EFFECTIVENESS OF A PAIN MANAGEMENT PROGRAMME FOR CHINESE ADULTS UNDERGOING A MAJOR THORACOTOMY OPERATION

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Effectiveness of a pain management programme for Chinese adults undergoing a major thoracotomy operation

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CERTIFICATION OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to my best knowledge and belief, it reproduces no materials previously published, written, nor material that accepted for the award of any other degree or diploma, except where due acknowledgement has been made in this text.

_____ (Signed)

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February15, 2012

Abstract of thesis entitled, " Effectiveness of a pain management programme for Chinese adults undergoing a major thoracotomy operation", submitted by Hai-Hui Yin for the degree of Master of Philosophy at the Hong Kong Polytechnic University in February 2012.

Background: A major thoracotomy operation can cause patients to experience an extremely distressing amount of pain. Unrelieved acute post-thoracotomy pain greatly increases the risks of postoperative complications and compromises the quality of life of patients in the long run. There are reports in the literature about the effectiveness of nurse-led pain education interventions in the management of postoperative pain. Educating patients does not, in itself, seem an adequate way to resolve the various conflicting issues related to increasing knowledge and actual behaviors in pain management or to relieve patients from pain suffering in clinical practice.

Aim: The purpose of the study was to investigate the effectiveness of a pain management programme on the postoperative experience of pain, barriers to pain management, pain management behaviours, and clinical outcomes related to a major thoracotomy operation for Chinese adult patients.

Method: A randomized controlled trial with a single-blinded design was adopted for the present study and conducted in a tertiary general hospital in mainland China. A total of 108 patients who were scheduled to undergo a major thoracotomy were recruited and 94 participants (N=94) completed the study (48 participants in the experimental group, and 46 participants in the comparison group). Preoperative pain education was provided to

both groups, while the postoperative pain round was performed only for the experimental group from postoperative day 1 until the patient was discharged.

Pain intensity and the interference of pain with daily activities were measured by the Brief Pain Inventory-Chinese version (BPI-C). The concerns of patients about reporting pain and taking analgesics were assessed using the Barrier Questionnaire Taiwan Form-Surgical version (BQT-S). Pain management behaviors (using drug and non-drug methods to relieve pain) were documented by a log-record. Objective clinical outcomes (including the length of hospital stay, and the postoperative recovery from thoracic surgery as the first day to initiate ambulation, length of chest tube insitu, and the occurrence of postoperative complications) were collected from the patients' medical records. Data collection was conducted before preoperative pain education and throughout the entire period of postoperative hospitalization.

Results: The experimental group reported significant lower scores on pain severity and the interference of pain with activities than did the comparison group from postoperative day 1 till day7 ($p < 0.05$). The experimental group's scores on the total BQT-S and the subscales of BQT-S were lower than those of the comparison group ($p < 0.05$), except for the subscales of "fear of injections" and "fatalism" ($p > 0.05$). Patients in the experimental group used more non-drug methods to relieve pain than those in the comparison group from postoperative day 1 to 7 ($p < 0.05$); and there were no significant differences found here between the experimental group and the comparison group regarding the total amount of analgesic use or using PCA for pain in the postoperative period ($p > 0.05$). Comparisons of the two group's clinical outcomes did not significantly

differ ($p > 0.05$), including the length of hospital stay, days of chest drain retention, and the occurrence of postoperative complications. However, the experimental group initiated out-of-bed activities much earlier than did the comparison group, with the difference being significant ($p < 0.05$). The study also tested the relationships between pain intensity, pain interference, barrier scores, and the use of drug or non-drug methods for pain relief. The patients' scores on pain intensity and the interference of pain with daily activities were significantly positively correlated to their barrier scores; but were significantly negatively correlated to the use of drug or non-drug methods for pain relief in the postoperative period.

Conclusion: The findings of the present study provide positive evidence of the effectiveness of nurse-led educational interventions in reducing patient-related barriers to pain management, improving pain management behaviors, and relieving patients from pain suffering after surgery. A pain management programme based on the PRECEDE framework, which integrated preoperative pain education and a reinforcing intervention, can lead to a new model of care to improve the outcomes of postoperative care. This study also provides insights on developing the role of advanced nursing practice to address issues of safety and cost-effectiveness in pain care in mainland China.

Conference presentations

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Publications

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Chapter 1 Introduction

This chapter begins with a background discussion on inadequately treated postoperative pain in current clinical settings and follows with an examination of the research efforts in this area. Gaps in information on the subject are identified, and the purposes of this study and the research questions are formulated. Then, the significance of this study is highlighted. The structure of this thesis is also outlined in this chapter.

Multi-modal analgesia and advanced techniques have facilitated pain relief for patients undergoing surgery in current clinical settings, but postoperative pain continues to be undermanaged (Apfelbaum, Chen, Mehta & Gan, 2003; Chung & Lui, 2003; Shen, Sherwood, McNeill & Li, 2008; Yan, Wang, Tang, Zhu & Guo, 2011). It has been reported that nearly 80% of patients experience pain in the first 24 hours following an operation (Apfelbaum et al., 2003; Chung & Lui, 2003; Shen et al., 2008); also, approximately 60% of patients experiencing postoperative pain receive inadequate treatment (Shen et al., 2008;Yan et al., 2011). Unrelieved postoperative pain causes several physiological responses that can be detrimental to surgical patients and have a profound psychological impact on them (Huang, Cunningham, Laurito & Chen, 2001; Nendick, 2000; Sinatra, 1992).

1.1 Background of this study

Digestive tract cancers, such as gastric, liver, and oesophageal cancer remain among the top five forms of cancer in Chinese people and have become the leading cause of death from cancer during the past three decades (Chen, 2009; Zhao, Dai & Li, 2010; Zhou et al.,

2010). Lung cancer, in particular, has increased 465% during the past 30 years and is now the form of cancer with the highest incidence and mortality rate worldwide. The World Health Organization (WHO) estimates that by 2025 more than 1,000,000 Chinese will be diagnosed with lung cancer alone each year (Parkin, Bray, Ferlay & Pisani, 2005). A major thoracotomy operation is still the primary form of treatment for patients diagnosed with malignant lung or esophageal diseases. It involves surgical removal of the primary carcinoma and clearance of the surrounding tissue, as well as dissection of the cervical, thoracic, and abdominal lymph nodes to limit metastasis and improve prognosis (Gerner, 2008; Xu & Guo, 2000).

Patients who have undergone a major thoracotomy operation tend to suffer severe pain from the surgical procedure, postoperative chest drainage procedures, and during ambulation and physical exercises in the postoperative period (Gerner, 2008; Soto & Fu, 2003; Yu & Li, 2001). Some factors contributing to postoperative thoracotomy pain include the surgical trauma of the operation, which involves mechanical damage during rib resection and compression, and incidental rib fractures, which cause damage to intercostal nerves; and injuries to the respiratory muscles and the shoulder joint, and damage to the integrity of the chest wall during the surgical procedure. Moreover, retention of postoperative chest drainage also causes severe pain during the patients' deep-breathing and coughing exercises, their repositioning, and out-of-bed ambulation; and so does the removal of their chest tube (Gerner, 2008; Yu & Li, 2001).

Advanced analgesia techniques and multimodal analgesics are used for treating post-thoracotomy pain; however, acute and chronic pain conditions subsequent to thoracotomy remain a challenge to clinicians (Decosmo, Aceto, Gualtieri & Congedo, 2009; Gerner, 2008). Inadequately treated post-thoracotomy pain greatly increases the incidence of postoperative pulmonary complications; moreover, such pain can persist for months and even years, substantially worsening a patient's quality of life (Gerner, 2008; Savage, McQuitty, Wang & Zwischenberger, 2002; Soto & Fu, 2003). A significant amount of attention is required in the management of pain in the acute phase after a thoracotomy operation because the immediate consequences of insufficient attention include the possibility that the patient's respiratory function will be compromised and the high risk (more than 50%) of a progression to post-thoracotomy pain syndrome (postoperative pain persists for more than 6 months after thoracotmy operation was defined as post-thoracotomy pain syndrome, PTPS) (Gerner, 2008; Perkins & Kehlet, 2000; Savage et al., 2002).

Because pain is also a highly personal and subjective experience, Margo McCaffery (1968, p.95) defined pain as "whatever the experiencing person says it is, existing whenever he says it does". This means that the patient's own report of pain is the single most reliable indicator of pain (APS, 2003; Pasero & McCaffery, 2011). The hesitation on the part of patients to report pain and use analgesics are important barriers to effective pain management, as they are direct or indirect determinants of pain. The patients' erroneous beliefs or misconceptions about pain and pain medication are defined as patient-related barriers to cancer pain management (Gunnarsdottir, Donovan, Serlin, Voge & Ward, 2002; Ward et al., 1993). The hesitation on the part of surgical patients to

report pain and their concerns about using analgesics have been identified in the literature in the West (Manias, Botti & Bucknall, 2006) and among Chinese adult patients (Tzeng, Chou & Lin, 2006; Wong & Chan, 2008; Yan et al., 2011).

Some influential factors have been found to be related to these barriers to pain management, including ethnocultural factors and patients' personal characteristics. Cultural background has a significant impact on the perception and expression of pain, and therefore influences an individual's communication of pain and strategies to cope with pain (Chen, Miaskowski, Dodd & Pantilat, 2008; Melzack, 2001). Regardless of gender, American patients were more overt at expressing pain than Japanese patients, with their eastern culture of stoicism (Hobara, 2005). The impact from the patients' personal characteristics such as their age, gender, educational background, and profession, could not be changed. Culturally appropriate educational interventions for patients and their family caregivers may greatly overcome attitudinal barriers and improve the outcomes of pain management.

The effectiveness of various educational approaches in addressing pain and its treatment, and the implementation of such approaches using different strategies, has been investigated in various patient populations in the literature on postoperative care in the West and China. These interventions usually consist of instructions on pain knowledge; analgesics and techniques (i.e., the use of a patient-controlled-analgesia pump); non-drug methods to relieve pain; the use of pain assessment instruments; and the importance of communicating pain with health care providers (Lin & Wang, 2005; Sjoling, Nordahl,

Olofsson & Asplund, 2003; Watt-Watson et al., 2004; Wen & Li, 2008). A commonly used method of conducting preoperative pain education is face-to-face sessions (Chen, Yeh & Yang, 2005; Chumbley, Ward, Hall & Salmon, 2004; Knoerl, Faut-Callahan, Paice & Shott, 1999; Lin & Wang, 2005; Wong, Chan & Chair, 2010a; Lin, Li,Yang & Xu, 2007; Ren, 2011), written information such as booklets or pamphlets (Chumbley et al., 2004), or a combination of oral instructions and written material (Lam, Chan, Chen & Kee, 2001; McDonald, Freeland, Thomas & Moore, 2001; McDonald & Monoly, 2004; McDonlad, Thomas, Livingston & Severson, 2005; Reynolds, 2009; Shi & Li, 2005; Sjoling et al., 2003;Watt-Watson et al., 2004; Wen & Li, 2008; Zhan, Wang, Dong & Fang, 2009). In these studies, in most cases, the timing of the education intervention was at post admission and just prior to surgery (Chen et al., 2005; Chumbley et al., 2004; Knoerl et al., 1999; Lam et al., 2001; Lin & Wang, 2005; Lin et al., 2007; McDonald et al., 2001; McDonald & Monoly,2004; McDonald et al., 2005; Ren, 2011; Shi & Li, 2005; Sjoling et al., 2003; Wen & Li, 2008;Wong et al., 2010a; Zhan et al., 2009); some others were provided at the preadmission period (Watt-Watson et al., 2004). Very few education interventions were conducted in the postoperative period, and only one study provided both pre and postoperative pain education to patients (Reynolds, 2009).

Most studies supported the view that pain education for patients is an effective approach to improving outcomes related to pain (i.e., leading to lower levels of pain, less interference of pain with daily activities, and less anxiety; more positive pain management behaviours; and more satisfaction with pain care) and other clinical outcomes, such as better physical recovery from surgery and a shorter hospital stay. The

common features of successful pain education interventions included the use of such teaching strategies as combining detailed oral instructions with written information to ensure that the patients fully understood what they had been taught and to help them to recall the information that they had learned (McDonlad & Monoly, 2004; McDonald et al., 2005; Shi & Li, 2005; Wen & Li, 2008; Zhan et al., 2009). According to the literature, the extent of the patients' learning played a vital role in generating significant outcomes for pain education approaches to postoperative pain management.

Nevertheless, in some previous studies, patient education alone appeared inadequate for resolving such issues as increased knowledge not linked to behavioural changes in pain management, or failed to achieve significant improvement in pain outcomes (Chumbley et al., 2004;Watt-Watson et al., 2004). There is much room for nurses to further improve patients' learning and to narrow down the gaps between knowledge and actual behaviours, and improve the outcomes of pain care. In addition, the contributions of the care provider, such as the attentive pain care delivered by nurses, needs to be addressed in the process of pain management (Pasero & McCaffery, 2011).

Although the programmes in previous studies were conducted in different clinical settings for patients with different disease characteristics, the education interventions had some features in common. First, the education programmes were designed from the perspective of health professionals; the educational needs of individual patient were possibly not identified; and the amount of information for individual patient requires further exploration (Lam et al., 2001; Sjoling et al., 2003). Second, such strategies as nurses'

reinforcing interventions, followed by education to improve the patients' learning, were scarcely applied or documented. On-going evaluations by nurses after patient education and reinforcement may resolve the above issues and ensure that the patients fully understand what they have learned, and facilitate patients' positive behavioural changes in pain management (Lin, Chou, Wu, Chang & Lai, 2006). In addition, individual patients' pain issues in the postoperative period were not identified and addressed (Chumbley et al., 2004; Reynolds, 2009). Attentive pain care rendered by nurses, such as assessing pain accurately and taking appropriate actions to deal with the patients' pain should be emphasized to improve the outcomes of pain care (Pasero & McCaffery, 2011).

In mainland China, however, pain education is still not a routine care provided for patients undergoing surgeries in clinical care settings (Shen et al., 2008; Yan et al., 2011). In addition, very few of the existing studies documented the effectiveness of an education approach that integrates reinforcing interventions by nurses to enhance patients' learning and to facilitate positive behavioural changes in pain management. It is evident that a comprehensive, well-designed nurse-led pain management programme involving the active participation of patients and attentive pain care by nurses is likely to generate positive patient and clinical outcomes. Integrating preoperative pain education for patients and the postoperative pain round by nurses as a reinforcing factor is the special feature of the present study.

1.2 Purpose of this study

The purpose of this study is to examine the effectiveness of a pain management programme for Chinese adult patients undergoing a major thoracotomy operation.

1.3 Objectives of this study

The objectives of this study are to investigate whether preoperative patient education integrated the postoperative reinforcing intervention (the experimental group) would result in less pain suffering (pain severity and interference with daily activities), more positive pain management behaviours, lower barriers to reporting pain and using analgesics for pain treatment, and better clinical outcomes than preoperative pain education alone (the comparison group). The relationships between the patients' pain intensity, the interference of pain, the barriers to pain management, and the use of drug or non-drug methods for pain relief are also examined in the present study.

1.4 Research questions

The specific research questions for the present study are:

1. What is the effect of the pain management programmme on the severity of the patients' pain, the interference of pain with their daily activities, pain management behaviours, and patient-related barriers to pain management for Chinese adult patients undergoing a major thoracotomy operation?

2. What is the effect of the pain management programme on the clinical outcomes for thoracotomy patients?

3. Are there any relationships between the severity of the patients' pain, the interference of pain, barriers to pain management, and use of drug or non-drug methods of managing pain for thoracotomy patients?

1.5 Operational definitions

The operational definitions used in the present study are listed as follows.

1.5.1 Patient-related barriers to pain management

Erroneous beliefs or misconceptions held by patients about pain and pain medication have been defined as patient-related barriers to pain management (Gunnarsdottir et al., 2002; Ward et al. 1993). With regard to surgical patients, these are summarized into nine themes: fatalism about pain; addiction; the desire to be a good patient; distracting the physician; inhibition of wound healing; side effects; tolerance; fear of injections; and time intervals (Tzeng et al., 2006).

1.5.2 Pain management programme

The pain management programme in this study is an integrated approach to empowering patients by imparting knowledge and skills, correcting erroneous beliefs or misconceptions that they may have about pain and pain medications, and supporting and encouraging positive changes in their behaviour to improve the outcomes of pain management. There are two aspects to this programme: preoperative pain education and the nurse's postoperative pain round.

In the present study, pain education is a structured approach to providing education for patients, consisting of imparting knowledge about pain, analgesics and techniques, and non-drug methods to relieve pain; the use of pain assessment instruments; and teaching skills for communicating pain with health care professionals. The pain round refers to the reinforcing intervention that is conducted, followed by pain education, which involves the nurse's assessment and management of pain in the postoperative period.

1.5.3 Pain management behaviour

The behavioural dimension of the pain experience refers to the behaviours that an individual in pain uses either to decrease pain (i.e., interventions to relieve pain, communication, and level of activity) or to indicate the presence of pain (i.e., stiffness, body guarding) (Edrington, Miaskowski, Dodd, Wong & Padilla, 2007). In the present study, pain management behaviours included the frequency with which the patients used non-drug methods to relieve pain, the total amount of analgesics used, and using PCA for treating pain.

1.5.4 Objective clinical outcomes

The objective outcomes are those measured or interpreted by the physician, nurses, and other qualified health professionals (Willke, Burke & Erickson, 2004). Objective outcomes are the opposite of subjective outcomes in that their existence is independent of the perceptions of the individual under observation (Jette, 1989). In the present study, objective clinical outcomes were documented or interpreted by the nurses and physicians. These included issues of cost, such as the length of the hospital stay; and the patients'

recovery from surgery (i.e., the first day to initiate ambulation, the length of the chest tube in situ, and the occurrence of postoperative complications).

1.6 Significance of this study

This study is significant in a number of ways. First, inadequately treated pain continues to be a major clinical issue, in spite of the advanced techniques of analgesia and multi-modal analgesics for pain relief that are extensively applied in acute pain care settings (Apfelbaum et al., 2003; Chung & Lui, 2003). A knowledge deficit in pain management, negative beliefs about pain, and misconceptions about analgesics are prevalent among Chinese patients in postoperative care settings (Wong & Chan, 2008; Yan et al., 2011). In addition, pain education for surgical patients is still not a routine approach to care in clinical practice in mainland China, according to previous studies conducted by other researchers (Shen et al., 2008).

Although, there are many positive findings supporting the effectiveness of education for postoperative pain care, there is still much space for nurses to improve patients' learning, and to narrow the gaps between knowledge and actual behaviours. Such strategies as applying reinforcing interventions after education in order to strengthen the patients' learning need to be considered in practice. In addition, the needs of individual patients with regard to education and pain issues need to be identified and addressed for postoperative patients. The contributions of attentive pain care delivered by nurses in the postoperative period need to be emphasized to relieve patients from unnecessary suffering (Pasero & McCaffery, 2011). On-going evaluations and reinforcement by

nurses may resolve the issues related to patients' learning; and practice in assessing pain and taking appropriate actions to address the patients' pain may greatly improve the outcomes related to pain care. However, there is still a paucity of studies on the use of attentive pain care by nurses, integrated with patient education, and testing its effectiveness on postoperative pain management.

Second, a well-designed and comprehensive pain management programme was implemented in the present study, which integrated preoperative pain education for patients and attentive care delivered by a nurse (pain round) in the postoperative period. The programme involves modifying patients' negative pain beliefs and clarifying misconceptions about using analgesics (the predisposing factor), empowering patients by imparting to them knowledge and skills on pain to enable them to actively participate in pain management (the enabling factor), and having the nurse in the postoperative pain round facilitate the patients' positive behavioural changes (the reinforcing factor). This new model of care is based on the framework of PRECEDE (Green, Kreuter, Deeds & Partridge, 1980), which is an effective model extensively used for delivering health education among different populations to improve health behaviours (Chiang, Huang & Lu, 2003; Newall, Johnston & Monagle, 2008; Yates et al., 2004; Zhang et al., 2008).

Third, invited ward nursing staff and the researcher were involved in the implementation of the pain management programme. Trained ward nurses provided preoperative pain education to patients. The researcher acted as a pain nurse in conducting preoperative visits relating to pain education and the daily postoperative pain round. The present study

emphasized an advanced role for nurses in pain management, requiring nurses: to be an educator to train ward staff; to consult with both patients and their family regarding issues related to pain treatment; and to act as an advocate for patients in relieving their pain. In addition, it was believed that the practice of involving both ward nurses and the researcher in the study would have the following benefits: help build trust and collaborative relationships between the participants and the researcher (Kirchhoff & Dille, 1994; Pruitt & Privette, 2000); minimize participant drop-out rates and ensure a sufficient sample size for the study (Pruitt & Privette, 2000); and help to ensure the smooth implementation of the study intervention (Kirchhoff & Dille, 1994; McGuire et al., 2000; Pruitt & Privette, 2000). These would greatly improve the efficacy of the study intervention and could facilitate its acceptance and generalization in future practice.

The aim of the present study is to provide research-based evidence to develop an innovative nurse-led care model for clinical practice. The findings from this study should provide clinical nurses with evidence on approaches to implementing nurse-led pain care for patients undergoing thoracic surgeries, to optimize the outcomes of pain management. In addition, the results should strengthen the ability of institutions to train advanced practising nurses in pain management, and thereby to further improve the quality of postoperative pain care.

1.7 Organization of this thesis

This thesis contains seven chapters. Following the introductory chapter, it is organized as follows. Chapter 2 contains a review of the literature on the underlying theories of pain

and research efforts in nurse-led educational approaches for postoperative pain management, and information gaps are identified in previous studies. Chapter 3 presents the detailed methodology for this study. The results of the pilot study are reported in Chapter 4. Chapter 5 reports on the results generated from the main study. A discussion of the findings of this study is given in Chapter 6. The overall conclusion, implications and limitations of the present study are indicated in Chapter 7.

Chapter 2 Literature review

2.1 Introduction

Multi-modal analgesia and advanced techniques have facilitated pain relief for patients undergoing surgeries in current clinical settings, but postoperative pain continues to be inadequately treated (Apfelbaum et al., 2003; Shen et al., 2008; Yan et al., 2011). Standard practices and quality improvement guidelines suggest that the outcomes of pain care could be improved through collaboration among multi-disciplinary or interdisciplinary healthcare teams, attentive nursing care, and the involvement of the patient and his/her family (Gordon et al., 2005). Nurses play a vital role in pain management, acting as care-providers, educators, and advocates for patients suffering from pain. The major purpose of a nurse-led pain education programme is to empower patients by imparting knowledge and skills, to clarify misconceptions they may have about pain and its treatment and to encourage active participation in pain management, thereby facilitating greater pain relief, and to minimize the incidence of postoperative complications and chronic post-surgical pain, reducing the consequent financial burden, and even improve the quality of life for patients in the long-term.

This chapter presents a literature review aimed at demonstrating the underlying theory of the experience of pain, presenting the situation of inadequately treated postoperative pain in current clinical settings, and highlighting pain after a thoracotomy operation. This is followed by a discussion of patient-related barriers to pain management and cultural influences on pain experiences for Chinese patients. Nurse-led educational interventions to relieve postoperative pain were reviewed in both the western and Chinese literature on

the subject, and information gaps were identified. The conceptual framework of the present study is presented in the last section of this chapter.

2.2 The underlying theory of the experience of pain

The most commonly used definition of pain is that put forward by the International Association for the Study of Pain (IASP). The IASP defines pain as "an unpleasant sensory and emotional experience associated with actual or potential damage or described with in terms of damage" (IASP 1979, p. 250). This definition implies that pain is a phenomenon with multiple components that has an impact on a person's psychosocial and physical functions. It also acknowledges the complexity of the experience of pain (McCaffery & Pasero, 1999).

Prior to 1965, a simple neurophysiologic model (a sensory stimulus-response model) of pain was commonly accepted. It proposed that pain was produced by the activation of specific pain receptors in the periphery (known as nociceptors), which initiated pain impulses that travelled through a spinal pathway to the brain. In this model, the contribution of the brain was its perceptive responses to the ascending afferent sensory inputs; while the contribution of psychological or affective components to pain were not recognized (Trout, 2004).

Wall and Melzack (1965) revolutionized the understanding of pain with the introduction of the gate-control theory. They recognized that the perception of pain is inherently more complex than simply a matter of receiving or recording. Their most important

contribution to the understanding of pain was the emphasis that they placed on central neural mechanisms. The brain acts as an active system that filters, selects, and modulates inputs; the dorsal horns are also not merely passive transmission stations but sites at which dynamic activities (inhibition, excitation, and modulation) occur. Melzack later recognized that this model fails to account for perceptions of pain in the absence of sensory stimuli and the perception of the body as a "unit" (Melzack, 2001).

Pain is a multidimensional experience influenced by multiple factors and better illustrated by the framework of a neuromatrix of pain (Melzack, 1999). It is proposed that pain is produced by characteristic "neurosignature" patterns of nerve impulses generated by a widely distributed neural network as "the body-self neuromatrix" in the brain. These neurosignature patterns could be triggered by sensory inputs or generated independently of them. Pain is produced by the output of a widely distributed neural network in the brain rather than directly by sensory inputs evoked by injury, inflammation, or other pathologies. The processing of pain perceptions by the "body-self" neuoromatrix is modulated by the powerful stress system and cognitive function of the brain, in addition to the traditional genetic and sensory inputs (Melzack, 1999; 2005).

The neuromatrix theory of pain recognizes the simultaneous convergence of a panoply of influences, including one's past experiences, cultural factors, emotional state, cognitive inputs, stress regulation, and immune systems, as well as the immediate sensory input. The multiple influences that produce perceptions of pain are generated from three parallel processing networks: sensory-discriminative (somatosensory inputs), affective-

motivational (thalamocortical and limbic systems), and evaluative-cognitive (tonic inputs from the brain such as cultural learning and past experience; and phasic inputs such as attention, expectation, anxiety, and depression). Additional contributions of the autonomic nervous system, the stress response system, and the modulation of the immune are also involved in this model (Melzack, 2001). The contributions of three parallel processing networks converge to create individual perceptions of pain and the "action systems", or what the person does in response to their pain. Acton systems include both involuntary and voluntary strategies used by the individual to cope with pain (Melzack, 1999; Melzack, 2001).

2.3 Situation of inadequately treated postoperative pain

Pain is inevitable associated with surgery and is a predictable part of the postoperative experience. Despite significant advances in analgesia techniques and the application of multimodal approaches in the last few decades, inadequately treated postoperative pain is still common (Apfelbum et al., 2003).

Unrelieved postoperative pain has profound implications, leading to clinical and psychological changes that increase morbidity and mortality as well as costs, and decrease the quality of life (Carr & Goudas, 1999). Negative clinical outcomes resulting from the ineffective management of postoperative pain include deep vein thrombosis, pulmonary embolism, coronary ischemia, myocardial infarction, pneumonia, poor wound healing, insomnia, and lasting psychological distress (Carr & Goudas, 1999; Huang et al., 2001; Sinatra, 1992). In addition, the severity of acute postoperative pain has been

reported to be a striking predictor of chronic pain after breast surgery, thoracic surgery, and hernia repair; and inadequately treated acute postoperative pain has been associated with a high risk of the incidence of chronic post-surgical pain (Perkins & Kehlet, 2000). These complications have economic and medical implications, such as extended length of hospital stays, readmissions, and patient dissatisfaction with medical care (Huang et al., 2001; Nendick, 2000).

In the United States, Apfelbum and colleagues (2003) conducted a national survey and reported that postoperative pain continued to be undertreated. A random sample of 250 adults who had recently undergone surgical procedures was conducted. Approximately 80% of the patients experienced acute pain after surgery; among those patients, 86% had moderate, severe, or extreme pain, with more patients experiencing pain after discharge than before discharge. Among those patients (59%), experiencing postoperative pain was the most common concern (Apfelbum et al., 2003). Patients' postoperative pain intensity and satisfaction with pain care were explored in the Hong Kong Chinese population (Chung & Lui, 2003). Similar findings were reported as in the study on US patients regarding the prevalence of postoperative pain (nearly 85%) and patients' satisfaction (> 65%) with the responsiveness of health care professionals to their pain (Chung & Lui, 2003).

In mainland China, a cross-sectional survey was conducted in five tertiary hospitals in Beijing to describe Chinese patients' postoperative pain intensity, interference of pain with function, adequacy of pain medication, use of non-drug methods of dealing with

pain, and the patients' satisfaction with pain care (Shen et al., 2008). In the study, 78% of the postoperative patients reported moderate to severe pain and mild to moderate interference from pain with their mood and daily activities in the first 24 hours after surgery. According to the measure by the Pain Management Index, 60.2% of the patients had been inadequately treated for pain; yet the patients reported a high degree of satisfaction (8.54 out of 10) with the pain care that they had received. The most frequently used non-drug methods of managing pain were tolerating pain (84.4%), changing position (83.7%), and family support (81.9%) for Chinese patients in postoperative period (Shen et al., 2008).

Undermanaged postoperative pain continues to be a major clinical issue (Apfelbum et al., 2003; Chung & Lui, 2003; Shen et al., 2008). In current clinical settings in mainland China, inadequately managed postoperative pain needs to be addressed, since more than 60% of patients are under-treated for pain (Shen et al., 2008). Education for patients and health professionals, an appropriate pain management regimen, together with attentive nursing care should be provided to achieve better pain relief for Chinese patients.

2.4 Postoperative pain after thoracotomy

Oesophageal cancer and lung cancer remain among the top five types of cancer in Chinese people and have become the leading cause of deaths from cancer during the past three decades (Chen, 2009; Parkin et al., 2005; Zhao et al., 2010). A major thoracotomy is the primary treatment for patients diagnosed with malignant lung or esophageal diseases. It involves surgical removal of the primary carcinoma and clearance of the

surrounding tissue, as well as dissection of the cervical, thoracic, and abdominal lymph nodes to limit metastasis and improve prognosis (Gerner, 2008; Soto & Fu, 2003; Xu & Guo, 2000). Patients suffer severe pain after a thoracotomy due to extensive surgical trauma (such as the retracting, resectioning, or fracturing of ribs, dislocation of costovertebral joints, and injury of intercostal nerves) during the operation and further irritation of the pleura by chest tubes and the continuous motion of the patients' breath (Gerner, 2008; Savage et al., 2002; Soto & Fu, 2003).

Inadequately treated postoperative pain after a thoracotomy operation has major consequences (Decosmo et al., 2009; Gerner, 2008; Savage et al., 2002). Postoperative deep breathing causes extreme pain to patients because of the need to stretch the incision during the process. Patients without adequate analgesia try to prevent stretching of the skin incision by contracting their expiratory muscles, i.e., splitting to limit the stretch on the incision during inspiration. When a patient's inspiration is limited, this leads to diaphragmatic dysfunctions, decreasing functional residual capacity (FRC), consequently leading to atelactasis, shunting, and hypoxemia (Gerner, 2008; Savage et al., 2002). This failure to achieve deep inspiration before a forceful exhalation also results in ineffective coughing, which increases retention of secretions, leading to airway closure, atelactasis, and other respiratory complications (Decosmo et al., 2009; Gerner, 2008; Savage et al., 2002).

Furthermore, undertreated acute postoperative pain after a thoracotomy operation increases the incidence of post-thoracotomy pain syndrome (PTPS), substantially

compromising a patient's quality of life in the long term. Post-thoracotomy pain syndrome is defined as the pain that recurs or persists along a thoracotomy incision at least two months following the surgical procedure (Gerner, 2008). In the published literature, the incidence of persistent post-thoracotomy pain has been estimated at 26-67% (Katz, Jackson, Kavanagh & Sandler, 1996; Perttunen, Tasmuth & Kalso, 1999; Soto & Fu, 2003). In a follow-up study conducted by Katz and colleagues (1996) the incidence of long-term post-thoracotomy pain was reported as being 80% at 3 months, 75% at 6 months, and 61% at one year after the surgery. Persistent post-thoracotomy pain greatly interferes with a patient's normal life activities. More than 50% of the patients in another study reported moderate to severe pain and pain interfering with daily life at one year after thoracic surgery (Perttunen et al., 1999).

The possible etiology of post-thoracotomy pain syndrome (PTPS) is related to nerve damage, because PTPS is more severe after the resectioning of the chest wall. The loss of superficial abdominal reflexes is also associated with an increased occurrence of PTPS, with the other contributor being the recurrence of tumors (Perkins & Kehlet, 2000). However, post-thoracotomy pain syndrome has been reported to be unrelated to benign or malignant diseases; yet postoperative pain in the acute phase may predict a patient's risk of developing chronic persistent post-thoracotomy pain syndrome. Effective methods of acute pain management and the use of video-assisted thoracic surgery for pulmonary resectioning may reduce the rates of incidence of chronic pain (Gerner, 2008; Katz et al., 1996; Perkins & Kehlet, 2000). Some other studies have reported no differences in the rates of occurrence of post-thoracotomy pain syndrome associated with methods of

thoracic surgery or the techniques used for postoperative analgesia. Nevertheless, the effectiveness of acute pain relief for thoracotomy patients has been significantly negatively correlated with the incidence of post-thoracotomy pain syndrome (Gerner, 2008; Katz et al., 1996; Lu, Wang, Lai, Huang & Xu, 2008; Perkins & Kehlet, 2000).

Multimodal analgesia as combinations of drugs is increasingly used to control pain and minimize the side effects of analgesics to achieve optimal analgesia (Holdcroft & Power, 2003; Kehlet & Dahl, 1993; Skinner, 2004). This approach offers the possibility of reducing opioid requirements and side effects, and of achieving better pain relief than a single-drug regimen, benefitting recovery from surgery (Jin & Chung, 2001; Kehlet & Dahl, 1993; Skinner, 2004).

Multimodal therapeutic strategies that provide a central or a peripheral block combined with non-steroid anti-inflammatory drugs (NSAIDs) and other adjuvant drugs is recommended as a cornerstone in the treatment of post-thoracotomy pain (Decosmo et al., 2009; Gerner, 2008; Savage et al., 2002). The mainstay of postoperative analgesia after thoracic surgeries includes various routes of administrating opioids for pain management. It includes systematic administration of opioids via patient-controlled intravenous analgesia or patient-controlled epidural analgesia for neuraxial blockades via epidural or subarachnoid, intercostals, paravertebral blocks, and intralpleural analgesia (Gao, Dai, Guo & Chen, 2007; Savage et al., 2002; Yang, 2008); and transdermal fentanyl adhesives applied to thoracic surgery patients to manage postoperative pain (Fu et al., 2003). Epidural analgesia is used most frequently in clinical settings for post-

thoracotomy pain relief because of its high level of effectiveness, safety, and the consistent improvement of postoperative pulmonary functions in those patients that receive the treatment (Decosmo et al., 2009; Jin, 2005; Kehlet & Dahl, 2003; Savage et al., 2002; Soto & Fu 2003; Wu, Li, Wang & Sun, 2006).

Non-opioid analgesics as non-steroid anti-inflammatory drugs (NSAIDs) are widely used in the postoperative period, when administered in combination with opioids as part of a multimodal strategy to reduce the requirement for opioids and improve the effects of analgesia (Decosmo et al., 2009; Gilron, Milne & Hong, 2003). The analgesic effects of nonsteroid anti-inflammatory drugs are related to the inhibition of the two isoforms of the cyclooxygenase enzyme-1, 2 (COX-1, 2). Non-steroid anti-inflammatory drugs have been associated with the inhibition of platelet aggregation, gastrointestinal bleeding, and renal toxicity, limiting their usefulness in clinical practice. These drugs must be used at recommended dosages because of the plateau analgesia effects, which means that an increase in dosage only precipitates the rates of occurrence of such side effects as gastrointestinal bleeding or perforation, and renal failure (Decosmo et al., 2009; MacPherson, 2000; Schug, 2006).

In clinical settings in China, the systematic administration of opioids and local anesthesia techniques are extensively used to manage the pain of thoraotomy patients. Opioid analgesics combined with NSAIDs, local anesthetics, or other adjuvant drugs via epidural analgesia (PCEA) and patient-controlled intravenous analgesia (PCIA) are commonly used for post-thoracotomy pain relief in the first postoperative 24 to 48 hours (Gao et al.,

2007; Jin, 2005; Wu et al., 2006; Yang, 2008). Intermittent intramuscular injections and the administration of such oral analgesics as NSAIDs and other opioid analgesics (i.e., Tramadol) are also used to manage pain after a thoracic surgery (Yang, 2008). Local anesthesia such as intercostals, paravertebral blocks, and extralpleural analgesia are recommended for thoracotomy patients due to their easily mastered techniques with high efficacy in terms of pain relief, safety, and a low risk of complications (i.e., pulmonary complications, gastric discomforts, and urinary retention) (Yang, 2008).

Pain is a multi-dimensional experience, consisting not only of physical stimuli but also of psychosocial interpretations of pain. It has been suggested that non-pharmacological interventions are beneficial as a complementary approach to managing postoperative pain in conjunction with pharmacological interventions (McCaffery & Pasero, 1999). The rationale for using non-drug methods includes several aspects: to diminish the emotional components of pain; to strengthen coping abilities; to increase perceived control over pain; and to enhance comfort and sleep (McCaffery & Pasero, 1999; Pellino et al., 2005).

Music, relaxation, and massage are commonly used methods to reduce the sensory, physiologic and affective components of pain in acute pain care, and the effects of these have been reported in many previous studies. Tse and colleagues (2005) reported that music played intermittently had positive effects in postoperative pain relief for patients who had undergone nasal surgery, with lower pain intensity, systolic pressure, heart rates, and less consumption of analgesics. Vaajoki et al. (2011) conducted a study to examine the effects of listening music on pain intensity and its distress for patients undergoing

abdominal surgery. Patients in the experimental group reported significant lower scores on pain intensity and its distress in bed rest, deep breathing, and positioning on the second postoperative day comparing with the control group (Vaajoki, Pietila¨, Kankkunen, & Vehvila¨inen-Julkunen, 2011). Roykulcharoen & Good (2004) reported that for postoperative patients systematic relaxation could effectively reduce the sensation of pain and the distress arising from pain. For women patients undergoing gynaecologic surgery, Good and colleagues (2002) reported that music, relaxation, and a combination of music and relaxation achieved similar effects with regard to pain relief.

The effects of massage on reliving postoperative pain for patients undergoing major operations were investigated by Piotrowski and colleagues (2003). In their preliminary study, the experimental group that received a 10-minute effeurage back massage twice daily reported less unpleasantness in terms of postoperative pain (Piotrowski et al., 2003). A randomized controlled trial with a large sample size (n=605) was conducted to examine the effects of massage on postoperative pain. It was found that the massage group experienced a significant decrease in pain intensity, unpleasantness, and anxiety in the first 4 postoperative days compared with the control groups (Mitchinson et al., 2007). Another study conducted by Wang and Keck (2004) found positive effects for massage applied to the foot and hand as a useful adjuvant to significantly reduce the severity and distress of postoperative pain, and sympathetic responses to pain (i.e., heart rate and respiratory rate).

For thoracotomy patients, the removal of the chest drain is a painful experience. Puntillo and Ley (2004) conducted a study to examine the effects of different analgesic methods together with procedural and sensory information for controlling pain caused by the removal of the chest tube. They reported that all of these methods could substantially reduce pain during this procedure without causing adverse sedative effects. Non-drug methods such as slow deep breathing relaxation exercises were found to be effective adjuvants to oipoid analgesia for relieving pain during chest tube removal (Friesner, Curry & Moddeman, 2006). However, a literature review reported that pharmacological methods alone did not achieve satisfactory analgesia for chest drain removal; while the use of non-drug methods did not appear to have any effect on the pain caused by this procedure. Multimodal techniques were suggested for future investigations (Bruce, Howard & Frank, 2006).

However, in an early meta-analysis involving 49 studies a significant difference in pain relief was not observed between the groups that had received non-pharmacological nursing interventions and the control groups (Sindhu, 1996). Some factors need to be considered when interpreting this finding: there were few randomized controlled trials (RCTs) involved in this meta-analysis; and the majority of the research was uncontrolled and observational in nature. As a result, the 49 studies involved were too heterogeneous for differences between the treatment and control groups to be reliably detected (Sindhu, 1996). The effectiveness of non-pharmacological methods of treating acute pain needs to be tested in large RCTs that assess the efficacy of a particular intervention in a specific clinical area. Nevertheless, multiple recent studies support the view that various non-drug

methods have beneficial effects in alleviating pain and could be used as a complementary strategy to reduce levels of pain and the amount of analgesics used by patients in managing postoperative pain (Engwall & Duppils, 2009; Mitchinson et al., 2007; Roykulcharoen & Good, 2004; The Joanna Briggs Institute, 2011).

In summary, it is suggested that such non-drug approaches as music, relaxation, and massage are effective adjuvant therapies in the management of acute postoperative pain (Engwall & Duppils, 2009; Mitchinson et al., 2007; The Joanna Briggs Institute, 2011). The use of non-drug techniques as a complementary approach for dealing with postoperative pain appears attractive, with significance for reducing pain and because such methods are safe to use due to their non-invasiveness and absence of additional risks. In addition, such an approach is easily accepted by patients because of its convenience for use (since a physician's prescription is not needed), flexible alternatives, and lower cost.

2.5 Patient-related barriers to pain management

Pain is a subjective experience with multiple dimensions, consisting not only of physiological, sensory dimensions but also of the affective, behavioural, cognitive, and sociocultural interpretations of pain (Edrington et al., 2007). Margo McCaffery (1968, p. 95) defined pain as follows: "Pain is whatever the experiencing person says it is, existing whenever he says it does", indicating that pain is a highly personal and subjective experience. This also means that the patients' own report of pain is the single most reliable resource for assessments of pain and the best indicator for the management of pain (APS, 2003; Pasero & McCaffery, 2011). The neuromatrix theory of pain offers a

more comprehensive framework for understanding the subjectivity of pain. It recognizes the importance of both ascending and descending inputs to the perceptual experience of pain, and includes additional inputs that were not included in the gate-control theory, such as the important contributions of cultural learning and past experience (Melzack, 2001).

The response of patients to their pain, including both involuntary and voluntary strategies to cope with pain (such as the patients' hesitation to report pain and use analgesics, and their willingness to tolerate pain), have been important barriers to effective pain management, as these are direct or indirect determinants of pain (Melzack, 2001). Patients' erroneous beliefs or misconceptions about pain and pain medication are defined as patient-related barriers to cancer pain management (Gunnarsdottir et al., 2002; Ward et al., 1993). These concerns about communicating pain to health professionals and using analgesics to manage cancer pain have been summarized into eight themes: fatalism about experiencing uncontrolled cancer pain; fear of addiction; concern about tolerance and side effects; the desire to be a good patient and not complain about pain; fear of disease progression; fear that analgesics may impair the immune system; and concern about distracting the physician from treating the disease (Ward et al., 1993).

In surgical patients, these concerns about reporting pain and using analgesics were identified in the literature in both the West and among Chinese adult patients. Patients' decision-making strategies used in the management of postoperative pain were explored in 312 Australian surgical patients by Manias *et al.* (2006). The following three strategies

commonly used by patients were identified: acting as a passive recipient of pain relief (60%), problem solving (23%), and active negotiation (17%). The pattern for the prescription of analgesics was also reported in the study: only 7 postoperative patients (2.2%) were on regular medication for pain relief, whereas 217 patients (68.7%) were on PRN (pro re nata) medication in the postoperative period (Manias et al., 2006).

Patients' negative pain beliefs, misconceptions about opioid analgesics, and lack of pain knowledge are prevalent among Chinese patients in acute care settings (Wong & Chan, 2008; Yan et al., 2011). The pain experience and beliefs of postoperative patients were explored among Hong Kong Chinese who had sustained traumatic limb fractures (Wong & Chan, 2008). Twenty-six adult patients who had undergone surgeries in a trauma unit in a regional hospital in Hong Kong were invited to participate in this qualitative study. Seven themes in pain experience and belief were indentified: experiencing severe pain, lack of control over pain, regarding pain as a negative signal, worrying about "shan", limited knowledge about pain management, trying to be good patient, and eagerness to learn about how to cope with pain (Wong & Chan, 2008). In mainland China, in a survey conducted in postoperative care settings of three tertiary general hospitals, patients were also reported to be hesitant about reporting pain or using analgesics, and to be deficient in knowledge about pain management (Yan et al., 2011). More than 70% of the patients did not report pain to health professionals until the pain became moderate or severe; 72.6% of the patients knew nothing about morphine; and nearly 20% (18.5%) of the patients expressed a strong reluctance to using morphine for pain relief (Yan et al., 2011).

In addition, patients' concerns about reporting pain and using analgesics, the relationships among these concerns, the patients' postoperative pain experience, and their analgesics use were explored in Taiwan Chinese patients undergoing surgeries (Tzeng et al., 2006). Two hundred and seven postoperative patients were involved in this study. Their top three concerns, as reported using the subscales of the Barrier Questionnaire Taiwan Form-Surgical Version (BQT-S) on a scale ranging from 0-5, were time interval, tolerance, and fear of injections. Moreover, the BQT-S scores were significant positively correlated with pain intensity and pain interference, but were negatively correlated to the amount of postoperative analgesic use (Tzeng et al., 2006).

Some influential factors have been found to be related to these barriers to pain management, including ethnocultural factors and patients' personal characteristics. The perception and expression of pain was documented in different racial and ethnic groups. Regardless of gender, American patients felt that it was more acceptable to express pain behaviours than did Japanese patients, with the latter's culture of eastern stoicism (Hobara, 2005). Both gender and profession had significant effects on the perceived appropriateness of certain types of pain behaviour, as indicated in a Hong Kong Chinese population (Leung & Chung, 2008). Men showed a more stoical response to pain, possibly because of gender-role expectations (Soetanto, Chung & Wong, 2006). Among older patients, there may be barriers to the effective communication of pain (McDonald & Sterling, 1998; Schofield, 2006), given their expectation that nurses and doctors will manage their postoperative pain (Zalon, 1997). In addition, patients and family caregivers with a lower educational background were more concerned about using analgesics and

had more negative beliefs about pain. Most significantly, these concerns predicted the hesitancy to administer 'prn' (*pro re nata*) analgesics and inadequate pain relief in Taiwanese cancer patients (Lin, 2000; Lin et al., 2000). However, the patients' personal characteristics such as their age, gender, educational backgrounds, and profession, could not be modified by nurse-led educational interventions. In having nurses assess and manage pain, the above factors need to be considered to plan appropriate actions on patients' pain (Chung, Wong & Yang, 2000).

It is noteworthy that cultural background is an important aspect of the sociocultural dimension of pain, because people from different cultures perceive and respond to pain in different ways. In addition, how and whether people communicate pain to healthcare professionals and to others can be influenced by cultural factors. Perceptions of, responses to, and communications about pain can influence the patients' use of drug or non-drug methods for pain treatment (Chen et al., 2008).

The Chinese perspective of pain is complex, and can only be understood through an understanding of several traditional Chinese philosophies such as Taoism and Confucianism. Taoism arose from the thoughts of Lao Tzu, who was purportedly born in 604 BC. The word "Tao" has several meanings, including way, path, or discourse. To live according to the Tao, one must adapt oneself to the order of nature. Each individual is linked in a chain that consists of concepts related to each other in a harmonious balance (Chen et al., 2008). In Taoism, it is believed that there are two polar complements (Yin and Yang) within and between the body and its environment. The notion of Qi is as

fundamental to Chinese culture and medical thought as Yin and Yang. The key point in the harmonious balance of the body and its environment is the balance of Qi (Chen, 2003). Pain is regarded as stagnant Qi in limbs and meridians or an imbalance of Yin and Yang in the body (Chen, 2001; Chung et al., 2000). Chinese people believe that pain occurs if the circulation of Qi is blocked. A Chinese proverb says "there is no pain without a blockage and no blockage without pain" (通则不痛, 不通则痛). This phrase means that every pain is a blockage of Qi/blood, and that removing the blockage will eliminate the pain (Chen et al., 2008). Therefore, Chinese people may prefer to use traditional Chinese medicine or acupuncture, instead of using analgesics to treat the blockages in the meridians (Chung et al., 2000).

The teachings of Confucius are principles for social interaction, individual morality, and ethics. These teachings have a significant influence on Chinese behaviour. Harmony with all others and a lack of self-centredness, respect for parents, and loyalty to family are the main teachings of Confucianism (Chen, 2001). A Confucian believes that pain is an essential element of life. Pain is the best assurance that people are not really numb and insensitive. The experience of pain and suffering not only heightens a person's sensitivity but also reminds a person of his/her humanness. Confucians also believe that humanness means sharing the pain or suffering of another.To share the pain or suffering of another is to achieve the goodness of human nature. If one suffers from pain, one may derive some comfort from sympathetic relatives and friends, but one must bear the burden alone (Chen et al., 2008). The golden rule of Confucianism is that you should not do unto others what you would not want others to do unto you (Creel, 2000). Therefore, when a

person suffers from pain, he or she would rather bear the pain and not report it to a clinician until the pain becomes unbearable.

It is evident that negative beliefs about pain and treatment are prevalent among patients in both western and Chinese clinical settings, regardless of the patients' ethnicity and cultural background (Manias et al., 2006; Tzeng et al., 2006; Wong & Chan, 2008; Yan et al., 2011). For Chinese patients, nurses need to consider the impact of traditional philosophies and a stoical culture on the way individuals perceive appraise, and express pain. Educating patients about pain and its treatment may greatly reduce attitudinal barriers to reporting pain and using analgesics for pain relief (Bell & Duffy, 2009; Tzeng et al., 2006; Yan et al., 2011). In addition, attentive pain care by nurses should be emphasized, such as providing on-going evaluations, clarifications, and reinforcement of patients' learning; identifying pain issues for individual patients; and taking appropriate actions on patients' pain to achieve better outcomes in pain management.

2.6 Educational approaches to the management of postoperative pain

Nurse-led educational programmes are targeting on empowering the patients by imparting knowledge and skills, clarifying misconceptions about pain and its treatment, and facilitating active participation in pain management. The major purposes for these programmes are to achieve better pain relief, to minimize the incidence of postoperative complications and chronic post-surgical pain, reducing the subsequent financial burden, and to improve the quality of life for patients in the long-term.

Articles published in English and Chinese from January 2000 to December 2011were searched. Terms used for searching included ‘pain education’, ‘patient education’, ‘postoperative pain’, and ‘postoperative pain management’. These terms were searched for in five electronic databases: Medline, CINAHL, British Nursing Index, PsycINFO, and the China Academic Journals full-text database (CAJ). Initially, a total of 636 citations were identified and 32 articles were retrieved from the five databases: 20 in English, 11 in Chinese, and 1 in German. Further, duplicate articles, articles in which the contents of the education intervention were not focused on pain management, or studies conducted among children and ambulating surgical patients were also removed from this review. As a result, a total of 19 articles (13 of them in English and 6 in Chinese) were included and reviewed. A flow chart of the search and selection process is given in Figure 2.1.

There is much positive evidence for psycho-educational interventions in pain management (14 out of the 19 reviewed articles), although some researchers reported that an increase in knowledge did not necessarily improve the patients’ pain behaviours or achieve better outcomes related to pain (5 articles). In the literature in the West and China on postoperative pain care, the effectiveness of different educational approaches to addressing pain and its treatment, and their implementation using different strategies, was investigated in various patient populations. The research methods on pain education for postoperative pain management are presented in Table 2.1

Figure 2.1 The flow chart of the search and selection process

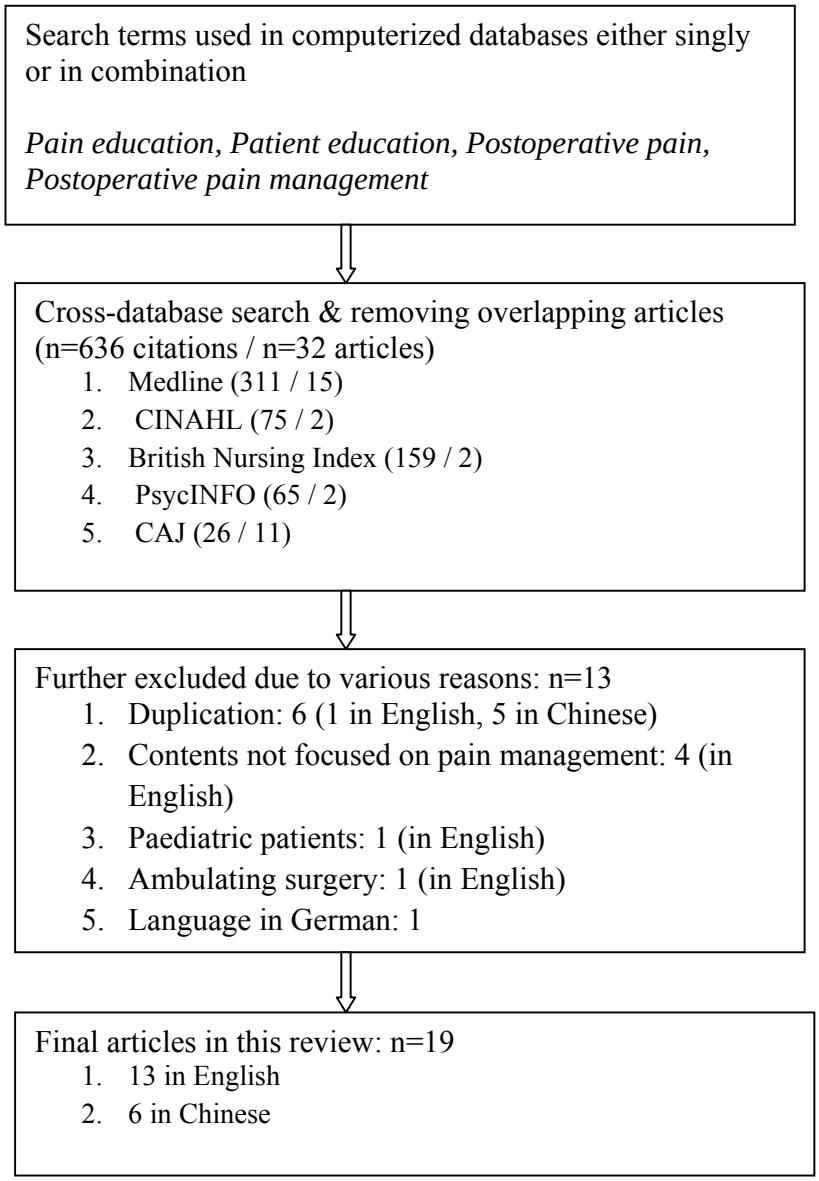


Table 2.1 Research methods used in overseas and local studies on pain education for postoperative pain management

Study	Sample	Design	Intervention	Timing	Contents of teaching	Duration	Written information	Nurses' reinforcement	Outcome measures & Statistically significant effects (+/-)
Chumbley et al. (2004) (UK)	225 patients undergoing major surgery	Cluster randomization (3-group design)	PCA teaching programme	1 day before surgery	Information about PCA	leaflet or 20min nurse interview	Yes	No	Knowledge (self-designed questionnaire): + (↑) between leaflet group and the control group Anxiety (POMS & HADS): - Worries about PCA: - ; Use of PCA: -; Side effects of PCA (St George's Hospital PCA questionnaire) : - Pain (VAS): - in 5 days after surgery
Knoerl et al. (1999) (USA)	76 surgical patients	Quasi-experimental	Preoperative PCA teaching programme	Preoperative	Watching 11-minute instructional video and practice pressing a control button on a PCA device	15min	No	No	Knowledge regarding the use of PCA (self-designed questionnaire): + (↑) Attitudes toward using pain medicine (self-designed questionnaire) : + (↑) Pain scores (NRS): + (↓) in the worst pain score 4 & 8 hrs after surgery Satisfaction with pain care (APS-POQ): + (↑)
McDonald et al. (2001) (USA)	31 elder patients undergoing total knee or hip replacement	RCT (post-test-design)	Pain education programme	Preoperative	General pain management information & pain management communication skills based on communication accommodation theory (CAT)	30min	Yes	No	Postoperative pain (intensity, affective& sensory dimensions of pain) (MPQ-SF): + (↓) from operation day to POD 2
McDonald & Molony (2004) (USA)	41 elder patients undergoing total knee or hip replacement	RCT(3-group post-test design)	Pain education programme	Preoperative	General pain management information & pain management communication skills (watching film)	14min	Yes	No	Postoperative pain (intensity, affective& sensory dimensions of pain)(MPQ-SF): + (↓) in sensory pain on POD2
McDonald et al. (2005) (USA)	38 elder patients undergoing total knee or hip replacement	RCT(2-group post-test design)	Pain education programme	Preoperative	General pain management information & pain management communication skills (video tape)	15min	Yes	No	Postoperative pain & interference with activities (BPI-SF): + (↓) on POD1

Sjoling et al. (2003) (Sweden)	60 patients undergoing total knee anthroplasty	RCT	Pain education programme	1 day before surgery	Knowledge and skills in postoperative pain management & emphasizing patients' role in pain management	Unclear	Yes	No	Trait & state anxiety (duplicated from other study): - ; except for state anxiety + (↓) Experience of pain (VAS, DPI & OPI): - ; Analgesic use: - in 3 days after surgery Satisfaction with care: + (↑) Length of hospital stay: -
Reynolds (2009) (USA)	146 surgical patients	RCT	Pain education programme	Before discharge	Information about self-management of postoperative pain	10min	Yes	No	Pain knowledge (PPQ): - Pain & interferences with activities (BPI-SF): - 1 week after discharge
Watt-Watson et al. (2004) (Canada)	406 coronary artery bypass graft surgery (CABG) patients	RCT	Pain education programme	Preadmission period	Information about how to manage postoperative pain (booklet delivered to patients)	Unclear	Yes	No	Pain interference with activities (BPI-I) : - from day 1 to 5 after surgery ;+ (↓) on day 5 by sex Pain and unpleasantness (MPQ-SF): - from day 1 to 5 after surgery; + (↓) across time by sex Concerns about taking analgesics (BQ-SF): - from day 1 to 5; + (↓) on day 5; + (↓) on day 3 in women patients Analgesics use (patient's chart): - Satisfaction (APS-POQ): - from day1to5 after surgery Length of hospital stay (patient's chart) : -; + (↑) in women
Chen et al. (2005) (Taiwan)	60 patients received total knee replacement	Quasi-experimental	Preoperative PCA teaching programme	Preoperative	Multi-video CD (VCD) of PCA: pre-admission pain education to patients and family, introduction of PCA, nursing care procedures, and questions concerning PCA.	20min	No	No	Pain knowledge (self-designed questionnaire): + (↑) Pain relief (pain controlling performance evaluation form): + (↑) in 3 days after surgery Usefulness of teaching (self-designed questionnaire): + (↑)
Lam et al. (2001) (Hong Kong)	60 women patients undergoing major gynaecologic surgery	RCT	PCA teaching programme	Preoperative	Information about PCA (verbal instruction & visual demonstration of PCA device)	20min	Yes	No	Pain score (VAS): - ; Side effects of PCA :- ; Morphine consumption : - in 48 hrs after surgery Satisfaction : + (↑) immediately after surgery Time of recovery : -

Lin & Wang (2005) (Taiwan)	62 patients undergoing abdominal surgeries	RCT	Pain education programme	1-3 days before surgery	General information about postoperative pain management	20-30min	No	No	Attitudes to pain (APS-POQ): + (↑) Anxiety(VASA): + (↓) postoperative pain & interference with activities (BPI-C): + (↓) 4hrs & 24hrs after surgery
Wong et al. (2010a,b) (Hong Kong)	125 orthopaedic patients	Quasi-experimental	Education intervention	1 day before surgery	Information about pain, coping strategies, and breathing relaxation exercises	30min	No	No	Pain level (VAS): + (↓); Anxiety (STAI): + (↓); Self-efficacy (C-SES): + (↑); Pain barriers (The Modified Pain Barrier Scale): + (↓) before surgery to POD7 Analgesic use : -
Lin et al. (2007) (mainland China)	272 women patients undergoing hysterectomy	RCT	Pain education programme	Preoperative	Information about postoperative pain management	Unclear	No	No	Knowledge and attitudes about pain & its treatment (purpose designed questionnaire) : + (↑) Pain management behaviours (medical records): + (↑) in use of drug methods Postoperative recovery (medical records) : + (↑) Days of hospital stay: + (↓)
Shi & Li (2005) (mainland China)	90 patients undergoing abdominal surgeries	Quasi-experimental (3-group design)	Pain education programme	Preoperative	Information about PCA (oral instruction & written information)	40min	Yes	No	Pain scores (VAS): + (↓) in 48hrs after surgery; + (↓) in 24 hrs between E1 & E2; - from36 to48hrs between E1 & E2
Wen & Li (2008;2009) (mainland China)	84 patients undergoing abdominal surgery	Quasi-experimental	Pain education programme	1 day before surgery	Information about postoperative pain management	30min	Yes	No	Knowledge about postoperative pain management (purpose designed questionnaire) : + (↑); Pain management behaviours : + (↑) in use of non-drug methods & correct use of PCA ; Pain scores : + (↓) in 48hrs after surgery

Ren (2011) (mainland China)	200 thoracic surgery patients	Quasi-experimental	Pain education programme	1 day before surgery	Information about postoperative pain management	Unclear	No	No	Pain knowledge (self-designed questionnaire): + (↑) Pain score (VAS): + (↓) in 48 hrs after surgery Postoperative recovery: + (↑)
Zhan et al. (2009) (mainland China)	201 lung cancer patients undergoing thoracic surgery	Quasi-experimental	Pain education programme	Pre & postoperative	Information about postoperative pain management	1hr (pre) & 20-30min (post)	Yes	Yes (till patient discharge)	Pain knowledge (self-designed questionnaire): + (↑) Pain score (PH): + (↓) in 48 hrs after surgery Postoperative recovery : + (↑)

2.6.1 Education with general information about pain management

The positive effects of preoperative patient education consisting of general information about pain management and self-care in the postoperative recovery are well documented in the literature both in the West and China. Empowering patients with knowledge about pain and the skills to manage pain helps them to achieve better pain relief when undergoing surgery.

The effects of preoperative education for pain management were investigated in Taiwan Chinese patients and supported the view of the positive impact of such a preoperative nursing intervention on the management of postoperative pain (Lin & Wang, 2005). An RCT was adopted for the study and 62 patients undergoing abdominal surgery were recruited. A comprehensive preoperative pain education programme and routine care were provided to the experimental group, while the control group received routine care alone. All of the participants were measured for anxiety levels, attitudes towards pain, pain severity, and interference with activities. The results indicated that the experimental group experienced a significant improvement in pain attitude, and decrease in preoperative levels of anxiety, gave lower pain ratings, and perceived less interference from pain than did the control group (Lin & Wang, 2005).

Educational approach about pain also demonstrated immediate and long-term benefits for patients with musculoskeletal trauma and consequent orthopaedic surgery in Hong Kong Chinese people (Wong et al., 2010a; 2010b). A pre and post-test quasi-experimental design was adopted and 125 participants completed the study. The experimental group

received a 30-minute education intervention consisted of information about pain, coping strategies, and breathing relaxation exercises the day before surgery. Pain level, anxiety, self-efficacy, and pain barriers were measured on the day before operation, during postoperative hospitalization; and follow-up at 1 and 3 months after surgery. Pain management behaviours as frequency of performing breathing relaxation exercises were only recorded for the experimental group; and use of analgesics or request for analgesics were measured for both the experimental and control groups. The experimental group reported significantly lower levels of pain, anxiety, barrier scores, and better self-efficacy before surgery to postoperative day 7 (Wong et al., 2010a; 2010b). No significant differences indicated in use of analgesics or request for analgesics except for postoperative day 2 (more requests in the experimental group, $p < 0.001$). At 3-month evaluation, anxiety level was significantly lower in the experimental group than that in the control group (Wong et al., 2010a).

In mainland China, the effects of pain education for surgical patients have been further supported by some previous studies. A randomized controlled trial was applied by Lin and colleagues (2007) to investigate the effects of preoperative pain education for women patients undergoing a hysterectomy. Two hundred and seventy-two patients were invited and randomly allocated to the experimental and control groups. Individualized preoperative education for pain management was provided to each participant by charge nurses in the experimental group, while the control group received routine care. All of the participants were measured for their knowledge and attitudes towards pain, analgesic use, and physical recovery from surgery. The patients in the experimental group demonstrated

significant improvement in their knowledge and attitudes towards pain, used more analgesia, and achieved better functional recovery than those in the control group (Lin et al., 2007). Similar findings were reported by Wen and Li (2008; 2009), supporting the positive effects of preoperative pain education in improving patients' knowledge and attitudes about pain, using more non-drug methods for relieving pain, and reducing pain severity for patients in 48 hours after abdominal surgeries.

In addition, Zhan and colleagues (Zhan et al., 2009) and Ren (2011) reported that preoperative pain education benefited patients undergoing thoracic surgery. A quasi-experimental with non-equivalent control group design was applied in their studies. Pain education was provided to patients by trained members of a pain team (Zhan et al., 2009) or by trained operating theatre nurses (Ren, 2011). Pain knowledge, pain scores in the 48 hours after surgery, and postoperative recovery in terms of the first time to initiate ambulation and the timing of the removal of the chest tube were measured. The experimental group achieved significant improvement in pain knowledge, lower pain scores, and better postoperative recovery than those in the control group (Ren, 2011; Zhan et al., 2009).

However, some conflicting results on the effectiveness of an educational approach to pain management were also found in some other studies, which reported that an education intervention had no impact on the patients' knowledge, attitudes towards pain, and pain outcomes. Sjoling *et al.* (2003) reported that patients who had received information about managing pain did not experience significantly lower levels of pain and anxiety than

those patients in the control group who received routine care. The impact of a preoperative pain education on pain outcomes for patients undergoing coronary artery bypass graft surgery (CABG) were investigated by Watt-Watson and colleagues (2004) in a large cardiovascular surgical unit of a university teaching hospital in Toronto. Four hundred and six patients were invited and randomly assigned to the standard care group and the intervention group. The former group received standard care, while the latter group received standard care, together with a pain booklet. Four hundred and six (n=406) CABG patients participated in the study. Data were collected at the preadmission clinic and across days 1-5 after the operation. Outcome measures included pain experience, pain-related interference, analgesic data, patients' concerns about using analgesics, and satisfaction with care. However, the intervention group did not have better overall outcomes related to pain in such areas as postoperative pain severity and interference with daily activities, concerns about using analgesics for pain, and satisfaction with pain care (Watt-Watson et al., 2004). A pain education implemented at the postoperative period such as before discharge was provided to improve patient outcomes as pain knowledge and pain relief. However, no significant benefits have been achieved in knowledge about pain and pain relief from the delivering such a pre-discharge patient education programme (Reynolds, 2009).

2.6.2 Education focused on specific information about pain management

The contents of the patient education programme, which focused on specific information about pain management such as skills for communicating pain and using PCA to treat pain, also had a positive impact on pain outcomes in various care settings. Most previous

studies supported the view that pain education with specific information could effectively improve the knowledge, attitudes, and pain management behaviours of patients, and consequently improve outcomes for postoperative pain care (Chen et al., 2005; Knoerl et al., 1999; McDonald et al., 2001; McDonald & Monoly, 2004; McDonald et al., 2005; Shi & Li, 2005).

Patient education that focused on pain communication skills together with the imparting of general information about pain could effectively improve the skills of elderly patients in communicating pain with health professionals, subsequently leading to better relief of pain and less interference with daily functions (McDonald et al., 2001; McDonald & Monoly, 2004; McDonald et al., 2005). McDonald and colleagues (2001) tested the effects of a preoperative pain management intervention for elderly patients undergoing a total hip or knee replacement. Thirty-one elderly people were randomly assigned to the experimental and control groups, and a double-blinded measure and post-test design were adopted for the study. The education intervention for the experimental group focused on developing the patients' communication skills on pain based on communication accommodation theory (CAT) and their general knowledge about pain management. The postoperative experience of pain in its affective and sensory dimensions, and the intensity of the pain was the primary outcome. The results from the study indicated that the intervention integrated general pain management information and communication skills about pain could effectively improve pain relief for elderly patients from operation day to postoperative day 2 (McDonald et al., 2001).

The positive effects of the above intervention for elderly patients to manage postoperative pain were supported by two further studies conducted by McDonald and colleagues (McDonald & Molony, 2004; McDonald et al., 2005). A total of 41 and 38 patients undergoing a total knee or hip replacement participated in the two studies respectively. The contents of teaching was same as the previous study (McDonald et al., 2001), but the format of teaching was changed to watching film and video-tape (a total duration of 15 minutes) respectively. The postoperative pain experience, interference with daily activities, and perceived pain relief were measured for all of the participants in the postoperative period, with follow-ups after the patients were discharged. The intervention group received general pain management information and communication skills about pain reported greater pain relief and less interference from pain on the first day after the operation (McDonald et al., 2005); or significant lower scores of sensory pain on postoperative day 2 (McDonald & Monoly, 2004).

Patient-controlled analgesia (PCA) was developed in the early 1980s and its use has become widespread in various care settings. PCA provides patients with greater control in managing their pain. Preoperative education focusing on knowledge about PCA, the application of its device, commonly used analgesics, and strategies to cope with side effects from its use has been considered to be effective at improving the knowledge and attitudes of patients about pain (Chen et al., 2005; Knoerl et al., 1999). The results have been better pain relief (Chen et al., 2005; Knoerl et al., 1999; Shi & Li, 2005), fewer side effects (Chen et al., 2005), and higher patient satisfaction with pain care (Knoerl et al., 1999). However, structured preoperative education focusing on knowledge about PCA

and the application of its device did not generate such positive results in some other studies (Chumbley et al., 2004; Lam et al., 2001).

Knoerl and colleagues (1999) conducted a randomized controlled trial (RCT) to examine the effectiveness of a structured preoperative teaching programme on PCA for patients (n=76) in a medical centre in the USA. The patients' beliefs about pain and analgesics, their postoperative experience with pain, satisfaction with pain care, and the analgesic data were collected. The results of the study revealed that the preoperative teaching session significantly improved knowledge and attitudes toward using analgesics, reduced pain severity for patients, and increased their satisfaction with the care they had received, although there was no significant difference in analgesic use between the experimental and control groups (Knoerl et al., 1999). In Taiwan, for Chinese patients receiving a total knee replacement (n=60), Chen et al (2005) provided a multi-media VCD on PCA at the time of the patients' admission. Its effects were investigated using a quasi-experimental design. The findings of the study supported the view that teaching patients about PCA had positive effects in improving the patients' knowledge about pain, bringing better pain relief, and less side effects from using PCA (Chen et al., 2005).

In mainland China, the effectiveness of different methods of teaching patients about the use of PCA after abdominal surgeries was investigated. Shi and Li (2005) conducted a quasi-experimental study with a three-group design to determine the differences in postoperative pain relief for patients when different teaching strategies were used. The patients were divided into the following three groups: the routine care group, the oral

instruction group (provided with 40 minutes of instruction by nurses on PCA), and the oral instruction together with written information group. Postoperative pain scores were measured at 6 hours, 24 hours, 36 hours, and 48 hours after surgery. Patients who had received both oral instruction and written information, or oral instruction alone, reported significantly lower pain scores than did those in the routine care group in the 48 hours after surgery. In addition, the group that had received both oral and written information reported significantly lower pain scores than did the oral instruction group in the first 24 hours; and no significant differences were found between the two groups in the following measurements (Shi & Li, 2005). Providing patients with structured oral PCA teaching together with written materials helped to relieve postoperative pain in Chinese patients.

However, some researchers have reported conflicting results about the effectiveness of education interventions involving PCA on postoperative pain management. Lam et al. (2001) conducted an RCT to investigate the effects of a structured preoperative education programme on PCA for Chinese women patients (n=60) undergoing major gynaecologic surgeries in one hospital of Hong Kong. The study results revealed that teaching about PCA did not affect patient outcomes regarding postoperative pain, the side effects caused by analgesics, the use of analgesics, recovery from surgery, and patient satisfaction with pain care (Lam et al., 2001). Moreover, Chumbley et al. (2004) designed an RCT with a three-group design to examine whether patients benefited from preoperative information about PCA. The three groups were: the patient information leaflet group, the nurse interview group, and the routine preoperative information group. Two hundred and forty-six patients undergoing major surgery were initially recruited from a hospital in the

United Kingdom and 225 of them (n=225) completed the study. The patients' knowledge about pain, use of PCA, their anxiety and pain, and the side effects of PCA were measured. However, the results indicated that the detailed provision of a preoperative nurse interview providing information on PCA (about 20 minutes) did not lead to any improvements among the patients with regard to pain relief, levels of anxiety, knowledge about side effects, and concerns related to analgesic use in terms of safety and risk of developing an addiction. Patients received written information expressed significant improvement in pain knowledge than the control groups; but this did not link to behaviour changes in using PCA or pain relief (Chumbley et al., 2004).

In the literature, most of the research findings supported the view that pain education has a positive effect on patient outcomes in postoperative pain care. These outcomes included: improving patients' knowledge and attitudes about pain (Chen et al., 2005; Knonerl et al., 1999; Lin & Wang, 2005; Lin et al., 2007; Wen & Li, 2008; Ren, 2011; Zhan et al., 2009), improving pain management behaviours (Lin et al., 2007; Wen & Li, 2008; 2009), significantly reducing pain levels (Chen et al., 2005; Knonerl et al., 1999; Lin & Wang, 2005; Lin et al., 2007; McDonald & Molony, 2004; McDonald et al., 2001; McDonald et al., 2005;Wen & Li, 2008; Wong et al., 2010; Ren, 2011; Shi & Li, 2005; Zhan et al., 2009), less interference from pain with daily activities (McDonald et al., 2005; Lin & Wang, 2005), and achieving better clinical outcomes such as a faster recovery from surgery (Lin et al., 2007; Ren, 2011; Zhan et al., 2009) and a shorter hospital stay (Lin et al., 2007). Patients also expressed significantly higher self-efficacy in managing pain (Wong et al., 2010a), fewer barriers to pain management (Wong et al., 2010b), lower

levels of anxiety (Lin & Wang, 2005; Wong et al., 2010a; 2010b), and more satisfaction with pain care (Knonerl et al., 1999; Lam et al., 2001; Sjoling et al., 2003). Nevertheless, a few studies did not find a significant improvement in such outcomes as patients' knowledge and attitudes (Chumbley et al., 2004; Reynolds, 2009) or behaviours in pain management (Chumbley et al., 2004; Sjoling et al., 2003; Watt-Watson et al., 2004), pain relief (Chumbley et al., 2004; Lam et al., 2001; Reynolds, 2009; Sjoling et al., 2003; Watt-Watson et al., 2004), and clinical outcomes (Lam et al., 2001; Watt-Watson et al., 2004).

The common features of successful pain education interventions included such teaching strategies as detailed oral instructions combined with written information (McDonlad & Monoly, 2004; McDonlad et al., 2005; Shi & Li, 2005; Wen & Li, 2008; Zhan et al., 2009). Only providing patients with oral instructions (Chumbley et al., 2004) or written information about pain (Watt-Watson et al., 2004) tended not to lead to positive outcomes in pain care. According to the literature, the extent of a patient's learning was vital in generating significant outcomes for pain education approaches to managing postoperative pain. Fully understanding what has been taught and the ability to recall the learned information influenced patients' application of knowledge and changes in their behaviour in managing pain in the postoperative period. In addition, the readiness and motivation of patients to learn should also be taken into consideration (Falvo, 2011). What a patient really needs to know (the amount of information) and individual pain issues need to be identified and addressed, and may greatly narrow the gaps between knowledge and actual behaviours (Lam et al., 2001; Reynolds, 2009).

It has been suggested that some factors contribute to bringing about a significant improvement in patients' learning, behavioural changes in managing pain, pain relief and, consequently, in clinical outcomes related to pain and surgery. First of all, patients' learning about pain management needs to be strengthened, and the amount of information provided to patients needs to be further explored. In previous studies, pain education usually consisted of extensive information about surgery, pain, and its treatment. On most occasions, the information was provided to patients on the day before the surgery. This led to the first question of whether the patients could really master all of the information that they had been taught. In fact, patients could only remember a fraction of the information that they had been taught about pain (Sjoling et al., 2003). It has been suggested that in order to improve the patients' learning and increase their ability to recall knowledge, some reinforcing strategies should be used, such as making simple or specific statements, repetitions, clarifications, or combining verbal instructions with written materials (Chumbley et al., 2004; Sjoling et al., 2003).

In addition, in previous studies the pain education programmes were designed from the perspective of health professionals; individual patient's needs in terms of education were not identified. This means that the information and skills that patients need to understand and apply in managing pain were determined from the viewpoint of the health professionals. This may also explain why adequate information did not bring about positive changes in behaviour in pain management and better pain relief for patients (Lam et al., 2001; Reynolds, 2009; Sjoling et al., 2003). In order to achieve significant improvement in pain outcomes, it is recommended that in postoperative care settings the

needs of individual patients with regard to education on how to deal with pain be identified (Lam et al., 2001; Reynolds, 2009). With the exception of general information about pain for patients, patients' specific needs for education should be based on individual pain issues in the postoperative period.

Further, very few studies have investigated the impact of reinforcing factors on patient education for postoperative pain care. In fact, only one study, that by Zhan and colleagues (2009), adopted postoperative reinforcing interventions. This consisted of one hour of preoperative pain education and 20-30 minutes of postoperative patient teaching implemented daily until the patient was discharged. The experimental group achieved significantly greater improvement in knowledge, lower pain scores in the 48 hours after surgery, and better postoperative recovery in terms of the first day to ambulate and the timing of the removal of the chest tube than did the control group (Zhan et al., 2009).

Some concerns were raised in the study conducted by Zhan and colleagues (2009): the feasibility of the teaching given to postoperative patients in actual practice; the outcome measurements for detecting the efficacy of the intervention; and the study design. In the acute postoperative phase (from the day of the operation to 72 hours after the surgery), it was hard for the patients to receive 20-30 of minutes teaching daily due to their physical condition, especially after having undergone a major surgery such as a thoracotomy operation. On the other hand, the mentioned duration of teaching (20-30 minutes a day until the patient is discharged) may be excessive when a patient's pain has diminished after time or when the patient had minimal pain before being discharged. In addition, pain

scores were only measured for the 48-hour period after the operation; and patients' pain management behaviours were not measured in the study. The impact of education on postoperative pain remained unknown from postoperative day 3 onwards (pain usually peaked when patients performed deep breathing/coughing exercises and increased ambulation). Therefore, to what extent did this intervention improve the patients' behaviours in managing their pain? In addition, the study adopted a two-group design: the experimental group received pre and post-operative teaching about pain; and the control group only received routine care. It is hard to judge whether a study intervention that integrated pre and post-operative teaching (patient education and nurses' reinforcement) would be more effective in improving pain outcomes than preoperative patient education alone. If issues over the feasibility and efficacy of the intervention cannot be examined appropriately, this may greatly limit the generalization of the research findings and its implications for clinical practice.

In the end, the gap between knowledge and actual behavioural changes needs to be addressed. Some researchers reported that it was difficult to have much change in the patients' behaviour or long-hold beliefs about pain or analgesics (Chumbley et al., 2004; Lam et al., 2001); or to clear up uncertainty about using pain treatments (Chumbley et al., 2004). Although the patients' positive participation in their pain treatment was the major purpose for delivering pain education, providing patients with information alone did not seem to be enough to improve pain management behaviours (Chumbley et al., 2004; Lam et al., 2001; Watt-Watson et al., 2004).

The following factors on issues of knowledge and behaviour need to be identified in future studies: how much knowledge the patients really need; the extent to which the patients are able to master the information that they are taught; and barriers or facilitators to achieving behavioural changes for pain management. Identifying individual needs for education and specific postoperative pain issues for individual patients may help to resolve the issue of the amount of information needed (Lam et al., 2001; Reynolds, 2009). Misconceptions and long-held beliefs are powerful factors influencing the attitudes and behaviours of individuals. They have been identified as barriers to performing expected behaviours; while it has been suggested that positive feedback, clarifications, and assistance from people in their surroundings are facilitators for changing or continuing a desired behaviour (Green et al., 1980).

In current clinical settings, nurses play a vital role in the management of postoperative pain, which includes acting as a care provider to assess and manage a patient's pain. With the exception of administering analgesics under a physician's order, nurses need to titrate dosage according to the patients' pain. They also need to collaborate with a multi-disciplinary pain team to address issues relating to the safety and effectiveness of analgesia for patients (Cox, 2010; Musclow, Sawhney & Watt-Watson, 2002). In addition, nurses also need to apply innovative strategies in managing postoperative pain (Chumbley, 2010).

Another important role of a pain nurse in clinical practice is to act as educators for both the patient and his/her family; and to lead the development of inter-professional

education in pain management (Musclow et al., 2002; Taylor, 2010). To improve the quality of pain management in all care settings, educating patients and their family about pain and its treatment, emphasizing patients' participation in treatment plan, and attentive pain care (as reassess and adjust pain management plan, monitor process and outcomes of pain management) were recommended in the Quality Improvement (QI) Guidelines for the Treatment of Acute Pain and Cancer Pain of American Pain Society (Gordon et al., 2005). In addition, pain education extended to ward staff and other members of a health care team is beneficial in that it increases knowledge, reduces attitudinal barriers to treating pain, and facilitates effective communication and collaboration, which may greatly resolve the issue of patients' suffering from the inadequate treatment of their postoperative pain. A comprehensive pain management programme integrated patients' active participation and nurse' attentive pain care may greatly improve the outcomes of postoperative pain management. The efficacy of such a pain management programme needs to be examined in current care settings.

2.7 Conceptual framework of the present study

Inadequately treated pain continues to be a major clinical issue in spite of the advanced techniques of analgesia and multi-modal analgesics for pain relief that are extensively applied in acute pain care settings. It has been suggested that a psycho-educational approach for patients is effective at improving the knowledge and attitudes of patients toward pain, and that patients will use the techniques that they have learned to manage their pain. Nevertheless, there is still a gap between increased knowledge and actual changes in behaviour in pain management. It seems that patient education alone is

inadequate to address the problem of unrelieved postoperative pain and to improve other clinical outcomes related to pain and surgery.

2.7.1 The PRECEDE framework

PRECEDE is an acronym for predisposing, reinforcing, and enabling causes in educational diagnosis and evaluation. The framework was developed by Green *et al*. (1980), and had been used as a successful model in clinical trials. The purpose of the PRECEDE framework is to direct the initial attention of health educators to outcomes rather than to inputs. It encourages the asking of why questions before the asking of how questions. It guides one to begin with the final outcome and asks what must precede that outcome by determining what causes that outcome. The view is that the important factors to an outcome must be diagnosed before the intervention is designed; if they are not identified, the intervention will be based on guesswork and there is a great risk that the intervention will be misdirected and ineffective (Green et al., 1980).

In the framework of PRECEDE, three categories of factors have been identified that will potentially affect health behaviour: predisposing factors, enabling factors, and reinforcing factors. Predisposing factors involve a person's attitude, beliefs, values, and perceptions, which may facilitate or hinder personal motivation for change. Enabling factors may be considered to be barriers created mainly by social forces or systems, such as limited facilities, inadequate personal or community resources, and lack of income or health insurance. The skills and knowledge required for a desired behaviour to occur are also regarded as enabling factors. Reinforcing factors are those related to the feedback that the

learner receives from others, the results of which may be to either encourage or discourage changes in behaviour.

PRECEDE is a successful model used in various care settings (Chiang et al., 2003; Newall et al., 2008; Yates et al., 2004; Zhang et al., 2008). In pain care settings, nurse-led education approaches based on the PRECEDE model of health behaviour for patients and nurses to improve patient outcomes and nurse's practices in pain management have indicated the effectiveness and feasibility of the educational strategies for clinical practice (Yates et al., 2004; Zhang et al., 2008).

In the study conducted by Yates and colleagues (2004), the PRECEDE model identified three categories of factors that may potentially influence a health behaviour, such as the use of strategies to relieve pain. Predisposing factors and enabling factors were targeted as evaluation indicators for the intervention, based on the assumption that strategies addressing the beliefs, attitudes, and skills necessary for effective pain management (e.g., knowledge about pain and concerns about pain treatment) will result in more effective behaviours in response to pain (e.g., communicating pain with medical staff and the use of pain medication). The results indicated that structured intervention strategies targeting specific contexts for patients are effective means of lowering behavioural barriers that may potentially impact outcomes of pain management (Yates et al., 2004).

2.7.2 Conceptual framework of the present study

Knowledge deficits, pain beliefs, negative beliefs about opioid analgesics, and undesirable behaviours in pain management can be modified and improvements achieved through various approaches to pain education (Chang, Chang, Chiou, Tsou & Lin, 2002; Lin et al., 2006; Wells, Hepworth, Murphy, Wujcik & Johnson, 2003). The specific predisposing, enabling, and reinforcing factors targeted in the pain management intervention for the present study were developed following a review of the published literature (Wong et al., 2008; Chung et al., 2000; Yan et al., 2011) and a descriptive qualitative study (Wong & Chan, 2008).

Negative pain beliefs, misconceptions about analgesics, and knowledge deficits about pain management were prevalent among Chinese patients undergoing surgeries. A current report from a survey conducted in three tertiary hospitals in mainland China indicated that more than 70% of the patients did not report their pain to health professionals until pain became moderate or severe; 72.6% of them knew nothing about morphine; and nearly 20% (18.5%) of the patients expressed a strong reluctance to using morphine for pain relief (Yan et al., 2011). In addition, seven themes were identified to describe the pain experience and beliefs of Chinese surgical patients who participated in a qualitative study (Wong & Chan, 2008). These included feelings of intense pain, a lack of control over pain, the view that pain is a negative signal, worries about the side effects of analgesics, limited knowledge of pain management, the desire to be a good patient, and passive coping methods to control pain, such as not thinking about pain, avoiding

negative thoughts, stoically tolerating pain, and avoiding any movements (Wong & Chan, 2008).

Perceptions, appraisals (negative beliefs about pain and analgesics), and the management of pain (hesitation to report pain, and the use of passive coping strategies to deal with pain) in Chinese culture were noted in the experience of patients who had undergone surgery (Wong & Chan, 2008; Chung et al., 2000; Yan et al., 2011). The patients also expressed the need to manage their pain by improving their knowledge and techniques in pain management (Wong & Chan, 2008). Culturally specific educational interventions are warranted to clarify the negative beliefs that patients have about pain and their misconceptions about the use of analgesics, to improve their knowledge and skills in managing pain; and, consequently, to facilitate active participation on the part of patients in their pain treatment (Wong & Chan, 2008). In addition, attentive care from nurses in the assessment and management of pain should be emphasized in pain care settings for Chinese patients, keeping in mind the culture of stoicism and traditional Chinese philosophies relating to pain (Chen et al., 2008; Chung et al., 2000).

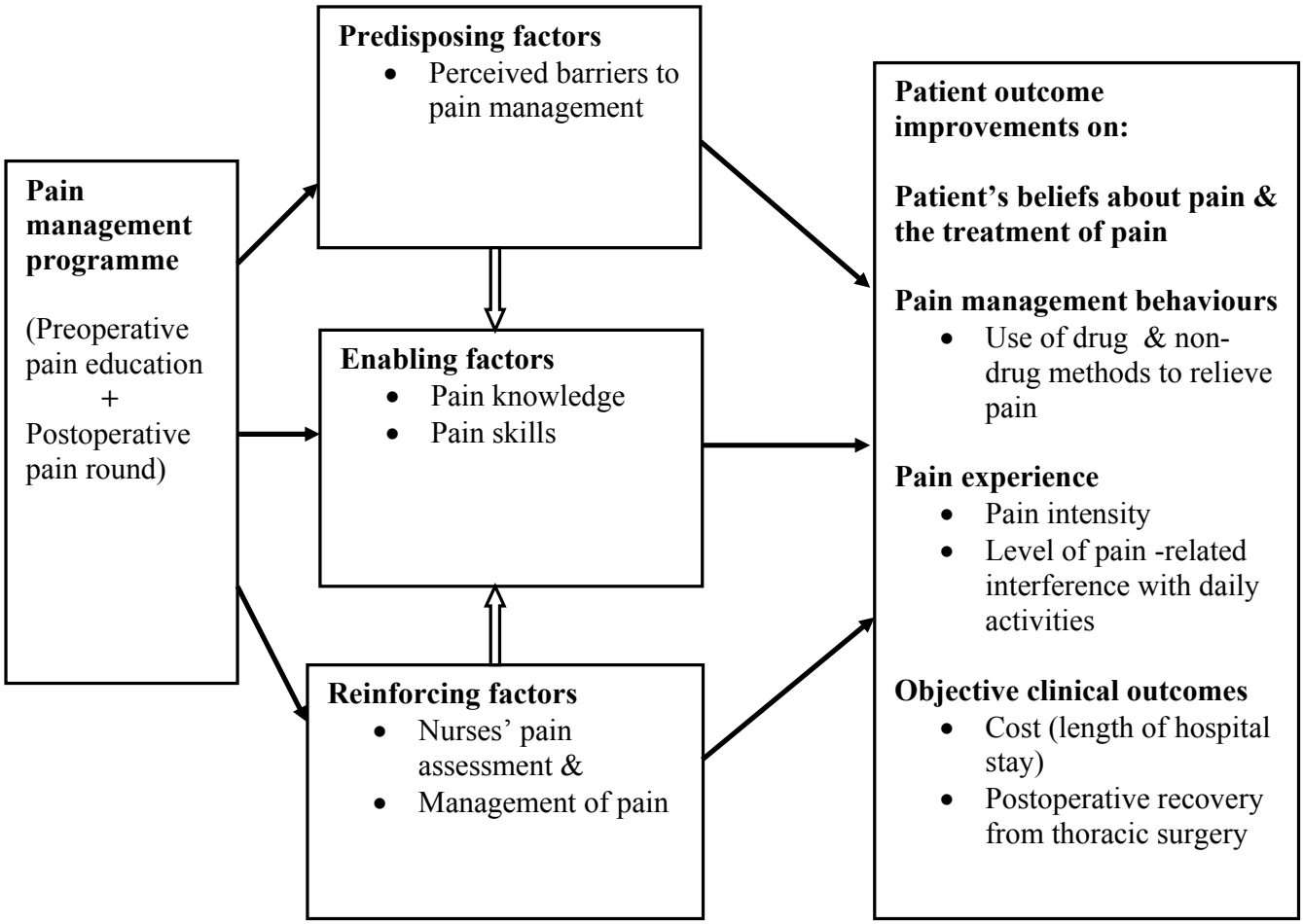
Further, enhancing the motivation of patients to participate in learning and improve their compliance with the instructions on health behaviour by taking advantage of surrounding factors could be useful to bringing about more positive effects from patient education. An individual's motivation to perform a specific action could be influenced by either intrinsic or extrinsic factors (Falvo, 2011). The intrinsic factors may be both physical and psychological, while the extrinsic factors are related to relationships or factors outside of

the individual and within their environment. The extrinsic factors may also be related to the degree of social encouragement or reinforcement received from family or friends, or to external rewards that the individuals may receive for reaching their goal (Falvo, 2011). In the postoperative period, unrelieved pain could be a powerful intrinsic factor driving patients to seek a resolution for their pain. On the other hand, in assessing and managing pain, nurses need to identify the pain issues of individual patients and provide appropriate treatment for that pain. It can be hypothesized that individualized postoperative reinforcing interventions by nurses (on-going evaluations, clarifications, and reinforcement) followed by patient education may greatly encourage or help patients to bring about positive changes in their behaviour with regard to pain management.

The intervention that will be evaluated in the present study specifically targets the predisposing, enabling, and reinforcing factors identified in the theoretical framework for health education by Green *et al*. (1980). The three categories of factors are: predisposing factors, which involve beliefs, attitudes, and perceptions that may facilitate or hinder a patient's motivation to perform a desired behaviour; enabling factors, which include the knowledge and skills to manage pain (the use of drug and non-drug methods for pain relief); and reinforcing factors, which are referred to as the nurse's reinforcing intervention after patient education (the assessment and management of pain) that may influence the continuance or discontinuance of pain management behaviours among the patients. The factors identified in the present study are listed in Figure 2-2. The approach designed for the current study is based on the assumption that strategies focusing on the beliefs, attitudes, and skills necessary for effective pain management will result in a

reduction of perceived barriers (e.g., pain beliefs, and concerns about pain management), and an increase in positive pain management behaviours (e.g., communicating pain with health professionals, and the use of drug and non-drug methods to relieve pain).

Figure 2.2 Conceptual framework of the study



(The framework is based on the PRECEDE model by Green et al., 1980; Yates et al., 2004 and Zhang et al., 2008).

As demonstrated in Figure 2.2, the outcome of the present study is to improve relevant measures of those factors that predispose, enable, and reinforce patients to engage in effective pain management behaviours; and consequently to improve patient outcomes. Such outcomes include patients' beliefs about pain and its treatment; pain experience, which involves pain intensity, and the pain-related impact on daily activities; and objective clinical outcomes as cost, and outcomes related to recovery from thoracic surgery (i.e., the first day to initiate ambulation, timing of chest-tube removal, and occurrence of postoperative complications). The intervention administered in the present study which is based on PRECEDE model, is to improve the knowledge and skills of patients; and to clarify their beliefs about pain and its treatment, which may lead to desired changes in behaviour relating to pain management, and subsequently to positive patient outcomes. The specific feature of the study intervention is an individualized reinforcing nursing intervention (the postoperative pain round) followed by patient education was provided in the postoperative period.

2.8 Summary of the literature review

Unrelieved postoperative pain continues to be a major clinical issue in current clinical settings (Apfelbaum et al., 2003; Shen et al., 2008; Yan et al., 2011). Patients' negative pain beliefs and misconceptions about using analgesics are important barriers to effective pain management (Ward et al., 1993; Gunnarsdottir et al., 2002). Existing research indicates that patient education may do a great deal to clarify patients' misconceptions, relieve their feelings of uncertainty, and bolster their understanding of health information, leading to improved health-related behaviours or facilitating positive behavioural changes to maintain health (Bastable, 2006; Janz & Becker, 1984). However, gaps still exist in

knowledge and actual behaviours. Educating patients alone does not appear to be enough to resolve all of the above issues. In addition, there is still a scarcity of research reports on the efficacy of nurses' reinforcing interventions integrated with patient education for improving outcomes of postoperative care.

In mainland China, educating patients about the management of postoperative pain is still not a routine part of care in clinical settings (Shen et al., 2008; Wen & Li, 2008). Even when preoperative pain education was provided to patients and significantly increased their knowledge and improved their attitudes about pain, approximately 50% of them (ranging from 43.6% to 64.1%) still agreed with the opinion that pain should be tolerated and there was no significant difference regarding analgesic use between the experimental group and the control group (Wen & Li, 2008). In addition, patients' use of health care resources to manage pain and accessibility to such care are a result of many factors, such as organizational factors, and barriers related to health professionals. Education for patients alone does not seem to be enough to resolve all of these issues or to improve the suboptimal outcomes of postoperative pain management. Such organizational factors as institutional polices, practice guidelines, and resources for treating pain cannot be altered easily in current clinical settings. Addressing the subject of attentive pain care delivered by nurses in postoperative pain management may relieve patients from a great deal of unnecessary suffering (Pasero & McCaffery, 2011).

To narrow the gap between increasing patients' knowledge and improving their pain management behaviours, a comprehensive pain management programme integrated

patients' active participation and nurses' attentive pain care was necessary and its effectiveness needed to be examined in the present study. The programme involves clarifying patients' negative beliefs about pain and misconceptions about analgesics (the predisposing factor), empowering patients by imparting to them knowledge and skills on pain to enable them to actively participate in pain management (the enabling factor), and having the nurse in the postoperative pain round facilitate the patients' positive behavioural changes (the reinforcing factor). This new model of care is based on the framework of PRECEDE (Green et al., 1980), which is an effective model extensively used for health education among different populations (Chiang et al., 2003; Newall et al., 2008; Yates et al., 2004; Zhang et al., 2008).

To generate the strongest evidence, a randomized controlled trial is recommended for clinical trials. To maintain the integrity of the intervention and the internal validity of a study, it is suggested that blinded measures be applied to participants, researchers, or both (Moras, 1998; Portney & Watkins, 2009). To improve the efficacy of the study intervention and facilitate its acceptance and generalization in future practice, skilled ward nursing staff were invited to participate in the study and trained as educators to conduct pain education for patients. This practice may greatly help to build trust and collaborative relationships between the participants and the researcher; minimize drop-out rates; and ensure the smooth implementation of the study (Kirchhoff & Dille, 1994; McGuire et al., 2000; Pruitt & Privette, 2000). In addition, the researcher acted as a pain nurse in conducting preoperative visits relating to pain education and the daily postoperative pain round. An advanced role for nurses in pain management was

emphasized in the present study, requiring nurses to: be an educator in training ward staff; to be consultation resources for both patients and their family regarding issues related to pain treatment; provide pain care and act as an advocate for patients in relieving their pain in the postoperative period.

Chapter 3 Methods

In this chapter, the research variables, objectives of the study, and research hypotheses are presented, followed by a detailed discussion of the research design, sampling method and study setting, ethical issues, procedures, study intervention, instruments used, and data analysis methods.

3.1 Research variables

3.1.1 Independent Variable

Variables are the building blocks of the research question, representing a concept, or a factor, that can have more than one value (Portney & Watkins, 2009). Research is performed to examine the relationship among variables or to describe how a variable exists in nature. In experimental studies, the researcher examines the relationships among two or more variables to predict outcomes or to establish that one variable influences another. For these types of studies, research variables are generally classified as independent or dependent, according to how they are used (Portney & Watkins, 2009).

A predictor variable is called an independent variable, which is a condition, intervention, or characteristic that will predict or cause a given outcome (Portney & Watkins, 2009). In the present study, the independent variable has two levels: the pain management programme (preoperative pain education together with a postoperative pain round); and preoperative pain education alone. The experimental group received both preoperative pain education (provided by trained ward nurses) and the postoperative pain round

(conducted by the researcher throughout the postoperative period). The comparison group only received the same preoperative pain education as the experimental group. All of the participants received routine perioperative care and treatment, such as physical assessments, preparation, operation, and nursing care, provided by the same healthcare team of anesthetists, physicians, and ward nurses.

3.1.2 Dependent variables

The outcome variable is called the dependent variable, which is a response or effect that is presumed to vary depending on the independent variable (Portney & Watkins, 2009). The dependent variables in the present study consisted of four categories: patients' beliefs about pain and concerns with pain treatment (patient-related barriers to pain management); patients' pain management behaviours (use of drug and non-drug methods to relieve pain); patients' pain experience (pain intensity and interference of pain with daily activities); and objective clinical outcomes, including postoperative recovery from surgery (i.e., the first day to initiate out-of-bed ambulation, length of chest-tube in situ, and occurrence of postoperative complications) and length of hospital stay.

In the present study, outcomes were measured for both the experimental and comparison groups at three time points: T0 (before preoperative pain education), T1 (the entire postoperative period), and T2 (the day before the patients' discharge). Data collection was conducted by a research assistant.

3.2 Objectives of the study and research hypotheses

The objectives of the present study were to investigate the effects of a nurse-led pain management programme on reducing patient-related barriers to pain management, to improve patients' pain management behaviours, and to achieve better pain relief, as well as to improve the consequent objective clinical outcomes related to thoracic surgery. Relationships between pain intensity, interference of pain with activities, barriers to pain management, and pain management behaviours (use of drug and non-drug methods for pain relief) were also examined in the study. The research hypotheses are:

(1) There will be no significant difference in pain intensity between the experimental group that received the pain management programme (preoperative pain education together with the postoperative pain round) and the comparison group that received preoperative pain education alone at baseline (on the day of the operation) and across time in the postoperative period;

(2) There will be no significant difference in the interference of pain with daily activities between the experimental group and the comparison group at baseline (on the day of the operation) and across time in the postoperative period;

(3) There will be no significant difference in the patients' pain management behaviours between the experimental group and the comparison group across time in the postoperative period;

(4) There will be no significant difference regarding patient-related barriers to pain management between the experimental group and the comparison group before and after pain education;

(5) There will be no significant difference in the objective clinical outcomes between the experimental group and the comparison group after a thoracotomy operation.

3.3 Design

This is a single-blinded randomized trial with a two-group pre and post-test design. A random sampling method was used for the present study, which involved recruiting all patients who met the inclusion criteria and assigning them into two groups by using computer-generated random numbers. The random categorization into groups is aimed at minimizing any influences related to age, gender, or other factors, and at providing a control over most threats to internal validity for the study and thereby generating the strongest evidence of cause-and-effect relationships (Portney & Watkins, 2009). Patients admitted to the thoracic surgery ward and who met the criteria for inclusion were randomly allocated to the experimental and the comparison groups, respectively.

Both groups of patients received preoperative pain education by trained ward nurses 1 to 3 days before their operation was performed. A daily pain round was conducted by the researcher, provided only to patients in the experimental group during the postoperative period. All of participating patients underwent a routine assessment, preparation, an operation, and treatment provided by the same medical team; as well as conventional peri-operative care provided by the same nursing team of the ward.

The construct validity of the experimental design concerns the biases that are introduced to a study by the expectations of either the subjects or the researcher. Subjects often try their best to fulfil the experimenter's expectations or to present themselves in the best

way possible, so that their responses are no longer representative of natural behaviour. This phenomenon is known as the Hawthorne effect (Portney & Watkins, 2009). In addition, the experimenters may also have certain expectations that can influence how the subjects respond. They may react more positively to the subjects of the experimental group or give less attention to the control group, because of the emotional or intellectual investment in their research hypothesis. This has been described as "experimenter effects" and categorized into several types: the experimenter's active behaviours and interaction with the subjects, such as verbal cues and smiling; and passive behaviours such as those related to appearance (Rosenthal, 1996). This threat to construct validity can be avoided by employing testers (the data collector in the present study) who are blinded to the subject assignment and the research hypothesis (Portney & Watkins, 2009).

To minimize experimental bias, a single-blinded measure (a data collector) was employed in the present study. All outcome measurements were conducted by an invited research assistant who was not involved in the assignment of the patient groups and in the implementation of the intervention. The researcher was responsible for the random assignment of the subjects and for ensuring that the correct intervention was provided for each subject in a specific group. To protect the integrity of the study and its implementation, the ward nurses and nurse educators did not have access to the randomization procedure or the research instruments for data collection. It was not possible to blind the patients in the study due to exchanges of information between patients in one ward setting. However, patients in the experimental group and the

comparison group were assigned to the two sides of the ward, and separated by the nursing station and other function rooms.

3.4 Setting & Sampling

A provincial tertiary hospital in Hefei City of Anhui Province in mainland China was involved in the study. The chest surgery ward of the hospital was selected as the study setting. Approximately 1,000-1,200 thoracic surgeries are performed annually in this ward. The subjects were admitted to the ward between January 2010 and July 2010.

The criteria for inclusion in the study were those who: had been admitted to the thoracic surgery ward from the study hospital; were scheduled to undergo a major thoracotomy operation for the first time, with chest drain postoperatively; had stayed in the Intensive Care Unit (ICU) of the ward for only the day of the operation and who were transferred to the general unit the next morning; were aged 18 years or above; and who could communicate in and understand Chinese. The exclusion criteria were patients who had undergone emergency surgeries; an operation or procedure under local anaesthesia; have neurological or psychological disorders; and those who have functional disabilities, such as visual or acoustic disorders. Those patients who were in an unstable hemodynamic state, had been re-admitted to the ICU, or whose stay there was prolonged were excluded from the study.

The patients who were sequentially recruited for the study were those who had been admitted to the thoracic surgery ward and met the criteria for inclusion. They were assigned to the experimental and the comparison groups respectively by using a simple

randomization method. One hundred and eight random sequences consisting of the numbers '1' and '2' were generated from a computer. Patients were assigned to the experimental group when they arrived and met the inclusion criteria with a computer number '1'; and patients with a computer number '2' were assigned to the comparison group. This was performed sequentially to achieve two groups of approximately equal size in the present study.

3.5 Sample size

Sample size is a major issue in conducting and evaluating a research study. The sample size was calculated for the present study according to the published literature (Lin & Wang, 2005; Wen & Li, 2008) to verify the size of the effect for predicting significant differences in the reduction of postoperative pain intensity. The rules of Cohen (1988) were used to determine sample size based on statistical power and effect size determinant. To achieve a statistical power of 80% with a significance level of 0.05 by using an effect size of 0.3 (*f* value) for an ANOVA analysis, the sample size would be 90 according to Cohen's table (Portney & Watkins, 2009). A 10% drop-out rate was considered, and a total of 100 patients needed to be recruited for the present study. According to the pilot study, drop-out rates were 22.2%, so an extra 10% was added for the main study. In the end, the total sample size was 108 patients, with 54 patients for each group.

3.6 Procedures

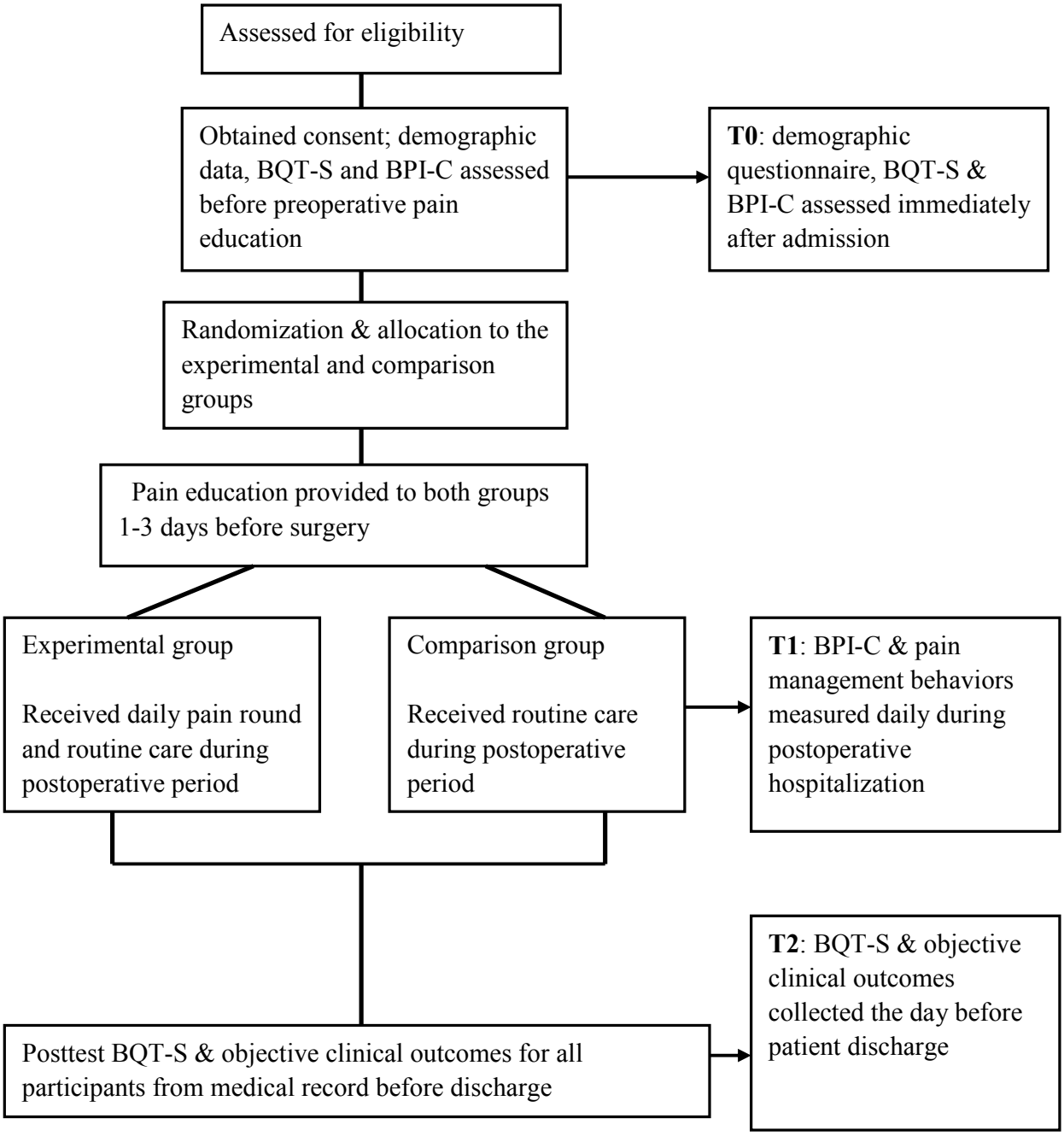
Prior to the commencement of the study, ethic approval was obtained from the Human Subjects Ethics Sub-Committee of The Hong Kong Polytechnic University and access approval was granted from the participating hospital (Appendix-1).

Participation in the study was voluntary. An information sheet (Appendix-3) for the study was provided to the eligible patients. The investigator approached each participant, gave a detailed explanation of the purpose of the present study, and invited them to participate in the study. The patients were also informed of their right to voluntarily participate or withdraw from the study at any time for any reason; and their decision had no impact whatsoever on their medical and nursing care. The participant then signed the written consent form (Appendix-5), which was collected by the researcher. The contact details, such as telephone numbers and e-mail addresses, of the researcher were given to all of the participants to facilitate requests for information. Confidentiality was strictly assumed for all of the data, with only the investigator having access to the data.

Preoperative pain education was provided to both groups 1 to 3 days before the surgery by 2 trained ward nurses, and a daily postoperative pain round was conducted for each participant in the experimental group from postoperative day 1 until the patient was discharged.

Data collection was conducted at the point of the patients' admission (T0), throughout the postoperative period (T1), and the day before discharge (T2). The implementation and data collection process are illustrated in Fig. 3.1.

Figure 3.1 Procedure of the study



3.7 Pain management programme

Educating patients about pain and the role of nurses in postoperative pain management were issues that were not directly addressed in the current study setting or elsewhere in mainland China (Shen et al., 2008). Patients received routine perioperative nursing care provided by ward nurses. Preparations for surgery and strategies to facilitate physical recovery were the major components of nursing care in the current study setting. Preoperative education focusing on preparing the patient for surgery was provided for hospitalized patients scheduled to undergo an operation. The postoperative care for thoracotomy patients consisted of monitoring and maintaining physical functions such as a stable hemodynamic situation, and self-care strategies such as performing deep breathing / coughing exercises, caring for the chest-drain, and addressing issues relating to enteral feedings or TPN (Total Parenteral Nutrition, TPN). However, the information about postoperative pain management was not emphasized in preoperative patient education, and only simple instructions on reporting pain to health professionals were mentioned. In addition, the routine assessment and management of pain by nurses was not provided as part of the standard care accorded to postoperative patients.

In the present study, we designed a pain management programme integrating patient empowerment (preoperative pain education) and attentive pain care by nurses (the postoperative pain round) to improve patient outcomes in the management of postoperative pain. The contents and implementation of the pain management programme are demonstrated in Table 3.1. Preoperative pain education was provided to all of the participants in the experimental and comparison groups; the postoperative pain round was

only implemented in the experimental group. The preparation and the development of the protocol for the intervention are described in detail as followed.

Table 3.1 Contents and implementation of the pain management programme

	Preoperative pain education	Postoperative pain round
Objectives	To improve patients' knowledge about pain and its treatment and clarify misconceptions.	To assess and manage postoperative pain for patients.
Contents	① Nature of a thoracotomy operation & postoperative pain ② Communicating pain ③ Drug and non-drug methods to manage postoperative pain ④ Techniques of performing physical exercises (i.e., deep breathing and coughing, ambulating, shoulder exercises, etc.) ⑤ Techniques to relieve procedural pain (removal of chest tube)	①Assess patients' pain before assisting positioning, ambulating, performing deep breathing and coughing exercises ② Assess patients' use of analgesics, non-drug methods to relieve pain, and management of side effects ③ Clarify misconceptions, encourage patient to express concerns ④Apply strategies to manage unrelieved pain ⑤ Encourage patients to participate in pain treatment
Timing of implementation	1 to 3 days before surgery	Daily; from postoperative day 1 until the patient is discharged

Duration	40 to 60 minutes	10 to 15 minutes
Provider	2 trained ward nurses	The researcher
Recipient	Both groups of participants	The experimental group

3.7.1 Preoperative pain education

In the present study, the focus of pain education is to empower patients by imparting pain knowledge and skills, and to improve the patient's ability to control pain during hospitalization. Preoperative pain education conducted by two invited ward nurses was provided to all participants in the study 1 to 3 days before surgery, and the researcher performed 2 preoperative visits following the teaching session to ensure that the patients understood what they had been taught. An education booklet was delivered to each participant after the teaching session. The preparation of pain education programme, which included training for nurse educators and evaluating the consistency of the teaching sessions, is illustrated (Table 3.2). The contents of the education booklet and the implementation of the teaching session are then presented in detail.

Preoperative pain education was performed by trained ward nurses. It is crucial to select and train nurse educators. To maintain the validity and consistency of the study intervention, the selection of nurse educators was crucial. First of all, the selected nurses should be competent in providing patient education. As a result, the qualification or certification of nursing education was the indicator for their theoretical knowledge base; and their competency in clinical practice was judged by their current level of professional position. In addition, they need to possess rich working experience in caring of thoracic surgical patients to deal with various situations in patient care; and their current position

in the nursing team of the chest ward was referenced as an indicator to judge their overall competencies in providing patient care.

In the present study, the two selected ward nurses were possessed the associated degree or above in nursing profession, with the position of senior staff nurse, and worked in the thoracic surgery ward for at least 5 years. In addition, they were the two primary team leaders in the ward nursing team, which required them to have sound clinical knowledge, well-developed health education and communication skills in providing patient care and collaboration with nursing staff, physicians and other health professionals.

In order to maintain the integrity of the intervention, the two selected ward nurses were trained as nurse educators to conduct the preoperative pain education for patients at the beginning of the pilot study. The preparation for the implementation of pain education is presented in Table 3.2.

Table 3.2 Preparation for the implementation of pain education

Task	Rationale	Performed by
Training nurse educators	Prepare competent nurse educators to conduct pain education for patients	The researcher
• **Phase 1** (Self-study)	Become familiar with the topic, teaching content & boundaries	Invited nurse educators
• **Phase 2** (8-hour Theoretical training on pain)	Be confident about the topic on pain management	The researcher
• **Phase 3** (2-hour model session & 2-hour rehearsal session)	Mentoring & role-playing; review challenges, support & share alternative strategies	The researcher & nurse educators
Evaluating the consistency of the teaching sessions	Maintain the integrity of the intervention	4-member panel
• Review the tape-recorded teaching sessions of nurse educators	Review & evaluate the consistency of the teaching sessions to patients	The researcher, the ward nurse manager, a senior member of the nursing staff & a medical officer of thoracic surgery
• Feedback from patients	Assess the appropriateness of the teaching session & the readability of the education booklet	The researcher & nurse educators

It took 3 weeks (a total of 12 hours) to complete the training for the nurse educators. The training programme included an 8-hour session on theoretical training, a 2-hour demonstration session, and a 2-hour rehearsal session. In the first week, the main task was to get to know the selected staff and extend knowledge about the research. The researcher approached the two senior staff nurses from the study ward and delivered the information booklet about postoperative pain management and related study material to them. Self-learning was the major strategy in this phase, and the contact details of the researcher were given out for the purpose of facilitating the raising of questions about the learning.

In the second week, the major task was to conduct theoretical training about pain management for thoracic surgery patients. Three teaching sessions were delivered. The first was a 3-hour session on basic knowledge about acute pain, followed by a discussion on unrelieved postoperative pain, the significance of pain after a thoracotomy operation, and an explanation of a commonly used instrument to assess pain. Another 3-hour session addressed pharmacological and non-pharmacological methods of managing postoperative pain. The last 2-hour session was to elaborate upon the strategies used to manage pain for thoracotomy patients. After each teaching session, a mini-discussion was provided to ensure that the educators understood what they had been asked to learn, and feedback was gathered for future consideration.

In the last week of training, the purpose was to enable the educators to give an effective performance of the teaching approach, and to evaluate their competence in this. A model session was provided for the two educators. Three eligible patients who met the inclusion

criteria were invited to participate in the teaching session. Following that, a rehearsal session was conducted by the two invited nurse educators. Patient participants were also invited. In addition, the senior nurse manager and the other two senior members of the nursing staff of the ward were invited to participate in the rehearsal. Feedback from the nurse and patient participants was gathered. Specific issues such as the depth of the participants' knowledge and the appropriateness of the teaching material were discussed and necessary modifications were made. The duration of the teaching session and demonstration strategies were also discussed and elaborated upon. A mutual agreement was achieved on the details of the implementation of the teaching session.

Several strategies were applied to maintain the integrity of the intervention, due to the use of two educators for the present study. Protocols for teaching sessions were developed according to the literature and to actual practice. The contents of the teaching session were prepared through detailed planning, with the same power point being used for each session and for the same education booklet, which were produced by the researcher. The duration of each session ranged from 40-60 minutes. A session was divided into instruction and discussion sections. The timing for teaching session was set at 1 to 3 days before surgery, since the effect of the information intervention on anxiety levels was not different at day 1 to day 7 before the operation (Lepczyk, Raleigh & Rowley, 1990). In addition, the patient's preoperative stay was 1-3 days, according to the usual practice of the studying setting and the retrospective data gathered from medical records.

To maintain the consistency of the teaching intervention, the documentation and construct validity were assessed. Video-taped teaching sessions (a total of 4 sessions conducted by the 2 educators) were evaluated by 4 panel members, including the researcher, nurse manager of the ward, a senior member of the nursing staff, and a medical officer, who is an MD who majored in cardio-thoracic surgery and who has rich clinical experience. A construct validity index was calculated to address the consistency of the pain education that had been implemented by the two nurse educators. At least 90% agreement amongst the team members needed to be reached before the commencement of the main study.

Several strategies for teaching (Table 3.3) were employed to ensure that the patients learned what was being conveyed. Face-to-face instruction and demonstrations were the major approach to delivering patient education, facilitating interactions between the educator and the participants. Meanwhile, relationships of trust and a good rapport were established via constructive communications, to achieve better compliance and lower drop-out rates (Kirchhoff & Dille, 1994; McGuire et al., 2000). Group-teaching is another effective strategy to improve learning, and at least 2-3 patients were assigned to a group in the study. Peer support is important to encourage positive changes in behaviour, by sharing experiences and clearing up uncertainties (Edwards et al., 2001). At the end of each session, a discussion section was provided to patients to further clarify misconceptions and concerns they might have about pain and its treatment. An information consultation was also provided to patients immediately after the teaching

session by the researcher. A preoperative visit was conducted for each patient by the researcher to ensure that the patients fully understood what was being taught.

Table 3.3 Strategies used in pain education for patients

Educators	Two trained ward nurses
Timing	1-3 days before surgery
Duration	40-60 minutes
Teaching method	Face-to-face instruction, demonstration, discussion & group teaching (2 to 3 patients a group)
Written material	A booklet produced for pain education delivered to each participant after teaching session
Reinforcement of learning	Two preoperative visits provided by the researcher

To ensure the appropriateness of the intervention, feedback from the patients was gathered for further modifications to the teaching approach. A simple questionnaire was designed to collect opinions from patients about the teaching session and the education booklet. Nine patients in the pilot study were invited to discuss their impressions of the quality and comprehensiveness of the education session, and of readability and usefulness of the booklet with regard to pain management. They were also asked to give suggestions

for improvement. The questionnaire was collected before the patients were discharged, and 7 of the patients (77.8%) had filled it out. The patients found the education session and the booklet highly acceptable, except for some specific information about postural drainage and uncertainty about the correct positions postoperatively. This information was taken into consideration in the revisions of booklet for the main study, and clarifications were addressed in the future teaching session.

The contents of education booklet were referenced from published literature (Lin & Wang, 2005; Sjoling et al., 2003; Watt-Watson et al., 2004) and addressed the specific characteristics of a thoractomy operation (Gerner, 2008; Yu & Li, 2001). The education booklet, produced by the researcher, integrated information about pain and analgesics, techniques for dealing with pain (commonly used drug and non-drug methods for pain relief), the communicating of pain, clarified misconceptions, and provided information about physical rehabilitation exercises (i.e., deep breathing / coughing, shoulder exercises, etc.) after thoracic surgery.

Some postoperative factors for thoracotomy patients that precipitated or exacerbated pain needed to be considered and constructive strategies should be offered. The retention of chest drainage is necessary for performing thoracic surgery. Unfortunately, it causes severe pain to patients when they change position; perform ambulation, and even deep breathing and coughing exercises. The removal of the chest tube is another stressful experience for patients. Essential instructions were provided to patients. They included instructing them on how to maintain the safety and potency of the chest-drain; splinting

and supporting the wound while performing deep breathing or coughing exercises; and specific strategies for controlling the pain caused by these physical functions. The optimal timing for coughing was emphasized to facilitate effective clearance of respiratory secretions, to minimize pain, and to reduce the risks of pulmonary complications. These included coughing a few minutes after the nebulization therapy, administration of analgesics, and after adequate hydration early in the morning. The patients were instructed in both drug and non-drug methods of dealing with the stress and pain caused by the procedure of removing the chest tube.

Trained ward nurses conducted pain education for all of the participants in the preoperative period (1 to 3 days before surgery). For practical purposes and to avoid disturbance to ward routines, the pain education was scheduled to take place every other day (3 sessions a week). It included two lunch sessions (1pm to 2pm), on Tuesday and Thursday respectively, and one afternoon session (4 pm to 5pm) on Saturday.

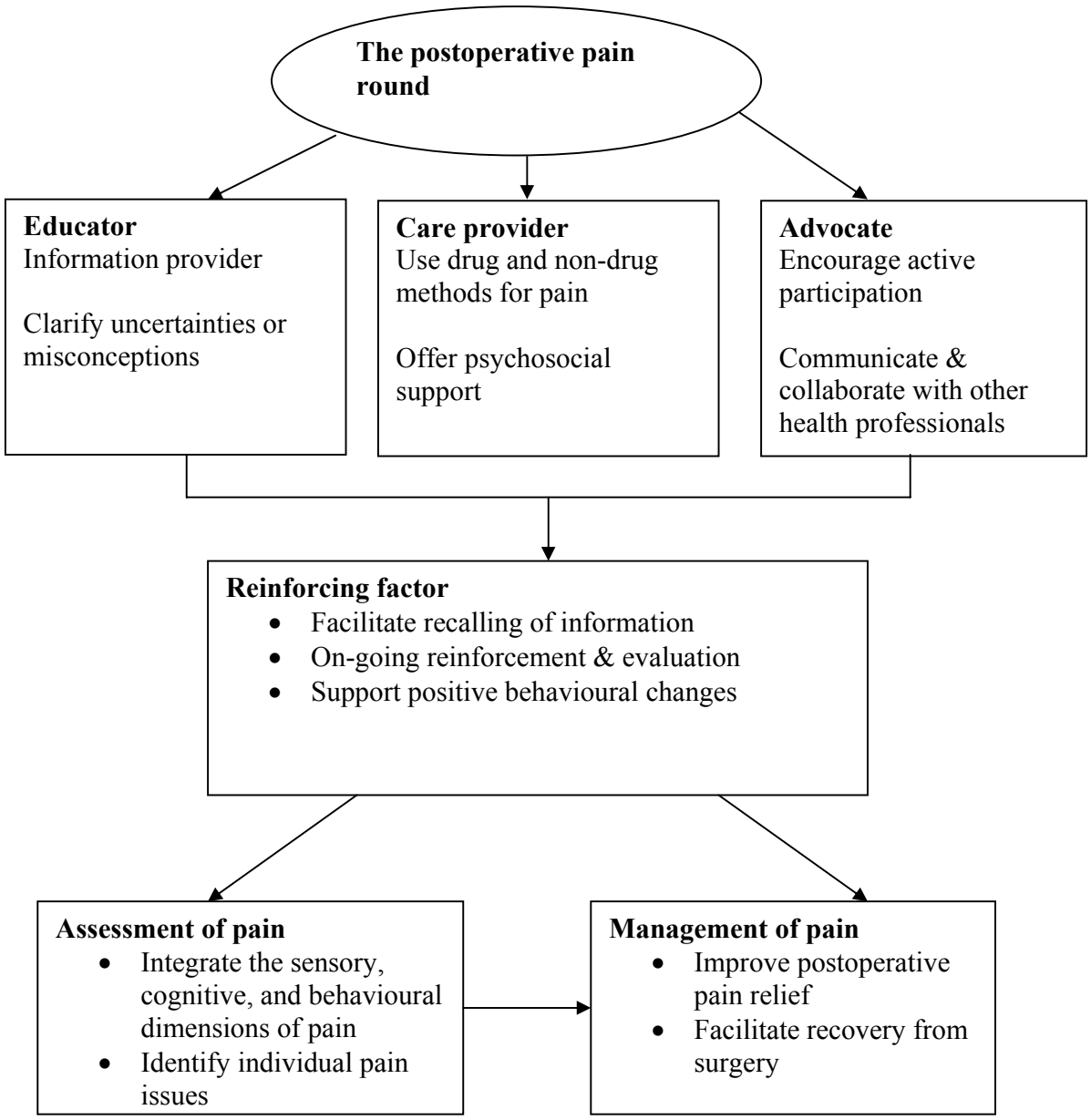
Face-to-face demonstrations and group-teaching strategies were used in the teaching session. An education booklet (attached in Appendix-7) was delivered to each participant to allow the patients to fully understand the teaching contents. To further ensure that the patients learned what was being conveyed, two preoperative visits were conducted by the researcher: immediately after each teaching session and the day before the operation.

3.7.2 Postoperative pain round

The postoperative pain round was only provided to the experimental group from postoperative day 1 until the patient was discharged. The purpose of the postoperative pain round was to provide attentive pain care for patients, acting as reinforcing factor to encourage and facilitate positive behavioural changes in pain management on the part of the patients, and to improve the outcomes of pain care.

In the present study, the major components for the postoperative pain round were assessment and the management of pain for patients. The roles taken on by the nurses in pain management included acting as the educator of both patients and family caregivers in offering adequate information and psychosocial support, being care-providers in implementing appropriate analgesic practices, and acting as an advocate in managing the patients' pain and resolving challenges arising from the current clinical culture. The flow of the postoperative pain round is illustrated in Figure 3.2.

Figure 3.2 The flow of the postoperative pain round



The major purpose of the pain round was to identify the needs of individual patients for education and pain issues in the postoperative period; and to act as a reinforcing factor to strengthen patients' learning and facilitate patients' positive behavioural changes in pain management. The researcher provided information consultations to both patients and their families on how to deal with the uncertainties related to pain and its treatment. Appropriate action then needed to be taken to address the patients' pain, such as the use of drug or non-drug methods for pain relief. Further communication or collaboration with health professionals also needed to be carried out on unresolved issues of pain. In the pain management process, the emphasis was placed on the nurses' attentive pain care and the patients' active participation to improve the outcomes of pain care.

The first step was to identify the needs of individual patients with regard to education, strengthen the patients' learning, and facilitate the transformation from knowledge to actual behaviour. Postoperative patients may experience such problems as pain, nausea, vomiting, disorientation, impaired thinking, and reduced psychomotor functions; they may also have difficulty remembering instructions received preoperatively (Skilton, 2003). In addition, the patients' uncertainty and anxiety, and negative attitudes from family caregivers, may hinder positive changes in behaviour (Falvo, 2011). Although extensive information was provided to patients, and strategies such as individual visits and written information were applied to ensure that the patients understood what they had been taught in the preoperative period, the patients could only remember a fraction of this information in the postoperative period. Individual patients' needs for education should be addressed to lead to positive behavioural changes (Lam et al., 2001; Reynolds et al.,

2009). Repetition, further clarification, and demonstrations of related information may greatly help patients to recall what they have been taught, and clear up misconceptions and uncertainties related to pain or the use of analgesics for treating pain (Chumbley et al., 2004; Sjoling et al., 2003). Negative beliefs and attitudes from family caregivers also need to be clarified and modified to reduce barriers to effective pain management (Lin et al., 2000; Lin et al., 2006). In the postoperative pain round, the researcher provided on-going reinforcement and evaluations of what the patients had learned, and offered information consultations for patients and family members to address specific needs with regard to education.

The second step was to identify the pain issues of individual patients and take appropriate actions to address such pain. Pain is a subjective experience with multiple dimensions, consisting not only of physiological, sensory dimensions but also of the affective, behavioural, cognitive, and sociocultural interpretations of pain (Edrington et al., 2007). The response of the patients to their pain, including both involuntary and voluntary strategies to cope with pain (such as their hesitation to report pain and use analgesics, and their willingness to tolerate pain), have been important barriers to effective pain management, as these are direct or indirect determinants of pain (Melzack, 2001). Cultural background is an important aspect of the sociocultural dimension of pain because people from different cultures perceive and respond to pain in different ways. In addition, how and whether people communicate pain to healthcare professionals and to others can be influenced by cultural factors. Perceptions of, responses to, and communication about pain can influence patients' use of drug or non-drug methods to

treat pain (Chen et al., 2008). Traditional Chinese philosophies and a stoical eastern culture influence the pain experience of Chinese patients. Pain assessments should integrate the sensory, cognitive, and behavioural dimensions of pain for individual patients, and underlying triggers should be identified so that appropriate interventions can be used for pain relief (Melzack, 1999; Sim & Watfield, 1997). In the present study, the researcher needed to determine the pain issues of individual postoperative patients when they reported feeling pain and to plan appropriate strategies for managing pain.

The role of nurses as an advocate for patients in addressing the issues related to safety and effectiveness in pain care was emphasized at the end of the postoperative pain round. The analgesic practice of nurses is one of the most important components in pain management. After completing a pain assessment, appropriate responses should be followed. The practice guidelines direct the maintenance of the previous dosage of analgesics when pain is under control or the titration of analgesic doses according to the patients' self-reports of pain (Gordon, Pellino, Higgins, Pasero & Murphy-Ende, 2008; McCaffery, Ferrel & Pasero, 2000). However, the actual situation for the administration of analgesics seems to be more complex than provided for in the guidelines. When a patient's pain remains unrelieved, several actions need to be taken, such as evaluating the adequacy of the analgesic that was administrated, the potency of the drug, the potency of the drug-delivering system, and determining whether extra dosages or drugs need to be prescribed. In mainland China, nurses are still not eligible to prescribe medication or change the dosage of a medication without a physician's order. Further communications and collaborations are needed here due to the physician-led clinical culture in current care

settings. In the postoperative pain round, the pain nurse should act as an advocate for patients in obtaining and receiving appropriate pain treatment. In this study, the patients were encouraged to actively participate in making decisions on pain treatment options. This issue was addressed to improve the quality of pain care, as recommended in the revised practice guidelines of the Agency for Healthcare and Clinical Practice and Research (AHCPR) in the US (Gordon et al., 2005).

In the present study, the assessment and management of pain are the two major components in the daily postoperative pain round that was provided to the experimental group. Conducting by the researcher, the daily pain round lasted for an average of 10 to 15 minutes for each patient and was performed at approximately the same time every morning from postoperative day 1 until the patient was discharged.

3.8 Instruments

The severity of the patients' pain and its interference with activities were assessed using the Brief Pain Inventory-Chinese Version (BPI-C). Patients' beliefs about pain and its treatment were assessed by the Barrier Questionnaire-Taiwan Form Surgical Version (BQT-S). Patients' pain management behaviours, which included the patients' use of non-drug and drug methods of achieving pain relief, were documented in log records. Information on objective clinical outcomes (cost issues as the length of the hospital stay) and the postoperative recovery from thoracic surgery were collected from the patients' medical records. Information on the patients' demographic and disease characteristics were also collected at the time that the subjects were recruited.

3.8.1 Demographic data

The form on information about demographic characteristics was used to collect demographic data about the patients, such as their age, gender, level of education, profession, economic status, diagnosis, and previous medical history (attached in Appendix-8).

3.8.2 Chinese Version of the Brief Pain Inventory (BPI-C)

Pain is a multidimensional experience integrating sensory-discriminative, motivational-affective, and cognitive-evaluative aspects (Melzack, 1999). Among the three dimensions of pain, much more common is the finding that "pain" (sensory-discriminative) and "reaction to pain" (cognitive-evaluative) account for most of the variances seen among the patients (Cleeland & Ryan, 1994).

The Brief Pain Inventory (BPI), which was developed by Cleeland (1989), addresses the two dimensions of pain as "sensory" and "reactive". It is a self-reported instrument used to assess the multi-dimensional nature of pain, including its intensity and its subsequent interference with the activities of life in the previous 24 hours (Cleeland, 1989). The first part of the BPI consists of four single-item measures of pain severity: the worst pain, the least pain, average pain, and pain now. Each item is rated on a scale of 0 (no pain) to 10 (the worst pain one can imagine). The second part consists of seven items that assess the extent to which pain interferes with general activity, mood, walking, working, relations with others, sleeping, and enjoyment of life. Each item is rated on a 0 to 10 point scale, from "does not interfere" to "completely interferes". Other items in the BPI were used to document the location of the pain, pain relief (the patients' satisfaction with pain

treatment), the duration of pain relief, and the cause of pain, such as by disease, treatment, or conditions unrelated to disease (Cleeland & Ryan, 1994).

The psychometrics of the BPI were tested and validated in cross-cultural and cross-linguistic populations with cancer pain. It demonstrated respectable test-retest item correlations (reliability), In addition, the intercorrelations among the items differed in a logical way from one disease to another, which suggests that the BPI is sensitive to differences in pain characteristics associated with different diseases (Daut, Cleeland, & Flannery, 1983). A common factor analysis demonstrates two factors, with the pain intensity and pain interference items loading separately on one of the factors in each testing sample, which included the People's Republic of China, the Dominican Republic, France, Mexico, the Philippines, Vietnam, and the US. Furthermore, the factor structure is similar in each of the samples (Cleeland & Ryan, 1994).

The BPI has been extensively used worldwide, including for exploring the epidemiology of cancer pain, for routine clinical assessments of pain, as indicators for the quality of pain management, and in clinical trials to examine the effectiveness of cancer pain treatments (Cleeland & Ryan, 1994). In addition, the BPI has been tested and validated in various populations with non-cancer pain, including patients suffering from chronic pain (Keller et al., 2004) and those from different surgical samples suffering from postoperative pain (Gjeilo, Stenseth, Wahba, Lydersen & Klepstad, 2007; Mendoza et al., 2004; Tittle, McMillan & Hagan, 20003; Zalon, 2006). In surgical patients, the subscale of pain interference in the BPI was slightly modified, with the elimination of the items of

"enjoyment of life", "work", and "activity" due to their lack of relevance to the immediate postoperative period; and the addition to the scale of a single-item measure of procedure-specific pain (Mendoza, et al., 2004).

The Brief Pain Inventory-Chinese Version (BPI-C) was developed and tested on Chinese patients by Wang *et al*. (1996). The reliability and validity of the instrument were assessed in 147 cancer patients (n=147) from 3 hospitals in Beijing. The internal consistency α values for the pain severity and pain interference items were 0.89 and 0.92, respectively (Wang, Mendoza, Gao & Cleeland, 1996). Validity was supported by a factor analysis and a significant correlation was found between the pain intensity score and the ECOG (Eastern Cooperative Oncology Group) performance status and pain interference (Wang, Mendoza, Gao & Cleeland, 1996). The reliability and validity of the BPI-C were also established in the Taiwan Chinese population (Chang et al., 2002; Lin et al., 2006).

In the subscale of interference of pain with activities, the items relating to work and the enjoyment of life in the original scale were not considered to be relevant in the postoperative context and were therefore not administered; the interference of pain with repositioning, deep breathing, and coughing were included (Lin & Wang, 2005; Watt-Watson et al., 2004). The modified scale was validated in Taiwan Chinese patients (Ger, Ho, Sun, Wang & Cleeland, 1999). The test-retest reliability for the pain intensity subscale was 0.79, while for the pain interference subscale it was 0.81. The Cronbach's α for internal reliability was 0.81 for the pain intensity subscale and 0.89 for the

interference subscale (Ger et al., 1999). Details on the instrument are attached in Appendix-10.

3.8.3 Barrier Questionnaire - Taiwan Form Surgical Version (BQT-S)

The beliefs of patients are important barriers to the effective management of pain, either as direct or indirect determinants of pain. A Barrier Questionnaire (BQ) was originally developed to measure patients' concerns about reporting pain and using analgesics for cancer pain (Ward, et al., 1993). The Barrier Questionnaire-Taiwan (BQ-T) was developed by translating the BQ into Chinese using a translation and back-translation procedure and modifying the questionnaire to suit Taiwanese culture (Lin & Ward, 1995). The BQ-T measures those concerns that are considered to be barriers to managing cancer pain for Taiwanese patients. These include fatalism, fear of addiction, concern about tolerance and side effects, fear of injections, the desire to be good patient, fear of the disease progressing, concern about distracting the physician from treating the disease, and concerns about time intervals (Lin & Ward, 1995).

The reliability and validity of the Barrier Questionnaire-Taiwan Form Surgical Version (BQT-S) in measuring patient-related barriers to managing postoperative pain were established in Taiwanese postoperative patients (Tzeng et al., 2006). The content validity of the BQT-S for appropriate use in postoperative pain management was reviewed by a panel of experts in surgery and pain management at the time when the questionnaire was being developed for use among surgical patients in Taiwan (Tzeng et al., 2006). In the BQT-S, some subscales were modified. For example, the subscale of fear of the disease progressing was dropped and an additional subscale of fear of inhibiting the healing of

wounds was added. For each BQT-S item, patients rated the extent to which they agreed on a scale from 0 (do not agree at all) to 5 (agree very much). The BQT-S consists of nine subscales with a total of 29 items, including: fatalism; addiction; desire to be a good patient; distracting the physician; inhibition of wound healing; tolerance; side effects; fear of injections; and time intervals. Both subscale scores (the mean of the items in a given subscale) and the total score (the mean of all items) were used in analyses. The internal consistency for the total BQT-S was 0.89 (Tzeng et al., 2006). The concurrent validity of the BQT-S was supported by significant relationships between the BQT scores and the patients' hesitancy to report pain and to take analgesics, and by significant relationships between the BQT-S scores and the adequacy of the patients' postoperative pain management (Tzeng et al., 2006). The internal consistency for the total BQT-S was 0.839 in the present study. Details of the instrument are attached in Appendix-12.

3.8.4 Pain management behaviours

The behavioural dimension of the pain experience is related to the behaviours that an individual in pain uses either to decrease pain (i.e., interventions to relieve pain, communication, and level of activity) or to indicate the presence of pain (Edrington et al., 2007). In the present study, pain management behaviours included the patients' use of non-drug and drug methods to relieve pain (the total amount of analgesics used and the use of PCA) in the postoperative period. The frequency of the use of non-drug methods was measured by a 5-point scale (0 to 4), with higher scores indicating higher frequency. The data were recorded in a log, attached in Appendix-14.

3.8.5 Objective clinical outcomes

An objective clinical outcome is one for which the data exists independently from the perception of the observed individual (Jette, 1989). Objective clinical outcomes are measured or interpreted by physicians, nurses, or other qualified health professionals; and they should be reliable and consistent across different disciplines (Willke et al., 2004). In the present study, objective clinical outcomes were documented or interpreted by the nurses and physicians. These included outcomes related to cost issues such as the length of the hospital stay; and the postoperative recovery from thoracic surgery (i.e., the first day to initiate ambulation, the length of the chest tube in situ, and the occurrence of postoperative complications). Objective clinical data were collected from the patients' medical records and documented on the demographic information form.

3.9 Data collection

Data collection was conducted by an invited research assistant. The research assistant was not part of the ward staff and she worked in other department of the study hospital. Before the commencement of the study, she was trained on the correct use of the research instruments for collecting data from the participants. In the preparation phase of the study, the researcher gave detailed oral instructions to the research assistant about the use of the instrument, and elaborated on necessary explanations and clarifications for the patients. The researcher then selected two valid patients (one preoperative patient and one postoperative patient) and demonstrated the collection of data using these instruments. The researcher also observed the research assistant collect data from two other valid patients. Uncertainties were cleared up and consistency was achieved between the researcher and the research assistant regarding the process of data collection.

To maintain the integrity of the study intervention and minimize potential threats to the internal validity of the study, blindness to the rater is necessary in order to control the diffusion of the intervention and the Hawthorne effect (Portney & Watkins, 2009). In the present study, the research assistant was blinded to the subject allocation procedure, and was not involved in the implementation of the study intervention. She also had no clinical associations with the patients. In addition, staffs working in the chest ward were aware that the patients were participating in a study relating to the experience of postoperative pain. They were not informed about the allocation of patients or involved in the randomization procedure.

Data collection was conducted at three time points: the preoperative period (T0), the postoperative period during the patients' hospitalization (T1), and the day before the patient was discharged (T2). T0 included the measurement of the patients' demographic and disease characteristics, barrier scores on pain management (BQT-S) before preoperative pain education, and scores on pain and its interference with activities (BPI-C) before surgery. T1 measured the levels of pain severity and interference with function (BPI-C) for all of the participants daily and pain management behaviours (log-record) in the entire postoperative period. Finally, T2 included post-test barrier scores (BQT-S) and objective clinical outcomes (collected from the patients' medical records) collected the day before the patient was discharged. The time frame for data collection is illustrated in Table 3.4.

Table 3.4 Time frame of data collection for the study

Time	Outcome measurement
T0 (Before preoperative pain education	• Demographic & disease data • Barrier scores on BQT-S • Pain & interference with activities (BPI-C)
T1 (during the entire period of postoperative hospitalization)	• Pain & interference with activities (BPI-C) • Pain management behaviours including the use of non-drug and drug methods (total amount of analgesics used and use of PCA) for pain relief
T2 (the day before discharge)	• Barrier scores on BQT-S • Objective clinical outcome including length of hospital stay; the postoperative data as the length of the chest tube in situ, the first day to initiate ambulation, and occurrence of postoperative complications

Note: BQT-S, Barrier Questionnaire-Taiwan Form Surgical Version; BPI-C, Brief Pain Inventory-Chinese Version

3.10 Data analysis

Pain scores and levels of interference from pain with activities in the two groups were measured from postoperative day 1 until the patient was discharged. The results from postoperative day 1 to day 7 were analyzed and presented in detail. The patients suffered the most severe pain in the acute phase after surgery. Levels of pain peaked when patients performed deep breathing and coughing exercises and initiated ambulation during the above period.

The rationales for data management were determined from previous studies and the actual situation in the present study. In determining the efficacy of an intervention, the

timing of the data collection process and the cut-off point for the data analysis are crucial. Watt-Watson et al. (2004) conducted a study to examine the effectiveness of a preoperative education programme on pain outcomes for patients after undergoing coronary artery bypass graft surgery. The time point for the collecting of data was determined by the time in the postoperative period when patients usually become more ambulatory (on postoperative day 3) and the average length of the patients' postoperative stay (approximately five days). The time point for such outcome measures as pain scores and the interference of pain with daily activities was set during the first five days after surgery (Watt-Watson et al., 2004).

Several concerns need to be noted in the assessment of meaningful changes for RCTs (Randomized Controlled Trials). These concerns include: ceiling and floor effects associated with continuous measures of health outcomes; determining appropriate time intervals for measuring changes in health; and identifying the amount of change in health that is clinically significant. In addition, three aspects of the response to treatment need to be noted, namely the length of time for the intervention to produce clinical improvements, the rate of improvement, and the maximum level of functioning the participant could attain from the intervention. Thus, the timing for measuring meaningful change is crucial in determining the efficacy of an intervention (Fogg & Gross, 2000).

Further, such threats to the internal validity of the study as diffusions of the intervention and inadequate control conditions may greatly increase the risks of generating false conclusions on the efficacy of the intervention (Kirchhoff & Dille, 1994; Pruitt & Privette,

2000). In the present study, the integrity of the intervention may possibly have been violated by participant interactions in one ward setting. As all of the patients could get out of bed and ambulate on postoperative day 5 after the thoracotomy operation, careful consideration needs to be given of the cut-off point for the data analysis to determine the effectiveness of the study intervention.

Providing cost-effective care is a global trend in the development of nursing practices in accordance with reforms of health care systems and actual clinical settings (Wong, 2004; Sheer & Wong, 2008). Pain relief (the effectiveness of the intervention) is the major indicator to determine the cut-off point for the data analysis in the present study. A pain score at or less than 3 on a 0-10 numerical rating scale is considered to represent mild pain and indicates adequate pain relief after surgery (Apfelbum et al., 2003; Chung & Lui, 2003; Shen et al., 2008). On postoperative day 7, the quartile range of the mean pain scores for the experimental and comparison groups was 2.00 to 3.00 and 3.00 to 4.25, respectively. In addition, all of the participants stayed in the hospital for the first seven days after surgery in the present study. The end-point for the data analysis was set at postoperative day 7, according to the efficacy and feasibility of an intervention (Fogg & Gross, 2000; Newman & Tejada, 1996).

Descriptive and inferential statistics were used for data analysis for the present study. The demographic data was presented by using descriptive statistics (mean, standard deviation, and frequency); an independent t-test, and a Chi-square test were used to examine the differences between the two groups of participants. Ratio or interval data meeting the

normal distribution was tested by an independent *t*-test. Nominal data was analyzed by a non-parametric test (a *Chi*-square test was used).

A protocal compliant analysis was adopted to determine whether the intervention worked when participants adhered to the interventions. The normality of data distribution was examined using the Kolmogorov-Smirnov test for each dependent variable. The homogeneity of variance of the collected data was examined using Levene's test. The result of the test was not significant ($p > 0.05$), indicating that the variance was roughly equal in the two groups and that the assumption of homogeneity was tenable (Field, 2005; Portney & Watkins, 2009). Parametric and non-parametric statistical methods were applied to determine the effectiveness of the intervention.

The effectiveness of the intervention were tested using an independent *t*-test (between group effects) and a paired *t*-test (within group changes) if normal distribution was assumed for the collected data (barrier scores on BQT-S). The changes in the pre and post-test scores on each subscale and the total score on BQT-S for both groups were calculated and compared. To control family-wise type I errors, the Bonferroni-Holm procedure was applied in the case of multiple comparisons (Field, 2005; Portney & Watkins, 2009).

Extremely skewed data distribution was found in the patients' pain severity, interference, and pain management behaviour such as the frequency of using non-drug methods for pain relief. These data were presented using descriptive statistics including mean, median,

and quartile range. A non-parametric test, namely the Mann-Whitney U test, was used to determine the effectiveness of the intervention (between-group effects). Friedman's ANOVA was applied for testing the within-group effects (time effects) for both groups. The Wilcoxon-signed-rank test was used to determine significant changes in the comparisons between different time points. To control family-wise type I errors, the Bonferroni-Holm procedure was applied in the case of multiple comparisons (Field, 2005; Portney & Watkins, 2009). The parametric statistical method (independent *t*-test) was used to determine whether there were any differences in the total amount of analgesics used (continual data) between the two groups; and a Chi-square test was used to examine the difference in the use of PCA for treating pain in the postoperative period between the two groups.

The objective clinical outcomes were presented by using descriptive statistics (mean, standard deviation, and frequency). An independent t-test and a Chi-square test were used to examine the differences between the two groups of participants. Ratio or interval data meeting the normal distribution was tested by an independent *t*-test. Nominal data was analyzed by a non-parametric test (a *Chi*-square test was used).

A Spearman's correlation test was used to investigate the relationships among the dependent variables, such as pain intensity, pain interference, barriers scores, and the use of drug or non-drug methods for pain relief. An analysis of the data was performed in SPSS / PASW 17.0 for Windows (SPSS Inc, Chicago, IL, USA) and the results were considered statistically significant at $p < 0.05$ in all analyses.

3.11 Ethical consideration

Ethical approval was obtained from the Human Subjects Ethics Sub-Committee of The Hong Kong Polytechnic University and the Institutional Review Board of the selected hospital before the commencement of the study. An information sheet (Appendix-12) and a detailed verbal explanation by the researcher for the study were given to each participant. The patients were also informed of their right to voluntarily participate or withdraw from the study at any time for any reason. Then the written consent form (Appendix-14) signed by the participant was obtained by the researcher. Contact details such as telephone numbers and e-mail addresses were given to all of the participants to facilitate inquiries for information. In addition, the patients' personal information and data were kept strictly confidential and anonymous throughout the study, with access permitted only to the researcher, the research assistant, and the supervisors.

Chapter 4 The pilot study

4.1 Introduction

This chapter reports the results of the pilot study. The pilot study was divided into two parts: the first part was to train patient educators and to develop the protocols for the pain round, which is presented in Chapter 3. The second part was to investigate the feasibility and effectiveness of the main study.

4.2 Aims of the pilot study

There were several aims to the pilot study: (a) to train the patient educators to maintain the consistency of the intervention that was implemented for the study, (b) to develop the protocols for the postoperative pain round, (c) to test the feasibility of the data collection procedure, (d) to identify possible problems in the study design, and (e) to allow the researcher to make necessary modifications before the commencement of the main study.

4.3 Method

After the completion of the preparatory work, a pilot study was conducted from January to March 2010. A major purpose of the pilot study was to test the feasibility of the pain management programme before moving on to the main study.

4.3.1 Setting & Sampling

The pilot study was conducted from January to March 2010, in Hefei city, Anhui province. A randomized trial with a two-group pre and post-test design was adopted. The criteria for the recruitment of subjects and allocation procedure in the pilot study were exactly the same as those in the main study.

A total of 7 male (78.0%) and 2 (22.0%) female participants were recruited from the study hospital. The recruited patients were randomly assigned to the experimental and the comparison groups by using a computer-generated sequence of number sets. A patient with the number "1" was assigned to the experimental group (preoperative pain education and postoperative pain round group); and a patient with the number "2" was allocated to the comparison group (preoperative pain education group). However, 2 participants (1 male and 1 female) in the experimental group dropped out from the pilot study due to a deterioration in their postoperative condition and because their relatives refused to allow them to participate.

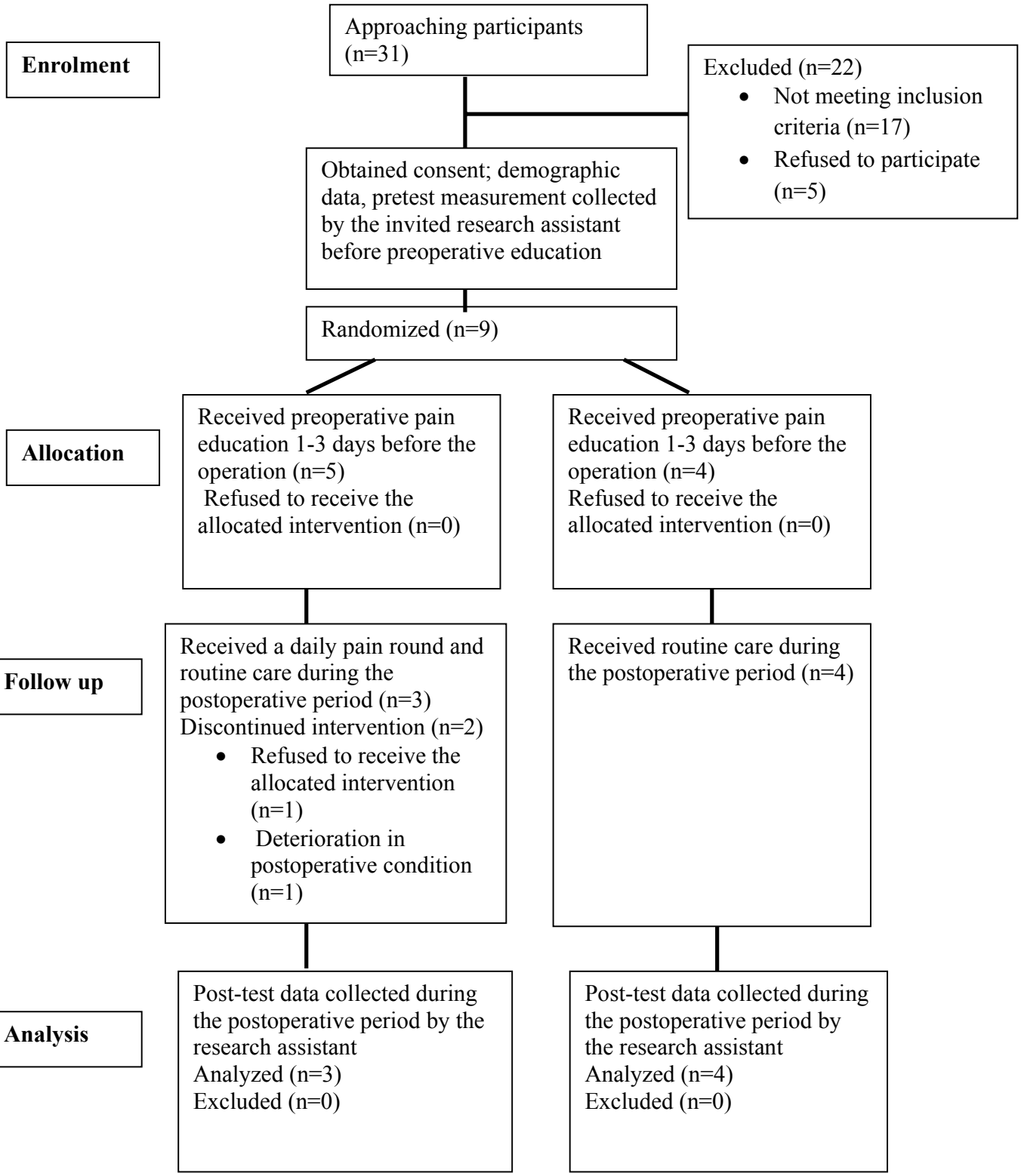
4.3.2 Procedure

Prior to the commencement of the pilot study, ethical approval for the study was obtained from the Hong Kong Polytechnic University and the study hospital. Nine subjects were randomly assigned to the experimental group (n=5) and the comparison group (n=4).

Preoperative pain education, performed by two trained ward nurses, was provided to both groups of patients 1 to 3 days before the operation. A structured pain management booklet was delivered to each participant. The researcher conducted 2 visits to each preoperative patient (immediately after the teaching session and the day before the operation) to ensure that the patients' fully understood what had been taught. A daily pain round (at approximately the same time every morning) was only provided for patients in the experimental group from postoperative day 1 until the patient was discharged.

The researcher gave detailed information and an explanation to the participants, and obtained from them a signed form consenting to their participation in the study. The invited research assistant conducted outcome measurements for all of the participants, which were the same procedure as that proposed in the main study for data collection. A detailed description of the intervention and the data collection procedure is given in Figure 4.1.

Figure 4.1 Consort map



4.3.3 Data Analysis

Data analysis was performed by SPSS / PASW 17.0 for Windows (SPSS Inc, Chicago, IL, USA). Due to the very small sample size, significant differences could hardly be determined in comparisons between the two groups to indicate the efficacy of the intervention. Descriptive statistics, including the mean (M), standard deviation (SD), and frequency was calculated for the collected data of the pilot study.

4.4 Results

Outcomes were measured at three time points: before preoperative pain education (T0); during the postoperative period (T1); and the day before the patient was discharged (T2).

4.4.1 T0 (Before preoperative pain education)

Demographic data, scores of pain and pain interference with daily activities on BPI-C, the patients' barrier scores on the BQT-S were assessed before the preoperative pain education and are given in Table 4.1 and Table 4.2, respectively. None of the participants reported any pain or pain interferences with daily activities on BPI-C before surgery.

4.4.1.1 Demographic and disease characteristics

A total of 7 patients participated in the study, which included 6 men and 1 woman with a mean age of 52.86 years (ranging from 21 to 68 years). More than 70% of the patients (n=5, 71.4%) had been diagnosed with esophageal cancer; nearly 60% of them (n=4, 57.1%) were in very difficult economic straits. In addition, none of them had ever attended an education session on pain management or used non-drug methods for pain

relief. The distribution of the personal data and disease characteristics for the two groups is shown in Table 4.1.

Table 4.1 Demographic and disease characteristics of the participants

	Experimental group (n=3) 〔n (%)/ Mean (SD)〕	Comparison group (n=4) 〔n (%)/ Mean (SD)〕
Sex		
Male	3 (100.0)	3 (75.0)
Female	0 (0.0)	1 (25.0)
Age	49.00 (24.43)	55.75 (13.52)
Education (years)	7.00 (1.73)	7.25 (2.87)
Marital status		
Has spouse	2 (66.7)	4 (100.0)
No spouse	1 (33.3)	0 (0.00)
Employment		
Yes	1 (25.0)	2 (50.0)
No	2 (75.0)	2 (50.0)
Family income (RMB/month)		
<1000	1 (33.3)	3 (75.0)
1001-2000	2 (66.7)	0 (0.0)
2001-3000	0 (0.0)	1 (25.0)
Diagnosis		
Esophageal cancer	2 (66.7)	3 (75.0)
Lung cancer	0 (0.0)	1 (25.0)
Other disease	1 (33.7)	0 (0.0)
Medical history		
Hypertension	0 (0.0)	1(25.0)
Previous surgery		
Yes	0 (0.0)	1 (25.0)
No	0 (100.0)	3 (75.0)
Experience of using analgesics		
Yes	3 (100.0)	4 (100.0)
Use of non-drug methods		
Yes	0 (0.0)	0 (0.0)
Attending pain education		
Yes	0 (0.0)	0 (0.0)

4.4.1.2 Barrier scores on the BQT-S

The patients' concerns about reporting pain and using analgesics were assessed by a 6-point likert scale ranging from 0 to 5 before the pain education programme was delivered to all of the participants. High scores indicate high barriers to the treatment of pain. At the baseline assessment, the 4 highest scores on the BQT-S reported by the participants were those in the subscales of "inhibition of wound healing", "distraction", "time interval", and "tolerance" (Table 4.2).

The experimental group gave slightly lower scores than did the comparison group to the above subscales, namely 4.67 vs 4.84, 4.55 vs 4.75, 4.33 vs 4.58, and 4.22 vs 4.34, respectively. In addition, the experimental group reported lower scores in the subscale of "desire to be a good patient" than did the comparison group (3.00 vs 3.92). However, a lower level on the subscale of "fatalism" was reported by the comparison group than by the experimental group (2.50 vs 3.22). The total scores of the BQT-S indicated that on a 0-5 scale the patients in the two groups expressed high levels of barriers to pain management.

Table 4.2 Patients' barrier scores on the BQT-S before pain education

Subscales of BQT-S	Experimental group (n=3) Mean (SD)	Comparison group (n=4) Mean (SD)
Inhibition of wound healing	4.67 (0.34)	4.84 (0.19)
Distraction	4.55 (0.39)	4.75 (0.17)
Time interval	4.33 (0.58)	4.58 (0.32)
Tolerance	4.22 (0.19)	4.34 (0.67)
Fatalism	3.22 (0.77)	2.50 (1.51)
Desire to be a good patient	3.00 (1.73)	3.92 (0.88)
Side effects	1.80 (1.04)	2.05 (1.48)
Fear of injections	1.56 (1.26)	1.25 (2.50)
Addiction	0.89 (1.54)	1.33 (2.45)
Total score of the BQT-S	2.99 (0.37)	3.15 (0.55)

Note: Barrier Questionnaire-Taiwan Form Surgical Version, BQT-S; BQT-S scores ranged from 0 to 5.

4.4.2T1 (during the entire period of postoperative hospitalization)

Postoperative pain and interference with activities and patient-reported subjective clinical outcomes were measured daily during the entire postoperative period. For both groups, pain and interference scores were also assessed 4 hours after the surgery. Minimal differences were found between the two groups with regard to scores for pain and interference with activities, and for the pain behaviours, as indicated in Table 4.3, Table 4.4, and Table 4.5.

4.4.2.1 Pain and interference scores with activities 4 hours after surgery

It is feasible to assess patients' pain and interference with activities at approximately 4 hours after surgery as the baseline measurement for pain and interference with activities. Patients may not find it possible to report pain to health professionals immediately after a

major thoracotomy operation because they may be unconscious or have difficulty communicating while on mechanically assisted ventilation. For routine practice in this study setting, the participants were admitted to the post-anesthesia care unit (PACU) after surgery and stayed for 2 to 3 hours until they were fully awake from the anesthesia and their hemodynamic status was stable. The patients were then transferred back to the ICU ward and stayed there for the day of the operation. In the present study, the baseline scores for pain and pain interference were assessed on patients' arrival at the ward.

As shown in Table 4.3, all of the participants gave extremely high scores when asked about the worst pain they had experienced (10.00) and its interference with daily activities (6.50 to 9.00) on a 0-10 numerical rating scale (NRS) on the day of the operation. Patients gave a rating of 10 for the worst pain they had experienced; 3.33 to 4.25 for the least pain; 5.33 to 6.50 for average pain; and 5.66 to 7.25 for current pain. Little difference could be seen between the two groups regarding levels of pain and interference on the day of the operation (Table 4.3).

Table 4.3 Pain and interference scores of the participants 4 hours after surgery

	Experimental group (n=3) Mean (SD)	Comparison group (n=4) Mean (SD)
Pain intensity		
Worst pain	10.00 (0.00)	10.00 (0.00)
Least pain	3.33 (0.57)	4.25 (0.95)
Average pain	5.33 (1.52)	6.50 (1.29)
Current pain	5.66 (0.57)	7.25 (1.50)
Pain interference		
Repositioning	9.00 (1.00)	9.00 (0.00)
Deep breathing/coughing	8.33 (0.57)	6.75 (2.50)
Walking	8.00 (0.00)	8.00 (0.00)
Mood	7.00 (1.00)	7.50 (1.00)
Chatting	6.67 (1.15)	6.50 (1.50)
Sleep	7.33 (1.15)	8.00 (0.00)

Note: pain and interference was measured using a 0-10 numerical rating scale (NRS).

The scores for pain and pain interference with activities for each participant were assessed daily from postoperative day 1 until the patient was discharged (Table 4.4 and Table 4.5). Pain behaviours as the frequency of using non-drug methods of obtaining pain relief, requesting medication for pain, performing deep breathing / coughing exercises, and ambulating were assessed daily. The results are presented in Table 4.6.

4.4.2.2 Pain scores during postoperative hospitalization

Patients in both groups experienced severe pain in the early postoperative period (postoperative day 1 to 3), which decreased in the following days. Patients in the experimental and comparison groups reported moderate to high levels of the worst pain in the first 3 days after surgery. In the experimental group, the worst pain scores dropped from postoperative day 1 to 3 (9.33 ± 1.15 to 6.0 ± 1.00) and then decreased gradually from postoperative day 4 to 7 (4.67 ± 1.15 to 3.33 ± 0.57). From postoperative day 8 and in the following days during hospitalization, the patients reported mild pain on the highest pain scores. A similar trend was seen in the comparison group regarding the worst pain scores from postoperative day 1 to 7. In the following days during the postoperative period, the patients still reported mild to moderate pain as their worst pain scores.

All of the participants reported higher levels of pain with regard to the least, average, and the current pain on postoperative day 1. For both groups the pain scores decreased over time in the postoperative period. Except for the worst pain scores on postoperative days 1 and 2, the experimental group reported lower scores for pain than did the comparison group in the postoperative period, as indicated in Table 4.4. However, significant differences could not be determined for the two groups due to the very small size of the sample.

Table 4.4 Pain scores for all participants in the postoperative period

	Experimental group Mean (SD)				Comparison group Mean (SD)			
	Worst pain	Least pain	Average pain	Current pain	Worst pain	Least pain	Average pain	Current pain
Day 1 (E=3, C=4)	9.33 (1.15)	5.00 (1.41)	5.75 (1.70)	6.25 (1.23)	9.25 (0.50)	6.00 (2.00)	6.67 (2.08)	7.67 (1.53)
Day 2 (E=3, C=4)	8.00 (0.00)	3.50 (0.58)	5.00 (0.82)	5.75 (0.50)	8.00 (0.82)	5.00 (1.00)	6.00 (1.00)	6.33 (0.58)
Day 3 (E=3, C=4)	6.00 (1.00)	3.25 (0.50)	5.00 (0.00)	5.25 (0.50)	7.50 (0.58)	3.33 (0.58)	4.33 (0.58)	5.00 (1.00)
Day 4 (E=3, C=4)	4.67 (1.15)	2.75 (0.98)	4.00 (0.82)	4.75 (0.50)	6.50 (0.58)	3.00 (1.00)	3.67 (1.53)	4.33 (1.53)
Day 5 (E=3, C=4)	4.33 (0.58)	2.50 (0.58)	3.25 (0.50)	3.75 (0.98)	5.75 (0.50)	2.00 (1.00)	2.67 (0.58)	3.33 (0.58)
Day 6 (E=3, C=4)	3.33 (0.58)	1.00 (0.00)	2.25 (0.50)	2.25 (0.98)	3.50 (0.58)	0.67 (0.58)	1.67 (0.58)	2.00 (0.00)
Day 7 (E=3, C=4)	3.33 (0.57)	1.66 (0.57)	2.33 (0.57)	2.33 (0.57)	3.50 (0.57)	2.50 (0.57)	2.75 (0.50)	2.00 (0.81)
Days 8-10	3.5 (0.70)	2.0 (0.0)	2.0 (0.0)	2.0 (0.0)	3.50 (0.57)	1.75 (0.50)	2.50 (0.57)	2.50 (0.57)

(E=2, C=4)								
Days 11-13 (E=2, C=3)	2.0 (0.0)	0.50 (0.70)	1.0 (0.0)	0.50 (0.70)	4.33 (1.15)	2.0 (1.0)	2.66 (0.57)	2.66 (0.57)
Days 14-18 (E=0, C=1)	—	—	—	—	4.0	2.0	2.0	2.0

Note: pain scores were measured using a 0-10 numerical rating scale (NRS).

E-experimental group; C-comparison group

4.4.2.3 Pain interference with activities during postoperative hospitalization

Patients in both groups reported extremely high scores for the interference of pain with daily activities in the early postoperative period (postoperative days 1 to 3). The interference scores decreased in the following days. However, the differences between the two groups with regard to the scores on the interference of pain with daily activities were minimal (Table 4.5).

Table 4.5 Interference of pain with activities in the postoperative period

	Experimental group Mean (SD)						Comparison group Mean (SD)					
	Repositioning	Deep breathing/ coughing	Walking	Mood	Chatting	Sleep	Repositioning	Deep breathing/ coughing	Walking	Mood	Chatting	Sleep
Day 1 (E=3, C=4)	8.00(0.00)	8.00(0.00)	9.33(1.15)	7.33(2.08)	7.00(1.53)	5.33(2.52)	8.25(0.95)	5.75(0.50)	7.75(1.26)	5.75(1.50)	5.50(1.73)	4.25(1.26)
Day 2 (E=3, C=4)	7.33(1.15)	6.00(1.73)	6.00(0.00)	5.33(0.58)	4.33(1.55)	4.33(1.15)	4.50(1.00)	5.00(0.82)	6.25(0.50)	4.25(0.96)	3.50(1.00)	3.00(0.00)
Day 3 (E=3, C=4)	4.66(1.52)	5.00(0.00)	5.33(0.58)	4.67(1.58)	3.00(0.00)	3.00(0.00)	3.50(0.57)	3.75(0.96)	6.00(0.00)	3.00(0.00)	3.00(1.00)	2.75(0.50)
Day 4 (E=3, C=4)	5.00(1.73)	3.00(0.00)	4.00(0.00)	3.67(0.58)	3.00(0.00)	2.67(0.58)	4.25(0.95)	3.25(0.50)	5.00(0.00)	2.75(0.50)	2.50(0.58)	2.25(0.50)
Day 5 (E=3, C=4)	4.00(1.73)	2.00(0.00)	2.67(0.58)	2.00(0.00)	1.33(1.15)	1.33(1.15)	4.00(1.15)	2.25(0.50)	3.50(0.00)	2.00(0.00)	1.50(0.58)	1.50(0.58)
Day 6 (E=3, C=4)	3.33(0.57)	1.33(0.58)	1.67(0.58)	1.00(0.00)	0.67(1.15)	0.67(1.15)	2.75(0.95)	1.00(0.00)	2.50(0.00)	1.00(0.00)	0.75(0.50)	1.00(0.58)
Day 7 (E=3, C=4)	2.66(0.57)	2.00(0.00)	1.66(0.57)	2.33(0.57)	1.66(0.57)	1.66(0.57)	2.75(1.25)	2.00(0.81)	2.00(0.81)	2.00(0.81)	1.25(0.95)	1.50(1.29)
Days 8-10	2.50(2.12)	2.00(1.41)	1.50(0.70)	2.00(1.41)	0.50(0.70)	0.50(0.70)	2.75(0.50)	2.0(0.0)	1.75(0.50)	2.25(0.50)	1.75(0.50)	2.00(0.81)

(E=2, C=4)												
Days 11-13 (E=2, C=3)	2.0 (0.0)	1.0(0.0)	1.0(0.0)	1.0(0.0)	1.0(0.0)	2.0(0.0)	3.33(1.15)	2.66(1.52)	3.0(2.0)	2.33(1.52)	2.0(2.0)	2.0(1.0)
Days 14-18 (E=0, C=1)	—	—	—	—	—	—	2.0	2.0	1.0	1.0	2.0	3.0

Note: interference scores were measured using a 0-10 numerical rating scale (NRS).
E- experimental group; C-comparison group

4.4.2.4 Pain management behaviours

Pain management behaviours included the frequency of the patients' use of non-drug methods to relieve pain, and use of drug methods for pain relief (the total amount of analgesic used and use of PCA). In the postoperative period, a log record was used to document the patients' use of the recommended treatment, which was assessed daily using a 5-point likert scale with range of 0-4 ("0" stands for "never use" and "4" for "very frequently use") in using non-drug methods for pain relief. The pharmaceutical methods for patients to manage pain such as the amount of analgesic use and use of PCA were also documented on the log record.

On postoperative day 1 and day 2, the patients in both groups seldom used non-drug methods for pain relief. This changed in the following days. From postoperative day 4, patients in the experimental group frequently used non-drug methods to relieve pain; similar trend could be found in the comparison group. The experimental group expressed higher frequency of using non-drug methods than did the comparison group. However, minimal differences indicated in the total amount of analgesic used for both groups; as well as in the use of PCA in the postoperative period. The results are presented in Table 4.6.

Table 4.6 Pain management behaviours for all participants in the postoperative period

	Experimental group	Comparison group
Use of non-drug methods	Mean (SD)	Mean (SD)
Day 1 (E=3, C=4)	0.67 (1.15)	0.0 (0.0)
Day 2 (E=3, C=4)	0.0 (0.0)	0.50 (1.0)
Day 3 (E=3, C=4)	1.67 (1.53)	1.25 (0.96)
Day 4 (E=3, C=4)	3.33 (0.58)	1.75 (1.25)
Day 5 (E=3, C=4)	3.33 (0.58)	2.50 (0.58)
Day 6 (E=3, C=4)	3.00 (0.0)	2.0 (0.82)
Day 7 (E=3, C=4)	3.67 (0.58)	3.0 (0.0)
Days 8-10 (E=2, C=4)	3.50 (0.71)	2.50 (0.58)
Days 11-13 (E=2, C=3)	3.50 (0.71)	2.50 (0.58)
Days 14-18 (E=0, C=1)	—	4.0
Total amount of analgesic used	Mean (SD)	Mean (SD)
Morphine dosage equivalent	31.67 (27.63)	31.46 (21.20)
Use of PCA	n (%)	n (%)
Yes	2 (66.7)	3 (75.0)
No	1 (33.3)	1 (25.0)

E-experimental group; C-comparison group; PCA-patient-controlled analgesia

4.4.3 T2 (the day before discharge)

Post-test BQT-S and objective clinical outcomes were assessed the day before a patient was discharged. The patients' barrier scores on the BQT-S are presented in Table 4.7 and the objective clinical outcomes collected from the patients' medical records are listed in Table 4.8.

4.4.3.1 Post-test barrier scores on the BQT-S

After pain education, the patients' concerns about reporting pain and using analgesics were assessed for all participants the day before discharge. Barrier scores on the BQT-S clearly fell in both groups. The patients in the experimental group reported lower scores in the subscales of the BQT-S than did those in the comparison group, except for the subscales of "tolerance", "side effects", and "fear of injections" (Table 4.7). The 4 highest pretest scores, for the BQT-S subscales of "inhibition of wound healing", "distraction", "time interval" and "tolerance", clearly decreased in the two groups. Lower scores were given by the experimental group than by the comparison group for the above subscales, at 1.22 vs 1.33, 1.67 vs 2.00, 2.22 vs 2.25 respectively, except for the subscale of "tolerance" (1.78 vs 1.08).

Table 4.7 Post-test barrier scores on the BQT-S after pain education

Subscales of the BQT-S	Experimental group (n=3) Mean(SD)	Comparison group (n=4) Mean (SD)
Inhibition of wound healing	1.22 (0.69)	1.33 (0.00)
Distraction	1.67 (0.34)	2.00 (0.27)
Time interval	2.22 (0.84)	2.25 (0.74)
Tolerance	1.78 (0.51)	1.08 (0.17)
Fatalism	1.78 (0.51)	2.09 (0.42)
Desire to be a good patient	1.11 (0.84)	1.33 (0.47)
Side effects	0.93 (0.50)	0.80 (0.43)
Fear of injections	1.00 (1.73)	0.75 (1.29)
Addiction	0.89 (1.54)	1.33 (2.45)
Total score of the BQT-S	1.33 (0.28)	1.28 (0.30)

Note: Barrier Questionnaire-Taiwan Form Surgical Version, BQT-S; BQT-S scores range from 0 to 5.

4.4.3.2 Objective clinical outcome

The objective clinical outcome included outcomes related to cost issues as the length of hospitalization. Postoperative data was also documented such as the length of the chest tube insitu, the first day to initiate ambulation, and the occurrence of postoperative complications. This information was collected from the patients' medical records on the day before a patient was discharged. Minimal differences were found in the objective clinical outcome and the postoperative data for the two groups as indicated in Table 4.8.

Table 4.8 Objective clinical outcome and postoperative data for the two groups after a thoracotomy operation

	Experimental group (n=3) Mean (SD)	**Comparison group** (n=4) Mean (SD)
Total days of hospitalization	14.67 (1.58)	16.50 (3.10)
Pre-operative stay	4.33 (1.15)	3.75 (0.50)
Post-operative stay	11.00 (1.00)	12.00 (4.54)
Days of chest tube insitu	9.33 (0.57)	10.00 (3.74)
The first day to initiate ambulation	n (%)	n (%)
Day 3	1 (33.3)	1 (25.0)
Day 4	2 (66.7)	2 (50.0)
Day 5	0 (0.0)	1 (25.0)
Postoperative complications	n (%)	n (%)
Pulmonary complication	0 (0.0)	1 (25.0)

4.5 Implications of the pilot study for the main study

Significant differences could not be determined between the experimental and comparison groups due to the very small size of the sample. However, the results of the pilot study provided a clear view of the patients' postoperative pain experience, their use of recommended care for pain relief, and concerns about reporting pain and using analgesics. In addition, it also provided valuable information about the data collection procedure for the main study. Based on the preliminary results of the pilot study, the following changes regarding the process of data collection will be made for the main study to determine the efficacy of the intervention.

First, some of the information about thoracotomy operations and postural drainage found in the information booklet was difficult for the participants to understand and was not appropriate for the majority of the subjects (since more than 70% of the patients were undergoing an esophagectomy, and only a semi or high-Fowler's position is recommended for those postoperative patients). The relevant information that was difficult to understand will be made clearer in both the teaching session and the booklet. Second, the researcher noted that some of the patients had difficulty reading the pain scale on the questionnaire during the data collection process. A 10-cm cupboard scale with numbers from 0 to 10 will be used as the pain or interference measurement scale, standing for "least pain" and "worst pain" or "do not interfere" and "interfere completely".

In addition, from what was observed in the pilot study, the drop-out rates of the participants need further consideration in the main study. Postoperative patients in an unstable hemodynamic condition or those who have been readmitted to the Intensive

Care Unit (ICU) need to be excluded in a future study. More comprehensive information and explanations will be provided to both the participants and their primary caregivers or relatives to build a relationship of trust and facilitate cooperation.

4.6 Summary

The pilot study was conducted to the train patient educators and to investigate the feasibility and effectiveness of the main study. The training of ward nurses was completed in the early stage of the pilot study. The preliminary findings also indicated that the protocols for the intervention are appropriate and could produce the data required to answer the research questions of the study. More careful consideration needs to be taken in the main study to obtain the cooperation of the participants and their relatives to minimize drop-out rates. In the data collection procedure, slight modifications will be made to fit the main study. Because of the very small sample size, the effects of different interventions provided to the participants could not be determined. Further conclusions have to be drawn from the results of the main study.

Chapter 5 Results

5.1 Introduction

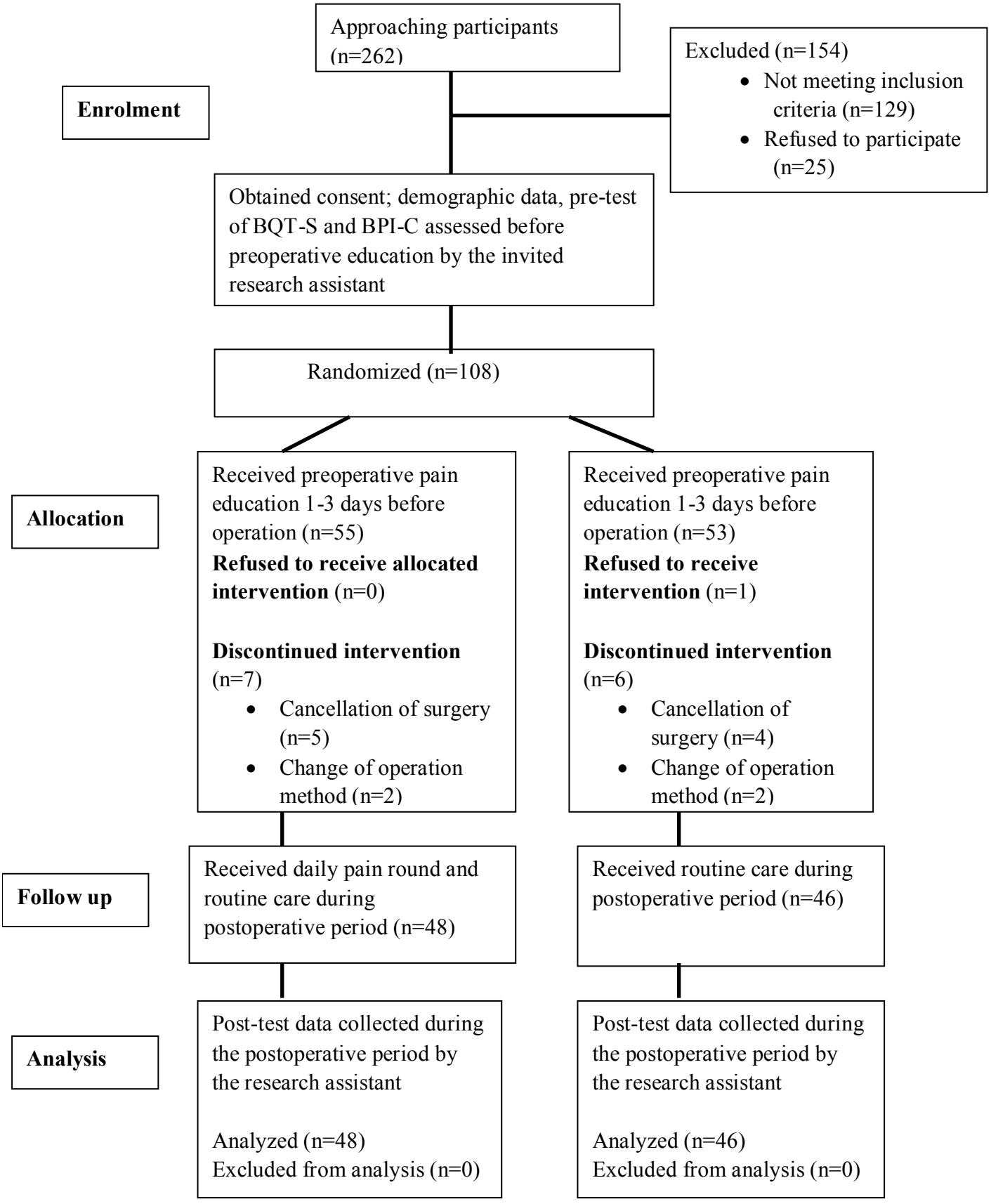
This chapter reports the results of the main study. It includes two sections: subject recruitment is presented in the first section; and followed by the results of the main study.

5.2 Subject recruitment

During the data collection period, 262 patients admitted to the thoracic surgery ward of the study hospital were assessed for eligibility by the hospital nurse for recruitment in the present study. The ward nurse examined the inclusion criteria and briefly discussed the study with the patients and their families and informed the researcher. A total of 154 patients (58.8%) were excluded: 128 of them failed to meet the inclusion criteria; and 25 declined to sign the written consent form.

The 108 invited participants were randomly assigned to either the experimental or the comparison group by using computer-generated sequences. Fifty-five patients were allocated to the experimental group, while 53 participants were assigned to the comparison group. Fourteen of the participants (13.0%) were further excluded from the study: 13 of them did not meet the inclusion criteria (cancellation of surgery or change of operation method); while one of them refused to receive the intervention. In the end, a total of 94 patients completed the study. There were 48 participants in the experimental group and 46 participants in the comparison group. A per protocol analysis was employed in the present study. A detailed description of the intervention and data collection procedure for the present study is given in Figure 5. 1.

Figure 5.1 Consort map



5.3 T0 (before preoperative pain education)

Before preoperative pain education, the demographic data, the patients' barrier scores on the BQT-S, pain scores, and interference with activities on BPI-C were assessed for all of the participants. The results are presented in Table 5.1a, Table 5.1b, and Table 5.2.

5.3.1 Demographic characteristics of the participants

A total of 94 patients (48 patients in the experimental group, and 46 patients in the comparison group) participated in the study. Their demographic characteristics, disease information, and postoperative data are presented in Table 5.1a and Table 5.1b. No significant differences were found in the demographic and disease characteristics between the experimental and comparison groups ($p > 0.05$).

Most of the participants were male (65 males and 29 females). The mean age of the participants was 59.32 years (ranging from 30-77 years). Nearly all of the patients (90.4%) were married and had spouses. Most of the participants (61.7%) did not have a high level of education, at primary school level or less, and 62 participants (66.0%) had a very low level of income. About 70% of them performed farm work in the countryside, and none of them had ever pursued work in the medical or health care fields. None of the participants indicated that they had religious beliefs.

Seventy-two of the patients (76.6%) had been diagnosed with esophageal cancer, 18 (19.1%) with lung cancer, and 4 (4.3%) with other diseases. In none of the patients was metastasis detected at the time of admission. None of the participants had ever attended any type of education about pain management. Although 73.4% of the

patients reported having used analgesics, none of them had ever used non-drug methods for pain relief.

Pain and interference scores were also measured by BPI-C for both groups before surgery. Only a total of 12 patients (12.8% of the total sample, 7 of them from the experimental group and 5 from the comparison group) reported mild pain (1.46 vs 1.70) or interference with daily activities (0.59 vs 0.56) on a 0-10 Numerical Rating Scale (NRS). No significant difference was indicated between the two groups regarding the levels of pain and interference of with daily life before the operation ($p > 0.05$).

Table 5.1a Demographic data of the participants (n=94)

	Experimental group (n=48) *n* (%)	Comparison group (n=46) *n* (%)	*P*-value [a]
Sex			0.932
Male	33 (68.8)	32 (69.6)	
Female	15 (31.3)	14 (30.4)	
	Mean (SD)	Mean (SD)	0.219 [b]
Age	58.02 (10.60)	60.67 (10.20)	
	n (%)	*n* (%)	*P*-value [a]
Level of education			0.784
Primary school or less	28 (58.3)	30 (58.3)	
Junior high school	9 (18.8)	6 (13.0)	
Senior high school	7 (14.6)	5 (10.9)	
University or above	4 (8.3)	5 (10.9)	
Marital status			0.676
Has spouse	44 (91.7)	41(89.1)	
No spouse	4 (8.3)	5 (10.9)	
Occupation			0.457
Farmer	31 (64.6)	33 (71.7)	
Non-farmer	17 (35.4)	13 (28.3)	
Employment			0.283
Yes	23 (47.9)	17 (37.0)	
No	25 (52.1)	29 (63.0)	
Family income (RMB/month)			0.394
<1000	30 (62.5)	32 (69.6%)	

1001-2000	4 (8.3)	4 (8.7%)
2001-3000	6 (12.5)	8 (17.4%)
3001-4000	7 (14.6)	2 (4.3%)
>4000	1 (2.1)	0 (0.0)

[a:] A Chi-square test was used.
[b]: An independent t-test was used.
A *p*-value of < 0.05 is considered statistically significant.

Table 5.1b Disease characteristics of the participants (n=94)

	Experimental group (n=48) *n* (%)	Comparison group (n=46) *n* (%)	*P*-value [a]
Diagnosis			0.336
Esophageal cancer	34 (70.8)	38 (82.6)	
Lung cancer	12 (25.0)	6 (13.0)	
Other diseases	2 (4.2)	2 (4.3)	
Medical history			
Hypertension	8 (16.7)	11(23.9)	0.382
Diabetes mellitus	0 (0.0)	1 (2.2)	0.304
Cardiovascular diseases	3 (6.3)	0 (0.0)	0.085
Other diseases	12 (25)	17 (37.0)	0.210
Previous surgery			0.937
Yes	6 (12.5)	6 (13.0)	
No	42 (87.5)	40 (87.0)	
History of analgesic use			0.721
Yes	36 (75)	33 (71.7)	
No	12 (25)	13 (28.3)	
Pain before surgery [c]			0.590
Yes	7 (14.6)	5 (10.9)	
No	41 (85.4)	41 (89.1)	
	Mean (SD)	Mean (SD)	*P*-value [b]
Mean pain score	1.46 (0.52)	1.70 (0.37)	0.414
Mean pain interference score	0.59 (0.81)	0.56 (0.91)	0.958

[a:] A Chi-square test was used.
[b:] An independent t-test was used.
[c:] Scores of pain and its interference with activities were measured by BPI-C, and rated on a 0-10 scale.
A *p*-value of <0.05 is considered statistically significant.

5.3.2 Barrier scores on the BQT-S

Patients' concerns about reporting pain and using analgesics were measured by the BQT-S before preoperative pain education for both groups. An independent t-test was used to determine the differences between the two groups regarding the scores on each subscale and the total score of the BQT-S.

The 4 greatest concerns of the patients in the experimental group, as measured on a 6-point Likert scale ranging from 0 to 5, were "Tolerance" (3.71 ± 1.33), "Time interval" (3.39 ± 0.99), "Inhibition of wound healing" (3.30 ± 1.31), and "Distraction" (2.98 ± 1.25). Similarly, the patients of the comparison group expressed their 4 greatest concerns as "Tolerance" (3.69 ± 1.26), "Inhibition of wound healing" (3.55 ± 1.27), "Time interval" (3.42 ± 1.13), and "Distraction" (3.08 ± 1.05). All of the participants reported considerably high scores for reporting pain and using analgesics for pain treatment, except for the subscale of "Fear of injections". However, no significant differences ($p > 0.05$) were found between the two groups either in the scores of each subscale of the BQT-S or in the total scores of the BQT-S before preoperative pain education, as indicated in Table 5.2.

Table 5.2 Comparison of subscales and total scores of the BQT-S for the two groups before pain education

	Experimental group (n=48) Mean (SD)	Comparison group (n=46) Mean (SD)	[a] *P*-Value
Tolerance	3.71(1.33)	3.69 (1.26)	0.950
Time interval	3.39 (0.99)	3.42 (1.13)	0.883
Inhibition of wound healing	3.30 (1.35)	3.55 (1.27)	0.362
Distraction	2.98 (1.25)	3.08 (1.05)	0.685
Desire to be good	2.87 (0.89)	2.98 (1.08)	0.586
Fatalism	2.81 (1.01)	2.90 (0.97)	0.680
Side effects	2.56 (1.16)	2.59 (1.13)	0.889
Addiction	2.48 (1.70)	2.72 (1.69)	0.489
Fear of injections	1.36 (1.37)	1.37 (1.32)	0.968
Total BQT-S	2.84 (0.72)	2.90 (0.69)	0.679

Note: Barrier Questionnaire-Taiwan Form Surgical Version, BQT-S; BQT-S scores ranged from 0 to 5.
[a]: Independent t-tests were used for the comparison between the experimental and comparison groups.
*: A *p*-value of < 0.05 was considered statistically significant.

Patients in both groups reported moderate to strong concerns about reporting pain and using analgesics to treat pain. Since the scores ranged from 0 to 5, it can be seen that most of the means are toward the moderate to high end of the scale. However, no significant differences between the two groups were seen either in each subscale or in the total score of the BQT-S ($p > 0.05$), indicating that the two groups were comparable before the preoperative pain education.

5.4 T1 (During the entire postoperative hospitalization period)

Pain scores, levels of interference by pain with activities, and pain management behaviours such as the frequency of the patients' use of non-drug methods, and drug methods (use of PCA, and amount of analgesics used) to relieve pain were assessed daily for both groups during the entire postoperative hospitalization period. Between-group effects were tested by the Mann-Whitney U test to determine the differences in pain intensity, interference of pain with activities, and patients' use of non-drug methods between the experimental group and the comparison group at each time point in the postoperative period. Friedman's ANOVA was used to examine the within-group effects for the two groups; if the results were significant, Wilcoxon signed rank tests were performed to examine which pairs of time points showed any differences. In such multiple comparisons, the Bonferroni correction was applied to determine the level of statistical significance.

5.4.1 Pain and interference with daily activities 4 hours after surgery

On the day of the operation, the scores for pain and the interference of pain with activities were also measured for the two groups of participants approximately 4 hours after surgery. All of the postoperative patients were transferred to the post-anesthesia care unit (PACU) for monitoring immediately after surgery, and returned to the ward ICU on the day of the operation in accordance with the routine practice of the study setting. The approximate length of stay in the PACU is 2 to 3 hours. It is feasible to measure the patients' scores for pain and interference with activities at the time point of 4 hours after surgery. A Mann-Whitney U test was used for between-group comparisons, since normal distribution was not assumed for the collected data. No significant differences were seen between the experimental and the comparison

groups at the baseline measures on pain scores and interference scores ($p > 0.05$), as presented in Table 5.3 and Table 5.4.

Pain scores were measured for both groups of participants using a 0 to 10 numerical rating scale (NRS) 4 hours after the operation. Patients in the experimental group reported pain of moderate severity as their worst pain (6.70 ± 1.68), average pain (4.47 ± 1.28), and current pain (5.04 ± 1.16). Similarly, the patients of the comparison group experienced moderate to severe pain after the operation as their worst pain (7.10 ± 2.17), average pain (4.91 ± 1.58), and current pain (5.17 ± 1.65). However, no significant differences ($P > 0.05$) were seen between subject and group comparisons in the experimental and comparison groups, as indicated in Table 5.3.

Table 5.3 Pain scores of the participants 4 hours after surgery

	Experimental group (n=48) Mean (SD)	Comparison group (n=46) Mean (SD)	[a]*P*-Value
Mean pain intensity	4.94 (1.13)	5.18 (1.61)	0.116
Worst pain	6.70 (1.68)	7.10 (2.17)	0.172
Least pain	3.35 (1.02)	3.54 (1.34)	0.132
Average pain	4.68 (1.16)	4.91 (1.58)	0.099
Current pain	5.04 (1.16)	5.17 (1.65)	0.446

[a]: A Mann-Whitney U test was used for between-group comparisons.
A *p*-value of < 0.05 is considered statistically significant.

For both groups, the worst, least, average, and current pain scores were combined to obtain a mean score for pain severity. The mean pain intensity for all of the participants in the two groups was moderate (4.94 ± 1.13 vs 5.18 ± 1.61) at 4 hours

after surgery. No significant differences were seen between the experimental and the comparison groups on the measurement of pain scores on the day of the operation ($P > 0.05$), as presented in Table 5.3. The two groups were comparable at the baseline measurement of pain severity.

In both groups, the scores on the interference of pain with activities were measured 4 hours after the operation using a numerical rating scale (NRS) ranging from 0 to 10. Patients in the experimental group reported extremely high scores for pain-related interference with functions such as repositioning (8.22 ± 1.68), deep breathing/coughing (7.29 ± 1.09), performing out of bed ambulation (7.64 ± 0.72); and considerably high scores for the interference of pain with mood (6.54 ± 1.16), chatting (5.93 ± 0.90) and sleep (6.47 ± 1.45). Similarly, the patients in the comparison group experienced extremely high interference from pain with daily activities after the operation with regard to repositioning (8.34 ± 0.73), deep breathing/coughing (7.41 ± 1.18), ambulating (7.89 ± 0.64), mood (7.04 ± 1.33), chatting (6.28 ± 0.95), and sleep (6.73 ± 1.45). However, no significant differences were seen in the between-group comparisons ($p > 0.05$), as indicated in Table 5.4.

Table 5.4 Scores on interference by pain with activities for the participants 4 hours after surgery

	Experimental group (n=48) Mean (SD)	Comparison group (n=46) Mean (SD)	[a]*P*-Value
Mean interference	7.02 (0.71)	7.28 (0.76)	0.074
Repositioning	8.22 (0.72)	8.34 (0.73)	0.290
Deep breathing/coughing	7.29 (1.09)	7.41 (1.18)	0.484
Walking	7.64 0.72)	7.89 (0.64)	0.065
Mood	6.54 (1.16)	7.04 (1.33)	0.060
Chatting	5.93 (0.90)	6.28 (0.95)	0.085
Sleep	6.47 (1.45)	6.73 (1.45)	0.348

[a]: A Mann-Whitney U test was used for between-group comparisons.
A *p*-value of <0.05 is considered statistically significant.

Levels of interference from pain with repositioning, deep breathing /coughing, walking, mood, chatting, and sleep were combined to obtain a mean interference score for both groups. The mean interference score was high in both groups (7.02 vs 7.28) at 4 hours after surgery. However, no significant differences were indicated between the experimental and the comparison groups regarding the measurement of

interference from pain on the day of the operation ($p > 0.05$), as presented in Table 5.4. Thus, the two groups were comparable regarding the levels of interference from pain in daily activities.

5.4.2 Pain and interference with daily activities during postoperative hospitalization

Pain scores and levels of interference from pain with activities in the two groups were measured from postoperative day 1 until the patient was discharged. The results from postoperative day 1 to day 7 were analyzed and presented in detail.

5.4.2.1 Pain scores during the postoperative period

Pain scores for all participants in the postoperative period were measured daily using a 0-10 numerical rating scale (NRS). The worst, least, average, and current pain scores were combined to obtain a mean score on pain severity for both groups. As seen in Table 5.5, there were significant differences ($p < 0.05$) between the two groups in mean pain severity from postoperative day 1 to day 7.

The experimental group reported pain severity as moderate from postoperative days 1 to 4 (mean 4.16 to 3.51), with the severity decreasing in the following postoperative days. From postoperative day 5, the participants of the experimental group reported pain intensity as mild (the mean pain scores were less than 3 on a 0-10 scale) in the postoperative hospitalization period. Similarly, the comparison group rated the pain severity as moderate from postoperative days 1 to 4 (mean 5.30 to 4.25), and pain scores decreased gradually over time in the postoperative period. From postoperative

day 5 to day 7, the participants of the comparison group still reported moderate pain intensity (mean 3.99 to 3.44).

The participants in the experimental group reported significant lower levels of pain severity than did the comparison group from postoperative day1 to day 7 (mean 4.16 to 2.40 vs mean 5.30 to 3.44, $p < 0.05$). As illustrated in Table 5.5, the suffering from pain was less severe in the experimental group than in the comparison group: patients of the experimental group experienced moderate pain in the first 4 days after surgery; while the comparison group reported moderate pain from postoperative days 1 till day 7.

Table 5.5 Comparisons of the pain scores for the two groups in the postoperative period

	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7	
	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46
Mean pain	4.16	5.30	3.94	5.02	3.82	4.82	3.51	4.25	2.98	3.99	2.73	3.63	2.40	3.44
Median	3.75	5.50	4.00	5.00	4.00	5.00	3.50	4.25	3.00	3.75	2.87	3.50	2.00	3.37
Quartile range	3.00-4.93	3.93-6.50	3.06-4.68	3.68-6.25	3.06-4.25	4.25-5.50	2.75-4.18	3.75-4.75	2.00-3.50	3.25-4.81	2.00-3.00	3.00-4.25	2.00-3.00	3.00-4.25
[a] *P*-value	0.003*		0.000*		0.000*		0.000*		0.000*		0.000*		0.000*	
Worst pain	6.04	7.10	5.28	6.84	5.39	7.08	5.06	6.21	4.37	6.21	4.08	5.36	3.58	5.13
[a] *P*-value	0.019*		0.001*		0.000*		0.000*		0.000*		0.000*		0.000*	
Least pain	2.81	3.67	2.54	3.65	2.52	3.34	2.22	2.80	1.75	2.73	1.56	2.50	1.41	2.30
[a] *P*-value	0.006*		0.000*		0.000*		0.006*		0.000*		0.000*		0.000*	
Average pain	3.95	5.08	3.81	4.73	3.70	4.43	3.39	3.91	2.93	3.67	2.60	3.32	2.35	3.17
[a] *P*-value	0.001*		0.003*		0.000*		0.005*		0.000*		0.001*		0.000*	
Current pain	3.85	5.30	3.83	4.84	3.68	4.41	3.35	4.06	2.87	3.78	2.68	3.34	2.27	3.17
[a] *P*-value	0.000*		0.004*		0.000*		0.001*		0.000*		0.001*		0.000*	

[a]: Mann-Whitney U tests were used for comparisons between the experimental and comparison groups.

*: Significant results according to the Bonferroni-Holm procedure.

E, experimental group; C, comparison group

Referring to Table 5.5, the experimental group reported significantly lower scores on the worst pain from postoperative day 1 to day7 (mean 6.04 to 3.58 vs mean 7.10 to 5.13, $P < 0.05$). The experimental group rated the highest pain as moderate to severe from postoperative day 1 to day 4 (mean 5.06 to 6.04); the worst pain score was rated as moderate to severe during postoperative day 1 to day 7 in the comparison group (mean 5.13 to 7.10). The worst pain scores clearly decreased in the experimental group in the first 7 days (mean 6.04 to 3.58) and a similar trend was indicated in the comparison group (mean 7.10 to 5.13) in the above period.

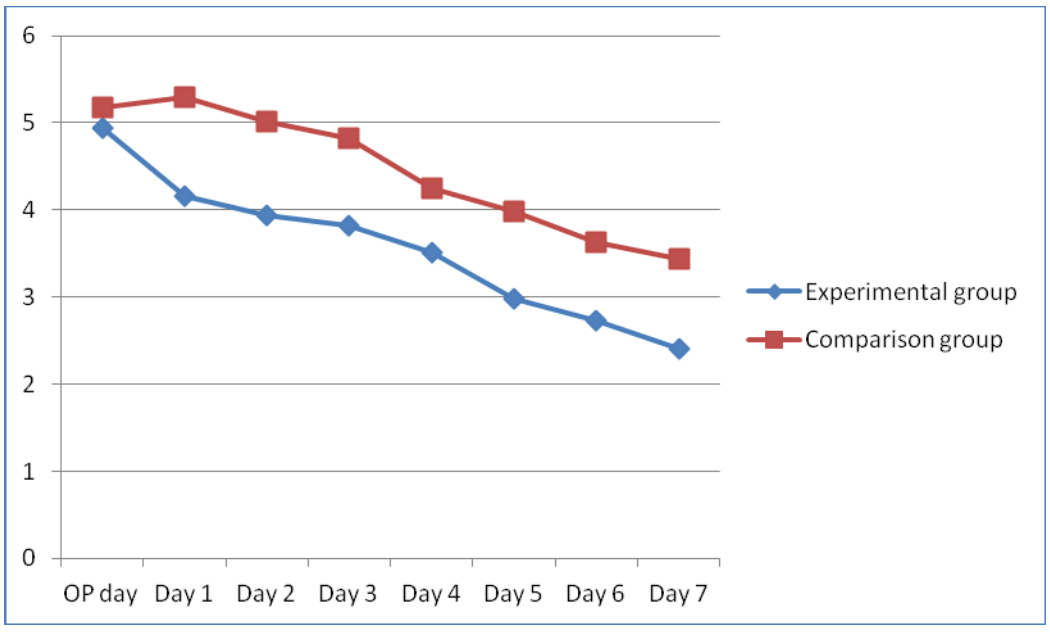
Within-group changes of the mean pain scores in both groups were tested by Friedman's ANOVA, and Wilcoxon tests were used to determine the difference between the comparisons in each time point for the seven days after surgery (i.e., Day 1 vs OP, Day 2 vs Day 1, Day 3 vs Day 2, etc.). Friedman's test showed significant differences in decreased levels of mean pain severity across time for both the experimental and comparison groups. A further analysis by the Wilcoxon test indicated obvious decreases in the mean pain scores ($p < 0.05$) from the OP day until day 7 in the experimental group except for days 1 to day 3 (Day 2 vs Day 1 and Day 3 vs Day 2, $p > 0.05$). For the comparison group, the mean pain scores decreased across time; however, the results in most of the comparisons did not achieve statistical significance except for Day 4 vs Day 3 ($p < 0.05$). The results are presented in Table 5.6 and the trend of the mean pain scores for the two groups is illustrated in Figure 5.2.

Table 5.6 Comparisons of within-group changes in the mean pain scores for the two groups in the postoperative period

Mean pain scores	**Experimental group** Z-score [a]	*P*-value	**Comparison group** Z-score	*P*-value
Day 1vs OP	-5.145	0.000*	-2.026	0.043
Day 2 vs Day1	-0.439	0.661	-2.022	0.043
Day 3 vs Day2	-1.038	0.299	-1.312	0.190
Day 4 vs Day3	-3.305	0.001*	-3.688	0.000*
Day 5 vs Day4	-4.061	0.000*	-2.319	0.020
Day 6 vs Day5	-2.434	0.015*	-2.359	0.018
Day 7 vs Day6	-2.861	0.004*	-2.072	0.038

OP-operation day
[a]: Wilcoxon signed rank tests were used for pair-wise comparisons.
*: Significant results according to the Bonferroni-Holm procedure.

Figure 5.2 Mean pain scores for the two groups in the postoperative period



As indicated in Figure 5.2, the mean pain scores for the experimental group decreased more rapidly than for the comparison group in the first seven days after surgery. In the experimental group, the pain scores decreased most evidently from OP day to day 1; then steadily declined from day 1 to day 3; evident decreases were also indicated from day 3 until day 7. By contrast, the pain scores on day 1 were slightly higher than those on the OP day for the comparison group; they then gradually declined across time during the first seven days after the operation. Only on Day 3 vs Day 4 was a significant decrease seen for the comparison group during the above period. The experimental group demonstrated better pain relief across time than the comparison group, as seen in the figures presented in Table 5.6 and Figure 5.2.

5.4.2.2 Scores on the interference from pain with activities in the postoperative period

For all participants, the interference of pain with daily activities was measured daily from postoperative day 1 until a patient was discharged. Levels of interference from pain with repositioning, deep breathing /coughing, walking, mood, chatting, and sleep were combined to obtain a mean interference score. As illustrated in Table 5.7, there were significant differences ($p < 0.05$) between the two groups in terms of the mean pain interference score from postoperative day 1 to day 7.

The experimental group reported the highest score on the interference from pain with activities on operation day (mean 7.02); with the interference score decreasing clearly in the 4 days after surgery (mean 7.02 to 3.02); and then further in the following postoperative days. From postoperative day 5, the participants of the experimental group reported the interference from pain as mild (the mean scores were less than 3 on a 0-10 scale) in the postoperative hospitalization period. Similarly, the comparison

group rated the interference from pain at highest level on postoperative day 1 (mean 7.76), with the interference score decreasing obviously from days 1 to 4 (mean 7.76 to 4.08) and decreasing gradually over time in the postoperative period. On postoperative day 7, the participants of the comparison group reported mild interference from pain with daily activities (the mean interference scores were less than 3 on a 0-10 scale).

Table 5.7 Comparisons of the interference scores for the two groups in the postoperative period

	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7	
	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46	E=48	C=46
Mean interference	6.69	7.76	4.40	6.14	3.51	5.01	3.02	4.08	2.61	3.58	2.16	3.17	1.83	2.97
Median	6.50	7.83	4.33	6.50	3.66	5.16	2.83	4.00	2.66	3.33	2.00	2.83	1.66	2.75
Quartile range	5.70-7.62	3.93-6.50	3.66-4.83	3.68-6.25	2.70-4.12	4.25-5.50	2.33-3.66	3.75-4.75	1.70-3.00	3.25-4.81	1.66-2.62	3.00-4.25	1.16-2.33	3.00-4.25
[a] *P*-value	0.000*		0.000*		0.000*		0.000*		0.000*		0.000*		0.000*	
Repositioning	7.91	8.67	5.70	7.36	4.75	6.45	4.31	5.21	3.79	4.58	3.06	4.15	2.72	3.95
[a] *P*-value	0.001*		0.000*		0.000*		0.000*		0.004*		0.000*		0.000*	
Deep breathing/coughing	7.00	7.65	4.58	6.54	3.66	5.21	3.18	4.21	2.79	3.65	2.31	3.21	1.93	2.91
[a] *P*-value	0.009*		0.000*		0.000*		0.000*		0.000*		0.000*		0.000*	
Walking	7.47	8.41	4.79	6.46	3.68	5.43	3.20	4.30	2.72	3.73	2.22	3.23	1.89	3.00
[a] *P*-value	0.000*		0.000*		0.000*		0.000*		0.000*		0.000*		0.000*	
Mood	6.25	7.47	3.97	5.50	3.00	4.34	2.39	3.47	2.08	3.06	1.70	2.67	1.31	2.50
[a] *P*-value	0.000*		0.000*		0.000*		0.000*		0.000*		0.000*		0.000*	
Chatting	5.72	7.08	3.66	5.02	2.87	4.04	2.27	3.23	1.95	2.82	1.64	2.47	1.29	2.28
[a] *P*-value	0.000*		0.000*		0.000*		0.000*		0.000*		0.000*		0.000*	
Sleep	5.77	7.30	3.72	5.69	3.10	4.60	2.79	4.04	2.31	3.63	2.04	3.26	1.85	3.17
[a] *P*-value	0.000*		0.000*		0.000*		0.000*		0.000*		0.000*		0.000*	

[a]: Mann-Whitney U tests were used for comparisons between the experimental and comparison groups.

*: Significant results according to the Bonferroni-Holm procedure.

E, experimental group; C, comparison group

The participants in the experimental group reported significantly lower levels of interference from pain than did the comparison group from postoperative day 1 to day 7 (mean 6.69 to 1.83 vs mean 7.76 to 2.97, $p < 0.05$). As illustrated in Table 5.7, levels of interference from pain in activities were less severe in the experimental group than in the comparison group. The patients of the experimental group experienced moderate to severe interference from pain in the first 3 days after the surgery, and mild interference in daily activities from postoperative day 5 to day 7. Meanwhile, the comparison group reported levels of interference from pain as moderate to severe from postoperative day 1 till day 5, and as mild on postoperative day 7.

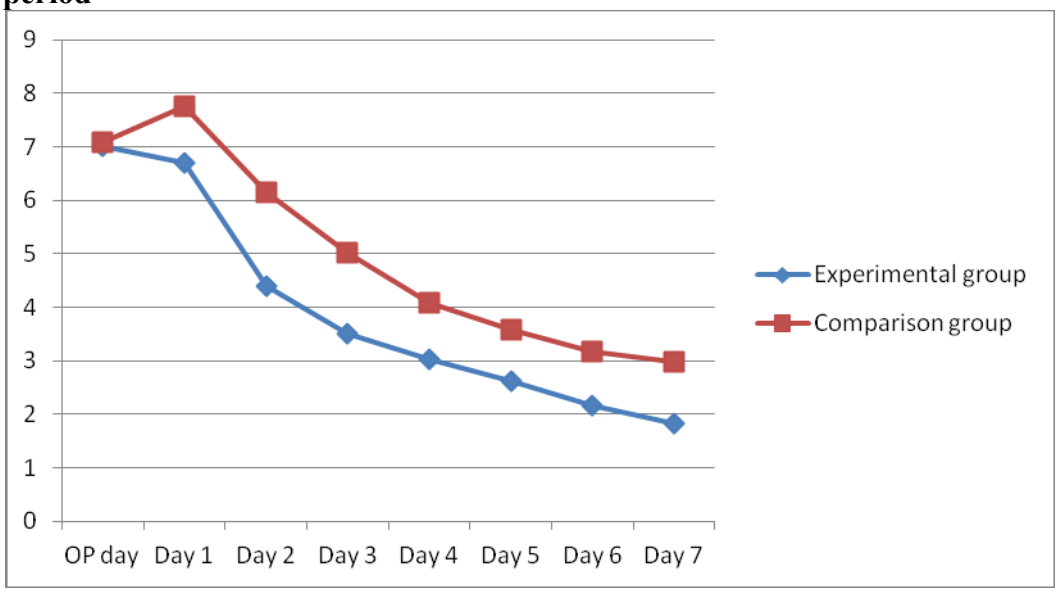
Within-group changes in the mean pain interference scores of both groups were tested by Friedman's ANOVA, and Wilcoxon tests were used to determine the difference between the comparisons in each time point for the seven days after surgery (i.e., Day 1 vs OP, Day 2 vs Day 1, Day 3 vs Day 2, etc.). Friedman's test showed significant differences in decreased levels of mean pain interference with activities across time for both the experimental and comparison groups. A further analysis by the Wilcoxon test indicated an obvious decrease in the mean pain interference scores ($p < 0.05$) from postoperative day 1 until day 7 in the experimental group, except for the OP day to day 1 (Day 1 vs OP, $p > 0.05$). Similarly, the mean pain interference scores decreased across time for the comparison group in the above period. However, the pain interference score was significant higher on day 1 than on the OP day in the comparison group ($p < 0.05$). The results are presented in Table 5.8 and the trend in the mean pain interference scores for the two groups is illustrated in Figure 5.3.

Table 5.8 Comparisons of within-group changes in mean pain interference with activities for the two groups in the postoperative period

Mean pain interference	**Experimental group** Z-score [a]	*P*-value	**Comparison group** Z-score [a]	*P*-value
Day 1vs OP	-1.320	0.187	-4.873	0.000*
Day 2 vs Day1	-5.939	0.000*	-5.749	0.000*
Day 3 vs Day2	-5.037	0.000*	-5.076	0.000*
Day 4 vs Day3	-4.565	0.000*	-5.133	0.000*
Day 5 vs Day4	-3.748	0.000*	-4.088	0.000*
Day 6 vs Day5	-3.812	0.000*	-3.545	0.000*
Day 7 vs Day6	-3.730	0.000*	-2.563	0.010*

OP-operation day
[a]: Wilcoxon signed rank tests were used for pair-wise comparisons.
*: Significant results according to the Bonferroni-Holm procedure.

Figure 5.3 Mean pain interference scores for the two groups in the postoperative period



As indicated in Figure 5.3, the mean pain interference with activities scores for the two groups decreased rapidly across time in the first seven days after surgery. In the experimental group, the pain interference scores showed an obvious decrease from postoperative day 1 to day 7. A similar trend of a decrease in mean scores for pain interference was seen in the comparison group, with the exception of the OP day to day 1; while patients reported the highest score for pain interference on day 1 during the seven days after operation. The experimental group demonstrated less pain interference with activities across time (from day 1 to day 7) than the comparison group, as illustrated in Figure 5.2.

5.4.3 Pain management behaviours

Pain management behaviours included the frequency of the patients' use of non-drug methods of pain relief, and the total amount of analgesics used and use of PCA in the postoperative hospitalization period. Both groups were assessed daily on their use of non-drug methods of pain relief, using a 0-4 Likert scale in a log record, with higher scores indicating higher frequency. The amount of analgesics used and the use of PCA were also documented in the log record. The experimental group indicated a significantly higher frequency in the use of non-drug methods of pain relief than the comparison group; yet the two groups were similar in the total amount of analgesics used and the use of PCA.

Referring to Table 5.9, non-drug methods for pain relief were less frequently used by patients on postoperative day 1 in the experimental group (mean 1.04), and were frequently used in the following days after surgery (mean 2.08 to 3.02). Similarly, the patients of the comparison group seldom used non-drug methods of relieving pain on

postoperative day 1 (mean 0.64), but the frequency of use increased obviously in the following days (mean 1.37 to 2.41). There were no significant differences regarding the total amount of analgesic used or the using of PCA for pain treatment in the two groups during the postoperative period ($p > 0.05$).

Table 5.9 Comparisons of pain management behaviours between the two groups in the postoperative period

Use of non-drug methods	**Experimental group (n=48)** Mean	Median	Quartile range	**Comparison group (n=46)** Mean	Median	Quartile range	*P*-value [a]
Day 1	1.04	1.00	1.00	0.63	1.00	0.00-1.00	0.005*
Day 2	2.08	2.00	2.00-2.75	1.37	1.00	1.00-2.00	0.000*
Day 3	2.73	3.00	2.00-3.00	1.37	1.00	1.00-2.00	0.000*
Day 4	3.02	3.00	3.00-3.00	2.22	2.00	2.00-3.00	0.000*
Day 5	2.92	3.00	3.00-3.00	2.35	2.00	2.00-3.00	0.000*
Day 6	2.96	3.00	3.00-3.00	2.41	2.00	2.00-3.00	0.001*
Day 7	2.90	3.00	3.00-3.00	2.39	2.00	2.00-3.00	0.001*
Total amount of analgesic used		Mean (SD)			Mean (SD)		*P*-value [b]
Morphine dosage equivalent		48.86 (18.95)			40.07 (25.08)		0.066
Tramadol		503.45 (233.73)			458.62 (338.61)		0.560
NSAIDs		146.15 (94.56)			140.83 (127.00)		0.899
Use of PCA		n (%)			n (%)		0.276 [c]
Yes		39 (81.3)			33 (71.7)		

No	9 (18.8)	13 (28.3)

[a]: Mann-Whitney U tests were used for comparisons between the experimental and comparison groups.
[b]: Independent *t*- tests were used for comparisons between the experimental and comparison groups.
[c]: a *Chi*-square test was used to compare differences between the two groups.
*: Significant results according to the Bonferroni-Holm procedure
A *p*-value is considered statistically significant at < 0.05.
NSAIDs, non-steroid anti-inflammatory drugs; PCA, patient-controlled analgesia

As seen in Table 5.9, there was a significant difference between the experimental and comparison groups in terms of pain management behaviour in terms of the frequency of use of non-drug methods for relieving pain. The frequency with which non-drug methods of pain relief were used in the experimental group was significantly higher than in the comparison group from postoperative days 1 to 7 ($p < 0.05$). However, the total amount of analgesics used and the use of PCA for pain treatment were similar in the two groups; no significant differences were indicated ($p > 0.05$).

Within-group changes in the use of non-drug methods of pain relief in both groups were tested by Friedman's ANOVA, and Wilcoxon tests were used to determine the difference between comparisons in each time point for the seven days after surgery (i.e., Day 2 vs Day 1, Day 3 vs Day 2, Day 4 vs Day 3, etc.). Friedman's test showed significant differences in the use of non-drug methods across time for both the experimental and comparison groups. A further analysis by the Wilcoxon test indicated an obvious change in the frequency of the use of non-drug methods for the first four days after surgery in both groups ($p < 0.05$). No significant differences were indicated in the comparisons from postoperative day 5 to day 7 ($p > 0.05$). The results are presented in Table 5.10.

Table 5.10 Comparisons of within-group changes in the use of non-drug methods of pain relief for the two groups in the postoperative period

	Experimental group		**Comparison group**	
Use of non-drug methods	*Z*-score [a]	*P*-value	*Z*-score [a]	*P*-value
Day 2 vs Day1	-5.826	0.000*	-4.863	0.000*
Day 3 vs Day2	-5.070	0.000*	-3.771	0.000*
Day 4 vs Day3	-2.985	0.003*	-3.024	0.002*
Day 5 vs Day4	-1.000	0.317	-1.500	0.134
Day 6 vs Day5	-0.577	0.564	-0.655	0.513
Day 7 vs Day6	-0.905	0.366	-0.209	0.835

[a]: Wilcoxon signed rank tests were used for pair-wise comparisons.
*: Significant results according to the Bonferroni-Holm procedure.

As indicated in Table 5.10, the frequency of the use of non-drug methods for pain relief increased significantly in the first four days after surgery for both the experimental and comparison groups. A similar improvement in the use of non-drug methods was achieved in both groups. However, the experimental group indicated higher frequency in terms of using non-drug methods than the comparison group during the first seven days after surgery.

5.5 T2 (the day before discharge)

The patients' barrier scores on the BQT-S and the objective clinical outcomes were assessed for both groups on the day before the patients were discharged. Between-group and within-group changes in the BQT-S scores for both groups were compared and illustrated in Table 5.11. The objective clinical outcomes included patients' recovery from thoracic surgery such as the first day to initiate ambulation, the length

of chest tube retention, the occurrence of postoperative complications; and cost issue as the length of hospital stay. These data were collected from the patients' medical records before a patient was discharged, and comparisons were made between the two groups (Table 5.12).

5.5.1 Patients' barrier scores on the BQT-S after pain education

Post-test barrier scores (after pain education) for all participants were measured using the BQT-S the day before a patient was discharged. The hypothesis on whether there were any differences in patient-related barriers to pain management between the experimental group and the comparison group was tested using an independent *t*-test for comparisons of the degree of pre- and post-test changes in the two groups; and a paired t-test was used to examine the within-group effects for each group. A Bonferroni-Holm correction was applied in the case of multiple comparisons to minimize family-wise type I errors.

As presented in Table 5.11, the scores of each subscale and the total score of the BQT-S for the experimental group dropped significantly. A similar trend was seen in the comparison group. The scores for the 4 greatest concerns of the experimental group improved dramatically as follows: "Tolerance" (3.71 ± 1.33 vs 1.93 ± 0.56), "Time interval" (3.39 ± 0.99 vs 1.77 ± 0.54), "Inhibition of wound healing" (3.30 ± 1.31 vs. 0.37 ± 0.57), and "Distraction" (2.98 ± 1.25 vs 1.60 ± 0.58). Similarly, the scores of the 4 concerns of the patients of the comparison group saw a dramatic improvement: "Tolerance" (3.69 ± 1.26 vs 2.28 ± 0.47), "Inhibition of wound healing" (3.55 ± 1.27 vs 0.79 ± 0.65), "Time interval" (3.42 ± 1.13 vs 2.29 ± 0.52), and "Distraction" (3.08 ± 1.05 vs 1.97 ± 0.54). A significant improvement in all of the

patients was seen with regard to reporting pain and using analgesics for pain treatment after pain education (Table 5.11).

Table 5.11 Within and between-group comparisons in BQT-S scores for the two groups before and after pain education (experimental, n=48; comparison, n=46)

	Pretest Mean (SD)	Posttest Mean (SD)	Within groups *p*-value [a]	Pretest-posttest Mean (SD)
Addiction				
Experimental	2.48 (1.70)	0.20 (0.38)	0.000*	2.28 (1.78)
Comparison	2.72 (1.69)	0.42 (0.60)	0.000*	2.31(1.66)
Between groups *p*-value [b]	0.489	0.034*		0.948
Side effects				
Experimental	2.56 (1.16)	0.45 (0.30)	0.000*	2.11(1.23)
Comparison	2.59 (1.13)	0.71 (0.46)	0.000*	1.88 (1.15)
Between groups *p*-value [b]	0.889	0.003*		0.351
Distraction				
Experimental	2.98 (1.25)	1.60 (0.58)	0.000*	1.38 (1.33)
Comparison	3.08 (1.05)	1.97 (0.54)	0.000*	1.11(1.09)
Between groups *p*-value [b]	0.685	0.003*		0.283
Tolerance				
Experimental	3.71 (1.33)	1.93 (0.56)	0.000*	1.77 (1.27)
Comparison	3.69 (1.26)	2.28 (0.47)	0.000*	1.40 (1.23)
Between groups *p*-value [b]	0.950	0.001*		0.159
Fear of injections				
Experimental	1.36 (1.37)	0.12 (0.25)	0.000*	1.23 (1.36)
Comparison	1.37 (1.32)	0.24 (0.39)	0.000*	1.13 (1.39)
Between groups *p*-value [b]	0.968	0.153		0.714
Fatalism				

Experimental	2.81 (1.01)	1.75 (0.41)	0.000*	1.06 (1.18)
Comparison	2.90 (0.97)	1.86 (0.50)	0.000*	1.02 (1.12)
Between groups *p*-value [b]	0.680	0.691		0.868
Inhibition of wound healing				
Experimental	3.30 (1.35)	0.37 (0.57)	0.000*	2.93 (1.36)
Comparison	3.55 (1.27)	0.79 (0.65)	0.000*	2.76 (1.38)
Between groups *p*-value [b]	0.362	0.001*		0.556
Time interval				
Experimental	3.39 (0.99)	1.77 (0.54)	0.000*	1.61 (0.91)
Comparison	3.42 (1.13)	2.29 (0.52)	0.000*	1.13 (1.20)
Between groups *p*-value [b]	0.883	0.000*		0.031*
Desire to be good				
Experimental	2.87 (0.89)	1.33 (0.58)	0.000*	1.53 (0.85)
Comparison	2.98 (1.08)	1.67 (0.55)	0.000*	1.30 (1.13)
Between groups *p*-value [b]	0.586	0.003*		0.264
Total BQT-S				
Experimental	2.84 (0.72)	1.05 (0.25)	0.000*	
Comparison	2.90 (0.69)	1.35 (0.31)	0.000*	
Between groups *p*-value [b]	0.679	0.000*		0.135

Note: BQT-S scores range from 0 to 5.

[a] : A paired t-test was used for the comparisons within the experimental and comparison groups before and after pain education

[b] : An independent t-test was used for comparisons between the two groups before and after pain education

*: Significant results according to the Bonferroni-Holm procedure.

Referring to Table 5.11, the post-test scores of each subscale of the BQT-S and the total score of the BQT-S were significant lower for the experimental group than for the comparison group except for the subscales of "Fear of injections" and "Fatalism" ($p > 0.05$). However, in terms of the degree of the within-group changes (the pre-test scores subtracted from the post-test scores on BQT-S) the two groups did not differ significantly ($p > 0.05$); the exception was for the subscale of "Time intervals" ($p < 0.05$). The participants in the experimental group expressed less concern about reporting pain to health professionals and using pain medications for pain relief than did those in the comparison group, as seen from the BQT-S ratings.

5.5.2 Objective clinical outcome

Objective clinical outcomes included issues of cost, as information on the length of hospitalization was collected for all participants. Information on postoperative recovery (i.e., the length of chest tube retention, the first day to initiate ambulation, and the occurrence of postoperative complications) was also collected from the patients' medical records for all participants the day before they were discharged. No significant difference was seen between the two groups in terms of the objective clinical outcomes as the length of hospital stay and most of the items in the postoperative recovery ($p > 0.05$), with the exception of the first day to initiate ambulation in the postoperative period ($p < 0.05$). The results of comparisons in the objective clinical outcomes between the two groups are presented in Table 5.12.

There were no significant differences between the two groups on the issue of cost, as the length of the hospital stay was not significantly different ($p > 0.05$) for the two groups; nor was the postoperative recovery of the two groups significantly different,

including data on days of chest drain retention and the occurrence of postoperative complications. However, the experimental group initiated out-of-bed activities much earlier than the comparison group, and the difference there was significant ($p < 0.05$). Nearly 90% (89.6%) of the patients in the experimental group initiated out-of bed ambulation on postoperative day 2 and day 3; while this was the case with less than 70% (67.4%) of the patients of the comparison group. Almost all of the patients (n=46, 95.8%) in the experimental group performed earlier ambulation in the acute postoperative phase (the first 72 hours after surgery) than did the patients in the comparison group (n=32, 69.6%).

Table 5.12 Between-group comparisons of objective clinical outcomes after a thoracotomy operation

	Experimental group (n=48) Mean (SD)	Comparison group (n=46) Mean (SD)	*P*-value [a]
Total days of hospitalization	17.27 (5.05)	18.17 (5.85)	0.425
Preoperative stay	4.65 (1.56)	4.93 (1.62)	0.382
Postoperative stay	12.60 (4.71)	13.28 (5.86)	0.537
Days of chest tube in situ	10.31 (4.41)	10.67 (5.60)	0.739
	n (%)	*n* (%)	*P*-value [b]
The first day to initiate ambulation			0.003*
Day 1	3 (6.3)	1 (2.2)	
Day 2	20 (41.7)	7 (15.2)	
Day 3	23 (47.9)	24 (52.2)	
Day 4	2 (4.2)	12 (26.1)	
Day 5	0 (0.0)	2 (4.3)	
Postoperative complications			0.789
Pulmonary complications	4 (8.3)	6 (13.0)	
Surgical site infection	3 (6.3)	4 (8.7)	
Other	2 (4.2)	1 (2.2)	
Total	9 (18.8)	11 (23.9)	

[a]: An independent t-test was used.
[b]: A Chi-Square test was used.
*: A *P*-value of <0.05 was considered statistically significant.

Although a significant difference could not be determined, the experimental group achieved somewhat better objective clinical outcomes than did the comparison group in such areas as a shorter length of stay in the hospital (17.27 ± 5.05 vs 18.17 ± 5.85) and chest tube retention (10.31 ± 4.41 vs 10.67 ± 5.60), and lower rates of occurrence of postoperative complications (18.8% vs 23.9%). The experimental group also expressed more activeness in performing out-of-bed ambulation than the comparison group in the postoperative period.

5.5.3 Relationships between the worst pain score, pain interference, the barrier score, and the use of drug or non-drug methods for pain relief

The worst pain score has often been used as an indicator of treatment and is the most highly correlated to pain interference (Serlin, Mendoza, Nakamura, Edwards & Cleeland, 1995). In the postoperative period, the worst pain peaked when the patients performed deep breathing, coughing, and ambulation (Watt-Watson et al., 2004). In the first 7 days after surgery, the participants in the present study experienced moderate to severe pain for their worst pain. The relationships between the mean worst pain scores, the mean interference scores, the amount of analgesics used (morphine dosage equivalent), and the frequency of using non-drug methods for pain relief in the first 7 days after surgery, and the post-test barrier score (total scores of the BQT-S) were tested in the present study using Spearman's correlation. The correlation coefficient (r) from ± 0.10 to 0.29 was small; (r) from ± 0.30 to 0.49 was medium, and (r) ± 0.50 to 1.0 was large (Cohen & Cohen, 1983).

The relationships between the above variables are presented in Table 5.13. A large positive correlation was found between the mean worst pain score and the mean

interference score. A large negative correlation was found between the use of non-drug methods of pain relief and the total score of the BQT-S. Small to medium negative correlations were seen between the use of nondrug methods of pain relief and the mean worst pain score, the mean interference score, and the total score of the BQT-S. A small negative correlation was found between the amount of analgesics used and the total score of the BQT-S.

Table 5.13 Spearman's correlation between the worst pain score, pain interference, the barrier score, and the use of drug and non-drug methods for pain relief

Variables		**1**	**2**	**3**	**4**	**5**
1. Mean worst pain (Scale : 0-10)	rho Sig (2-tailed)	1.00	.917** .000	-.225* .029	-.305** .003	.264* .010
2. Mean interference (Scale : 0-10)	rho Sig (2-tailed)	_	1.00	-.213* .039	-.413** .000	.341** .001
3. Amount of analgesics use (Continual)	rho Sig (2-tailed)	_	_	1.00	-.001 .995	-.139 .183
4. Use of non-drug methods (Scale : 0-4)	rho Sig (2-tailed)	_	_	_	1.00	-.458** .000
5. Total score of the BQT-S (Scale : 0-5)	rho Sig (2-tailed)	_	_	_	_	1.00

*: The correlation is significant at the 0.05 level (2-tailed); ** : The correlation is significant at the 0.01 level (2-tailed).
rho: Spearman's correlation coefficient

Referring to Table 5.13, the patients' interference score was significantly positively correlated with the worst pain score in the postoperative period (Spearman's rho =.917, p =.000). There were moderately significant negative correlations either between the use of non-drug methods and the worst pain score (Spearman's rho= -.305, p =.003) or the interference score (Spearman's rho= -.413, p =.000). Significant negative correlations were also found either between analgesics use and the worst pain score (Spearman's rho= -.225, $p < .05$) or the interference score (Spearman's rho= -.213, $p < .05$). The worst pain score was significantly correlated with the total score of the BQT-S (Spearman's rho=.264, p =.010), as was the interference score and the total score of the BQT-S (Spearman's rho=.341, p =.001). A moderately negative correlation was found between the use of non-drug methods of pain relief and the total score of the BQT-S (Spearman's rho= -.458, p =.000). However, only a small negative correlation was seen between the amount of analgesics used and the total score of the BQT-S (Spearman's rho=-.139, $p > .05$). These correlations indicate that the patients' concerns about reporting pain and the use of drug or non-drug methods were related to levels of pain intensity and the interference of pain with activities.

Chapter 6 Discussion

The purpose of the study was to examine the effectiveness of a postoperative reinforcing intervention followed by patient education on the postoperative pain experience, barriers to pain management, patients' pain management behaviours, and clinical outcomes in relation to a major thoracotomy operation for Chinese adult patients. The relationships among pain intensity, the interference of pain with daily activities, barrier scores, and the use of drug or non-drug methods for pain relief were also investigated. The research hypotheses are:

(1) There will be no significant difference in pain intensity between the experimental group that received the pain management programme (preoperative pain education together with the postoperative pain round) and the comparison group that received preoperative pain education alone at baseline (on the day of the operation) and across time in the postoperative period;

(2) There will be no significant difference in the interference of pain with daily activities between the experimental group and the comparison group at baseline (on the day of the operation) and across time in the postoperative period;

(3) There will be no significant difference in the patients' pain management behaviours between the experimental group and the comparison group across time in the postoperative period;

(4) There will be no significant difference regarding patient-related barriers to pain management between the experimental group and the comparison group before and after pain education;

(5) There will be no significant difference in objective clinical outcomes between the experimental group and the comparison group after a thoracotomy operation.

The results of the study indicated that a nurse-led pain management programme that integrated patient education and a reinforcing intervention delivered by nurses led to significant improvements in pain relief, pain management behaviours, lower scores on barriers to pain treatment, and the earlier initiation of postoperative ambulation after surgery. This finding is in line with the results of many previous studies using patient education to improve pain knowledge, attitudes, and skills to achieve better pain relief for patients (Knoerl et al., 1999; Lin et al., 2007; McDonald et al., 2005; Wen & Li, 2008; Wong et al., 2010b; Ren, 2011; Zhan et al., 2009). Educating patients about pain was beneficial to improving the outcomes of postoperative pain care. This approach could be introduced to the routine care for patients to reduce their suffering from pain and to improve their recovery from surgery and other clinical outcomes in acute care settings.

In the present study, the participants in the experimental group reported significantly lower scores on pain and the interference of pain with daily activities than those in the comparison group who had received pain education alone from postoperative day 1 to day 7 after a major thoracotomy operation ($p < 0.05$). In addition, levels of pain and its interference with activities dropped more rapidly in the experimental group than in the comparison group. The participants in the experimental group also expressed more positive pain behaviours in terms of using non-drug methods for pain relief, reporting lower barrier scores, and initiating ambulation earlier than did the comparison group in the postoperative period ($p < 0.05$). Patients with lower barrier scores tended to be more likely to use drug and non-drug methods for pain relief and, consequently, experienced less intense pain and interference from pain with daily life in the postoperative period. The null research hypotheses regarding no significant

differences between the two groups in pain intensity and interference of pain with activities, use of non-drug methods for pain relief, barrier scores, and initiation of out-of-bed ambulation are rejected; while the null hypothesis regarding the other aspects of the objective clinical outcomes such as the length of hospital stay, the length of chest-tube in situ, and the occurrence of postoperative complications can not be rejected.

The significant improvements in patient outcomes in the present study can be explained by the pain management programme that is based on the framework (demonstrated in Figure 2.2) adapted from the PRECEDE model (Green et al., 1980; Yates et al., 2004; Zhang et al., 2008). Attentive pain care delivered by nurses in the form of a daily postoperative pain round was the specific feature differentiating this study from previous studies (Knoerl et al., 1999; Lin et al., 2007; McDonald et al., 2005; Wen & Li, 2008; Wong et al., 2010b; Ren, 2011). The major purpose of the pain round was to assess and manage the patients' pain by identifying the needs of individual patients in education and pain issues in the postoperative period, and taking appropriate actions to address the patients' pain. Through the nurse's on-going evaluations, clarifications, and continuing reinforcement in the daily pain round, significant improvements were seen in the patients' learning about pain, negative pain beliefs, and misconceptions about using analgesics for treating pain. This practice greatly resolved the issue of linking knowledge to positive changes in the patients' behaviour in acute pain care, and led to greater improvements in pain relief for patients. In addition, the nurse's role in the process of pain management was fully addressed, namely, it is: to act as a resource for both patients and their family to consult regarding issues related to pain treatment; to assess and manage the patients'

pain and to act as an advocate for patients in relieving their pain (Pasero & McCaffery, 2011).

In this chapter, discussions on how the pain management programme improved patient outcomes relation to the research objectives and hypotheses are presented in the following sections. The findings of the study compared with those of previous studies are also discussed.

6.1 Improvements in patient outcomes

The following sections will present discussions on the patients' experience with pain, pain management behaviours, barriers to pain management, and clinical outcomes as a result of the pain management programme; and the relationships among pain intensity, pain interference, barrier scores, and the use of drug or non-drug methods for pain relief.

6.1.1 Severity of pain

The most striking finding of the study is that patients in the experimental group reported significantly lower pain scores than those in the comparison group from postoperative days 1 to 7. This result is consistent with the findings of previous studies supporting the effectiveness of an educational approach in improving postoperative pain relief for patients (Lin & Wang, 2005; Wen & Li 2008; Wong et al., 2010a; McDonald & Molony, 2004; McDonald et al., 2005; Zhan et al., 2009; Ren et al., 2011).

Empowering patients with the knowledge and skills to manage their pain and encouraging the patients to actively participate in treating their pain are important to improving outcomes in pain care (Good & Moore, 1996; Gordon et al., 2005). There is positive evidence from both western and local studies that improving the patients' cognitive dimension of pain through such approaches as increasing their knowledge about pain and clarifying misconceptions about the use of analgesics could effectively modify the patients' negative pain beliefs and attitudes about their treatment, followed by positive behavioural changes, better pain relief, and other beneficial clinical outcomes. McDonald and colleagues examined the effects of an approach to pain education that integrated general information about pain management and specific skills for communicating pain for elderly patients undergoing a total knee or hip replacement. They found that the experimental group reported significantly lower scores on pain intensity (McDonald & Molony, 2004; McDonald et al., 2005) and less interference from pain with daily activities on postoperative day 1 (McDonald et al., 2005).

Among Chinese patients in Taiwan, Lin and Wang (2005) reported that a preoperative pain education programme for patients undergoing abdominal surgeries could effectively increase patients' knowledge and attitudes about pain, reduce anxiety levels, and significantly reduce the severity of the pain and its interference with activities for patients in the first 24 hours after surgery. In addition, members of the experimental group initiated out-of-bed ambulation 1.5 days earlier than did those of the control group (Lin & Wang, 2005). Wong et al. (2010a) reported that Hong Kong Chinese patients who had received an education intervention consisting of information about pain, coping strategies, and breathing relaxation exercises

experienced significant improvements in terms of self-efficacy and reduced levels of pain and anxiety in the 7 days after undergoing orthopaedic surgery (Wong et al., 2010a). In mainland China, several studies supported the view that pain education leads to significant improvements in patients' knowledge and attitudes (Lin et al., 2007; Ren, 2011; Wen & Li, 2008; Zhan et al., 2009), use of drug (Lin et al., 2007) or non-drug methods for managing pain (Wen & Li, 2008), pain relief in the first 48 hours after surgery, resulting in better recovery from surgery (Lin et al., 2007; Ren, 2011; Zhan et al., 2009).

In the present study, there were no significant differences between the two groups ($p > 0.05$) in the total amount of analgesics used and in the use of PCA (81.3% vs 71.7%, $p > 0.05$) for treating pain. However, the experimental group used more non-drug methods to relieve pain than did the comparison group in the postoperative period. Consequently, the experimental group reported significantly lower scores on pain severity than did the comparison group from postoperative day 1 to day 7. In both groups, the mean pain scores decreased significantly over time. The pain scores for the experimental group showed a clear reduction from the day of the operation to postoperative day 7 ($p < 0.05$), except for day 1 to day 3 (Day 2 vs Day 1 and Day 3 vs Day 2, $p > 0.05$); however, statistically significant results were not achieved for the comparison group in most of the comparisons in the first 7 days after surgery, except for Day 4 vs Day 3 ($p < 0.05$). The research hypothesis of no significant difference in pain intensity between the experimental group and the comparison group at baseline and across time in the postoperative period is rejected on the basis of the above findings. It can also be concluded that the nurse's postoperative pain round provided to each participant in the experimental group may have had a significant impact on

this result. That a nurses' reinforcing intervention integrated with patient education is both efficacious and feasible is supported by the positive evidence generated in the present study.

6.1.2 Interference of pain with daily activities

The patients in the experimental group experienced significantly less interference from pain in daily activities than did the comparison group from postoperative day 1 to day 7 ($p < 0.05$). This could be explained by the lower severity of pain experienced by members of the experimental group in the above observation period. This is consistent with the findings from previous studies (Lin & Wang, 2005; McDonald et al., 2005). Those patients who perceived less suffering from pain tended to report less interference from pain with their physical activities, emotions, relationships with others, and sleep than those patients who reported higher levels of pain.

Both groups of patients reported considerably higher scores on the interference of pain with daily activities in the first 24 hours after surgery, ranging from 6.69 to 7.02 in the experimental group and 7.28 to 7.76 in the comparison group on a 0-10 rating scale. This is much higher than findings reported in previous studies regarding the interference of pain with daily life for abdominal surgery patients of 3.2 to 4.9 vs 3.8 to 6.5 (Lin & Wang, 2005), and of 4.9 vs 6.2 for patients undergoing orthopaedic surgeries (McDonald et al., 2005). This result could be explained by the extensive surgical trauma from undergoing a major thoracotomy operation, experienced by patients in the present study.

In the present study, nearly 80% of the participants (76.6%) had been diagnosed with esophageal cancer, and underwent a major thoracotomy operation. Several factors attributed to pain suffering, interference from pain with daily life activities, and discomfort for patients in the postoperative period. These included the extensive surgical trauma arising from damage to the integrity of the chest wall, the respiratory muscles, the ribs, and the intercostal nerves during a major thoracotomy operation; chest drainage in situ and removal during the postoperative period; and the patients' performance of deep breathing and coughing postoperatively (Gerner, 2008; Soto & Fu, 2003; Yu & Li, 2001). There are several IV lines and tubing insitu for those patients, such as the PICC line (peripherally-inserted central catheter, PICC) for total parenteral nutrition (TPN) in the early postoperative phase, the IV line for patient-controlled intravenous analgesia (PCIA), an oxygen apparatus, nasogastric tubing for gastric drainage, naso-gastric-jejunum tubing for enteral feeding, a device for wound drainage, a chest tube in situ, and the urinary catheter. The patients reported extremely high scores on the interference of pain with daily activities such as repositioning and out-of bed ambulation. The performance of deep breathing and coughing also exacerbated the severity of the pain, as these activities caused the surgical site to expand (Gerner, 2008; Yu & Li, 2001).

The factors associated with surgical trauma and the rehabilitation exercises that thoracotomy patients need to engage in during the postoperative period should be addressed and it is expected that doing so will further strengthen the possibility of introducing a reinforcing intervention to reduce interference with daily activities relating to pain for those patients. A better pain management programme is necessary for patients to deal with pain and its interference with daily activities. In the

postoperative pain round for the experimental group, the major task was to assess and manage the patients' pain. The issues that individual patients had with pain were identified and addressed. Appropriate actions were planned and the specific needs of each patient in dealing with pain were addressed. Techniques to manage pain such as the use of drug and non-drug methods were provided and recommended. Strategies to minimize pain when repositioning oneself, coughing, and ambulating were applied. Lowering the intensity of pain may greatly reduce its interference with these functions, improve the patients' mood, their desire to chat with others, and their sleep. The findings from the present study indicated that levels of interference from pain were significantly and positively correlated with the worst pain scores in the postoperative period (Spearman's rho=.917, p =.000). This is consistent with a previous study regarding the association between the worst pain score and the interference of pain with daily activities (Serlin et al., 1995).

In the present study, a significant difference was found between the experimental group and the comparison group regarding the severity of pain and its interference with daily activities from postoperative day 1 to day 7 for participants who had undergone a major thoracotomy operation. Levels of interference from pain for both groups decreased across time in the first 7 days after surgery. The interference from pain was significantly reduced from postoperative days 1 to 7, with the exception Day 1 vs OP day for both groups. However, the experimental group demonstrated significantly lower levels of interference from pain than the comparison group. The research hypothesis of no significant difference in interference from with activities between the experimental group and the comparison group at baseline and across time in the postoperative period is rejected. In conclusion, a pain management programme

integrating patient education and a nurses' reinforcing intervention could greatly relieve the pain suffered by patients in the postoperative period.

6.1.3 Pain management behaviours

Approaches to managing pain in the postoperative period include the use of drug or non-drug methods for managing pain. The patients in the experimental group showed a significantly higher frequency in the use of non-drug methods than did the comparison group from postoperative day 1 to day 7 ($p < 0.05$). An obvious increase was seen in frequency of using non-drug methods ($p < 0.05$) across time in the first 4 days after surgery for both groups; and no significant differences were indicated from postoperative days 5 to 7. The two groups expressed a similar frequency in the use of PCA or in the total amount of analgesics used for pain relief in the postoperative period ($p > 0.05$). The research hypothesis of no significant difference in pain management behaviours as using non-drug methods for pain relief between the experimental group and the comparison group across time in the postoperative period was rejected by the above results; while the null hypotheses of no significant differences between the two groups regarding the use of drug methods as using PCA and the amount of analgesic use could not be rejected.

The findings of the present study were consistent with those of a previous study relating to the effectiveness of an educational approach in improving patients' use of non-drug methods for pain relief (Wen & Li, 2008; 2009). Wen and Li reported that pain education could significantly increase patients' use of non-drug methods to relieve postoperative pain in the first 48 hours after surgery, such as listening to music and reading newspapers or books (Wen & Li, 2008; 2009). The following factors

need to be considered in order to address patients' knowledge of pain and their changes in behaviour with regard to pain treatments: the patients had difficulties recalling learned information (Sjoling et al., 2003; Watt-Watson et al., 2004); and an increase in knowledge did not lead to acute changes in long-hold beliefs or clear up uncertainties regarding pain treatments, nor was it linked to pain management behaviours (Chumbley et al., 2004; Lam et al., 2001). The postoperative pain round adopted in the present study was characterized as an individualized approach to assessing and managing the participants' pain, that acted as a reinforcing factor to facilitate or encourage positive changes in behaviour on the part of patients with regard to managing their pain. Strategies to strengthen the patients' ability to learn and recall information were applied in the daily pain round. In addition, the needs of individual patients were identified and addressed through on-going evaluations and reinforcement by nurses; postoperative pain issues for individual patients were identified and appropriate actions were implemented to alleviate the patients' pain. Meanwhile, active participation by patients in pain management was encouraged in the pain round. Therefore, the nurse's postoperative pain round is almost certainly associated with positive effects in improving and facilitating actual changes in behaviour among the patients in the experimental group.

However, no significant differences were found between the two groups of patients in the present study in terms of their use of drugs to relieve pain, such as in their use of PCA or in the total amount of analgesics used. These results also agree with the findings from many previous studies. Providing patients with structured education did not change their use of PCA (Chumbley et al., 2004; Lam et al., 2001) or the amount of analgesics that they used (Lam et al., 2001; Sjoling et al., 2003; Watt-Watson et al.,

2004). No significant difference in the use of analgesics for pain relief between the experimental and the comparison groups colud be explained by a couple of reasons related to the nature of surgical procedure, the pain treatment regimen provided in routine practice in the present study setting, and the patients' attitudinal barriers to pain management. First of all, patients required the use of analgesics for manaing pain is expected after a major thoracotomy operation. The other factors related to the pharmacological pain treatment regimen such as the practice of prescribing analgesics, the attitudinal barriers of health professionals, and patient-related barriers to pain management also contributed to the use of analgesics for pain relief (Pasero & McCaffery, 2011).

The inadequate prescription of analgesics for patients to relieve pain is common in postoperative care settings in West (Orgill, Krempl & Medina, 2002; Watt-Watson, Stevens, Garfinkel, Streiner & Gallop, 2001) and in China (Yan et al., 2011). In many countries all over the world, nurses still do not have the right to prescribe analgesics to relieve the pain of patients in the current physician-led clinical culture. In mainland China nurses do not have the authority to prescribe pain medications or to determine the use of pharmacological techniques such as PCIA (patient-controlled intravenous analgesia, PCIA), PCEA (patient-controlled epidural analgesia, PCEA) or other procedures for managing patients' pain. In addition, a phobia about the use of opioid analgesics and negative beliefs and attitudes towards pain held by health professionals are barriers to pain management that continue to be cited as major contributors to the suboptimal delivery of pain relief for patients (Couling, 2005; Gordon et al., 2008; McCaffery & Ferrell, 1997; Rejeh, Ahmadi, Mohammadi, Anoosheh & Kazemnejad, 2008). Further, knowledge deficits and negative beliefs about pain among physicians

and nurses are prevalent in Chinese clinical settings (Feng, Yuan & Wu, 2005; Huang, Ma, Zhang, Zhang & Lu, 2001; Li & Liu, 2003; Zhang, Hsu, Zou & Zu, 2006). It is strongly recommended that pain education be extended to nurses, physicians, and other members of a multidisciplinary pain team in future clinical practice, in order to improve outcomes of pain management.

However, in the present study, patient-related barriers to pain management had a minimal impact on the use of analgesics for pain relief. The patients' total scores on BQT-S only had a small negative correlation to the amount of analgesics used in the postoperative period. This result has several major implications: first of all, pain education can effectively reduce patient-related barriers to pain management. It seems patients chose to use more non-drug methods for managing pain in the present study. This result is in line with literature that patients tended not to use pain medications for the fear of side effects caused by analgesics (Wen et al., 2008; 2009).

In addition, the implementation of a nurse-led pain management programme does not lead to immediate changes in institutional polices or in the clinical practices such as the prescription of analgesics by a physician. As a result, the expert role of nurses in pain management should be further developed and addressed in current care settings. Apart from educating patients and family, pain education also needs to be extended to ward staff and other members of the healthcare community to reduce attitudinal barriers to pain management (Musclow et al., 2002). Effective communication and collaboration among members of a multi-disciplinary team may also do much to resolve issues of safety and cost-effectiveness in pain care (Cox, 2010; Musclow et al., 2002).

Except for patient-related barriers to pain management, pharmacological pain treatment was influenced by several factors such as the pain practice of physicians, anaesthetists, and other members of the multi-disciplinary team involved in a patient's treatment in hospital, and legal or institutional policies or restrictions on the use of analgesics (Pasero & McCaffery, 2011). By contrast, the use of non-drug methods of pain relief such as listening to music (Engwall & Duppils, 2009; The Joanna Briggs Institute, 2011), methods of relaxation (Roykulcharoen & Good, 2004), and massage (Mitchinson et al., 2007) was convenient and easily accepted by patients for the following reasons: physicians' orders were not needed for their use; no additional risks were associated with the patients' use of these techniques; these techniques are effective at reducing the severity of the patients' pain; and these techniques are cost-effective and represent a useful complementary form of therapy to relieve postoperative pain.

As a result, all of the participants in the present study used non-drug methods for pain relief frequently in the postoperative period. Educating patients about pain and on-going evaluations, clarifications, and continuing reinforcement by nurses had a significant impact on reducing patients' attitudinal barriers and improving their skills in such areas as using non-drug methods for managing pain, leading to better pain relief for patients. In addition, the expert role of nurses in the process of managing pain needs to be addressed in clinical practice to improve outcomes of pain care.

6.1.4 Patient-related barriers to pain management

Patients' erroneous beliefs or misconceptions about pain and pain medications have been defined as patient-related barriers to effective pain management for cancer

patients (Gunnarsdottir et al., 2002; Ward et al., 1993). Patient-related barriers were significantly associated with the reporting of pain by patients and the use of analgesics for treating pain in a postoperative setting (Tzeng et al., 2006).

In the present study, the barrier scores for both groups dropped significantly after pain education ($p < 0.05$); and the post-test scores on each subscale and the total score on the BQT-S of the experimental group were significant lower than those in the comparison group ($p < 0.05$) except for the subscales of "Fear of injections" and "Fatalism" ($p > 0.05$). This result indicated that the experimental group had less barriers to pain management than the comparison group. Despite the fact that the degree of the within-group changes for the two groups was not significantly different ($p > 0.05$) except for the subscale of "Time intervals". The result also indicates that, for both groups, pain education would be effective at reducing attitudinal barriers to managing pain. The research hypothesis of no significant difference in patient-related barriers to pain management between the experimental group and the comparison group before and after pain education was rejected by the above findings.

Before pain education, the 4 highest mean scores in the BQT-S subscales on a 0-5 rating scale at the baseline assessment for the two groups were: tolerance (3.71vs 3.69), time intervals (3.39 vs 3.42), inhibition of wound healing (3.30 vs 3.55), and distraction (2.98 vs 3.08). These findings differed from the findings among Taiwanese cancer patients, who were more concerned about tolerance, time intervals for p.r.n. (pro re nata) analgesics, addiction, and the progression of the disease (Lin, 2000; Lin & Ward, 1995). The types of treatment received by cancer patients are a possible reason for the difference. Cancer patients under palliative care may experience

persistent pain and need to use analgesics for pain relief on a long-term basis, which may lead patients to have more concerns about tolerance, addiction, and the progression of the disease. On the other hand, patients undergoing surgery are supposed to use analgesics for short-term pain relief. Thus, the healing of wounds at the surgical site became the major concern for those patients.

Nevertheless, the findings of the study were consistent with such concerns among Taiwanese surgical patients as tolerance, time intervals, and inhibition of wound healing (Tzeng et al., 2006). The scores of the participants in the subscales of tolerance and inhibition of wound healing were considerably higher than those of the Taiwanese patients (3.70 vs 3.18, 3.43 vs 2.58). Furthermore, the patients in this study showed more concern than the Taiwanese patients about distracting the physicians treating disease (3.03 vs 2.52), while Taiwanese patients expressed a much greater fear of injections (2.72 vs 1.37).

These differences could be explained by the social-demographic background of the participants in this study. Their mean age was much older than the Taiwanese patients (59.32±10.43 vs 49.07±18.40), 70% of the participants were male, more than 60% (61.7%) of the patients had only a primary school education or less, and nearly 70% (68.1%) of them worked as farmers in the countryside. These are all potential factors relating to the patients' beliefs and attitudes towards pain, and directly or indirectly contributed to the outcomes of pain management. Greater age and lower levels of education are significantly associated with the hesitation to communicate pain to clinicians and to use analgesics, leading to inadequate pain relief for patients (Lin, 2000; Lin et al., 2000; McDonald & Sterling, 1998). Male patients tended to behave

with more stoicism than female patients because of gender roles in western and Chinese cultures (Hobara, 2005; Soetanto et al., 2006). Further, none of the participants had pursued a health-related profession or had even attended any type of pain education session in the past.

Empowering patients with knowledge and skills about pain is an effective approach to overcoming patient-related barriers to achieve better outcomes in pain management. The results of the study were consistent with the findings of many previous studies conducted in western and local care settings. Concerns about the treatment of pain may inevitably differ between cancer patients in palliative care and patients undergoing surgery. The positive effects of a structured pain education programme have been well documented in both cancer pain management (Chang et al., 2002; Lin et al., 2006; Yates et al., 2004) and acute pain care settings (Lin & Wang, 2005; Lin et al., 2007; Wong et al., 2010b).

In this study, the post-test barrier scores reported by the experimental group were significantly lower than those reported by the comparison group in each sub-scale and in the total scores of the BQT-S ($p < 0.05$), with the exception of the subscales of "Fear of injections" and "Fatalism" ($p > 0.05$). However, the two groups did not differ significantly in the degree of within-group changes, except for the subscale of "Time intervals". This result indicates that the pain management programme (pain education integrated with a reinforcing intervention) for the experimental group did not lead to significant reductions in patient-related barriers to pain management compared to pain education alone for the comparison group. This result is somewhat inconsistent with that of previous studies regarding the effectiveness of educational interventions on

reducing patient-related barriers to pain management. A possible explanation for this discrepancy is the use in previous studies of a true control group (did not receive pain education) compared to the experimental group (received pain education) (Chang et al., 2002; Lin & Wang, 2005; Lin et al., 2006; Lin et al., 2007; Wong et al., 2010b; Yates et al., 2004).

In addition, the five highest mean scores in the BQT-S subscales (ranged 0-5) at the post-test assessment for the two groups were: tolerance (1.93 vs 2.28), time intervals (1.77 vs 2.29), fatalism (1.75 vs 1.86), distraction (1.60 vs 1.97), and the desire to be good (1.33 vs 1.67). As for the scores in the other subscales of BQT-S, these were very low for both groups, ranging from 0.12 to 0.45 vs 0.24 to 0.79 for the experimental and comparison groups respectively. The results indicate that the patients still had negative pain beliefs, were still hesitant about reporting pain, and still had concerns about analgesics; while for both groups their worries about addiction, the inhibited healing of wounds, and fear of injections were almost cleared up after they had received pain education.

The finding also agreed with that of a previous study, which reported that pain education did not effect acute changes in long-held beliefs about pain and the use of analgesics (Chumbley et al., 2004). The cultural background of Chinese patients may also account for their pain beliefs, concerns about the use of analgesics, and their hesitation in reporting pain to health professionals. In traditional Chinese philosophies, pain is regarded as a result of stagnant Qi in limbs and meridians or as an imbalance of Yin and Yang in the body (Chen, 2001; Chung et al., 2000). Therefore, Chinese people may prefer to use traditional Chinese medicine or acupuncture, instead of

analgesics to treat the blockages in the meridians (Chung et al., 2000). In Chinese culture, the teachings of Confucius are principles for social interaction, individual morality, and ethics. These teachings have a significant influence on the behaviour of the Chinese. The golden rule of the Confucian is that a person should not do unto others what he would not want others to do unto him（己所不欲，勿施与人）(Creel, 2000). Therefore, when a person suffers from pain, he or she would rather bear the pain and not report it to a clinician until the pain becomes unbearable. In actual practice, nurses need to identify the needs of individual patients in education and pain issues, to understand the underlying reasons behind the patients' behaviour in dealing with pain, and then plan appropriate actions to alleviate the patient's pain. In addition, on-going evaluations, reinforcement, and clarifications by nurses may greatly reduce patient-related barriers to pain management (Lin et al., 2006).

6.1.5 Objective clinical outcomes

Objective clinical outcomes included two components: issues of cost, such as the length of a patient's hospitalization; and the patient's postoperative recovery from thoracic surgery, measured in such terms as the length of chest tube retention, the timing of initiating ambulation, and the occurrence of postoperative complications. Although no significant differences were found between the experimental and comparison groups in most of the objective clinical outcomes, the experimental group initiated out-of-bed ambulation much earlier than did the comparison group ($p < 0.05$). The research hypothesis of no significant difference in objective clinical outcomes between the experimental group and the comparison group after a thoracotomy operation could not be rejected.

The patients of the experimental group were more active at performing such physical activities as initiating out-of-bed ambulation than were those in the comparison group ($p = 0.003$). Nearly all of the patients (95.9%) in the experimental group were able to get out of bed to ambulate in the ward in the first 72 hours after surgery, which is a much higher figure than in the comparison group (95.9% vs 69.6%). This result is consistent with that of previous studies regarding the effects of pain education on such aspects of postoperative recovery as initiating ambulation earlier (Lin & Wang, 2005; Ren, 2011; Zhan et al., 2009). What may have contributed to the differences between the experimental and comparison groups was the nurse's attentive pain care, which took the form of timely assessments and management of pain, information consultations, on-going reinforcement, and providing assistance and encouragement for the patients to actively participate in pain treatment and perform daily activities, all of which the nurse provided in the daily pain round.

In the present study, no significant effect for education was found in the postoperative recovery from a thoracotomy operation in such aspects as the length of the chest tube in situ and the incidence of postoperative complications in the two groups ($p > 0.05$). In addition, there was no significant difference between the two groups either in the length of the patients' postoperative stay or in the total stay in hospital ($p > 0.05$). The results did not support the view that an educational approach is effective at achieving a significant shortening in the length of chest-tube retention for thoracic surgery patients (Ren, 2011; Zhan et al., 2009), and significantly shorter hospital stays for patients undergoing gynaecological surgeries (Lin et al., 2007). A possible explanation for this result is the different disease characteristics and the extensive surgical procedure for patients in the present study. In our study, most of the

patients (n=72, 76.5%) had been diagnosed with oesophageal cancer and had undergone a major thoracotomy operation involving surgical removal of the primary carcinoma and clearance of the surrounding tissue, as well as dissection of the cervical, thoracic, and abdominal lymph nodes to limit metastasis and improve their prognosis.

Although the experimental group reported significantly lower pain scores than the comparison group, both groups of patients still reported their pain as moderate in the first 4 days after surgery. This indicated that the patients' pain had not been adequately treated in this study setting. Unrelieved postoperative pain greatly limits such activities by patients as performing deep breathing/coughing, resulting in a failure to achieve deep inspiration and ineffective coughing. This in turn increases the retention of secretions, leading to airway closure, atelactasis, and other respiratory complications (Decosmo et al., 2009; Gerner, 2008; Savage et al., 2002). Except for educating patients and nurses in attentive pain care, thoractomy patients need to be provided with an appropriate pain treatment regimen in the postoperative period, to enable them to deal with their distressing pain.

In addition, the length of the patients' hospital stay was determined by the speed with which they recovered from surgery. Some factors contributed to this outcome: factors related to health care professionals, such as the skill of the surgeon and the treatment and care received from the medical and nursing team; factors related to patients, such as their general health condition, co-morbidities with other diseases; and the social-economic status of the patients, which could reflect the amount of support they may have available to rely on in their hospitalization. Although the randomization

procedure applied in the present study could eliminate most of the bias from the above factors, some important factors or a situation such as the patients' socioeconomic status could obviously not be changed by a nursing intervention. Most of the participants had undergone an oesophagectomy and needed intensive care and treatment, such as nutritional support and potent antibiotics, in the postoperative period. Nearly 70% of the patients (n=62, 65.9%) were in extremely difficult economic straits (with a monthly family income was less than RMB1000); and this may have had a significant impact on their treatment options and in the speed of their recovery from the operation. However, the pain management programme adopted in the present study had very little effect on resolving budget issues related to the comprehensive postoperative treatment needed for the patients' recovery; or on generating significant clinical outcomes such as shortening the length of hospitalization for patients.

6.1.6 Relationships between the worst pain score, pain interference, the barrier score, the use of analgesics, and non-drug methods for pain relief

Relationships between the patients' mean scores for the worst pain, pain interference, the use of drug or non-drug methods for pain relief in the first 7 days after surgery, and the post-test total barrier score on the BQT-S were tested. Significant correlations were found among these variables.

The mean worst pain score and the pain interference score were significantly positively correlated to the total barrier score; and significantly negatively correlated to the amount of analgesics used and the frequency of use of non-drug methods. A significantly negative correlation was also found between the use of non-drug

methods and total barrier scores; however, only a small negative correlation was found between analgesic use and the total barrier score. These correlations indicate that patients' concerns about reporting pain and use of drug or non-drug methods were related to levels of pain intensity and the interference of pain with activities. The result is consistent with that of a previous study conducted among Taiwan Chinese surgical patients (Tzeng et al., 2006). It can be seen that patients with higher scores on the BQT-S tended to be less likely to use analgesics or non-drug methods for pain relief and to have experienced higher levels of pain and greater interference from pain with daily activities in the postoperative period.

There were no significant correlation found in the present study between analgesic dosage and barrier score, which is inconsistent with the finding for Taiwanese patients regarding concerns about reporting pain and using analgesics (Tzeng et al., 2006). This could be explained by differences in how analgesics are prescribed between these two different clinical settings. In Taiwan, most postoperative analgesics are customarily provided to patients on as-needed basis (Tzeng et al., 2006). Yet, in the present study setting, patients were not routinely provided with 'p.r.n' (pro re nata) analgesics or pain medications in regular time intervals after discontinuing the use of PCA for the first 48 hours after surgery. As a result, in Taiwan the concern of patients (their willingness to report pain and request pain medication) may have a great impact on the use of analgesics for pain relief.

In the present finding, the specific point to be noted is that patients who reported higher barrier scores tended to be less likely to use non-drug methods for pain relief. This possibly contributed to the difference in the present study between the

experimental group and the comparison group regarding the intensity of pain and the interference of pain with activities. The experimental group reported a significantly lower barrier score than the comparison group and had a significantly higher frequency of using non-drug methods than did the comparison group. Consequently, the participants of the experimental group experienced significantly lower levels of pain and interference from postoperatively, since the dosage of the analgesics was not significantly different between the two groups. This finding also shed light on the impact of the education approach on overcoming patient-related barriers to pain management and improving pain relief (Chang et al., 2002; Lin et al., 2006).

6.2 The pain management programme

Unrelieved postoperative pain continues a major clinical issue in current care settings (Apfelbaum et al., 2003; Shen et al., 2008; Yan et al., 2011). The hesitation of patients to report pain and their misconceptions about the use of analgesics are important barriers to effective pain management (Ward et al., 1993; Gunnarsdottir et al., 2002). There is much positive evidence for educational interventions in postoperative pain management in the literature in the West and China. However, translating knowledge into actual behaviour on the part of patients through the use of different aspects of pain education conveyed through various teaching strategies remains a major issue (Chumbley et al., 2004; Lam et al., 2001; Sjoling et al., 2003). Educating patients alone does not seem sufficient to resolve the above issue or to achieve beneficial outcomes in pain care.

There is much space for nurses to use constructive strategies to further improve patients' learning and facilitate positive changes in behaviour by patients with regard

to pain management. In addition, the contributions of nurses in the process of pain care were not fully addressed in various care settings (Pasero & McCaffery, 2011); and the impact of attentive pain care delivered by nurses as a reinforcing factor integrated with patient education on postoperative pain management has not yet to be examined. According to the literature, the following factors need to be addressed in order to generate significant patient outcomes by using educational approaches in pain care: the amount of information that the patients really need (Lam et al., 2001; Reynolds, 2009); the extent of the patients' learning (Sjoling et al., 2003; Watt-Watson et al., 2004); and the pain issues of individual patients in the postoperative period (Reynolds, 2009). It is evident that a comprehensive, well-designed nurse-led pain management programme involving the active participation of patients and attentive pain care by nurses has the potential to generate positive patient and clinical outcomes.

The present study introduced a pain management programme targeting each domain of the three factors related to health behaviour identified by Green et al. (1980): to provide pain education for patients in order to modify the patients' negative beliefs or misconceptions about pain and its treatment (the predisposing factor), to increase the patients' knowledge and skills to enable them to participate in pain management (the enabling factor); and to provide a nurse's postoperative pain round as a reinforcing factor to further strengthen positive changes in behaviour on the part of patients with regard to pain management. The specific feature of the intervention was the attentive pain care delivered by nurses as a reinforcing factor integrated with patient education.

First, none of the previous studies used pain round integrated with patient education for postoperative pain management; and its effects on postoperative pain management

has not been tested in previous studies. Second, several issues regarding pain education from literature need to be addressed. The extent of patients' learning were closely associated with the outcomes of pain management; and successful pain education was achieved by detailed oral instructions together with written material (McDonald & Monoly, 2004; McDonald et al., 2005; Shi & Li, 2005;Wen & Li, 2008; Zhan et al., 2009). On the contrast, patients' difficulties in understanding the learning or recalling information in the postoperative period led to no significant improvements in pain-related outcomes (Chumbley et al., 2004; Sjoling et al., 2003). In addition, all the contents of previous pain education were designed from the perspectives of health professionals. Patients' individual needs in education could not be addressed (Lam et al., 2001; Sjoling et al., 2003), as well as their individual pain issues in the postoperative period (Reynolds, 2009). This could possibly explain why educating patients did not acutely change their behaviors in pain management and no significant improvement of pain outcomes.

In previous studies, nurse's role in pain management was not emphasized in postoperative pain care settings. In the process of pain management, nurse' attentive pain care should also be addressed to improve the outcomes of postoperative pain care. In the present study, the major purpose of the daily postoperative pain round was to assess and manage patients' pain: applying on-going assessment, evaluations, and reinforcement to meet individual patients' needs in education; identifying individual pain issues for each patient; and taking appropriate actions for patients' pain. In addition, the pain round was based on patient education and acting as a reinforcing factor to facilitate patients' positive behavior changes in managing pain and improve the outcomes of pain management.

The pain management programme in the present study integrated two key parts: preoperative pain education for patients and the postoperative pain round as a reinforcing factor followed by education. Pain education was provided by trained ward nurses and the pain round was conducted by the researcher. There were several strategies to ensure that the patients learned about pain: oral instructions combined with written information and information consultations in the preoperative visits (Chumbley et al., 2004; Shi & Li, 2005; Sjoling et al., 2003). The participants in the present study received a comprehensive preoperative pain education session consisting of a 40 to 60-minute teaching session, an information booklet, and two preoperative visits, provided to ensure that the patients fully understood what they had been taught. Such strategies as face-to-face instructions, demonstrations, discussions, and group teaching, together with two preoperative visits, were adopted in the pain education offered to patients. In addition, the consistency and quality of the teaching sessions provided by the trained ward nurses was assured by comprehensive staff training, an evaluation of construct validity, and monitoring of the teaching process for the study (Whitmer, Sweeney, Slivjak, Sumner & Barcevick, 2005).

In the experimental group, preoperative pain education and a daily postoperative pain round (the reinforcing factor) were provided to each participant from postoperative day 1 until the patient was discharged. Attentive pain care in the form of a postoperative pain round was conducted by the researcher and implementation protocols were established as presented in Chapter 3. The major task in a postoperative pain round is to assess and manage the patients' pain. In the postoperative pain round for the present study, the need of individual patients for education and their pain issues were identified and addressed through on-going

evaluations, clarifications, and continuing reinforcement; and appropriate actions were planned to alleviate the patients' pain. In addition, the pain nurse needed to encourage the patients to participate in making decisions on their pain treatment, such as their preferred routes, techniques, and timing for receiving treatment. Further communications with physicians and other health professionals were needed to provide patients with the appropriate pain treatment regimen when their pain remained unrelieved. The pivotal role of nurses in the process of pain management was addressed in the present study: to act as an educator, a care provider, and an advocate for patients in alleviating their pain (Pasero & McCaffery, 2011).

6.3 Summary

The findings from the study indicate that the pain management programme consisting of preoperative pain education and a postoperative pain round was effective at reducing patient-related barriers to managing pain and facilitating positive changes in behaviour and active participation in the management of postoperative pain. The experimental group, who received preoperative pain education and a reinforcing intervention throughout the entire period of postoperative hospitalization, demonstrated better pain relief, less interference from pain with daily activities, earlier initiating postoperative ambulation, less concern about reporting pain and using analgesics for pain treatment , and higher frequency in using non-drug methods for pain relief than did the comparison group, who received preoperative pain education alone.

The pain management programme targeting on the predisposing factor (patient-related barriers to pain management), the enabling factor (empowering patients by

transmitting knowledge and skills during the preoperative pain education session) and the reinforcing factor (the nurse's postoperative pain round) provides an evidence-based approach to improving the knowledge and attitudes of patients towards pain and its treatment, facilitating their positive behaviour changes in pain treatment, and to achieve better pain relief for Chinese patients after a major surgery. In addition, the contributions of nurses to pain management need to be emphasized; and their expert role in pain management is needed to provide quality pain care in clinical practice.

Chapter 7 Conclusions

This chapter presents the conclusions of the present study and its implications for clinical practice and research. The limitations of this study are also discussed and recommendations are suggested for future studies related to this topic.

7.1 Conclusions

The objective of this study was to investigate whether the pain management programme (the experimental group) resulted in less pain suffering (pain severity and interference with daily activities), more positive pain management behaviours, better clinical outcomes (length of hospital stay and postoperative recovery from surgery), and lower barriers to reporting pain and using analgesics for pain treatment than preoperative pain education alone (the comparison group). The relationships between postoperative pain intensity and the interference from pain with daily activities, barriers to pain management, and the use of drug or non-drug methods for pain relief were also examined in the present study.

The results indicated that the experimental group, which received the pain management programme (preoperative pain education integrated with a postoperative pain round), experienced significant lower levels of pain severity and interference from pain with daily activities, used more non-drug methods for relieving pain, achieved better clinical outcomes as earlier initiating ambulation after surgery, and reported significant lower barrier scores than did the comparison group, which received preoperative pain education alone. In addition, the scores on the patients' pain intensity and interference from pain with daily activities were significantly positively correlated to their barrier scores; but were significantly negatively

correlated to their scores on the use of drug or non-drug methods for pain relief in the postoperative period.

In conclusion, the findings from the present study provide positive evidence of the effectiveness of a nurse-led educational intervention in reducing patient-related barriers to the treatment of postoperative pain, improving pain management behaviours, relieving patients from their suffering from pain, and initiating out-of-bed ambulation earlier after surgery. The pain management programme adopted in the present study, which integrated preoperative pain education and a postoperative pain round, is a new model of care for improving the outcomes of postoperative care. It also sheds light on how to develop advanced nursing practices to address the issues of safety and cost-effectiveness in pain care in mainland China.

7.2 Implications of this study

The specific implications of this study for nursing practice in postoperative care relate to patient empowerment and the development of the role of advanced nursing practice to achieve positive clinical outcomes.

7.2.1 Clinical implications

Inadequately treated postoperative pain continues to be a major clinical issue (Apfelbaum et al., 2003; Chung & Lui, 2003; Shen et al., 2008). The benefits of a nurse-led pain management programme are substantial. Patients' negative beliefs about pain and misconceptions about using analgesics to treat pain were identified as patient-related barriers to effective pain management. Pain education provided to patients could effectively reduce these barriers, and a reinforcing intervention such as

a postoperative pain round could further help to clear up the misconceptions and uncertainties of patients, and facilitate positive changes in their behaviour with regard to pain management. This may lead to great improvements in postoperative pain care, such as relieving patients from pain, accelerating their recovery, and decreasing the incidence of postoperative complications in the acute and long-term phase. In addition, nurses in the pain management programme acted as educators, care providers, and advocates for patients in managing their pain, and facilitated the development of advanced nursing practices in pain care.

In mainland China, pain education is still not a routine part of care for patients undergoing surgeries (Shen et al., 2008; Yan et al., 2011). Preoperative pain education with an education booklet could be added to routine practice to improve the outcomes of postoperative care. It is feasible to implement this intervention since patients are usually admitted a few days before surgery. It is preferable for the educators to be ward nurses who have been trained in pain management, to ensure the quality of the education intervention and to provide patients with easy access to information. Education focusing on specific issues about pain and offering problem-solving information may increase the interest of patients to learn. In addition, providing patients with written information (such as a booklet) can help them to recall in the postoperative period the information that they have learned.

In the present study, a postoperative pain round performed daily was found to be an appropriate and effective measure to facilitate positive changes in the patients' behaviour in managing pain. In actual clinical settings, pain nurses act as educators for both the patient and his/her family. With the exception of administering analgesics

under a physician's order, pain nurses need to titrate dosage according to the patients' pain. They also need to collaborate with a multi-disciplinary pain team to address issues relating to the safety and effectiveness of analgesia for patients (Cox, 2010; Musclow et al., 2002). Further, pain nurses also need to apply innovative strategies in managing postoperative pain (Chumbley, 2010).

Another important role of a pain nurse in clinical practice is to lead the development of inter-professional education in pain management (Musclow et al., 2002; Taylor, 2010). Pain education extended to ward staff and other members of a health care team is beneficial in that it increases knowledge, reduces attitudinal barriers to treating pain, and facilitates effective communication and collaboration, which may greatly resolve the issue of patients' suffering from the inadequate treatment of their postoperative pain. Standard practice guidelines for pain management should be drawn up for clinical settings to improve the quality of pain care (Gordon et al., 2005; Pasero & McCaffery, 2011). The development of the nursing profession, with the emergence of nurse practitioners, nurse specialists, and APNs (Advanced Practicing Nurses) in the last few decades, may greatly change nursing practices and lead to positive clinical outcomes in pain management (Richards & Hubbert, 2007; Willens, DePascale & Penny, 2010).

Despite the extensive and rapid development of advanced nursing practices worldwide, national regulations for the practice of APNs, or institutions to train or accredit APNs are still lacking in mainland China (Sheer & Wong, 2008). An Advanced Practicing Nurse (APN) is "a registered nurse who has acquired expert knowledge base, complex decision-making skills and clinical competencies for expanded practice, the characteristics of which are shaped by the context and /or

country in which she/he is credentialed to practice" (The International Council of Nurses, 2004). APNs originated in the USA in the 1940s, and came to assume the following five roles: nurse specialist (NP), clinical practitioner (CP), nurse anesthetist (NA), nurse midwife (NM), and nurse case manager (Kilpatrick, 2008). The development of APNs is attributed to the reform of healthcare systems, the transformation of the health care model, and the advancement of nursing education (Wong, 2004).

There are five major areas in the practice of APNs: primary patient care, project collaboration, staff development, research, administration, and external communications (Cattini & Knowles, 1999; Wong, 1997; 2002). The practice of APNs in health care areas differs worldwide. Common aspects in the core competency for developing the expert role are the possession of a master's degree in the nursing profession, a strong knowledge base in a specific area, and related clinical practice experience. In addition, special training and accreditation for practicing are required in most countries (Bamford & Gibson, 2000; Cattini & Knowles, 1999; Wong, 2001; Kilpatrick, 2008). Role development usually goes through the process of skill acquisition, role acquisition, professional education, and professional development (Bamford & Gibson, 2000; Wong, 2001).

In the present study, the researcher acted as an advocate to the advanced nursing practice via designing and implementing this research, to change patient outcomes and to develop the role of APNs in acute pain care. Positive outcomes of the role of APNs were achieved in the aspects of patient, interdisciplinary team and nursing outcomes. Patient outcomes included continuity and holistic care, advocacy, education, increased adherence to recommended treatment, and better pain relief in

the postoperative period. The role facilitated interdisciplinary collaboration and coordination and increased opportunities for quality improvement. The researcher acted as a resource, providing staff nurses the opportunity for consultations for difficult pain management issues; and acted as an educator to provide nurses with ongoing education. The researcher also acted as a role model and advocated for greater accountability within nursing for pain management. Key responsibilities of the role of APNs in pain care identified in the present study are staff and patient education and daily pain round. Collaborations with other health professionals such as anesthetists, physicians and pharmacists continue to be pivotal to quality pain practice.

Findings of the present study provide positive evidence of the effectiveness of nurse-led educational interventions to improve patient outcomes in postoperative pain management. Patients' active participation and nurses' role in pain management were fully addressed and demonstrated beneficial effects on the outcomes of pain care. Educating patients' about pain and integrating nurse's attentive pain care in the postoperative period are the two key components of the pain management programme. Both the researcher and the selected ward nurses were involved in the implementation of the intervention: the researcher acted as a pain nurse to train nurse educators, to be consultation resources for patients and their family, and to assess and manage pain for individual patient after surgery; while, trained ward nurses conducted preoperative pain education for patients. This is a new model of care combined the expert role of pain nurse and ward nurses to deliver pain care and successfully improved outcomes of pain management. In clinical practice, a comprehensive training about pain management may enable experienced nursing staff to be competent in providing pain education and performing attentive pain care for patients. The pain management

programme adopted in the present study could be extended to acute care settings elsewhere in mainland China.

7.2.2 Implications for research area

None of the previous study examined effectiveness of nurse-led pain management programme integrated preoperative pain education and nurses' pain round in postoperative pain care settings. As indicated in previous investigations, most researchers agreed that empowering patients with pain knowledge and skills could improve outcomes of pain care. However, conflicting results were still found in different patient populations and different clinical settings. Educating patients alone does not seem to be enough to bring about improvements to patients' pain management behaviours or to the situation of suboptimal postoperative pain management in actual practice.

The present study concluded that a pain management programme integrating pain education and a reinforcing intervention had positive effects. It succeeded in bringing about a better pain experience and better clinical outcomes, by reducing barriers to the management of pain, and improving patients' pain behaviours in pain management. Attentive pain care in the form of a nurse's postoperative pain round was the specific feature of the present study. The protocol for implementing this new mode of care needs to be further tested in different clinical settings. The dosage of this nursing intervention also needs to be studied to address the issue of cost-effectiveness in health care systems.

The pain management programme adopted in the present study was based on the PRECEDE model developed by Green et al. (1980), which has been used extensively to improve health behaviour in various care settings (Chiang et al., 2003; Newall et al., 2008; Yates et al., 2004; Zhang et al., 2008). The programme targeted the three factors related to health behaviour as identified by Green et al. (1980): the predisposing factor, namely the patients' erroneous beliefs about pain and its treatment (patient-related barriers to pain management); the enabling factor, being the knowledge and skills to manage pain; and the reinforcing factor, referring to the nurse's assessment and management of pain in the postoperative period. Preoperative pain education provided to patients, followed by a postoperative reinforcing intervention, significantly reduced patient-related barriers to managing pain, improved pain management behaviours, and consequently led to better pain relief and less interference from pain with daily activities for thoracotomy patients.

Several benefits were achieved from the implementation of the pain management programme of the present study. First, the role of nurses in pain management was emphasized in the present study, which offers suggestions on how they could pioneer the development of advanced nursing practices in pain care in mainland China. The researcher acted as a pain nurse in providing education to both staff and patients, assessing and managing the patients' pain, and advocating for patients to relieve their pain. Second, the involvement of ward staff was another specific feature of the present study. This practice greatly helped to build trust and collaborative relationships between the participants and the researcher, which are key to minimizing drop-out rates and facilitating the successful implementation of the study intervention. It was also helpful for the acceptance and generalization of the evidence generated in

the study for actual practice. As a result, this may greatly facilitate the development of evidence-based practices (EBP) for the nursing profession to achieve optimal outcomes in pain care.

However, the limitations of the researcher as a pain nurse in the present study are also evident. First, the expert role of nurses in pain care has not been established in the current study setting or elsewhere in mainland China. In a physician-led clinical culture, the efforts of nursing staff to effectively communicate and collaborate with other health professionals (the role of collaborator) may be limited (Rejeh et al., 2008). In addition, in the present study pain education was not extended to other health professionals such as physicians and nursing staff (the role of educator), with the exception of the two invited nurse educators. The development of the nursing profession, as seen in the emergence of Advanced Practising Nurses (APNs) or nurse specialists in pain care, may do much to resolve the above issues and improve outcomes in pain care (Musclow et al., 2002). Supportive organizational factors, such as institutional policies and standard practice guidelines for pain care, may also reduce barriers to pain management related to health care systems and professionals, and facilitate improvements in the quality of pain care (Gordon et al., 2005; McCaffery & Pasero, 1999).

To date, however, standard clinical practice guidelines for managing acute pain are still unavailable in mainland China and very few pain education programmes have been provided to health professionals. Research efforts in China to evaluate the effectiveness of educational programmes in overcoming barriers to improving outcomes of postoperative pain management involving health professionals and

patients have also been very limited. Education about pain directed at both patients and health professionals, and the development of advanced nursing practices, may greatly improve the quality of postoperative pain care in mainland China.

7.3 Limitations and recommendations

There are several limitations in the present study. The major limitation was the selection bias, since only one tertiary hospital in mainland China was involved. The participants and health care or treatment provided for patients may vary in other hospitals elsewhere in mainland China, because they may have different demographic and disease characteristics. In Chinese culture and clinical settings, family care-givers always play a very important role in patient care during hospitalization; their knowledge, attitudes, and beliefs toward pain inevitably influence the outcomes of pain management (Edrington et al., 2007; Lin et al., 2000; Shen et al., 2008). The data on the family members of patients may also provide valuable information for health professionals to improve outcomes of pain management.

In the present study, the postoperative pain round was conducted by the researcher, who was not a member of the ward staff. As a result, it was not possible for the researcher to immediately reveal the pain situation to the multi-disciplinary pain team and communicate with physicians. This may have caused delays in responding to the patients' pain. In future practice, the daily pain round could be performed by ward nurses prepared with pain training, and documentation needs to be kept for maintaining the continuity of care and as a reference for physicians to make appropriate changes in the pain treatment regimen. In addition, pain education needs to be extended to all nurses and physicians to reduce barriers to pain management

related to health professionals. Standard practice guidelines on pain care also need to be developed to facilitate collaboration among the multi-disciplinary pain team. To address the issues of safety and cost-effectiveness in acute pain care, the role of the nurse in an advanced nursing practice in pain care should not remain one of waiting for a physician or simply implementing the physician's orders, but that of acting as an advocate for patients in dealing with their pain.

The study was only conducted in one hospital in mainland China and recruited patients undergoing a thoracotomy operation, which may limit the generalizability of the results of study. The effectiveness of the nurse-led pain management programme could be vary if conducted in a patient population with a different ethno-cultural background, or in a study setting in which standard practice guidelines for pain management already exist, or where only minimal attentions to this practice could be obtained from the hospital and its healthcare professionals.

In future study, multi-centre investigations involving patients with different disease characteristics and social-demographic backgrounds are strongly recommended in order to minimize the selection bias. In Chinese culture, family members play an important role in making decisions about treatment options for patients. Their beliefs and attitudes about pain and its treatment need to be explored and their active participation should be encouraged in a future investigation. Meanwhile, health professionals are also involved, and their knowledge and attitudes toward pain and its treatment also need to be explored for optimal pain management.

In addition, the participants in the present study reported pain as being moderate immediately after surgery on the day of the operation and from postoperative days 1 to 4, indicating that they were still underexposed to pain treatment after their thoracotomy operation. Barriers to pain management related to three areas identified by AHCPR: the healthcare system, healthcare professionals, and patients (Jacox et al., 1994). Except for patient-related barriers to pain treatment, the other important factors need to be considered as playing a role in the inadequate treatment of postoperative pain for the participants in the present study. This suggests that an educational approach alone for patients is inadequate to improve the present status of unrelieved postoperative pain. An appropriate pain treatment regimen together with attentive pain care should be provided immediately after a patient has been operated upon, to achieve better pain relief for Chinese patients.

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Appendix-1

安徽省立医院
ANHUI PROVINCIAL HOSPITAL
地址：合肥市长江路17号 电话：0551-2283114
传真：0551-2283121 http://www.ahslyy.com.cn

尹海辉 硕士生

香港理工大学护理学院

红勘 九龙 香港

回复：申请在贵院进行课题研究

“疼痛管理对开胸术后患者依从性及疼痛体验的效果”

尹海辉同学：

你于 2010 年 1 月 5 日写的申请信及与课题研究有关的材料已收悉，并经过审查决定批准你在我们医院做课题研究。你可以根据研究对象的入选条件在我院胸外科招募病人作为你的研究样本。请注意获得研究对象的知情同意，所获取的资料只能用于学术研究的目的，并严格遵守资料保密制度。同时，请注意在收集资料期间，尽量减少对病房工作的影响。如果需要任何帮助，请致电护理部宋瑰琦主任取得联系。

谨祝：课题研究进展顺利！

安徽省立医院护理部主任

宋瑰琦 教授

2010 年 1 月 22 日

Appendix-2

安徽省立医院
ANHUI PROVINCIAL HOSPITAL

January 22, 2010

Ms Haihui Yin, MPhil Student
School of Nursing,
The Hong Kong Polytechnic University,
Hung Hum, Kowloon, Hong Kong

Dear Ms Yin,

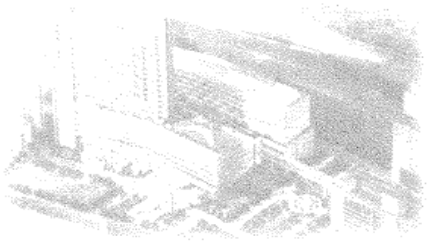
Re: Application of conducting research study on "Effectiveness of a pain management program on compliance and postoperative pain experience among thoracotomy patients".

Thanks for your application letter dated on January 5, 2010. I am pleased to inform you that approval is granted for you to conduct the captioned research study in our hospital. You can recruit patients as your study sample according to the inclusion and exclusion criteria. Please note that informed consent must be obtained from the subjects, and all data collected should be kept strictly confidential, and to be used for academic purpose only, and to ensure the minimal interference to the ward activities during your data collection. Please feel free to contact the undersigned Director, if you need further assistance.

Yours sincerely,

Prof. Guiqi Song

Director of the Department of Nursing Administration, Anhui Provincial Hospital



THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

護理學院
School of Nursing

香港 九龍 紅磡
Hung Hom Kowloon Hong Kong

INFORMATION SHEET

(Effectiveness of a pain management programme on postoperative pain experience and patient-related barriers for Chinese adults undergoing major thoracotomy)

You are invited to participate in a study supervised by Dr Mimi Tse, co-supervised by Prof Frances Wong and conducted by Ms. Haihui Yin, who is a MPhil student of the School of Nursing in The Hong Kong Polytechnic University.

The aim of the study is to evaluate the effectiveness of a pain management program on improvement of postoperative pain experience, reduce incidence rate of postoperative pulmonary complication and the length of hospital staying for patients after thoracotomy. It is hoped that this information would help to seek the effective strategy to improve postoperative pain experience, reduce the incidence rate of complications and overall outcomes for surgical patients and provide research-based evidence for future clinical practice.

You will be invited to participate in the study during the period of your stay in the hospital for the thoracic surgery. You will be assigned to receive preoperative pain education, or preoperative pain education together with postoperative intervention. You will be invited to complete questionnaires to assess barriers and behaviours in pain management and your pain experience. It takes about 15 minutes for you to complete each set of the questionnaires.

The study should not result in any discrepancies in normal care and have no risks on each participant. You have every right to withdraw from the study before or during the measurement without penalty of any kind. All information related to you will remain confidential, and will be identifiable by codes known only to the researcher.

If you have any complaints about the conduct of this research study, please do not hesitate to contact Ms. Kath Lui, Secretary of the Human Subjects Ethics Sub-Committee of The Hong Kong Polytechnic University in person or in writing (c/o Research Office in Room M502 of the University).

If you would like more information about this study, please contact Ms Yin Haihui at telephone number 3400 8194 or her supervisor Dr Mimi Tse at telephone number 2766 6541.

Thank you for your interest in participating in this study.

Principal Investigator： Dr Mimi Tse

THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

護理學院
School of Nursing

香港 九龍 紅磡
Hung Hom Kowloon Hong Kong

有 关 资 料

(疼痛管理干预对开胸术后患者疼痛体验及疼痛管理相关障碍的效果)

诚邀阁下参加由谢敏仪博士和黄金月教授共同负责监督, 尹海辉同志负责执行的研究计划 , 她是香港理工大学护理学院的研究生 。

这项研究的目的是评估疼痛管理对开胸术后患者疼痛体验,肺部并发症的发生率,及住院时间的效果。希望这些资料能有助于找到有效改善外科患者术后疼痛体验,降低术后并发症的发生率,提高手术整体效果的策略及为未来的临床实践提供科研依据。

在您接受胸外科手术的住院期间,您将被邀请参加此项研究。您将接受术前疼痛教育,或术前疼痛教育结合术后疼痛干预 。您将被邀请填写评估疼痛管理障碍,疼痛管理行为,及您的疼痛体验的问卷。您每次将花费大约 15 分钟的时间完成这些问卷。

该研究不会令阁下的正常医疗及护理有任何偏差或增加其他的风险。阁下享有充分的权利在研究开始之前或之后决定退出这项研究,而不会受到任何对阁下不正常的待遇或被追究責任 。有关阁下的资料将会保密,一切资料的编码只有研究人员得悉。

如果阁下对这项研究有任何的不满,可随時与香港理工大学人类实验对象操守小组委员会秘书吕小姐联络(地址 :香港理工大学研究事务处 M502 室转交) 。

如果阁下想获得更多有关这项研究的资料,请与尹海辉联络,电话 3400 8194 或联络她的导师谢敏仪博士,电话 27666541。

谢谢阁下有兴趣参与这项研究。

主要研究员(PI): 谢敏仪 博士

THE HONG KONG
POLYTECHNIC UNIVERSITY

香港理工大學
護理學院
School of Nursing

香港 九龍 紅磡
Hung Hom Kowloon Hong Kong

CONSENT TO PARTICIPATE IN RESEARCH

(Effectiveness of a pain management programme on postoperative pain experience and patient-related barriers for Chinese adults undergoing major thoracotomy)

I hereby consent to participate in the captioned research supervised by Dr Mimi Tse, co-supervised by Prof. Frances Wong and conducted by Ms Haihui Yin.

I understand that information obtained from this research may be used in future research and published. However, my right to privacy will be retained, i.e., my personal details will not be revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefits and risks involved. My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without penalty of any kind.

Name of participant:

Signature of participant:

Name of the researcher: Haihui Yin

Signature of the researcher:

Date:

THE HONG KONG
POLYTECHNIC UNIVERSITY

香港理工大學

護理學院
School of Nursing

香港 九龍 紅磡
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参 与 研 究 同 意 书

(疼痛管理干预对开胸术后患者疼痛体验及疼痛管理相关障碍的效果)

本人同意参加由谢敏仪博士和黄金月教授共同负责监督，尹海辉同志执行的研究项目 。

我理解此研究所获得的资料可用于未来的研究和学术交流 。然而我有权保护自己的隐私 , 我的个人资料将不能泄漏 。

我对所附资料的有关步骤已经得到充分的解释 。我理解可能会出现的风险 。我是自愿参与这项研究 。

我理解我有权在研究过程中提出问题, 并在任何时候决定退出研究而不会受到任何不正常的待遇或被追究责任 。

参加者姓名:

参加者签名:

研究人员姓名：尹海辉

研究人员签名:

日 期:

Appendix-7

术后疼痛自主管理手册

（胸外科）

二零零九年十二月

前　言

开胸手术在治疗疾病同时，不可避免地给您带来胸部肌肉、神经和肺的损伤，在术后深呼吸和咳嗽排痰的时候，会加重您伤口疼痛。但为了减少手术后的并发症，促进早日康复，一些康复锻炼，如：咳嗽运动是不能减少的。术后怎样减轻或化解疼痛和康复锻炼之间的矛盾？这正是您和我们共同关注的问题。

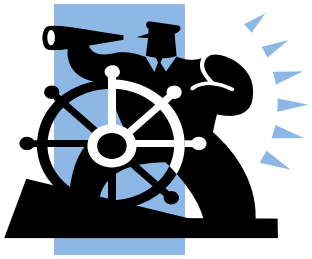
本手册在向您介绍与手术相关的知识的同时，着重强调疼痛的自我管理，以达到“减少痛苦，促进康复”的目标。

疼痛只有您自己知道，但我们也同样关心！让你和我共同努力，促进您早日康复。

本手册由香港理工大学护理学院师生编写，手册及住院期间的健康指导均不收取费用

学习目标

- 了解开胸手术及术后疼痛的基础知识
  - 学会自我评估和报告疼痛
  - 学会使用 PCA 泵
- 熟悉常用的镇痛药物及方法
  - 学会非药物镇痛方法
- 熟悉胸腔引流管的维护及拔除时的疼痛管理
  - 学会常用的锻炼方法



目　　录

第一章　胸外科手术的基础知识

第一节　开胸手术切口选择

根据病灶的位置和性质，胸部手术切口的位置也有不同选择，常见的有以下几种：

1、后外侧切口：适用于肺、食管、膈肌、大血管手术（图 1）。

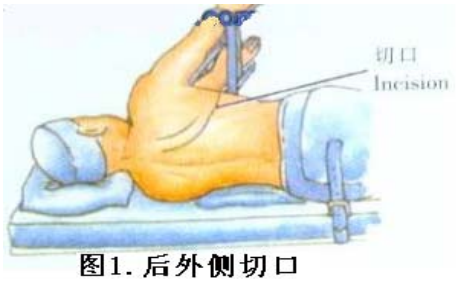


图1. 后外侧切口

2、前外侧切口：适用于肺、大血管及前纵隔肿瘤手术（图 2）。

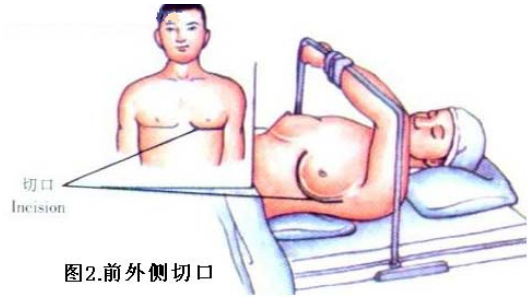


图2.前外侧切口

3、正中切口：适用心包切除及前纵隔肿瘤切除手术（图 3）；

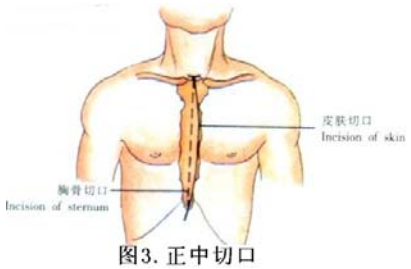


图3. 正中切口

4、腋下切口：适用肺边缘性病变切除或单纯性肺段、肺叶切除，胸膜腔疾病及后纵隔良性肿瘤切除，动脉导管结扎术（图 4）。

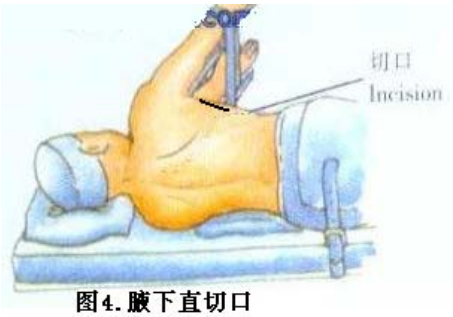


图4. 腋下直切口

5、胸腹联合切口：适用于下胸部、上腹部手术，如胸腹联合伤手术、贲门癌手术等（图 5）。另外，食管手术常采用二后三切口。

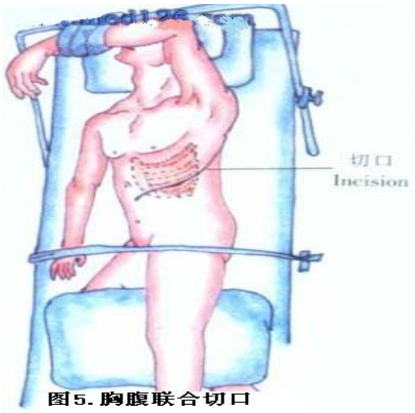


图5. 胸腹联合切口

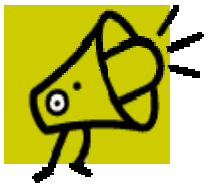
6、胸腔镜下小切口（图 6）。


图6. 胸腔镜下小切口

第二节　　开胸手术创伤

1. 切口损伤

虽然切口的选择有不同，但要进入胸腔内进行手术操作，必须要切开皮肤和肌肉，有些手术甚至要切除部分肋骨，由肋间隙使用胸廓撑开器进入胸腔。这些手术操作可对患者产生以下影响：



① 损伤肩关节运动肌肉，**术后上肢活动带来疼痛与不适；**

② 胸廓松动和部分呼吸肌损伤，**深呼吸和咳嗽时有明显疼痛；**

③ 皮神经和肋间神经损伤，**术后慢性疼 痛。**

2. 肺功能损伤

开胸手术麻醉时多采用复合麻醉，全麻时气管插管的一系列侵入性操作损伤了呼吸道粘膜；手术中术侧肺组织处于萎缩状态，呼吸道分泌物增加；还有开胸病人术后咳痰无力及术后镇痛自控泵的使用，使病人呼吸、咳嗽排痰均受到很大的影响，对肺功能影响更明显。

第三节　开胸手术常见的并发症

1. 肺不张

胸部手术后，由于疼痛限制呼吸运动和咳嗽，呼吸功能受到影响，肺泡和支气管内易于积聚分泌物，并逐渐变稠，且不易被咳出。支气管被痰堵塞后，气体不能进入这部分肺泡内，肺泡壁收缩，导致肺不张。

患者自我预防肺不张的措施主要有：①术前停止吸烟半个月以上；②术前在护理人员指导下积极进行呼吸运动训练；③ 术后采取正确体位，在医护人员协助下积极咳嗽排痰。

2. 肺部感染

胸部手术后患者容易发生肺不张，由于肺内分泌物增多，长期滞积在肺内可发生致病性细菌的生长；另外，胸部手术病人大多年老体弱、病程长、营养状况欠佳，加之术后患者抵抗力降低，很容易发生肺部感染。

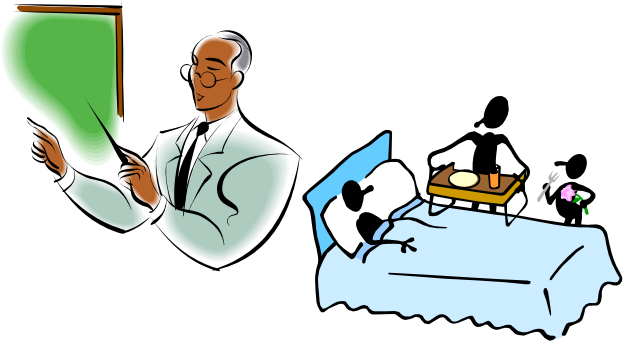
3. 心血管系统并发症

胸部手术病人大多为中、老年患者，常合并有高血压、糖尿病等病史。手术后患者呼吸运动受限和肺不张，往往导致术后缺氧，是并发心律失常和心脑血管意外的主要原因。

4. 其他并发症:如肺栓塞、伤口感染、脓胸、胃瘫综合征等。

第二章　疼痛管理知识

疼痛管理知识包括 4 方面的主要内容：①术后疼痛对机体的影响；②开胸术后疼痛的特点及影响；③ 疼痛评估及报告；④常用的镇痛药物及方法，和常用的非药物镇痛方法。



第一节　术后疼痛对机体的影响

术后疼痛对机体的影响是多方面的,主要有以下几个方面：

- 术后疼痛对心血管系统的影响

疼痛刺激可影响患者的心血管功能，表现为心率加快、血压升高、心动过速和心律失常，甚至引起心肌缺血。

- 术后疼痛对呼吸系统的影响

在开胸手术后，疼痛限制呼吸运动幅度和咳嗽，促使术后发生肺不张，容易引起术后肺部感染。

- 术后疼痛对内分泌功能的影响

疼痛可引起体内多种激素的释放，导致分解代谢增强，不利于术后患者机体的康复。

- 术后疼痛对胃肠功能 和泌尿系统的影响

疼痛可反射性抑制胃肠功能，引起术后胃肠 绞痛，腹胀，恶心，呕吐等不良反应；疼痛还可导致术后尿潴留或排尿困难。

- 术后疼痛对免疫功能的影响

疼痛反应使免疫处于抑制状态，使术后患者对病原体的抵抗力减弱，术后感染和其它并发症的发生率明显增加。

- 术后疼痛对康复进程的影响

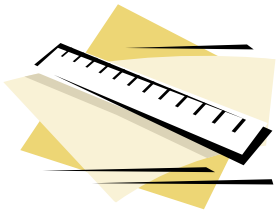
疼痛刺激可使患者出现失眠，焦虑，甚至无助的感觉，这些心理因素无疑会延缓患者术后的康复进程。

第二节　开胸术后的疼痛特点

开胸术后的疼痛特点

开胸手术过程损伤肋骨、呼吸肌肉和肋间神经，胸壁创伤大；术后留置胸腔引流管也可刺激肋间神经和胸膜神经；同时术后患者必须进行深呼吸及咳嗽运动，均可引起剧烈疼痛。

开胸手术后慢性疼痛综合症是指持续时间≥2 个月或 术后 2 个月以后再复发的疼痛。值得重视的是，其发生率高，在很大程度上影响患者术后的日常生活及功能的康复。**因此，学会自我管理疼痛对开胸手术的患者尤其重要。**



第三节　术后疼痛的评估

临床常用的疼痛评估方法很多。在此为便于患者评估和报告疼痛，介绍两种常用的主观

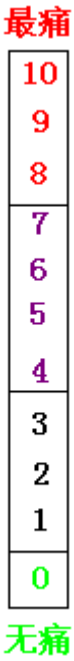
评估法。

1. 数字评价量表 （图 7）

将疼痛用 0 到 10 这 11 个数字表示

- 0 表示无痛，10 表示最痛；
- 4 以下为轻度疼痛(疼痛不影响睡眠)
- 4~7 为中度痛
- 7 以上为重度痛(疼痛导致不能睡眠或从睡眠中痛醒)

患者根据个人的疼痛感觉程度在其中一个数字上作记号



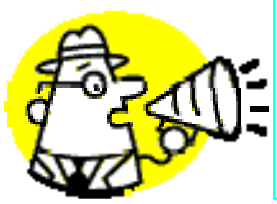
（图 7-数字评价量表）

2. Prince-Henry 评分法

此种方法主要用于胸部手术后的患者和气管切开或插管不能讲话者，评分方法如下：

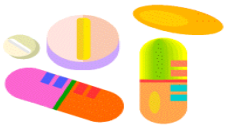
- 0 分：　咳嗽时无疼痛
- 1 分：　咳嗽时才有疼痛发生
- 2 分：　深呼吸时有疼痛发生，安静时无疼痛
- 3 分：　静息状态下有疼痛，但较轻，可以忍受
- 4 分：　静息状态下有剧烈疼痛，难以 忍受

3. 疼痛的报告



患者学会正确评估疼痛，向医护人员准确地描述自己的疼痛**程度**，疼痛**部位**，疼痛**性质**及**持续时间**。

第四节　常用的镇痛药物及方法



1．常用的镇痛药物及副作用

❖ 常用的镇痛药物分为 3 类：① 阿片类镇痛药,如：吗啡，哌替啶，芬太尼等；② 非阿片类镇痛药，如非甾体类药物和曲马多；③ 其他辅助类药物,如镇静药和抗抑郁药等。

❖ 药物镇痛常会产生一定的副作用，且与使用的次数与剂量有关。阿片类镇痛药常见的副作用如：呼吸抑制；幻觉等； 少数患者可发生恶心，呕吐，头痛，头晕及荨麻疹; 依赖性或成瘾性。非甾体类药物可引起胃肠道溃疡，出血，血小板功能障碍和肾功能损害等副作用。

2. 需澄清和正确理解的概念

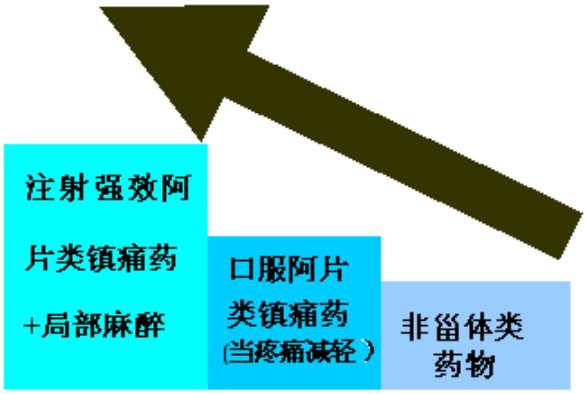
成瘾 ：是一种伴有强迫性追求用药行为和出现严重戒断症状的状态。正确使用阿片类镇痛药，发生成瘾 的风险<1% 。

耐受： 需要更大剂量的药物才能达到相同的止痛效果。指身体对药物产生了适应性，并不意味着成瘾。

身体依赖：使用阿片类镇痛药，突然停药时出现的一系列症状，如烦躁、骨骼或肌肉疼痛，失眠等。身体依赖是使用阿片类镇痛药常见的后果，这些症状通常会在短时间内消失。

3．止痛疗法的原则

手术后镇痛指南（图 8）同世界卫生组织镇痛治疗三阶梯疗法是一致的。



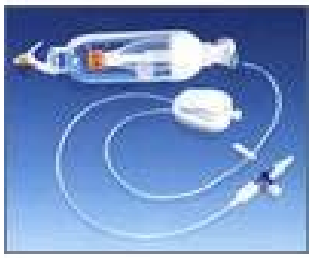
（图 8. 世界麻醉师协会镇痛指南；Charlton 1997 ）

4．术后常用的镇痛方法

病人自控镇痛药物输注泵（Patient-controlled analgesia pump, PCA 泵）

PCA 泵是一种将药物或液体以预定的速度或容量输注的装置。

PCA 即患者感觉痛时按压启动键，通过微处理器控制的微量镇痛泵，向体内注入设定剂量的镇痛药物以消除疼痛。



其特点是在医生设定的剂量范围内，患者按需调控注入镇痛药的时机和剂量。与传统的给药方法相比，优点是达到了“剂量个体化”和“按需镇痛”，是目前术后镇痛最常用和最理想的方法。

（2）PCA 常见的副作用

- 恶心、呕吐
- 呼吸抑制
- 尿潴留
- 睡眠障碍和过度镇静
- 瘙痒
- 耐受和身体依赖

5. 其它常用的给药方法

- **口服给药**

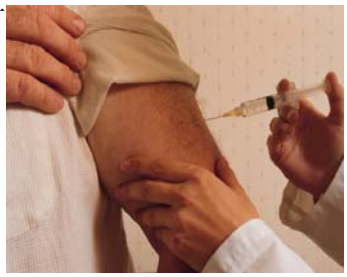
一般认为， 对术后重度急性疼痛的患者不宜采用口服镇痛药物镇痛。是因为口服给药难以确定给药剂量，起效慢，作用时间长，并且需要患者胃肠功能正常才能奏效。但对于术后慢性疼痛，口服途径仍然是术后镇痛的主要方法之一。

- **肌肉注射**

与口服给药相比，肌肉注射镇痛药物起效快。其缺点在于：需依赖医护人员的处方和给药，不及时；注射部位疼痛；药物吸收不恒定。

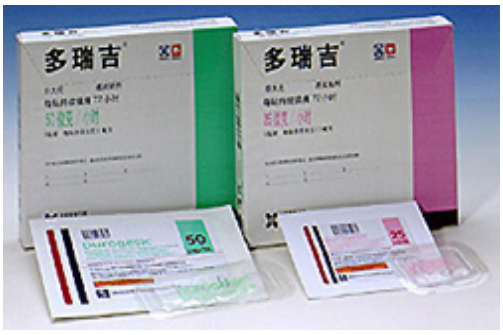
❖ 静脉注射

单次静脉注射作用时间较短，需反复给药；连续静脉输注可保持稳定的血药浓度，维持镇痛效果。



❖ 其他给药方法

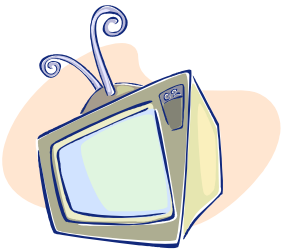
如经皮吸收的芬太尼缓释贴剂给药，可产生和维持稳定的血药浓度，也有良好的镇痛效果。



第四节　常用的非药物镇痛方法

常用的非药物镇痛方法有音乐疗法，松静疗法，按摩疗法等。

1．音乐疗法



欣赏自己喜欢的音乐可以分散注意力，缓解紧张的情绪，放松心情，是简单有效的缓解术后疼痛的方法。可以边听边唱，也可以闭目静听或是手脚随着节拍慢慢活动。

2．松静疗法

又称松弛疗法，通过锻炼放松肌肉，缓解血管痉挛，消除紧张焦虑情绪。治疗时，患者保持一种舒适自然的坐位或卧位，然后按照指令从头到脚依此放松全身肌肉；继之，患者闭目凝神，驱逐杂念，平静地呼吸。

❖ 放松与想象

患者放松全身，平静地呼吸，头脑中想象风景优美的画面，及流水的声音等，并尽量让身心感受这些美丽的事物而达到缓解疼痛的效果。

❖ 分散注意力

患者可以朗读，默念或祈祷，配合意境的想象； 及阅读自己感兴趣的书报都可以起到缓解疼痛的作用。

3．按摩疗法

研究表明 20 分钟左右的背部按摩,或手掌/足底按摩,是一种方便、安全有效的治疗术后疼痛的辅助方法。

第三章　自我管理及康复锻炼

第一节 胸腔引流管的自我管理

胸腔手术后常规放置胸腔引流管，其作用是引流出胸腔内的液体和气体，促进肺复张；同时也有利于观察胸腔内活动性出血情况。胸腔引流管对术后恢复非常重要，应注意维护，保持引流管通畅，防止引流管脱出。

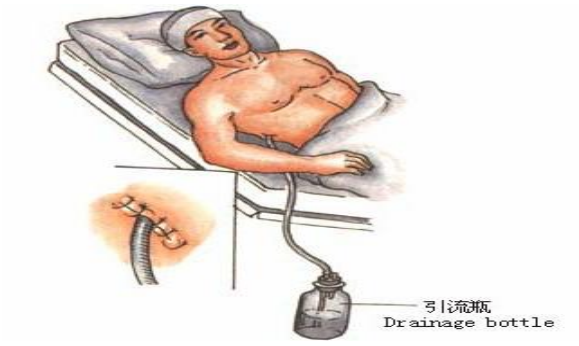
1. 预防措施

术后胸腔引流管的自我维护

- 防止管道扭曲、受压；
- 保持管道密封良好，水封瓶长玻璃管应以浸入水平面下 3～4cm 为宜；
- 水封瓶应放在床下某一固定位置，防止碰倒、踢翻或打碎；
- 带管下床活动时要注意引流瓶位置低于膝关节；水封瓶液面低于引流管胸腔出口平面 60 cm 处；
- 翻身、坐起、下床活动时，应避免牵扯引流管，否则会给您带来剧烈疼痛，严重时可致引流管脱出。

2. 术后应经常观察引流管是否通畅

- 主要观察水封瓶的长玻璃管有无水柱波动及气体排出
- 如短时间内发现水柱波动消失，无气泡冒出，出现胸闷气促，或者皮下气肿，应及时向医护人员报告。

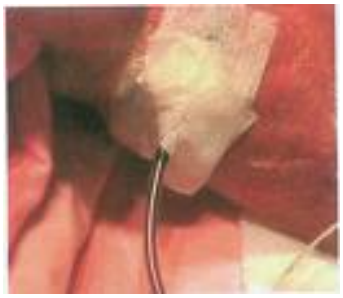


3. 拔除胸腔引流管的疼痛管理

拔除胸腔引流管是一种令人痛苦和恐惧的体验。合理使用镇痛药物，局部麻醉药，并结合非药物方法可有效减轻拔除胸腔引流管带来的痛苦。常用的方法如下：

拔管前

- 向医护了解操作过程及可能引起的不适
- 拔管前 5 分钟，做缓慢深呼吸放松运动：用鼻缓慢深吸气，然后缩唇缓慢呼出



拔管时

- 深吸气后屏住呼吸数秒，至引流管拔出后再呼出

第二节　常用的康复锻炼

1．呼吸锻炼——深呼吸运动

深呼吸运动主要包括胸式呼吸， 腹式呼吸，及简单的吹气球方法，其目的是使不张的肺组织或保留的肺组织扩张；同时促进痰液向气管流动。

- **胸式呼吸：**由鼻慢慢吸气，使胸廓扩张，然后由嘴慢慢吐出。

- **腹式呼吸：**深吸气时腹部徐徐凸隆后，憋气约 2 秒，然后缩唇慢呼气，腹部凹陷。呼气时间是吸气时间的 2 倍。
  - 患者取仰卧、半卧位 、坐位或半坐位
  - 两膝轻轻弯曲，使腹肌放松
  - 一手放在胸骨柄部，以控制胸部起伏
  - 另一手放在脐部，以感觉腹部隆起程度
  - 当凸隆的腹部下限 1/3 时稍用力向上向内推压，帮助腹肌收缩

- **简单的吹气球方法：**深吸气后尽量把气球吹大，每 4 小时 1 次。

- **深呼吸次数：**

清醒时, 每小时 ≥10 次； 3~4 次/ 每周期； 3~4 个周期/ 小时。

2. 体位引流---促进痰液向支气管流动

利用痰液的流动性和重量，将痰引向支气管，然后咳出。根据痰液积聚于肺内不同的位置，其引流的体位也有不同（见图 9-11）。食管术后的患者， 以坐位或半坐卧位为主，所使用的体位引流方式也有所限制。

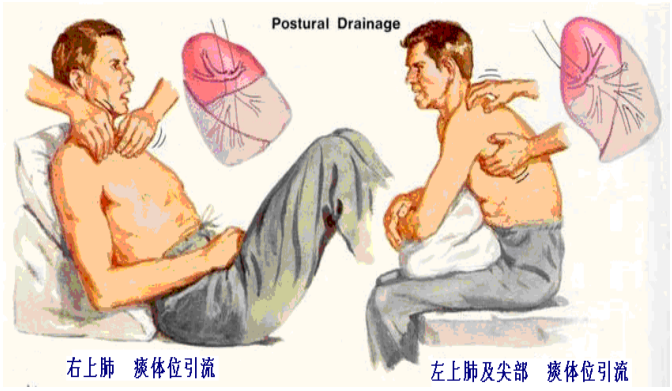


图 9. 肺上叶积痰的体位引流

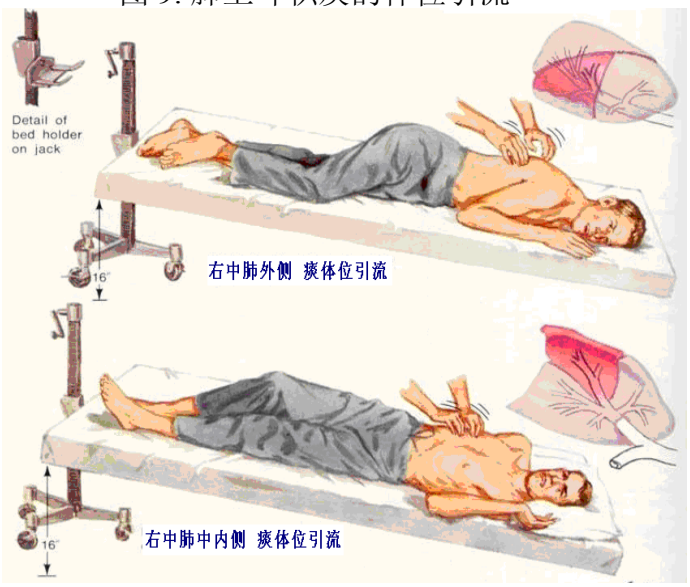


图 10. 右中肺内积痰的体位引流

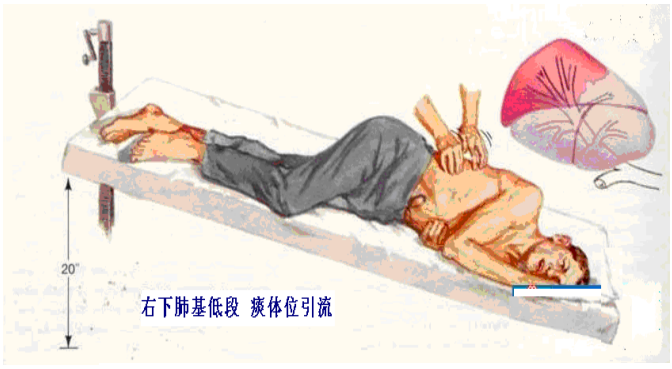


图 11. 右下肺内积痰的体位引流

医务人员可根据手术部位或 X 线片确定肺不张的位置，在患者雾化吸入后指导患者进行体位引流排痰。患者在做体位引流时，家属或护士可将手掌“窝起”拍背（见图 9-11），通过震动作用，有利于痰向支气管流动。

3．咳嗽运动锻炼

做体位引流 10-30 分钟后，如果觉得咽喉内有痰，患者可进行咳嗽运动，包括自主咳嗽及刺激气管诱发咳嗽。咳嗽运动在术后早期就必须进行，也是加重患者疼痛与不适的主要因素。

❖ **自主咳嗽：** 采用坐位或半卧位，将手掌轻按胸部，当咳嗽时以双手支撑胸壁让患者做一次深呼吸，然后用嘴呼气；当自肺部深部咳嗽时，做一次短呼吸，连续 3 次 短呼吸后咳 1 声。

❖ **刺激气管诱发咳嗽：**咳嗽无力或不会咳嗽者多行刺激气管咳嗽。刺激气管咳嗽前，患者取坐位或半斜卧位，患者用拇指或食指在吸气末稍用力向内按压胸骨上窝的气管，并同时横向滑动，可重复多次，至痰液咳出。

怎样缓解咳嗽运动给您带来的疼痛与不适？

- **合理安排咳嗽运动时机：**一般在雾化吸入的 同时，进行体位引流、辅助拍背。
- **正确使用自主咳嗽运动的方法：**不正确的咳嗽运动方式不能达到排痰效果，反而增加痛苦经历，术前患者应进行正确的咳嗽锻炼。

- **自我评估与管理咳嗽运动对您带来的疼痛：**如果咳嗽运动所致的疼痛超出您的忍耐程度，可求助于药物镇痛。使用镇痛泵的患者可在咳嗽运动前 5 分钟按压启动键，进行预防镇痛；无自控镇痛设备的患者，可向医务人员报告疼痛状况，寻求药物镇痛。
- **早晚清肺：**一夜的睡眠后，会有较多的痰滞积于呼吸道深处；而且人体在早上都处于轻度的脱水状态，痰液比较浓，滞留一段时间后容易结痂。清醒后可

饮 200-300ml 温水，然后积极咳嗽排痰。睡前，我们也建议您尽量排出肺内痰液，防止晨痰结痂。

早晚肺清空，并发症难发生

4．卧床运动——预防肺栓塞

卧床运动可以促进静脉回流，防止深静脉血栓的形成，预防肺栓塞。包括：

- **抬臀运动:**平卧,双膝弯曲,用力抬高臀部。
- **双下肢伸展运动：**平卧，尽量伸直双下肢，以足底顶住床沿。
- **足拍运动：**伸展下肢，足部呈球拍状做向下拍击的动作。
- **术后抬高双下肢:** 防止小腿受压, 促进静脉回流。
- **尽量避免双腿交叉 或 翘二郎腿**

4．肩部运动——促进肩关节功能恢复

肩部运动可以维持肩关节正常的功能，减轻因手术原因所致神经，肌肉的损伤及缺乏锻炼所致的关节功能障碍，从而影响日常工作及生活。

- **内收运动：**腋下夹一个小枕，肩部做水平方向内收的动作。
- **外展运动：**伸展上肢，尽量向上向外展开。
- **旋转运动：**肩部做向内及向外旋转的动作。
- **爬墙运动：**正面或侧面面对墙壁，伸展上肢触摸至最高点，然后停留数秒。

康复计划

术前——康复锻炼

- **深呼吸锻炼: 3~4 次/天**
- **咳嗽锻炼: 3~4 次/天**

术后——康复运动

- **深呼吸运动:**

➢ 清醒时, 每小时深呼吸次数: >10 次 (3~4 次/ 每周期; 3~4 周期/ 小时)

➢ 吹气球: 每 4 小时一次；每次 3~5 分钟

- **咳嗽锻炼： 3-4 次/日**

➢ 晨起排出夜晚积聚的痰液

➢ 睡前排净痰液，可减少晨痰和夜间咳嗽

- **卧床运动： 3 次/天**
- **肩部运动： 3 次/天**（术后及早进行）。

此为康复计划纲要，具体方案我们将在临床中参照实情，指导您具体实施。自我锻炼记录见附表 1 。

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(附表 1)　　自我锻炼记录（次/每天）

项目/日期	深呼吸	咳嗽	卧床运动	肩部运动

Appendix-8

研究编号:

个人及临床资料表

日期:　　年　　月　　日

入院日期:　　出院日期:　　住院天数:

A. 个人资料

A1. 年龄:

A2. 性别: ☐ 男　　☐ 女

A3. 文化程度 (年数): ☐ 小学　☐ 初中　☐ 高中　☐ 中专

☐ 大学及以上

A4. 职业:

A5. 工作状况: ☐ 在职　☐ 退休

A6. 婚姻状况: ☐ 单身　☐ 已婚　☐ 离异　☐ 丧偶

A7. 宗教信仰: ☐ 有　☐ 无

A8. 经济状况: ☐ <1000 元/ 月　☐ <2000 元/ 月　☐ <3000 元/ 月

☐ < 4000 元/ 月　☐ >4000 元/ 月

B. 临床资料

B1.疾病诊断:

B2.既往病史:

B2.1 所患疾病 : ☐ 心脏病　☐ 高血压　☐ 糖尿病　☐ 其他疾病

B.2.2 既往手术史 :☐ 有　☐ 无

B3. 您曾经接受过疼痛管理教育吗 ?☐ 有　☐ 无

B4.您以前使用过止痛药吗?☐ 有　☐ 无

B5. 除服用止痛药外, 是否使用过其他止痛方法? ☐ 有　☐ 无

B5.1 如果有, 请圈出曾使用过的止痛方法:

☐热敷 ☐ 冷敷 ☐ 按摩 ☐ 默想 ☐ 慢慢深呼吸放松

☐ 听音乐 /收音机 ☐ 看电视 ☐ 看书报 ☐ 与人交谈/ 聊天

☐ 其他: (请注明)

B5.2 请注明使用的次数: _____ 次/天

B5.3 是否感到有效: ☐ 有 ☐ 无

B6. 术后资料

B6.1 术后使用镇痛泵的情况:☐ 有 ☐ 无

B6.2 术后使用镇痛药物的总量（药名和剂量）:

B6.3 术后首次下床活动的时间: 术后第 _____ 天

B6.4 术后胸腔引流管留置时间: _____ 天

B6.5 术后并发症的发生情况: ☐ 有 ☐ 无

Appendix-9

Code:

Personal and disease information

Date：

Date of admission: Date of discharge: Days of hospitalization:

A. Personal information

A1. Age:

A2. Gender: ☐ Male ☐ Female

A3. Education background: ☐ Primary school ☐ Junior high school

☐ Senior high school ☐ University or above

A4. Occupation :

A5. Status of employment: ☐ In position ☐ Retired

A6.Marital Status: ☐ Single ☐ Married ☐ Divorced ☐ Widowed

A7. Religion belief: ☐ Yes ☐ No

A8. Average family income per month (RMB): ☐ <1000 ☐ <2000

☐ <3000 ☐ < 4000 ☐ >4000

B. Disease information

B1.Diagnosis:

B2.Medical history:

B2.1 Medical diseases: ☐ Heart diseases ☐ Hypertension ☐ Diabetic Mellitus ☐ Other diseases

B.2.2 History of surgery: ☐ Yes ☐ No

B3. Experience of receiving pain education: ☐ Yes ☐ No

B4. Experience of using analgesics: ☐ Yes ☐ No

B5. Except for analgesics, did you ever use other methods to relieve pain?

☐ Yes ☐ No

B5.1 If yes, please circle the ever used methods :

☐ Heat ☐ Cold ☐ Massage ☐ Imagination ☐ Deep breathing/ relaxation ☐ Listening music/ radio ☐ Watching TV ☐ Chatting with others ☐ Other methods (please specify)

B5.2 Frequency of using: _____ times / per day

B5.3 Perceived pain relief from using the above methods: ☐ Yes ☐ No

B6. Postoperative data

B6.1Use of PCA in the postoperative period: ☐ Yes ☐ No

B6.2Total amount of analgesic use postoperatively (name and dosage):

B6.3 The first data to perform out-of-bed ambulation postoperatively: Day _____

B6.4 Days of chest-tube insitu: _____ days

B6.5 Occurrence of postoperative complications: ☐ Yes ☐ No

Appendix-10

研究编号:

简明疼痛调查表

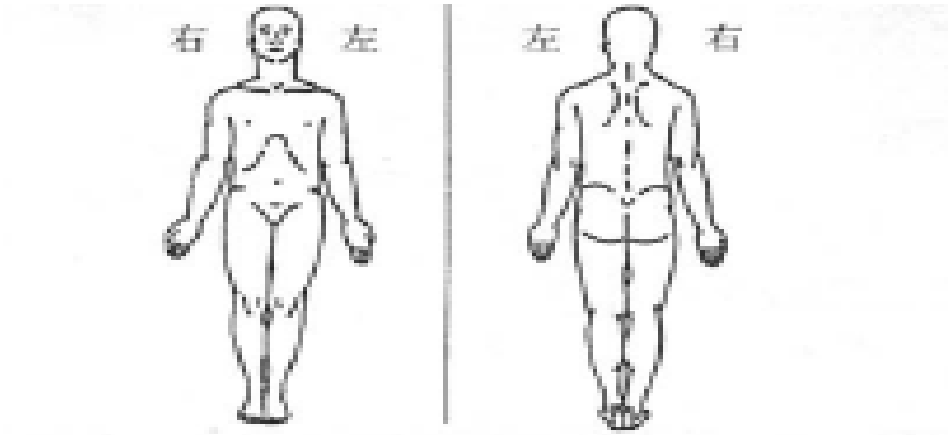
日期　　年　　月　　日　　时间

姓名

一. 在我们一生中大多数人都体验过头痛、扭伤、和牙痛,今天你是否有其他不常见的疼痛?

1.有　　**2.** 没有

二. 请在下图中用阴影标出你感到疼痛的部位,并在最痛的部位打 “ X ”



三.请圈出一个数字以表示你在 24 小时内疼痛最重的程度

0　1　2　3　4　5　6　7　8　9　10

不痛　　你能想象的最痛

四.请圈出一个数字以表示你在 24 小时内疼痛最轻的程度

0　1　2　3　4　5　6　7　8　9　10

不痛　　你能想象的最痛

五. 请圈出一个数字以表示你在 24 小时内疼痛的平均程度

0　1　2　3　4　5　6　7　8　9　10

不痛　　你能想象的最痛

六. 请圈出一个数字以表示你现在的疼痛程度

0　1　2　3　4　5　6　7　8　9　10

不痛　　你能想象的最痛

七. 请圈出一个数字以表示你在 24 小时内受疼痛影响的程度

1. 翻身 / 改换体位

0 1 2 3 4 5 6 7 8 9 10

无影响 完全影响

2. 深呼吸/ 咳嗽

0 1 2 3 4 5 6 7 8 9 10

无影响 完全影响

3. 行走能力 （下床活动）

0 1 2 3 4 5 6 7 8 9 10

无影响 完全影响

4. 情绪

0 1 2 3 4 5 6 7 8 9 10

无影响 完全影响

5. 与他人关系（比如聊天）

0 1 2 3 4 5 6 7 8 9 10

无影响 完全影响

6. 睡眠

0 1 2 3 4 5 6 7 8 9 10

无影响 完全影响

Appendix-11

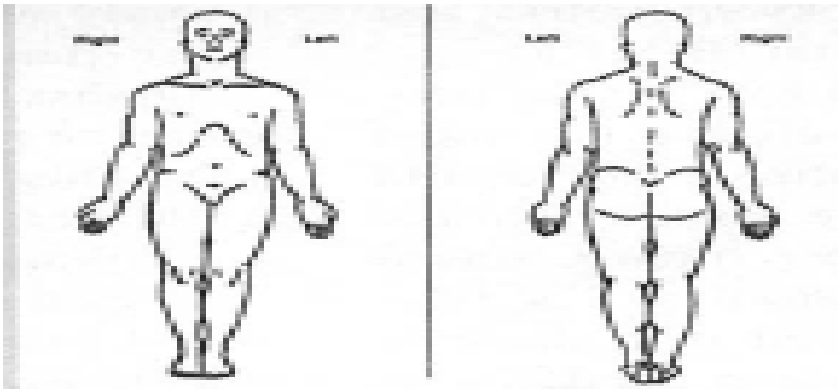
Code:

Brief Pain Inventory

Date / / / Time _____

Name _____

1. Throughout our life, most of us had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these everyday kinds of pain today?
   1. Yes 2. No
2. On the diagram, shade the areas where you feel pain. Put an X on the area that hurts you the most.



3. Please rate your pain by circling the one number that best describes your pain at its worst in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

4. Please rate your pain by circling the one number that best describes your pain at its least in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

5. Please rate your pain by circling the one number that best describes your pain on the average.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

6. Please rate your pain by circling the one number that tells how much pain you have right now.

0	1	2	3	4	5	6	7	8	9	10
No pain										Pain as bad as you can imagine

7. Circle the one number that describes how, during the past 24 hours, pain has interfered with your:

A. Repositioning

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

B. Deep breathing/ coughing

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

C. Walking ability

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

D. Mood

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

E. Relation with other people（i.e., chatting）

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

F. Sleep

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

Appendix-12

研究编号:

疼痛管理障碍问卷（台湾外科病人版）

日期:　　年　　月　　日

说明：该问卷是调查您对镇痛药物及手术后镇痛治疗的观点及态度。敬请您依照您的真实想法填写，0 分代表不同意，5 分代表极同意。有些问题并没有一个标准答案，有些问题看起来有些类似，但请您就您个人经验， 详细回答所有问题，圈出以下数字中最能代表您感受的回答。	不同意					极同意
1. 人很容易对止痛药上瘾。	**0**	**1**	**2**	**3**	**4**	**5**
2. 止痛药造成病人昏昏欲睡是令人担心的。	**0**	**1**	**2**	**3**	**4**	**5**
3. 和医师讲疼痛，可能分散医师对治疗疾病的注意力。	**0**	**1**	**2**	**3**	**4**	**5**
4. 把止痛剂“留”在以后，可能真的需要的时后再使用比较好。	**0**	**1**	**2**	**3**	**4**	**5**
5. 打针是让人不喜欢的。	**0**	**1**	**2**	**3**	**4**	**5**
6. 止痛剂并不能真正的控制手术后疼痛。	**0**	**1**	**2**	**3**	**4**	**5**
7. 止痛剂很容易让人上瘾。	**0**	**1**	**2**	**3**	**4**	**5**
8. 止痛剂造成病人恶心感是很痛苦的。	**0**	**1**	**2**	**3**	**4**	**5**
9. 您可能担心使用止痛剂会影响病人伤口的愈合。	**0**	**1**	**2**	**3**	**4**	**5**
10. 医师集中注意力在治疗疾病要比控制疼痛重要。	**0**	**1**	**2**	**3**	**4**	**5**
11. 假如病人有一点疼痛时就使用止痛剂，那么当疼痛加剧时，止痛剂可能就没那么有效了。	**0**	**1**	**2**	**3**	**4**	**5**
12. 假如正确使用药物，手术后造成的疼痛是可以解除的。	**0**	**1**	**2**	**3**	**4**	**5**
13. 止痛剂只有在每隔一段时间才会给予。	**0**	**1**	**2**	**3**	**4**	**5**
14. 假如病人使用止痛剂，您可能担心病人会上瘾。	**0**	**1**	**2**	**3**	**4**	**5**
15. 止痛剂造成便秘是令病人难过的。	**0**	**1**	**2**	**3**	**4**	**5**
16. 好病人是避免谈疼痛的。	**0**	**1**	**2**	**3**	**4**	**5**

17. 医师应该专注于治疗疾病而不是处理疼痛。	**0**	**1**	**2**	**3**	**4**	**5**
18. 使用止痛剂会使伤口较不容易愈合。	**0**	**1**	**2**	**3**	**4**	**5**
19. 病人忍受疼痛要比忍受止痛剂所造成的副作用容易。	**0**	**1**	**2**	**3**	**4**	**5**
20. 止痛剂应该”留在”以后万一疼痛加剧时使用。	**0**	**1**	**2**	**3**	**4**	**5**
21. 打针是非常痛的。	**0**	**1**	**2**	**3**	**4**	**5**
22. 药物并不能解除手术后造成的疼痛。	**0**	**1**	**2**	**3**	**4**	**5**
23. 病人时常向医师抱怨疼痛可能造成医师烦扰。	**0**	**1**	**2**	**3**	**4**	**5**
24. 使用止痛剂对手术后伤口复原是不好的。	**0**	**1**	**2**	**3**	**4**	**5**
25. 若时间还没到医师或护士不会给止痛剂的。	**0**	**1**	**2**	**3**	**4**	**5**
26. 止痛剂造成的意识昏乱是令人担心的。	**0**	**1**	**2**	**3**	**4**	**5**
27. 打针令病人害怕。	**0**	**1**	**2**	**3**	**4**	**5**
28. 不谈疼痛是坚强的表现。	**0**	**1**	**2**	**3**	**4**	**5**
29. 若时间还没到，就要使用止痛剂是不好的。	**0**	**1**	**2**	**3**	**4**	**5**

谢谢您的合作！

Appendix-13

Code:

Barrier Questionnaire Taiwan Form-Surgical Version (BQT-S)

Date: / / /

Instructions: This questionnaire is to investigate your opinions and attitudes about reporting pain and using analgesics for postoperative pain treatment. Please answer it according to your own experience, while "0"stands for "not agree at all" and "5"for "agree very much". There is no standard answer for the questions, and please circle the one number that best describes your experience.	**Not agree at all**					**Agree very much**
1. Patients are easily to get addicted to analgesics.	**0**	**1**	**2**	**3**	**4**	**5**
2. Drowsiness caused by the analgesics makes patients worry.	**0**	**1**	**2**	**3**	**4**	**5**
3. It may distract the physicians from treating diseases while talking about pain.	**0**	**1**	**2**	**3**	**4**	**5**
4. It would be better to "keep" analgesics for future use.	**0**	**1**	**2**	**3**	**4**	**5**
5. No patients like injections.	**0**	**1**	**2**	**3**	**4**	**5**
6. Analgesics may not effectively relieve patients from postoperative pain.	**0**	**1**	**2**	**3**	**4**	**5**
7. Analgesics make patients addicted easily.	**0**	**1**	**2**	**3**	**4**	**5**
8. It is a really distressing experience for patients to have nausea caused by analgesics.	**0**	**1**	**2**	**3**	**4**	**5**
9. You may worry about the inhibition of wound healing while using analgesics.	**0**	**1**	**2**	**3**	**4**	**5**
10. It is more important for physicians to treat disease than to manage pain	**0**	**1**	**2**	**3**	**4**	**5**
11. Analgesics may not be effective enough when pain is excruciating, since it is taken by patients with mild pain.	**0**	**1**	**2**	**3**	**4**	**5**
12. Postoperative pain could be managed by appropriately using analgesics.	**0**	**1**	**2**	**3**	**4**	**5**
13. Pain medication should be given in regular time intervals.	**0**	**1**	**2**	**3**	**4**	**5**
14. You may worry about addiction when using analgesics.	**0**	**1**	**2**	**3**	**4**	**5**
15. It is unhappy experience for patients to have constipations when using analgesics.	**0**	**1**	**2**	**3**	**4**	**5**
16. "Good patient" should avoid talking about pain.	**0**	**1**	**2**	**3**	**4**	**5**
17. Physicians should concentrate on treating diseases, but not on	**0**	**1**	**2**	**3**	**4**	**5**

managing pain.						
18. Using analgesics delays wound healing.	**0**	**1**	**2**	**3**	**4**	**5**
19. It is more acceptable for patients to bear pain than to experience side effects of analgesics.	**0**	**1**	**2**	**3**	**4**	**5**
20. Analgesics should be "kept" for use when pain is getting worse.	**0**	**1**	**2**	**3**	**4**	**5**
21. It is painful to have injections.	**0**	**1**	**2**	**3**	**4**	**5**
22. Medications could not relieve postoperative pain.	**0**	**1**	**2**	**3**	**4**	**5**
23. It may disturb physicians if patients complain about pain all the time.	**0**	**1**	**2**	**3**	**4**	**5**
24. Using analgesics is unfavorable for wound healing.	**0**	**1**	**2**	**3**	**4**	**5**
25. Physicians and nurses may not give pain medication to patients if time is not due.	**0**	**1**	**2**	**3**	**4**	**5**
26. Confusions caused by analgesics upset patients.	**0**	**1**	**2**	**3**	**4**	**5**
27. Injections make patients scared.	**0**	**1**	**2**	**3**	**4**	**5**
28. A brave person should never talk about pain.	**0**	**1**	**2**	**3**	**4**	**5**
29. It is not good to use analgesics if its time is not due.	**0**	**1**	**2**	**3**	**4**	**5**

Thanks for your cooperation!

Appendix-14

研究编号:

术后病人疼痛管理记录

病人住院号：

项目/日期	非药物方法管理疼痛（如看书报、听音乐、手足及背部按摩等）					药物镇痛方法(药物名称和剂量)				药物副作用(有/ 无)			要求使用镇痛药物	深呼吸/咳嗽	下床活动
	0 从来不用	1	2	3	4 频繁使用	口服	肌肉注射	病人自控镇痛	其他途径	恶心	呕吐	瘙痒	0 从来不 1 2 3 4 频繁地		

Appendix-15

Code:

Log record for patients in postoperative pain management

Patient's hospital ID:

Item / Date	Non–drug methods for pain relief (i.e., reading, listening music, hands / feet or back massage)					Drug methods for pain relief (Name and dosage)				Side effects of analgesics (Yes/ No)			Requesting analgesics for pain	Deep breathing/ coughing	Out-of-bed ambulation
	0 Never	1	2	3	4 Very frequently	PO	IM	PCA	Other	Nausea	Vomit	Itch	0 1 2 3 4 Never Very frequently		