทวี กทม. ๑๐๔๐๐
โทร. (๐๒) ๒๐๑-๑๐๐๐

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Tel. (662) 201-1000

Documentary Proof of Ethical Clearance
Committee on Human Rights Related to Research Involving Human Subjects
Faculty of Medicine Ramathibodi Hospital, Mahidol University

No MURA2015/604

Title of Project EC_590015	The Pain Management Combined with Complementary Care Program on Acute Pain and Physiological Responses in Patients with Cardiac Surgery
Protocol Number	ID 10 – 58 – 15
Principal Investigator	Miss Pakamas Keawnantawat
Educational Institution	Faculty of Nursing Chulalongkorn University

The aforementioned project has been reviewed and approved by the Committee on Human Rights Related to Research Involving Human Subjects, based on the Declaration of Helsinki.

Signature of Chairman **Committee on Human Rights Related to** **Research Involving Human Subjects**	..... Prof. Pat Mahachoklertwattana, M.D.
Date of Approval	November 6, 2015
Duration of Study	1 Year

Appendix M
Patient/participant information sheet and
Informed consent form

เอกสารชี้แจงข้อมูล/คำแนะนำแก่ผู้เข้าร่วมการวิจัย

(Patient/Participant Information Sheet)

ชื่อโครงการ โปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ

ชื่อผู้วิจัย นาวสาว ผกามาศ แก้วนันทวัฒน์

สถานที่วิจัย แผนกผู้ป่วยศัลยกรรมและทรวงอก โรงพยาบาลรามาธิบดี

บุคคลและวิธีการติดต่อเมื่อมีเหตุฉุกเฉินหรือความผิดปกติที่เกี่ยวข้องกับการวิจัย

นาวสาว ผกามาศ แก้วนันทวัฒน์ โทร. 08-7068-4532

ผู้สนับสนุนการวิจัย อยู่ระหว่างดำเนินการขอทุน 90 ปีจุฬาลงกรณ์มหาวิทยาลัย

ความเป็นมาของโครงการ

โครงการวิจัยนี้มุ่งพัฒนาโปรแกรมการพยาบาลแบบบูรณาการต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ เป็นโปรแกรมการพยาบาลที่มุ่งเน้นให้ผู้เข้าร่วมการวิจัยมีความรู้ ความเข้าใจ และมีความสามารถที่จะนำความรู้ที่ได้รับไปใช้ในการจัดการและควบคุมความปวดแบบเฉียบพลันหลังผ่าตัดหัวใจ รวมทั้งมีความสามารถในการปฏิบัติตนหลังผ่าตัดหัวใจเพื่อส่งเสริมการฟื้นหายได้อย่างมีประสิทธิภาพ โปรแกรมนี้ครอบคลุมเนื้อหาหลัก ได้แก่ การผ่าตัดหัวใจ, ความปวดแบบเฉียบพลันหลังผ่าตัดหัวใจ, ความสำคัญของการจัดการความปวด กิจกรรมของโปรแกรมการจัดการตนเองนี้ เริ่มตั้งแต่ครั้งแรกที่พบกับผู้วิจัยที่แผนกผู้ป่วยนอกศัลยกรรมและทรวงอก โรงพยาบาลรามาธิบดี ครั้งต่อไปในวันมานอนโรงพยาบาลวันแรกเพื่อเตรียมผ่าตัดหัวใจ หลังจากนั้น ผู้วิจัยมีการติดตามเพื่อประเมินผลการวิจัยในช่วงหลังผ่าตัดหัวใจ รวมถึงให้การบำบัดด้วยความเย็นประคบปวดเพื่อบรรเทาอาการปวดแบบเฉียบพลัน โดยผู้ป่วยสามารถประเมินอาการรุนแรงของความปวดและขอยาแก้ปวดและการประคบเย็นได้ตามต้องการ เริ่มตั้งแต่วันรุ่งขึ้นหลังผ่าตัดหัวใจภายหลังถอดท่อช่วยหายใจ จนถึงวันที่สามภายหลังการผ่าตัดหัวใจ ซึ่งเป็นการสิ้นสุดการดำเนินการวิจัยอย่างสมบูรณ์

วัตถุประสงค์ เพื่อศึกษาผลของโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ

รายละเอียดที่จะปฏิบัติต่อผู้เข้าร่วมการวิจัย รายละเอียดของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย มีดังนี้

ผู้เข้าร่วมวิจัย คือ ผู้ป่วยโรคหัวใจที่มีอายุมากกว่า 18 ปี ได้รับการวินิจฉัยจากแพทย์ว่าต้องเข้ารับการผ่าตัดหัวใจ และเข้ามารับการผ่าตัดหัวใจที่ โรงพยาบาลรามาธิบดี จังหวัด กรุงเทพมหานคร จำนวน 66 คน คัดเลือกกลุ่มตัวอย่างแบบเฉพาะเจาะจงเข้ากลุ่มควบคุมและกลุ่มทดลอง

กลุ่มทดลอง ได้รับโปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสาน โดยพบกับผู้วิจัย 6 ครั้ง เริ่มตั้งแต่ครั้งแรกที่พบกับผู้วิจัยที่ แผนกผู้ป่วยนอกศัลยกรรมและทรวงอก โรงพยาบาลรามาธิบดีเป็นเวลา 45 นาที เพื่อเตรียมความพร้อมในการนอนโรงพยาบาล ครั้งต่อไปในวันมานอนโรงพยาบาลวันแรกเพื่อเตรียมผ่าตัดหัวใจ เป็นเวลา 30 นาที หลังจากนั้น ผู้วิจัยมีการติดตามเพื่อประเมินผลการวิจัยในช่วงหลังผ่าตัดหัวใจ รวมถึงให้การบำบัดด้วยความเย็นประคบปวดเพื่อบรรเทาอาการปวดแบบเฉียบพลัน เริ่มตั้งแต่วันรุ่งขึ้นหลังผ่าตัดหัวใจภายหลังถอดท่อช่วยหายใจจนถึงวันที่สามภายหลังการผ่าตัดหัวใจ ครั้งละ 30 นาที โดยระหว่างนี้ ผู้ป่วยสามารถประเมินอาการรุนแรงของความปวดและขอยาแก้ปวดและการประคบเย็นได้ตามต้องการ ส่วนครั้งสุดท้ายจะเป็นการประเมินผลการวิจัยในวันที่ 4 หลังผ่าตัดหัวใจ เป็นเวลา 20 นาที ซึ่งเป็นการสิ้นสุดการดำเนินการวิจัยอย่างสมบูรณ์

กลุ่มควบคุม ได้รับการพยาบาลตามปกติโดยได้รับคำแนะนำต่างๆจากเจ้าหน้าที่พยาบาลของโรงพยาบาลรามาธิบดี เกี่ยวกับการผ่าตัดหัวใจและการปฏิบัติตัวที่เหมาะสม มีการพบกับผู้วิจัย 6 ครั้ง เริ่มตั้งแต่ครั้งแรกที่พบกับผู้วิจัยที่ แผนกผู้ป่วยนอกศัลยกรรมและทรวงอก โรงพยาบาลรามาธิบดีเป็นเวลา 20 นาที เพื่ออธิบายวัตถุประสงค์การวิจัยจากนั้นผู้วิจัยรวบรวมข้อมูลทั่วไปโดยแบบสอบถามข้อมูลทั่วไป และ นัดพบอีกครั้งวันเตรียมผ่าตัดหัวใจเพื่อสอบถามอาการและข้อสงสัย หลังจากนั้นผู้วิจัยมีการติดตามเพื่อประเมินผลการวิจัยในช่วงหลังผ่าตัดหัวใจ เริ่มตั้งแต่วันรุ่งขึ้นหลังผ่าตัดหัวใจภายหลังถอดท่อช่วยหายใจ จนถึงวันที่สามภายหลังการผ่าตัดหัวใจครั้งละ 10 นาที ครั้งสุดท้ายจะเป็นการประเมินผลการวิจัยในวันที่ 4 หลังผ่าตัดหัวใจ ซึ่งเป็นการสิ้นสุดการดำเนินการวิจัยอย่างสมบูรณ์

ประโยชน์และผลข้างเคียงที่จะเกิดแก่ผู้เข้าร่วมการวิจัย

ประโยชน์ของการวิจัยนี้ คือ เป็นข้อมูลในการวางแผนให้ความรู้แก่ผู้ป่วยโรคหัวใจที่กำลังเข้ารับการผ่าตัดหัวใจ ให้มีความรู้ความเข้าใจในอาการที่เกิดขึ้น เพื่อให้ผู้ป่วยมีความสามารถในการจัดการตนเองและควบคุมความเจ็บปวดให้ลดลง ทำให้สามารถปฏิบัติกิจกรรมเพื่อการเคลื่อนไหวได้อย่างมีประสิทธิภาพ เร่งอัตราการฟื้นหาย ลดระยะเวลาการนอนโรงพยาบาล ฟื้นตัวเร็วขึ้น และลดภาระค่าใช้จ่ายได้

ผลข้างเคียงที่อาจเกิดขึ้นจากการวิจัย คือ เนื่องจากการวิจัยครั้งนี้จะเป็นการใช้การบำบัดความปวดแบบไม่ใช้ยาด้วยการดูแลแบบผสมผสาน เพื่อให้อาการปวดแบบเฉียบพลันทุเลาลงด้วยการบำบัดเย็น ด้วยการวางเจลเย็นที่มีอุณหภูมิระหว่าง 0 -18.33 องศาเซลเซียส เป็นระยะเวลา 20 นาที เพื่อรักษาอุณหภูมิผิวหนังให้อยู่ในระดับการรักษาที่ลดความปวดได้ ดังนั้น อาจมีความเสี่ยง

หรือความไม่สุขสบายที่จะเกิดขึ้นอันได้แก่ รอยแดงหรือการเปลี่ยนสีของผิวหนังในบริเวณที่ได้รับความเย็น อาการปวดที่เพิ่มขึ้นหรืออาการชาหลังได้รับการประคบด้วยความเย็น รวมถึง การเกิดภาวะผิวหนังขาดเลือดไปเลี้ยงในตำแหน่งที่ได้รับการประคบด้วยความเย็นซึ่งอาจเกิดขึ้นได้ในกรณีที่ผิวหนังได้รับความเย็นที่ต่ำกว่า 0 °C เป็นเวลามากกว่า 30 นาที

อย่างไรก็ดี เพื่อเป็นการประเมินและป้องกันความเสี่ยงต่อผู้เข้าร่วมการวิจัย จะมีวิธีป้องกันดังนี้ กล่าวคือ ผู้ป่วยที่มีภาวะเสี่ยงต่อการประคบเย็นจะถูกคัดออกจากการทดลอง หลังจากนั้นก่อนเริ่มประคบเย็น จะมีการทดสอบการตอบสนองของผิวหนังในตำแหน่งที่ต้องประคบด้วยความเย็นก่อน ระหว่างประคบเย็นก็จะมีการสำรวจผิวหนังในตำแหน่งนั้นซ้ำทุก 10 นาที โดยมีเหตุผลดังนี้ เพื่อรักษาระดับอุณหภูมิที่ต้องการจนครบ 2 ครั้ง(20นาที) และเพื่อเป็นการทดสอบการตอบสนองของผิวหนังที่ได้รับความเย็น และมีการสอบถามอาการปวดที่เพิ่มขึ้นหรืออาการชาหลังได้รับการประคบด้วยความเย็นและเพื่อป้องกันการเกิดภาวะผิวหนังขาดเลือดไปเลี้ยงในตำแหน่งที่ได้รับการประคบด้วยความเย็น(Frost bite) อีกทั้งยังเป็นการสำรวจความพึงพอใจของผู้ป่วยที่มีต่อการประคบเย็น หากเกิดเหตุฉุกเฉินหรือภาวะแทรกซ้อนระหว่างการทดลองหรือผู้ป่วยมีความไม่สุขสบาย นักวิจัยจะหยุดการทดลองทันทีและประเมินปัญหาอย่างทันทีเพื่อให้การช่วยเหลือต่อไปอย่างเหมาะสม

การเก็บข้อมูลเป็นความลับ

การรักษาความลับของท่านในแบบสอบถามจะไม่มีการระบุชื่อของท่าน ข้อมูลที่ท่านตอบจะถูกเก็บไว้สำหรับการวิจัยโดยเฉพาะและจะเปิดเผยต่อหน่วยงานหรือสาธารณชนในลักษณะที่เป็นภาพรวม และสรุปผลการวิจัยด้วยเหตุผลทางวิชาการ โดยไม่มีระบุรายละเอียดเกี่ยวกับตัวบุคคลแต่อย่างใด หากมีข้อมูลเพิ่มเติมทั้งทางด้านประโยชน์ และโทษที่เกี่ยวข้องกับการวิจัยนี้ ผู้วิจัยจะแจ้งให้ทราบโดยรวดเร็วไม่ปิดบัง

หากท่านอ่านเอกสารนี้แล้วยังมีข้อความที่ท่านไม่เข้าใจ โปรดสอบถามผู้วิจัยทันที เพื่อให้ช่วยอธิบายจนกว่าท่านจะเข้าใจดี หรือท่านอาจจะปรึกษาหารือกับญาติพี่น้อง เพื่อนสนิท แพทย์ประจำตัวของท่าน หรือแพทย์ท่านอื่น ก่อนการตัดสินใจเข้าร่วมหรือไม่เข้าร่วมการวิจัยได้

หากท่านมีข้อสงสัยประการใด โปรดสอบถามหรือติดต่อได้ที่ นางสาวผกามาศ แก้วนันทวัฒน์ คณะพยาบาลศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย โทร. 08-7068-4532

ถ้าท่านมีปัญหาข้องใจหรือรู้สึกกังวลใจกับการเข้าร่วมในโครงการวิจัยนี้ ท่านสามารถติดต่อกับประธานกรรมการจริยธรรมการวิจัยในคน สำนักงานวิจัยคณะฯ อาคารวิจัยและสวัสดิการ คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี โทรศัพท์ 02-2011544

หนังสือยินยอมโดยได้รับการบอกกล่าวและเต็มใจ

(Informed Consent Form)

ชื่อโครงการ โปรแกรมการจัดการความปวดร่วมกับการดูแลแบบผสมผสานต่อความปวดแบบเฉียบพลันและการตอบสนองทางสรีรวิทยาในผู้ป่วยผ่าตัดหัวใจ
ชื่อผู้วิจัย นาวสาว ผกามาศ แก้วนันทวัฒน์
*ชื่อผู้เข้าร่วมการวิจัย .....
อายุ .....เลขที่เวชระเบียน .....
.....

คำยินยอมของผู้เข้าร่วมการวิจัย

ข้าพเจ้า นาย/นาง/นางสาว ..... ได้ทราบรายละเอียดของโครงการวิจัยตลอดจนประโยชน์ และข้อเสี่ยงที่จะเกิดขึ้นต่อข้าพเจ้าจากผู้วิจัยแล้วอย่างชัดเจน ไม่มีสิ่งใดปิดบังซ่อนเร้นและยินยอมให้ทำการวิจัยในโครงการที่มีชื่อข้างต้น และข้าพเจ้ารู้ว่าถ้ามีปัญหาหรือข้อสงสัยเกิดขึ้นข้าพเจ้าสามารถสอบถามผู้วิจัยได้ และข้าพเจ้าสามารถไม่เข้าร่วมโครงการวิจัยนี้เมื่อใดก็ได้ โดยไม่มีผลกระทบต่อการรักษาที่ข้าพเจ้าพึงได้รับ นอกจากนี้ผู้วิจัยจะเก็บข้อมูลเฉพาะเกี่ยวกับตัวข้าพเจ้าเป็นความลับและจะเปิดเผยได้เฉพาะในรูปที่เป็นสรุปผลการวิจัย การเปิดเผยข้อมูลเกี่ยวกับตัวข้าพเจ้าต่อหน่วยงานต่างๆที่เกี่ยวข้อง กระทำได้เฉพาะกรณีจำเป็นด้วยเหตุผลทางวิชาการเท่านั้น

ลงชื่อ.....(ผู้เข้าร่วมการวิจัย)

.....(พยาน)

.....(พยาน)

วันที่ .....

คำอธิบายของแพทย์หรือผู้วิจัย

ข้าพเจ้าได้อธิบายรายละเอียดของโครงการ ตลอดจนประโยชน์ของการวิจัย รวมทั้งข้อเสี่ยงที่อาจจะเกิดขึ้นแก่ผู้เข้าร่วมการวิจัยทราบแล้วอย่างชัดเจนโดยไม่มีสิ่งใดปิดบังซ่อนเร้น

ลงชื่อ.....(แพทย์หรือผู้วิจัย)

วันที่.....

หมายเหตุ : กรณีผู้เข้าร่วมการวิจัยไม่สามารถอ่านหนังสือได้ ให้ผู้วิจัยอ่านข้อความในหนังสือยินยอมฯ นี้ให้แก่ผู้เข้าร่วมการวิจัยฟังจนเข้าใจดีแล้ว และให้ผู้เข้าร่วมการวิจัยลงนามหรือพิมพ์ลายนิ้วหัวแม่มือรับทราบในการให้ความยินยอมดังกล่าวข้างต้นไว้ด้วย

* ผู้เข้าร่วมการวิจัย หมายถึง ผู้ยินยอมตนให้ทำวิจัย

Appendix N
The Permission Document for Instrument

RE: Order Form for Department of Symptom Research Assessment Tools
symptomresearch

7/25/2014
Documents
To: 'Pakamas Keawnantawat' Cc: symptomresearch

1 attachment (100.7 KB)

BPI-SF-Thai_Current.pdf

Hello,

I have attached the BPI as you requested. Please note that:

• Your use of the BPI is limited only to the study specified. To use the BPI in additional studies, you must reapply online at www.mdanderson.org/departments/prg > Symptom Assessment Tools > The Brief Pain Inventory (BPI).
•
You are permitted to reproduce the copy of the BPI that is included with this e-mail. However, you must not remove the copyright notice.
•
The BPI may not be modified in any way or translated into another language without the express written consent of the copyright holder; Charles S. Cleeland, PhD. Failure to comply may result in legal action. Permission to alter or translate the instrument may be obtained by contacting me at symptomresearch@mdanderson.org or by mail.

Please let me know if you have any questions. Thank you for your interest in the BPI.

Regards,

Mary Samad
-----Original Message-----

From: Pakamas Keawnantawat [mailto:tik070@hotmail.com]
Sent: Monday, July 07, 2014 12:20 AM
To: symptomresearch
Subject: Order Form for Department of Symptom Research Assessment Tools

Order Form for Department of Symptom Research Symptom Assessment Tools
---
Assessment Tool: Brief Pain Inventory (BPI)

Psychometrically validated language(s): Thai

Linguistically validated language(s):

Purpose: Non-funded academic research

Study Type: Other

Detailed description:
A dissertation for Doctor of Philosophy Program in Nursing Science: An experimental study:
"EFFECT
OF PAIN MANAGEMENT COMBINED WITH COMPLEMENTARY CARE PROGRAM ON ACUTE
PAIN AND PHYSIOLOGICAL RESPONSES IN PATIENTS WITH CARDIAC SURGERY"

Study ID:

Disease Type: cardiac surgery patients

Mailing Address:

First Name: Pakamas
Last Name: Keawnantawat
Address: Faculty of nursing, Chulalongkorn university
City: Bangkok
State:
Country: Thailand
ZIP Code:
Telephone: +668 7068 4532
Fax:
E-mail: tik070@hotmail.com

Billing Address: Same as Mailing Address

Re: Asking for a permission of using The BPI
Cleeland,Charles (ccleeland@mdanderson.org)
6/5/2014

To: 'tik070@hotmail.com'

Please feel free to use

From: pakamas tik [mailto:tik070@hotmail.com]
Sent: Thursday, June 05, 2014 10:49 AM

To: symptomresearch; Cleeland,Charles
Subject: Asking for a permission of using The BPI

Dear Professor Dr. Charles S. Cleeland,

I trust you are doing well. Let me first introduce myself before engaging into my questions. My name is Miss Pakamas Keawnantawat and I'm a PhD candidate at the faculty of nursing at the Chulalongkorn university, Bangkok, Thailand. I'd kindly like to ask your permission to use the instrument "The Brief Pain Inventory (BPI)". Here is the information about my letters:

(1) My dissertation proposal is "Effects of pain management combined with complementary care program on acute pain and physiologic responses in patients with cardiac surgery". The target populations of my study are cardiac surgery patients during the first post-operative day until day 3.

(2) Since the original version of BPI was composed out of two domains : pain intensity (severity) as well the impact of pain on the functioning (interference). The pain intensity domain will be used in my study in the original version.

(3) However, since I'm getting interested in acute pain occurs immediately following cardiac surgery as stated. Thus, the activities measured in the interference scale from the origin version might not match with the stage of my population. For this reason, I'm going to use "A modified version of the Interference Subscale of the Brief Pain Inventory (BPI-I) that was generated by Dr. Judy Watt-Watson(2001) at Faculty of Nursing and Center for the Study of Pain, University of Toronto, Ont., Canada. Since she and her colleagues conducted study in cardiac surgery with the same period as mine and the activities of patients seem to be more appropriated. Those activities include: sleep, mood, walking, deep breathing & coughing, relation with others and general activities.
I will ask Professor Dr. Judy Watt-Watson her permission as well before using her written reports.

After I obtain your permission and Professor Dr. Judy Watt-Watson as well, the instrument with be translated into Thai and will be validated for the psychometric properties.

Looking forward to your brief and kind reply.

Sincerely,

Miss Pakamas Keawnantawat
PhD candidate at the faculty of nursing,
Chulalongkorn university, Bangkok, Thailand
Phone: +668 7068 4532
Email: tik070@hotmail.com

Re: Asking permission for A modified version of the BPI-I
Judy Watt-Watson (j.watt.watson@utoronto.ca)
Add to contacts

6/5/2014

Documents
To: pakamas tik
1 attachment (430.7 KB)

CMAJ 2014.DOI-10.1503cmaj.131012.pdf

Dear Pakamas
Please feel free to use the NRS I used regarding pain interference modified from the BPS-Short Form. Your research is very important as inadequate pain management in the immediate postop period can lead to a persistent pain problem. I am attaching our recent publication to support this.
Best wishes with your work.
Regards
Judy

_____
Judy Watt-Watson, RN MSc PhD
Professor Emeritus
Lawrence S. Bloomberg Faculty of Nursing
Senior Fellow, Massey College
University of Toronto
155 College St., Suite 130
Toronto, ON M5T 1P8
Tel: (416) 978-2850
Fax: (416) 978-8222
j.watt.watson@utoronto.ca
www.nursing.utoronto.ca
_____

On 2014-06-05, at 11:40 AM, pakamas tik wrote:

Dear Professor Dr. Judy Watt-Watson,

I trust you are doing well. Let me first introduce myself before engaging into my questions. My name is Miss Pakamas Keawnantawat and I'm a PhD candidate at the faculty of nursing at the Chulalongkorn university, Bangkok, Thailand. I'd kindly like to ask your permission to use the instrument "A modified version of the Interference sub scale of the Brief Pain Inventory (BPI-I)" that was modified from "The Brief Pain Inventory" (BPI) by you. Here is the information about my letters:

(1) My dissertation proposal is "Effects of pain management combined with complementary care program on acute pain and physiologic responses in patients with cardiac surgery". The target populations of my study are cardiac surgery patients during the first post-operative day until day 3.

(2) Since the original version of BPI was composed out of two domains : pain intensity (severity) as well the impact of pain on the functioning (interference). The pain intensity domain will be used in my study in the original version. I will ask Professor Dr. Charles Cleeland his permission as well before using his written reports.

However, since I'm getting interested in acute pain occurs immediately following cardiac surgery as stated. Thus, the activities measured in the interference scale from the origin version might not match with the stage of my population. For this reason, I'm going to use your instrument as article as I have read "Impact of preoperative education coronary artery bypass on pain outcomes after graft surgery". Since those activities include: sleep, mood, walking, deep breathing & coughing, relation with others and general activities it seems to be very appropriated to the stage of my target population.

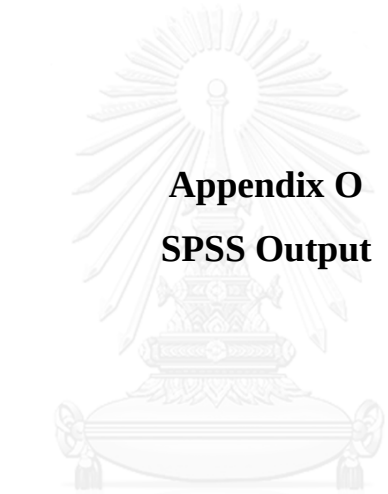
After I obtain your permission and Professor Charles Cleeland as well, the instrument with be translated into Thai and will be validated for the psychometric properties.

Looking forward to your brief and kind reply.

Sincerely,

Miss Pakamas Keawnantawat
PhD candidate at the faculty of nursing,
Chulalongkorn university, Bangkok, Thailand

Phone: +668 7068 4532
Email: tik070@hotmail.com



Appendix O
SPSS Output

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

Time	PAIN	Dependent Variable
1	1	int1
	2	inf1
2	1	int2
	2	inf2
3	1	int3
	2	inf3

Between-Subjects Factors

		Value Label	N
gr group	.00	con	35
	1.00	exp	35

Descriptive Statistics

	gr group	Mean	Std. Deviation	N
int1 IntensityDay1	.00 con	2.7929	1.74420	35
	1.00 exp	2.9429	1.33269	35
	Total	2.8679	1.54270	70
inf1 InterferenceDay1	.00 con	2.6476	1.53647	35
	1.00 exp	2.2095	1.30943	35
	Total	2.4286	1.43416	70
int2 IntensityDAy2	.00 con	3.5786	1.50828	35
	1.00 exp	1.9714	1.00691	35
	Total	2.7750	1.50852	70
inf2 InterferenceDay2	.00 con	2.8476	1.53466	35
	1.00 exp	1.4952	.95955	35
	Total	2.1714	1.44155	70
int3 IntensityDAy3	.00 con	3.5857	1.10137	35
	1.00 exp	1.0786	.64103	35
	Total	2.3321	1.54739	70
inf3 InterferenceDay3	.00 con	2.7952	1.39214	35
	1.00 exp	.9143	.59184	35
	Total	1.8548	1.42299	70

Box's Test of Equality of Covariance Matrices[a]

Box's M	100.156
F	4.318
df1	21
df2	17007.064
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + gr

Within Subjects Design: Time + PAIN + Time * PAIN

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Time	Pillai's Trace	.450	27.413[b]	2.000	67.000	.000	.450
	Wilks' Lambda	.550	27.413[b]	2.000	67.000	.000	.450
	Hotelling's Trace	.818	27.413[b]	2.000	67.000	.000	.450
	Roy's Largest Root	.818	27.413[b]	2.000	67.000	.000	.450
Time * gr	Pillai's Trace	.732	91.487[b]	2.000	67.000	.000	.732
	Wilks' Lambda	.268	91.487[b]	2.000	67.000	.000	.732
	Hotelling's Trace	2.731	91.487[b]	2.000	67.000	.000	.732
	Roy's Largest Root	2.731	91.487[b]	2.000	67.000	.000	.732
PAIN	Pillai's Trace	.191	16.092[b]	1.000	68.000	.000	.191
	Wilks' Lambda	.809	16.092[b]	1.000	68.000	.000	.191
	Hotelling's Trace	.237	16.092[b]	1.000	68.000	.000	.191
	Roy's Largest Root	.237	16.092[b]	1.000	68.000	.000	.191
PAIN * gr	Pillai's Trace	.002	.149[b]	1.000	68.000	.700	.002
	Wilks' Lambda	.998	.149[b]	1.000	68.000	.700	.002
	Hotelling's Trace	.002	.149[b]	1.000	68.000	.700	.002
	Roy's Largest Root	.002	.149[b]	1.000	68.000	.700	.002
Time * PAIN	Pillai's Trace	.076	2.764[b]	2.000	67.000	.070	.076
	Wilks' Lambda	.924	2.764[b]	2.000	67.000	.070	.076
	Hotelling's Trace	.083	2.764[b]	2.000	67.000	.070	.076
	Roy's Largest Root	.083	2.764[b]	2.000	67.000	.070	.076

Time * PAIN * gr	Pillai's Trace	.259	11.726[b]	2.000	67.000	.000	.259
	Wilks' Lambda	.741	11.726[b]	2.000	67.000	.000	.259
	Hotelling's Trace	.350	11.726[b]	2.000	67.000	.000	.259
	Roy's Largest Root	.350	11.726[b]	2.000	67.000	.000	.259

a. Design: Intercept + gr

Within Subjects Design: Time + PAIN + Time * PAIN

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.666	27.216	2	.000	.750	.774	.500
PAIN	1.000	.000	0	.	1.000	1.000	1.000
Time * PAIN	.664	27.431	2	.000	.749	.773	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + gr

Within Subjects Design: Time + PAIN + Time * PAIN

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	22.522	2	11.261	39.765	.000	.369
	Greenhouse-Geisser	22.522	1.499	15.020	39.765	.000	.369
	Huynh-Feldt	22.522	1.548	14.546	39.765	.000	.369
	Lower-bound	22.522	1.000	22.522	39.765	.000	.369
Time * gr	Sphericity Assumed	75.796	2	37.898	133.829	.000	.663
	Greenhouse-Geisser	75.796	1.499	50.550	133.829	.000	.663
	Huynh-Feldt	75.796	1.548	48.955	133.829	.000	.663

	Lower-bound	75.796	1.000	75.796	133.829	.000	.663
Error(Time)	Sphericity Assumed	38.513	136	.283			
	Greenhouse-Geisser	38.513	101.962	.378			
	Huynh-Feldt	38.513	105.283	.366			
	Lower-bound	38.513	68.000	.566			
PAIN	Sphericity Assumed	26.963	1	26.963	16.092	.000	.191
	Greenhouse-Geisser	26.963	1.000	26.963	16.092	.000	.191
	Huynh-Feldt	26.963	1.000	26.963	16.092	.000	.191
	Lower-bound	26.963	1.000	26.963	16.092	.000	.191
PAIN * gr	Sphericity Assumed	.250	1	.250	.149	.700	.002
	Greenhouse-Geisser	.250	1.000	.250	.149	.700	.002
	Huynh-Feldt	.250	1.000	.250	.149	.700	.002
	Lower-bound	.250	1.000	.250	.149	.700	.002
Error(INT)	Sphericity Assumed	113.938	68	1.676			
	Greenhouse-Geisser	113.938	68.000	1.676			
	Huynh-Feldt	113.938	68.000	1.676			
	Lower-bound	113.938	68.000	1.676			
Time * PAIN	Sphericity Assumed	.518	2	.259	1.207	.302	.017
	Greenhouse-Geisser	.518	1.497	.346	1.207	.293	.017
	Huynh-Feldt	.518	1.546	.335	1.207	.295	.017
	Lower-bound	.518	1.000	.518	1.207	.276	.017
Time * PAIN * gr	Sphericity Assumed	6.775	2	3.388	15.805	.000	.189
	Greenhouse-Geisser	6.775	1.497	4.526	15.805	.000	.189
	Huynh-Feldt	6.775	1.546	4.383	15.805	.000	.189
	Lower-bound	6.775	1.000	6.775	15.805	.000	.189
Error(Time*PAIN)	Sphericity Assumed	29.150	136	.214			
	Greenhouse-Geisser	29.150	101.799	.286			
	Huynh-Feldt	29.150	105.107	.277			
	Lower-bound	29.150	68.000	.429			

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
int1 IntensityDay1	3.732	1	68	.058
inf1 InterferenceDay1	.476	1	68	.493
int2 IntensityDAy2	5.552	1	68	.021
inf2 InterferenceDay2	4.527	1	68	.037
int3 IntensityDAy3	7.765	1	68	.007
inf3 InterferenceDay3	9.769	1	68	.003

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + gr

Within Subjects Design: Time + PAIN + Time * PAIN

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	1214.605	1	1214.605	346.303	.000	.836
gr	85.027	1	85.027	24.243	.000	.263
Error	238.499	68	3.507			

Estimated Marginal Means

group * Time * PAIN

Measure: MEASURE_1

group	Time	PAIN	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
.00 con	1	1	2.793	.262	2.269	3.316
		2	2.648	.241	2.166	3.129
	2	1	3.579	.217	3.146	4.011
		2	2.848	.216	2.416	3.279
	3	1	3.586	.152	3.282	3.890
		2	2.795	.181	2.434	3.156
1.00 exp	1	1	2.943	.262	2.419	3.466
		2	2.210	.241	1.728	2.691
	2	1	1.971	.217	1.539	2.404

		2	1.495	.216	1.064	1.927
	3	1	1.079	.152	.775	1.383
		2	.914	.181	.553	1.275

Time * PAIN * group

Estimates

Measure: MEASURE_1

Time	PAIN	group	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
1	1	.00 con	2.793	.262	2.269	3.316
		1.00 exp	2.943	.262	2.419	3.466
	2	.00 con	2.648	.241	2.166	3.129
		1.00 exp	2.210	.241	1.728	2.691
2	1	.00 con	3.579	.217	3.146	4.011
		1.00 exp	1.971	.217	1.539	2.404
	2	.00 con	2.848	.216	2.416	3.279
		1.00 exp	1.495	.216	1.064	1.927
3	1	.00 con	3.586	.152	3.282	3.890
		1.00 exp	1.079	.152	.775	1.383
	2	.00 con	2.795	.181	2.434	3.156
		1.00 exp	.914	.181	.553	1.275

Pairwise Comparisons

Measure: MEASURE_1

Time	PAIN	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
							Lower Bound	Upper Bound
1	1	.00 con	1.00 exp	-.150	.371	.687	-.890	.590
		1.00 exp	.00 con	.150	.371	.687	-.590	.890
	2	.00 con	1.00 exp	.438	.341	.204	-.243	1.119
		1.00 exp	.00 con	-.438	.341	.204	-1.119	.243
2	1	.00 con	1.00 exp	1.607*	.307	.000	.995	2.219

	1.00 exp	.00 con	-1.607*	.307	.000	-2.219	-.995
	.00 con	1.00 exp	1.352*	.306	.000	.742	1.963
2	1.00 exp	.00 con	-1.352*	.306	.000	-1.963	-.742
	.00 con	1.00 exp	2.507*	.215	.000	2.077	2.937
1	1.00 exp	.00 con	-2.507*	.215	.000	-2.937	-2.077
3	.00 con	1.00 exp	1.881*	.256	.000	1.371	2.391
2	1.00 exp	.00 con	-1.881*	.256	.000	-2.391	-1.371

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Time * PAIN * group

Estimates

Measure: MEASURE_1

Time	PAIN	group	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
1	1	.00 con	2.793	.262	2.269	3.316
		1.00 exp	2.943	.262	2.419	3.466
	2	.00 con	2.648	.241	2.166	3.129
		1.00 exp	2.210	.241	1.728	2.691
2	1	.00 con	3.579	.217	3.146	4.011
		1.00 exp	1.971	.217	1.539	2.404
	2	.00 con	2.848	.216	2.416	3.279
		1.00 exp	1.495	.216	1.064	1.927
3	1	.00 con	3.586	.152	3.282	3.890
		1.00 exp	1.079	.152	.775	1.383
	2	.00 con	2.795	.181	2.434	3.156
		1.00 exp	.914	.181	.553	1.275

Pairwise Comparisons

Measure: MEASURE_1

Time	group	(I) INT	(J) INT	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
							Lower Bound	Upper Bound
1	.00 con	1	2	.145	.234	.538	-.323	.613
		2	1	-.145	.234	.538	-.613	.323
	1.00 exp	1	2	.733*	.234	.003	.265	1.201
		2	1	-.733*	.234	.003	-1.201	-.265
2	.00 con	1	2	.731*	.208	.001	.316	1.146
		2	1	-.731*	.208	.001	-1.146	-.316
	1.00 exp	1	2	.476*	.208	.025	.061	.891
		2	1	-.476*	.208	.025	-.891	-.061
3	.00 con	1	2	.790*	.148	.000	.494	1.087
		2	1	-.790*	.148	.000	-1.087	-.494
	1.00 exp	1	2	.164	.148	.272	-.132	.461
		2	1	-.164	.148	.272	-.461	.132

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

Time	group		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	.00 con	Pillai's trace	.006	.384[a]	1.000	68.000	.538	.006
		Wilks' lambda	.994	.384[a]	1.000	68.000	.538	.006
		Hotelling's trace	.006	.384[a]	1.000	68.000	.538	.006
		Roy's largest root	.006	.384[a]	1.000	68.000	.538	.006
	1.00 exp	Pillai's trace	.126	9.784[a]	1.000	68.000	.003	.126
		Wilks' lambda	.874	9.784[a]	1.000	68.000	.003	.126
		Hotelling's trace	.144	9.784[a]	1.000	68.000	.003	.126

		Roy's largest root	.144	9.784[a]	1.000	68.000	.003	.126
	.00 con	Pillai's trace	.154	12.361[a]	1.000	68.000	.001	.154
		Wilks' lambda	.846	12.361[a]	1.000	68.000	.001	.154
		Hotelling's trace	.182	12.361[a]	1.000	68.000	.001	.154
		Roy's largest root	.182	12.361[a]	1.000	68.000	.001	.154
2		Pillai's trace	.072	5.246[a]	1.000	68.000	.025	.072
	1.00 exp	Wilks' lambda	.928	5.246[a]	1.000	68.000	.025	.072
		Hotelling's trace	.077	5.246[a]	1.000	68.000	.025	.072
		Roy's largest root	.077	5.246[a]	1.000	68.000	.025	.072
		Pillai's trace	.294	28.335[a]	1.000	68.000	.000	.294
	.00 con	Wilks' lambda	.706	28.335[a]	1.000	68.000	.000	.294
		Hotelling's trace	.417	28.335[a]	1.000	68.000	.000	.294
		Roy's largest root	.417	28.335[a]	1.000	68.000	.000	.294
3		Pillai's trace	.018	1.224[a]	1.000	68.000	.272	.018
	1.00 exp	Wilks' lambda	.982	1.224[a]	1.000	68.000	.272	.018
		Hotelling's trace	.018	1.224[a]	1.000	68.000	.272	.018
		Roy's largest root	.018	1.224[a]	1.000	68.000	.272	.018

Each F tests the multivariate simple effects of INT within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Time * PAIN * group

Estimates

Measure: MEASURE_1

Time	PAIN	group	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
1	1	.00 con	2.793	.262	2.269	3.316
		1.00 exp	2.943	.262	2.419	3.466
	2	.00 con	2.648	.241	2.166	3.129
		1.00 exp	2.210	.241	1.728	2.691
2	1	.00 con	3.579	.217	3.146	4.011
		1.00 exp	1.971	.217	1.539	2.404

3	2	.00 con	2.848	.216	2.416	3.279
		1.00 exp	1.495	.216	1.064	1.927
	1	.00 con	3.586	.152	3.282	3.890
		1.00 exp	1.079	.152	.775	1.383
	2	.00 con	2.795	.181	2.434	3.156
		1.00 exp	.914	.181	.553	1.275

Pairwise Comparisons

Measure: MEASURE_1

PAIN	group	(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
							Lower Bound	Upper Bound
1	.00 con	1	2	-.786*	.119	.000	-1.077	-.495
			3	-.793*	.181	.000	-1.237	-.349
		2	1	.786*	.119	.000	.495	1.077
			3	-.007	.130	1.000	-.327	.312
		3	1	.793*	.181	.000	.349	1.237
			2	.007	.130	1.000	-.312	.327
	1.00 exp	1	2	.971*	.119	.000	.680	1.263
			3	1.864*	.181	.000	1.420	2.308
		2	1	-.971*	.119	.000	-1.263	-.680
			3	.893*	.130	.000	.573	1.212
		3	1	-1.864*	.181	.000	-2.308	-1.420
			2	-.893*	.130	.000	-1.212	-.573
2	.00 con	1	2	-.200*	.073	.024	-.380	-.020
			3	-.148	.110	.554	-.418	.123
		2	1	.200*	.073	.024	.020	.380
			3	.052	.064	1.000	-.104	.208
		3	1	.148	.110	.554	-.123	.418
			2	-.052	.064	1.000	-.208	.104
	1.00 exp	1	2	.714*	.073	.000	.534	.894
			3	1.295*	.110	.000	1.025	1.566
		2	1	-.714*	.073	.000	-.894	-.534
			3	.581*	.064	.000	.425	.737
		3	1	-1.295*	.110	.000	-1.566	-1.025

	2	-.581*	.064	.000	-.737	-.425

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

PAIN	group		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
1	.00 con	Pillai's trace	.393	21.661[a]	2.000	67.000	.000	.393
		Wilks' lambda	.607	21.661[a]	2.000	67.000	.000	.393
		Hotelling's trace	.647	21.661[a]	2.000	67.000	.000	.393
		Roy's largest root	.647	21.661[a]	2.000	67.000	.000	.393
	1.00 exp	Pillai's trace	.614	53.342[a]	2.000	67.000	.000	.614
		Wilks' lambda	.386	53.342[a]	2.000	67.000	.000	.614
		Hotelling's trace	1.592	53.342[a]	2.000	67.000	.000	.614
		Roy's largest root	1.592	53.342[a]	2.000	67.000	.000	.614
2	.00 con	Pillai's trace	.132	5.074[a]	2.000	67.000	.009	.132
		Wilks' lambda	.868	5.074[a]	2.000	67.000	.009	.132
		Hotelling's trace	.151	5.074[a]	2.000	67.000	.009	.132
		Roy's largest root	.151	5.074[a]	2.000	67.000	.009	.132
	1.00 exp	Pillai's trace	.670	68.115[a]	2.000	67.000	.000	.670
		Wilks' lambda	.330	68.115[a]	2.000	67.000	.000	.670
		Hotelling's trace	2.033	68.115[a]	2.000	67.000	.000	.670
		Roy's largest root	2.033	68.115[a]	2.000	67.000	.000	.670

Each F tests the multivariate simple effects of Time within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

time	Dependent Variable
1	HR1_1
2	HR1_2
3	HR1_3
4	HR1_4
5	HR2_1
6	HR2_2
7	HR2_3
8	HR2_4
9	HR3_1
10	HR3_2
11	HR3_3
12	HR3_4

Between-Subjects Factors

		Value Label	N
group	0	con	35
	1	exp	35

Descriptive Statistics

	group	Mean	Std. Deviation	N
Heart rate D1_1	con	75.89	16.756	35
	exp	80.74	17.336	35
	Total	78.31	17.100	70
Heart rate D1_2	con	74.94	17.177	35
	exp	81.60	16.910	35
	Total	78.27	17.249	70
Heart rate D1_3	con	75.83	17.404	35
	exp	81.83	17.942	35
	Total	78.83	17.805	70
Heart rate D1_4	con	75.37	15.812	35
	exp	81.49	16.054	35
	Total	78.43	16.114	70
Heart rate D2_1	con	85.34	14.167	35
	exp	79.29	14.162	35
	Total	82.31	14.389	70

	con	83.34	12.400	35
Heart rate D2_2	exp	79.60	12.978	35
	Total	81.47	12.740	70
	con	84.40	13.889	35
Heart rate D2_3	exp	80.00	12.410	35
	Total	82.20	13.261	70
	con	83.54	12.505	35
Heart rate D2_4	exp	78.91	13.511	35
	Total	81.23	13.132	70
	con	85.74	10.771	35
Heart rate D3_1	exp	78.37	12.675	35
	Total	82.06	12.252	70
	con	85.03	11.977	35
Heart rate D3_2	exp	78.26	12.267	35
	Total	81.64	12.509	70
	con	87.40	9.481	35
Heart rate D3_3	exp	78.57	11.356	35
	Total	82.99	11.296	70
	con	88.37	8.243	35
Heart rate D3_4	exp	77.94	11.352	35
	Total	83.16	11.161	70

Box's Test of Equality of Covariance Matrices[a]

Box's M	209.501
F	2.181
df1	78
df2	14601.821
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + gr
Within Subjects Design: time

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.267	1.918[b]	11.000	58.000	.055
	Wilks' Lambda	.733	1.918[b]	11.000	58.000	.055
	Hotelling's Trace	.364	1.918[b]	11.000	58.000	.055
	Roy's Largest Root	.364	1.918[b]	11.000	58.000	.055
time * gr	Pillai's Trace	.404	3.578[b]	11.000	58.000	.001
	Wilks' Lambda	.596	3.578[b]	11.000	58.000	.001
	Hotelling's Trace	.679	3.578[b]	11.000	58.000	.001
	Roy's Largest Root	.679	3.578[b]	11.000	58.000	.001

a. Design: Intercept + gr

Within Subjects Design: time

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time	.000	847.366	65	.000	.206	.216	.091

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + gr

Within Subjects Design: time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	2761.756	11	251.069	2.695	.002

time * gr	Greenhouse-Geisser	2761.756	2.262	1221.197	2.695	.064
	Huynh-Feldt	2761.756	2.378	1161.527	2.695	.061
	Lower-bound	2761.756	1.000	2761.756	2.695	.105
Error(time)	Sphericity Assumed	7901.270	11	718.297	7.711	.000
	Greenhouse-Geisser	7901.270	2.262	3493.795	7.711	.000
	Huynh-Feldt	7901.270	2.378	3323.080	7.711	.000
	Lower-bound	7901.270	1.000	7901.270	7.711	.007
	Sphericity Assumed	69679.390	748	93.154		
	Greenhouse-Geisser	69679.390	153.783	453.102		
	Huynh-Feldt	69679.390	161.683	430.962		
	Lower-bound	69679.390	68.000	1024.697		

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Heart rate D1_1	.286	1	68	.595
Heart rate D1_2	1.186	1	68	.280
Heart rate D1_3	1.082	1	68	.302
Heart rate D1_4	.313	1	68	.578
Heart rate D2_1	.031	1	68	.861
Heart rate D2_2	.000	1	68	.988
Heart rate D2_3	1.306	1	68	.257
Heart rate D2_4	.097	1	68	.756
Heart rate D3_1	1.237	1	68	.270
Heart rate D3_2	.008	1	68	.929
Heart rate D3_3	1.829	1	68	.181
Heart rate D3_4	8.438	1	68	.005

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + gr

Within Subjects Design: time

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	5498773.058	1	5498773.058	4164.129	.000
gr	1192.858	1	1192.858	.903	.345
Error	89794.667	68	1320.510		

General Linear Model

Within-Subjects Factors

Measure: SBP

time	Dependent Variable
1	SBP1_1
2	SBP1_2
3	SBP1_3
4	SBP1_4
5	SBP2_1
6	SBP2_2
7	SBP2_3
8	SBP2_4
9	SBP3_1
10	SBP3_2
11	SBP3_3
12	SBP3_4

Between-Subjects Factors

		Value Label	N
group	0	con	35
	1	exp	35

Descriptive Statistics

	group	Mean	Std. Deviation	N
Systolic BP D1_1	con	114.49	16.921	35
	exp	117.06	10.412	35
	Total	115.77	14.006	70
Systolic BP D1_2	con	119.37	12.619	35

	exp	117.66	10.876	35
	Total	118.51	11.726	70
	con	121.23	14.328	35
Systolic BP D1_3	exp	119.54	12.726	35
	Total	120.39	13.479	70
	con	123.29	16.669	35
Systolic BP D1_4	exp	118.97	11.541	35
	Total	121.13	14.397	70
	con	123.83	14.816	35
Systolic BP D2_1	exp	121.06	11.143	35
	Total	122.44	13.088	70
	con	126.91	13.583	35
Systolic BP D2_2	exp	122.97	10.929	35
	Total	124.94	12.398	70
	con	129.37	14.219	35
Systolic BP D2_3	exp	122.37	9.428	35
	Total	125.87	12.484	70
	con	131.00	13.827	35
Systolic BP D2_4	exp	123.83	10.168	35
	Total	127.41	12.577	70
	con	122.91	14.736	35
Systolic BP D3_1	exp	119.26	9.259	35
	Total	121.09	12.354	70
	con	125.69	14.254	35
Systolic BP D3_2	exp	120.29	8.344	35
	Total	122.99	11.908	70
	con	129.40	14.057	35
Systolic BP D3_3	exp	122.46	9.382	35
	Total	125.93	12.368	70
	con	129.09	14.827	35
Systolic BP D3_4	exp	120.34	8.761	35
	Total	124.71	12.866	70

Box's Test of Equality of Covariance Matrices[a]

Box's M	178.615
F	1.859
df1	78
df2	14601.821
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + gr
Within Subjects Design: time

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.618	8.548[b]	11.000	58.000	.000
	Wilks' Lambda	.382	8.548[b]	11.000	58.000	.000
	Hotelling's Trace	1.621	8.548[b]	11.000	58.000	.000
	Roy's Largest Root	1.621	8.548[b]	11.000	58.000	.000
time * gr	Pillai's Trace	.334	2.649[b]	11.000	58.000	.008
	Wilks' Lambda	.666	2.649[b]	11.000	58.000	.008
	Hotelling's Trace	.502	2.649[b]	11.000	58.000	.008
	Roy's Largest Root	.502	2.649[b]	11.000	58.000	.008

a. Design: Intercept + gr
Within Subjects Design: time

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: SBP

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time	.000	637.846	65	.000	.294	.314	.091

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + gr
Within Subjects Design: time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: SBP

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	8944.270	11	813.115	9.391	.000
	Greenhouse-Geisser	8944.270	3.229	2770.171	9.391	.000
	Huynh-Feldt	8944.270	3.459	2586.133	9.391	.000
	Lower-bound	8944.270	1.000	8944.270	9.391	.003
time * gr	Sphericity Assumed	1872.956	11	170.269	1.967	.029
	Greenhouse-Geisser	1872.956	3.229	580.082	1.967	.115
	Huynh-Feldt	1872.956	3.459	541.544	1.967	.110
	Lower-bound	1872.956	1.000	1872.956	1.967	.165
Error(time)	Sphericity Assumed	64763.857	748	86.583		
	Greenhouse-Geisser	64763.857	219.557	294.975		
	Huynh-Feldt	64763.857	235.181	275.378		
	Lower-bound	64763.857	68.000	952.410		

Tests of Within-Subjects Contrasts

Measure: SBP

Source	time	Type III Sum of Squares	Mean Square	F	Sig.
time	Linear	4842.798	4842.798	15.078	.000
	Quadratic	1833.011	1833.011	9.686	.003
	Cubic	190.572	190.572	2.738	.103
	Order 4	274.209	274.209	2.161	.146
	Order 5	12.814	12.814	.512	.477
	Order 6	733.101	733.101	13.038	.001
	Order 7	529.267	529.267	11.400	.001
	Order 8	.395	.395	.022	.881

	Order 9	114.662	114.662	4.322	.041
	Order 10	248.562	248.562	4.498	.038
	Order 11	164.880	164.880	8.925	.004
	Linear	1355.462	1355.462	4.220	.044
	Quadratic	86.676	86.676	.458	.501
	Cubic	124.161	124.161	1.784	.186
	Order 4	7.395	7.395	.058	.810
	Order 5	59.722	59.722	2.384	.127
time * gr	Order 6	40.841	40.841	.726	.397
	Order 7	47.549	47.549	1.024	.315
	Order 8	2.954	2.954	.168	.683
	Order 9	145.774	145.774	5.494	.022
	Order 10	.097	.097	.002	.967
	Order 11	2.325	2.325	.126	.724
	Linear	21840.997	321.191		
	Quadratic	12868.232	189.239		
	Cubic	4732.938	69.602		
	Order 4	8626.811	126.865		
	Order 5	1703.230	25.048		
Error(time)	Order 6	3823.578	56.229		
	Order 7	3156.967	46.426		
	Order 8	1192.742	17.540		
	Order 9	1804.132	26.531		
	Order 10	3757.980	55.264		
	Order 11	1256.250	18.474		

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Systolic BP D1_1	2.549	1	68	.115
Systolic BP D1_2	1.351	1	68	.249
Systolic BP D1_3	.810	1	68	.371
Systolic BP D1_4	4.771	1	68	.032
Systolic BP D2_1	5.460	1	68	.022
Systolic BP D2_2	3.998	1	68	.050
Systolic BP D2_3	8.651	1	68	.004
Systolic BP D2_4	3.891	1	68	.053
Systolic BP D3_1	16.956	1	68	.000
Systolic BP D3_2	16.627	1	68	.000
Systolic BP D3_3	9.282	1	68	.003
Systolic BP D3_4	15.010	1	68	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + gr

Within Subjects Design: time

Tests of Between-Subjects Effects

Measure: SBP

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	12625593.201	1	12625593.201	13037.123	.000
gr	3759.201	1	3759.201	3.882	.053
Error	65853.514	68	968.434		

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

time	Dependent Variable
1	DBP1_1
2	DBP1_2
3	DBP1_3

4	DBP1_4
5	DBP2_1
6	DBP2_2
7	DBP2_3
8	DBP2_4
9	DBP3_1
10	DBP3_2
11	DBP3_3
12	DBP3_4

Between-Subjects Factors

		Value Label	N
group	0	con	35
	1	exp	35

Descriptive Statistics

	group	Mean	Std. Deviation	N
Dysatolic BP D1_1	con	64.91	10.469	35
	exp	67.23	11.601	35
	Total	66.07	11.031	70
Dysatolic BP D1_2	con	65.03	11.483	35
	exp	66.80	12.041	35
	Total	65.91	11.714	70
Dysatolic BP D1_3	con	66.26	9.182	35
	exp	68.11	12.499	35
	Total	67.19	10.927	70
Dysatolic BP D1_4	con	67.43	10.866	35
	exp	68.00	10.499	35
	Total	67.71	10.611	70
Dysatolic BP D2_1	con	66.77	9.201	35
	exp	64.09	10.402	35
	Total	65.43	9.842	70
Dysatolic BP D2_2	con	67.23	9.668	35
	exp	64.29	10.220	35
	Total	65.76	9.986	70
Dysatolic BP D2_3	con	68.14	8.681	35
	exp	64.46	10.826	35
	Total	66.30	9.916	70
Dysatolic BP D2_4	con	69.80	8.973	35

	exp	64.83	11.564	35
	Total	67.31	10.576	70
	con	71.37	10.279	35
Dysatolic BP D3_1	exp	64.29	10.913	35
	Total	67.83	11.112	70
	con	69.83	10.208	35
Dysatolic BP D3_2	exp	64.17	11.843	35
	Total	67.00	11.339	70
	con	72.37	8.599	35
Dysatolic BP D3_3	exp	64.69	11.834	35
	Total	68.53	10.974	70
	con	73.23	8.524	35
Dysatolic BP D3_4	exp	63.74	12.606	35
	Total	68.49	11.701	70

Box's Test of Equality of Covariance Matrices[a]

Box's M	128.659
F	1.339
df1	78
df2	14601.821
Sig.	.025

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + gr

Within Subjects Design: time

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
time	Pillai's Trace	.268	1.932[b]	11.000	58.000	.054
	Wilks' Lambda	.732	1.932[b]	11.000	58.000	.054
	Hotelling's Trace	.366	1.932[b]	11.000	58.000	.054
	Roy's Largest Root	.366	1.932[b]	11.000	58.000	.054
time * gr	Pillai's Trace	.263	1.884[b]	11.000	58.000	.060
	Wilks' Lambda	.737	1.884[b]	11.000	58.000	.060
	Hotelling's Trace	.357	1.884[b]	11.000	58.000	.060
	Roy's Largest Root	.357	1.884[b]	11.000	58.000	.060

a. Design: Intercept + gr

Within Subjects Design: time

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time	.000	712.644	65	.000	.271	.289	.091

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + gr

Within Subjects Design: time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	868.032	11	78.912	1.274	.235
	Greenhouse-Geisser	868.032	2.986	290.711	1.274	.284
	Huynh-Feldt	868.032	3.184	272.614	1.274	.284
	Lower-bound	868.032	1.000	868.032	1.274	.263
time * gr	Sphericity Assumed	3138.642	11	285.331	4.607	.000
	Greenhouse-Geisser	3138.642	2.986	1051.158	4.607	.004
	Huynh-Feldt	3138.642	3.184	985.719	4.607	.003
	Lower-bound	3138.642	1.000	3138.642	4.607	.035
Error(time)	Sphericity Assumed	46322.243	748	61.928		
	Greenhouse-Geisser	46322.243	203.040	228.143		
	Huynh-Feldt	46322.243	216.520	213.940		
	Lower-bound	46322.243	68.000	681.209		

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Dysatolic BP D1_1	.302	1	68	.584
Dysatolic BP D1_2	.107	1	68	.745
Dysatolic BP D1_3	4.037	1	68	.048

Dysatolic BP D1_4	.000	1	68	.991
Dysatolic BP D2_1	1.249	1	68	.268
Dysatolic BP D2_2	.324	1	68	.571
Dysatolic BP D2_3	1.014	1	68	.317
Dysatolic BP D2_4	2.629	1	68	.110
Dysatolic BP D3_1	.087	1	68	.768
Dysatolic BP D3_2	1.250	1	68	.268
Dysatolic BP D3_3	4.392	1	68	.040
Dysatolic BP D3_4	5.615	1	68	.021

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + gr

Within Subjects Design: time

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3766339.296	1	3766339.296	5622.186	.000
gr	2071.144	1	2071.144	3.092	.083
Error	45553.643	68	669.907		

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

Res	Dependent Variable
1	RR1_1
2	RR1_2
3	RR1_3
4	RR1_4
5	RR2_1
6	RR2_2
7	RR2_3
8	RR2_4
9	RR3_1
10	RR3_2
11	RR3_3
12	RR3_4

Between-Subjects Factors

		Value Label	N
gr group	0	con	35
	1	exp	35

Descriptive Statistics

	gr group	Mean	Std. Deviation	N
RR1_1 Respatatory rate D1_1	0 con	21.94	3.096	35
	1 exp	21.94	2.543	35
	Total	21.94	2.812	70
RR1_2 Respatatory rate D1_2	0 con	23.40	3.031	35
	1 exp	21.69	3.261	35
	Total	22.54	3.242	70
RR1_3 Respatatory rate D1_3	0 con	22.40	3.533	35
	1 exp	21.80	2.929	35
	Total	22.10	3.235	70
RR1_4 Respatatory rate D1_4	0 con	22.26	3.484	35
	1 exp	22.51	2.628	35
	Total	22.39	3.066	70
RR2_1 Respatatory rate D2_1	0 con	21.37	2.602	35
	1 exp	21.89	2.518	35
	Total	21.63	2.555	70
RR2_2 Respatatory rate D2_2	0 con	22.26	3.100	35
	1 exp	21.91	3.203	35
	Total	22.09	3.133	70
RR2_3 Respatatory rate D2_3	0 con	22.43	3.567	35
	1 exp	21.77	3.742	35
	Total	22.10	3.644	70
RR2_4 Respatatory rate D2_4	0 con	22.40	3.525	35
	1 exp	22.17	2.673	35
	Total	22.29	3.107	70
RR3_1 Respatatory rate D3_1	0 con	22.94	2.711	35
	1 exp	21.57	3.061	35
	Total	22.26	2.952	70
RR3_2 Respatatory rate D3_2	0 con	23.26	2.954	35
	1 exp	21.80	3.197	35
	Total	22.53	3.143	70
RR3_3 Respatatory rate D3_3	0 con	23.03	3.706	35

	1 exp	22.23	3.209	35
	Total	22.63	3.465	70
	0 con	22.54	3.951	35
RR3_4 Respatatory rate D3_4	1 exp	21.43	2.682	35
	Total	21.99	3.399	70

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Res	Pillai's Trace	.151	.938[b]	11.000	58.000	.511	.151
	Wilks' Lambda	.849	.938[b]	11.000	58.000	.511	.151
	Hotelling's Trace	.178	.938[b]	11.000	58.000	.511	.151
	Roy's Largest Root	.178	.938[b]	11.000	58.000	.511	.151
Res * gr	Pillai's Trace	.138	.844[b]	11.000	58.000	.598	.138
	Wilks' Lambda	.862	.844[b]	11.000	58.000	.598	.138
	Hotelling's Trace	.160	.844[b]	11.000	58.000	.598	.138
	Roy's Largest Root	.160	.844[b]	11.000	58.000	.598	.138

a. Design: Intercept + gr

Within Subjects Design: Res

b. Exact statistic

Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Res	.341	69.070	65	.345	.856	1.000	.091

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + gr

Within Subjects Design: Res

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Res	Sphericity Assumed	64.785	11	5.890	.695	.744	.010
	Greenhouse-Geisser	64.785	9.418	6.879	.695	.721	.010
	Huynh-Feldt	64.785	11.000	5.890	.695	.744	.010
	Lower-bound	64.785	1.000	64.785	.695	.407	.010
Res * gr	Sphericity Assumed	94.699	11	8.609	1.016	.430	.015
	Greenhouse-Geisser	94.699	9.418	10.056	1.016	.427	.015
	Huynh-Feldt	94.699	11.000	8.609	1.016	.430	.015
	Lower-bound	94.699	1.000	94.699	1.016	.317	.015
Error(Res)	Sphericity Assumed	6337.933	748	8.473			
	Greenhouse-Geisser	6337.933	640.393	9.897			
	Huynh-Feldt	6337.933	748.000	8.473			
	Lower-bound	6337.933	68.000	93.205			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	414207.630	1	414207.630	16135.406	.000	.996
gr	82.344	1	82.344	3.208	.078	.045
Error	1745.610	68	25.671			

VITA

Miss Pakamas Keawnantawat was born at January 20, 1981, Bangkok Metropolitan. She received a Bachelor of Nursing Science from Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand in 2003. She was a staff nurse at Cardio-Vascular-Thoracic Intensive Care Unit, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand Since 2003–2010. She has received the scholarship from Faculty of Medicine Ramathibodi Hospital to study a doctoral program in nursing science at Faculty of Nursing, Chulalongkorn University from 2011 until present.