

HONG-GU HE

Non-Pharmacological Methods in Children's Postoperative Pain Relief in China

Doctoral dissertation

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ABSTRACT

Background: Pediatric postoperative pain management has attracted much scientific interests in previous decades. However, children's pain is still poorly managed in different cultures. Non-pharmacological methods are stated to be effective in relieving children's postoperative pain when used independently or in conjunction with pain medication. However, little is known about the use of these methods by Chinese nurses, parents and children themselves in hospitals. Moreover, the education for nurses in pain management is inadequate, which largely results in nurses' lack of the knowledge to manage children's pain effectively.

Purposes: The purpose of this study was to describe Chinese nurses' and parents' use of non-pharmacological methods in school-aged children's postoperative pain relief, nurses' perceptions on providing guidance to parents, children's experience of their use of pain-relieving methods as well as perceptions on their parents' and nurses' use of methods for relieving their surgical pain. Besides, parents' views on their participation in their children's postoperative pain management and their recommendations to health care providers were explored. In addition, the purpose was to provide pain education to nurses and the differences among nurses in their use of these methods in practice were examined.

Methods: The empirical data were collected during year 2002 and 2004. Methodological, data sources and methods of data analysis triangulation were used in this study. The study consists of four empirical parts. In Part 1, a questionnaire survey was used to collect data from nurses (n=178, response rate 98%) working at 12 surgical wards in five hospitals of Fujian Province, China in 2002. In Part 2, the data were collected from parents (n=206, response rate 88%) who were taking care of their children in the same 12 surgical wards by using a questionnaire survey in 2004. In Part 3, structured-interviews were conducted with 59 children who were in patients at five surgical wards in three provincial hospitals in Fujian, China in 2004. In Part 4, a pain education booklet was developed and its copies distributed to the nurses working at the same 12 surgical wards in 2004, meanwhile lectures were presented to them. A questionnaire survey was conducted to examine nurses' use of non-pharmacological methods in 2004 (n=181, response rate 95%). Differences of nurses' use of these methods in 2002 and 2004 were compared. The questionnaires for nurses and parents used in this study were developed and validated earlier in Finland. The data were analyzed with statistical methods (descriptive statistics, Kruskal-Wallis ANOVA test, chi-square test, Mann-Whitney U test, factor analysis and reliability test) and the method of content analysis.

Results: Nurses and parents used versatile non-pharmacological methods to relieve children's postoperative pain, including especially giving preparatory information, comforting, creating a comfortable environment, distraction, and positioning by nurses; emotional support strategies, helping with daily activities, distraction and imagery by parents. The most commonly guided methods by nurses were distraction, positive reinforcement, comforting, positioning and relaxation. Some of the nurses and parents' background factors were significantly statistically related to their use of non-pharmacological methods. Most of the parents agreed to have had adequate information concerning their children's surgical procedure, but they felt the information concerning pain management was not enough, and more than half of them acknowledged their poor understanding of the information provided. According to children's perception, the most common self-initiated used methods were rest/sleeping, requiring parents' presence and positioning; the nurses used mostly comforting and positioning; the parents used mostly helping with daily activities and emotional support. For more effective pain management, parents' recommendations to nurses concerned mostly the topics of applying non-pharmacological methods for pain relief, providing more information and communication, whereas children's recommendations mostly concerned the presence of caregivers. Furthermore, pain education was provided to nurses and statistical significances were found concerning nurses' use of many non-pharmacological methods between 2002 and 2004.

Conclusions and implications: This study provides new knowledge of Chinese nurses', parents' and children's perceptions on their use of non-pharmacological methods in postoperative pain relief. The findings indicate a need for nurses and parents to use non-pharmacological methods more actively, especially those less frequently used like physical methods. Moreover, children and their parents need to be more actively involved in pain management in hospitals. Written guidelines about the use of these methods could be produced and provided to parents, with the reference of the educational booklet. More emphasis need to be placed on sufficient information and support provided to children and their parents, as well as effective communications among children and caregivers. This evidence-based knowledge can be used to develop the treatment of pediatric postoperative pain, to diversify nursing and patient education and to plan future research. One of the challenges for future studies is to examine the most effective non-pharmacological methods in conjunction with pain medication for postoperative pain relief in children who has undergone different types of surgical procedures.

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To my family

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Kuopio, June 2006



Hong-Gu He

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- II He H-G, Pölkki T, Pietilä A-M & Vehviläinen-Julkunen K (2005) A survey of Chinese nurses' guidance to parents in children's postoperative pain relief. *Journal of Clinical Nursing* 14(9), 1075-1082.
- III He H-G, Pölkki T, Pietilä A-M & Vehviläinen-Julkunen K (2006) Chinese parents' use of nonpharmacological methods in children's postoperative pain relief. *Scandinavian Journal of Caring Science* 20(1), 2-9.
- IV He H-G, Vehviläinen-Julkunen K, Pölkki T & Pietilä A-M (2006) Parents' views on participation in their hospitalised 6-12-year-old children's postoperative pain management in China. *Journal of Clinical Nursing*. (Revised in May 2006)
- V He H-G, Vehviläinen-Julkunen K, Pölkki T & Pietilä A-M (2006) Children's perceptions on the implementation of methods for their postoperative pain alleviation: an interview study. *International Journal of Nursing Practice*. (Revised in April 2006)
- VI He H-G, Vehviläinen-Julkunen K, Pietilä A-M & Pölkki T (2006) Comparison of nurses' use of non-pharmacological methods in children's postoperative pain alleviation in 2002 and 2004. (Submitted)

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Some unpublished data are also included in this dissertation.

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1 INTRODUCTION

Pain management has been a priority in nursing research (Gillis & Jackson 2002), and pediatric pain management has attracted many scientific interests in the past decades. Nevertheless, a review of the literature indicates that despite of the tremendous research advances in pediatric pain assessment and management, the clinical care of children in pain is still far from adequate and remains a challenge for health professionals (Helgadóttir 2000, Brennan-Hunter 2001, Hegyvary 2004). Bridging the gap between the research knowledge and everyday clinical practice remains a major difficulty (Ellis *et al.* 2002). Children in different cultures still suffer from moderate or severe postoperative pain (Gauthier *et al.* 1998, McCaffery & Pasero 1999, Huang *et al.* 2001, Dolin *et al.* 2002, Ellis *et al.* 2002, Hamers & Abu-Saad 2002, Karling *et al.* 2002, Paik & Ahn 2002, Apfelbaum *et al.* 2003, Pölkki *et al.* 2003b, Botti *et al.* 2004), which indicates the need for more effective intervention. The inadequate application of pain medication and non-pharmacological methods to pediatric patients contributes to the poor management of children's postoperative pain basically, although surgical techniques and anesthetic agents have greatly improved and non-pharmacological methods have been introduced to clinical practice for many years.

Adequate pediatric pain measurement is an ethical imperative that all health care professionals are obligated to implement (McGrath & Unruh 2006). Children have an ethical right to pain relief (Kankkunen *et al.* 2002a). When surgical pain is not relieved adequately, it can lead to a short-time pain experiences (Cohen 1993), nausea and vomiting (Korpela *et al.* 1999) and even other complications, thus result in a longer hospital stay, longer recovery periods and increased medical costs (Davidhizar & Bartlett 2000, Roykulcharoen & Good 2004). The surgical pain might also lead to up-to-four-week postoperative behavioral problems (Kotiniemi *et al.* 1997). Moreover, pain experiences in childhood may have long-term negative effects on subsequent development (Stevens 1999) and unfavorable consequences in later pain-related behavior and perception (Anand 2000). Therefore, it is of crucial importance to find effective ways to relieve children's surgical pain.

To ensure adequate pain relief, non-pharmacological methods are widely accepted as additional strategies that may be used independently with mild pain or as a complement to pain medication with moderate or severe pain, given the limitation in the types of medications available and the potential side effects with large dosages (Caty *et al.* 1995, Lee *et al.* 2002, LeRoy *et al.* 2003, Pellino *et al.* 2005). Those methods can make pain more tolerable and to give the children a sense of control over the situation (Caty *et al.* 1995, Pederson 1996). Some researchers have divided non-pharmacological methods into different categories (Vessey *et al.* 1994, Pölkki *et al.* 2001), but they have pointed out that a given classification is not exclusive of the others. For example, Pölkki *et al.* (2001) divided non-pharmacological methods into five categories: cognitive-behavioural methods, physical methods, emotional support, helping with daily activities and creating a comfortable environment. The effectiveness of these methods in pediatric pain relief has been demonstrated by earlier studies, especially cognitive-behavioural methods (e.g. Pasero & Smith 1997, Seers & Carroll 1998, Kleiber & Harper 1999, Lambert 1999, Kolk *et al.* 2000, Good *et al.* 2001, Sparks 2001, Sander Wint *et al.* 2002, Nilsson *et al.* 2003, Press *et al.* 2003, Gershon *et al.* 2004, Huth *et al.* 2004, Ikonomidou *et al.* 2004, Schaffer & Yucha 2004, Pölkki *et al.* 2005) and transcutaneous electrical nerve stimulation (TENS) as a physical method (Lander & Fowler-Kerry 1993, Mobily *et al.* 1994, Carroll *et al.* 1996, Kubsch *et al.* 2000, Chesterton *et al.* 2002, Lee *et al.* 2002, Bjordal *et al.* 2003, Chesterton *et al.* 2003). Other methods have attracted less interest. A review of the Chinese literature in the past decade shows that few studies have dealt with nurses' use of non-pharmacological methods in postoperative pain relief (Chen & Shao 1998, He 2000, Wei 2002, Chen 2003), that few studies have specifically with children's postoperative pain relief (Yu *et al.* 2002, Liang *et al.* 2005, Song *et al.* 2005) and that the only well-addressed method for children's postoperative pain relief is giving preparatory information (Chen & Shao 1998, He 2000, Song *et al.* 2005). Some review studies have mentioned the use of non-pharmacological methods in children's postoperative pain relief (Deng 1997, Wang *et al.* 2005, Xiao & Zhao 2005).

Nurses are the primary health professionals with responsibility for managing children's pain. However, according to earlier studies nurses used limited pain assessment instruments and were not able to alleviate children's pain adequately. Many previous studies have been focused on nurses' use of non-pharmacological methods for relieving children's pain in recent years, which indicated that

nurses have used versatile methods for children's pain alleviation (Salanterä *et al.* 1999b, Pölkki *et al.* 2001), but most of these methods were used in a manner that the nurse was in an active role and the child was passive (Salanterä *et al.* 1999b).

Many factors lead to ineffective acute pain management and the factors include nurses' and General Practitioners' lack of knowledge and experience of how to use the techniques, nurse's lack of time or resources to apply these techniques as well as caregivers' and patient's misconceptions (e.g. pain is an inevitable consequence of surgery, non-pharmacological methods are ineffective) (Caly *et al.* 1995, Woodgate & Kristjansson 1996a, Pederson *et al.* 1997, Rheiner *et al.* 1998, Howell *et al.* 2000, Robaux *et al.* 2002, Ashburn *et al.* 2004, Tapp & Kropp 2005). Nurses' lack of knowledge has been widely and repeatedly demonstrated by researchers in Europe (Salanterä *et al.* 1999b, Simons & Roberson 2002, Pölkki *et al.* 2003a), North America (Kubecka *et al.* 1996, Brockopp *et al.* 1998), Australia (Van Niekerk & Martin 2001) and China (He *et al.* 2003) in areas as follows: pain assessment (Brockopp *et al.* 1998, He *et al.* 2003), pharmacological management of pain (Salanterä *et al.* 1999b, Van Niekerk & Martin 2001) and non-pharmacological interventions for pain (Brockopp *et al.* 1998, Salanterä *et al.* 1999b, He *et al.* 2003). Another important factor is the inadequacy of pain medication administered to children postoperatively (Tesler *et al.* 1994, Kart *et al.* 1996a, Romsing 1996, Rheiner *et al.* 1998, Van Hulle Vincent 2005).

Inadequate pain education for nurses might be the most important factor leading to their lack of knowledge and this is a fact that has been supported by many earlier studies (e.g. Twycross 2000, He 2002, Simons & Roberson 2002, Pölkki *et al.* 2003a). There was no specific pain education provided to nurse students at different levels of educational institutes, and the continuing education concerning pain management provided for clinical nurses was very limited in mainland China (He 2002). Previous research suggested the need for continuing education in pain management among nurses (Francke *et al.* 1996, Lebovits *et al.* 1997, Pederson *et al.* 1997, Twycross 1999, Salanterä & Lauri 2001, Simons 2002b, He *et al.* 2003, Probst *et al.* 2005), which was considered as an appropriate way to promote pain education (Simons & Roberson 2002) and which conforms to nurses' positive attitudes towards pain management and satisfies their desire to learn different pain alleviation methods (Salanterä 1999a, Pölkki *et al.* 2003a). The effectiveness of educational

programs on the changes of nurses' pain knowledge and behaviour has been examined by many studies (e.g. Francke *et al.* 1996, Knoblauch & Wilson 1999). However, many of the studies concentrate simply on pain assessment (Francke *et al.* 1997) and the administration of analgesics (Coleman & Booker-Milburn 1996, Harmer & Davies 1998), which indicates a greater range of pain topics need to be considered.

Nowadays parents are encouraged to participate more actively in the care of hospitalized children (Kristensson-Hallström 1999, American Academy of Pediatrics 2001b, Daneman *et al.* 2003). A literature review concerning families' and children's postoperative pain suggests that families are a source of support for children in postoperative pain (Kankkunen *et al.* 2004). Parents may make a valuable contribution to the optimal management in their children's pain because they have an existing trust relationship with their children and they have a particular expertise regarding their children's behaviour (e.g. Simons *et al.* 2001, Simons & Roberson 2002, Kankkunen *et al.* 2003b). Parents are the best advocates for their children when children's pain is poorly managed and parents can also awaken nurses to their children's concern (Simons & Roberson 2002). For example, earlier studies demonstrated that compared with nurses' ratings, parents' ratings of their children's pain are closer to the children's own ratings (Jylli & Olsson 1995, Craig *et al.* 1996, Maciocia *et al.* 2003). Moreover, findings of other studies focused on parental roles in providing pain-relieving interventions for children in hospital (Woodgate & Kristjanson 1996a, Pölkki *et al.* 2002b) or at home (Gedaly-Duff & Ziebarch 1994, Kankkunen *et al.* 2003b) indicate that parents use strategies familiar to them in everyday life for alleviating their children's surgical pain. Some pain intervention studies (Pederson 1996, Christensen & Fatchett 2002, Simons & Roberson 2002) revealed that instructing parents to use non-pharmacological techniques could significantly reduce their children's pain during hospitalization. Parents can coach their child to use non-pharmacological methods like breathing skills (Powers 1999) and distraction (Kleiber *et al.* 2001, McCarthy & Kleiber 2006). In addition, involving parents in their child's care can enhance their feelings of usefulness and competency (Greenberg *et al.* 1999). Therefore, parental participation is beneficial both for the child and the family, and may have a positive effect on the child in such factors as anxiety, pain and other postoperative outcome (Kristensson-Hallström 1999, Rush & Harr 2001).

Many earlier studies concerning parental participation in general (Coyne 1995b, Kawik 1996, Neill 1996b, Callery 1997, Kristensson-Hallström 1999, 2000, Franck *et al.* 2005, Tourigny *et al.* 2005) demonstrated that parents had a strong desire to participate in their child's care by performing many of their usual care-giving tasks with the nurses' approval. Their participation increased their confidence and competences as carers. However, the situation of parental involvement in their children's pain management is not always optimistic (Coty *et al.* 1995, Salanterä 1999a, Simons *et al.* 2001, Carter *et al.* 2002). Parents have encountered many difficulties, such as lack of information and instructions (Coyne 1995b, Kawik 1996, Callery 1997, Kristensson-Hallström 1999, 2000, Kankkunen *et al.* 2002b, Pölkki *et al.* 2002a, Simons & Roberson 2002, Franck *et al.* 2004, Hug *et al.* 2005) and feeling of isolation or poor communication with nurses (Simon & Roberson 2002). Salanterä (1999a) also revealed the fact that nurses were not satisfied with their opportunities to work together with parents. Steps should be taken to encourage closer cooperation between nurses and parents and to identify the main obstacles to cooperation.

In addition to the efforts of health professionals and parents, children themselves also play an important role in their pain alleviation postoperatively. Children can express opinions about preferred postoperative outcomes and provide useful input about their care (Cucchiari *et al.* 2006). Vessey & Carlson (1996) suggested that the children themselves might administer many of the non-pharmacological methods although effective relief or appropriate preparation often requires the assistance of the nurses and children's parents. Only few studies have explored children's use of methods to relieve their surgical pain (LaMontagne *et al.* 1997b, Pederson *et al.* 2000, Pölkki *et al.* 2003b) and their experiences of how nurses and parents manage their pain in hospital (Woodgate & Kristjanson 1996c, LaMontagne *et al.* 1997b, Pölkki *et al.* 2003b).

In conclusion, most of the previous studies related to children's postoperative pain management were conducted in Europe and North America. A review of the Chinese literature shows that postoperative pain management has gradually attracted nursing researchers' interests in previous decade. However, the studies concerning postoperative pain management were fragment and few studies have dealt with nurses' use of methods in children's postoperative pain relief (Yu *et al.* 2002, Liang *et al.* 2005, Song *et al.* 2005). No research has been conducted in relation to pediatric

pain management from parents' and children's viewpoints in China. Moreover, there has been shortage of continuing pain education for nurses and no study has examined the differences of nurses' use of pain-relieving methods after the pain education in China. This study is intended to fill in these gaps.

In this study, the target group was 6-12-year-old (middle childhood) children, who were defined as school-aged children in many literature (American Academy of Pediatrics 2001a, O'Donnell *et al.* 2002). Children who are 6 to 12 years old can enrol in elementary schools in mainland China. Children in this stage start to learn to take another person's point of view; they are concrete thinkers and they can grasp symbols and classify things (DeBord 1998); they have improved in language and in neuromuscular skills (LeRoy *et al.* 2003); they can begin to relate to psychological pain and they desire to control their situation (Vessey & Carlson 1996, LeRoy *et al.* 2003). Many of non-pharmacological methods have been used successfully for pain relief with school-aged children who are able to cooperate and have adequate meta-cognitive maturity (Vessey & Carlson 1996, Pölkki *et al.* 2003b).

The purpose of this study was to describe Chinese nurses' and parents' use of non-pharmacological methods in school-aged children's postoperative pain relief, nurses' perceptions on providing guidance to parents, children's experience of their use of pain-relieving methods as well as perceptions on their parents' and nurses' use of methods for relieving their surgical pain. Besides, parents' views on their participation in their children's postoperative pain management and their recommendations to health care providers were explored. In addition, the purpose was to provide pain education to nurses and the differences among nurses in their use of these methods in practice were examined. This study is part of an international research project entitled "Pain Assessment and Alleviation in Children" at the University of Kuopio (Vehviläinen-Julkunen *et al.* 1999). The findings not only enrich nurses', parents' and children's knowledge and skills regarding the use of non-pharmacological methods in pain relief but also give health care providers clues to provide pain education to children and their parents in the future. The findings also offer directions for future research and clinical practice in China and other countries.

2 LITERATURE REVIEW

2.1 The phenomenon of pain and pain experience

Pain is an international problem (Davidhizar & Giger 2004) and it is a common problem in children (Perquin *et al.* 2000). Pain is a complex phenomenon, yet pediatric pain is even more complex due to their different stages of development. There are many ways for defining and classifying pain.

2.1.1 Definitions of pain and the phenomenon of pain and pediatric pain

A review of the literature shows that there are many definitions of pain proposed by different researchers or organizations for different purposes. In general, pain is a universal, subjective and unique experience. Pain is a complex phenomenon and can be understood as an unpleasant sensation with reactive or emotional components (Lutz 1986).

The most widely accepted definition of pain was given by International Association for the Study of Pain (1986): Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage. McCaffery (1983) proposed another definition appropriate for clinical use: “pain is what the patient says it is and exists when he says it does”, which means that the patient’s self-report is the most reliable indicator of pain (Pölkki 2002b). However, these two definitions do not apply to people incapable of self-report, such as newborn and older infants, small children, mentally retarded, comatose, demented or verbally handicapped individuals (Anand & Craig 1996, Cesaro & Ollat 1997, Stanford *et al.* 2005). Anand and Craig (1996) proposed that the behavioural alterations caused by pain are the infantile forms of self-report and should be considered seriously. The nature of these behavioural alterations depends on the repertoire associated with each developmental stage. Attention to the communicational specificity of these bibehavioral response patterns during painful events would reduce barriers to optimal pain management in children (Craig *et al.* 1996).

McGuire (1992) identified six dimensions of pain: physiologic, sensory, affective, cognitive,

behavioural and socio-cultural. Similarly, Zeltzer *et al.* (1997) regarded pain as an individualized experience with behavioral, physiological, emotional, sociocultural, and developmental components. Moreover, Montes-Sandoval (1999) conducted a concept analysis of pain, where pain was considered as a very complex concept to define and understand, where eight critical attributes related to pain were synthesized as follows: uncomfortable experience, response to a noxious stimulation, sensation that cannot be shared or perceived by others, sensation to an actual or potential injury or damage, form of verbal and/or non-verbal communication, unique experience that serves as a protective mechanism, reciprocal interaction with anxiety, and mental misperception leading to distressful thoughts. A person's expression of and reaction to pain are influenced by cultural heritage. The definition of pain is culturally influenced (Ludwig-Beymer 2003).

Pain can be variable and each patient takes on a unique set of characteristics to be evaluated (Tate & Acs 2002). A given tissue trauma may produce different sensory messages in different people or even in the same person at different times (Tyrrell 1997). Many factors can affect a person's perception of pain, such as mood, the memory of a previous painful experience, the cause of the pain and what that might signify to the sufferer, how one was brought up to view pain, and the time of day and what else is going on around (Carr & Mann 2000). Similarly, Peck (1986) reported that much of the variance of how individual respond to acute, noxious stimuli including postoperative pain is due to psychological factors such as cultural differences, observational learning, meaning of pain, fear and anxiety, neuroticism and extroversion perceived control of events.

There are four components of the clinical phenomenon of pain: nociception, pain, suffering and pain behavior (Loeser 1996). Nociception is the detection of tissue damage caused by thermal, mechanical or chemical energy. Pain is the perception of a noxious stimulus that occurs when nociceptive information reaches the central nervous system or when injury of the central nervous system leads to altered afferent input or central processing. Suffering is a negative affective response generated in higher nervous centers by pain or by other affective states (fear, anxiety, depression, isolation). Pain behaviors are what a patient says, does or does not do, which suggest that tissue damage has occurred (e.g. talking about pain, moaning, grimacing, limping, taking pain medicine, or going to doctors).

Pain threshold and pain tolerance level are two terms need to be kept in mind when we try to understand the experience of pain. The former is defined as “the least experience of pain which a subject can recognize” and the latter is defined as “the greatest amount of pain that a person is able to put up with at particular moment and in particular circumstance” (Bowsher 1993). Each individual has a different ability to tolerate pain and a different approach to being able to cope with the pain.

Pediatric pain is a complex, elusive, multi-dimensional phenomenon (Coty *et al.* 1995). Ashburn *et al.* (2004) reported that the emotional component of pain is particularly strong in infants and children. Absence of parents, security objects and familiar surroundings may cause as much suffering as the surgical incision. Rodrique *et al.* (1995) even thought that it was almost impossible to distinguish children’s emotions (such as fear, anxiety and distress) and pain. According to Peterson *et al.* (1991), the relationship between anxiety and pain is reciprocal. That is to say, fear exacerbates pain and pain in turn appears to promote fear and anxiety. Moreover, fear may cause more physical and emotional discomfort than the stressful stimulus itself. Therefore management of pain should be sufficiently diverse in order to take account of the various dimensions.

The types of strategies used to express pain by children vary according to the types of painful situation and factors such as age, gender and locus of control. Younger children tend to use self-protective behaviors (aggression or efforts to escape to prevent the procedure from occurring), seeking information and control, and/or reaching out to others for support and help. In the postoperative period, older children use controlling behaviors as their dominant coping strategies (McGrath *et al.* 1993). Although children’s developmental level affects their abilities to describe, assess and manage pain, children with normal cognitive development are able to describe their pain (Pölkki *et al.* 1999, Pederson *et al.* 2000) even at their age of 3 years (Harbeck & Pederson 1992). Pain should be anticipated, safely and effectively controlled in all children, whatever their age, maturity or severity of illness (Fisher 2000).

In conclusion, pain is a complex and subjective experience and is unique to each individual. Pain includes physiological, sensory, affective, cognitive, behavioural and socio-cultural components. Pediatric pain is a multidimensional phenomenon and the emotional component is very strong.

Children's pain perception might be influenced by their parents' cultural heritage. Children express their pain in various strategies besides self-report.

2.1.2 Classifications of pain and postoperative pain as an acute pain

There are many ways to classify pain. One classification is based on pain's location and to divide the pain into somatic or visceral pain (Bielefeldt & Gebhart 2006). Pain can also be divided into superficial, deep and referred pain (Sofaer 1998). According to Ekblom and Rydh-Rinder (1998), pain can roughly be divided into physiological and clinical pain. Physiological pain is due to the activation of nociceptive afferent nerve fibres, a group responding to potentially tissue-damaging or noxious stimuli. Activity in the nociceptive afferents is transmitted to the central nervous system and may result in reflex responses and the sensation of pain. It is normally of short duration and represents a warning system for potentially harmful stimuli. While clinical pain or pain due to pathology or injury is related to activation of the nociceptive afferents as part of a disease or trauma, and is therefore called nociceptive pain.

According to the pathophysiology of pain, pains can also be divided into nociceptive, neuropathic, psychogenic, and idiopathic categories (Lesage & Portenoy 1996). The term nociceptive refers to pains that are presumed to be maintained by ongoing tissue injury. Nociceptive pain is called somatic when the ongoing activation is related to primary afferent nerves in somatic tissues (e.g. bone, joint, or muscle) and visceral when viscera afferents are activated by injury. Neuropathic pain is pain that is believed to be sustained by aberrant somatosensory processing in the peripheral or central nervous system. Psychogenic pain refers to pain syndromes sustained mainly by psychological factors; Personality, mood, and comorbid psychiatric disorders can strongly influence the perception of pain. Idiopathic pain is a pain that exists in the absence of an identifiable physical or psychological substrate. Pain can also be classified into private and public pain based on how explicitly a person expresses pain (Helman 2000). Private pain refers to the situation where there may be no outward clue or sign that the person is experiencing pain even when the pain is very severe while public pain refers to pain behaviours that are influenced by social, cultural and psychological factors.

The most obvious division of pain falls into acute and chronic (Sofaer 1998, Bowsher 1993). Acute pain is a constellation of unpleasant sensory, emotional and mental experiences, certain autonomic responses and psychological and behavioural reactions provoked by tissue damage (Bonica 1990). Pain can be classified as chronic when it is spread beyond the usual time of tissue improvement. Chronic pain had better be regarded as a 'situation', whereas acute pain can be regarded as an 'event' (Richardson 1997).

Postoperative pain is considered a form of acute pain due to the surgical trauma with an inflammatory reaction and initiation of an afferent neuronal barrage. Postoperative pain involves multiple physiological mechanisms, including sensitization of peripheral and central neuronal pathways, and is a combined constellation of unpleasant sensory, emotional and mental experiences precipitated by the surgical trauma and associated with autonomic, endocrine-metabolic, physiological and behavioral responses (Dahl & Kehlet 2006). Recent findings suggest a self-fulfilling prophecy in adolescents' postoperative pain experience wherein teens who expect to have high levels of postoperative pain ultimately report more pain and use more opioid patient-controlled analgesia medication than those who anticipated lower levels of pain (Logan & Rose 2005). Postoperative pain is detrimental to healing because it causes patients' resistance to recovering mobility, which brings complications such as deep vein thrombosis and chest infection. Postoperative pain even causes depression and loss of morale (Hawthorn & Redmond 1998). The classification of postoperative pain is based on the pain sites and the pain intensity. Based on the pain sites, it can be classified into wound pain, somatic pain, and visceral pain. According to the pain intensity, it can be classified into mild, moderate, severe and extreme pain. Many factors affect the intensity of postoperative pain, among which are the severity of the surgical procedure, the anesthesia and analgesics administered (Palemo & Drotar 1996, Kotzer 2000, Henzler *et al.* 2004) as well as the psychological and experiential aspects in the individual's pain experience (Stevens *et al.* 1987). In this study, the focus is on children's acute, trauma-based nociceptive pain caused by surgical procedures and explicitly expressed by the children.

2.2 Pain assessment in children

Pain assessment is defined as “looking at the individual’s experience of pain, which involves identifying the occurrence, location, intensity and meaning of pain to individual patients” (Jorgensen 1995). It is well known that pain is a very complex phenomenon and difficult to be assessed. The difficulty of assessing pain objectively has been a longstanding problem in pediatric pain management (Charlton 1997, Ashburn *et al.* 2004). However, accurate, sensitive and reliable pain assessment is a cornerstone of adequate pain management. The JCAHO’s (Joint Commission in Accreditation of Healthcare Organizations) pain treatment standards require the assessment of pain in all patients, including young children in the United States (JCAHO 2001).

Appropriate management of pain in children depends on valid and reliable assessment and measurement that is implemented regularly and responded to appropriately (McGrath & Unruh 2006). As is proposed by Rutledge and Donaldson (1998), successful strategies to assess pediatric pain begin with institutional/clinical adoption of standardized protocols or program that guides and supports systematic, vigilant pain assessment and reassessment, documentation and effective communication. Tanabe (1995) proposed identifying discomfort or pain as the new D in the primary survey, and awakening the emergency nurses to the importance of pain management. There has been more focus on assessment of pain as the fifth vital sign, demanding intervention if pain scores are above 3 on a 10-point Visual Analogue Scale (Mayer *et al.* 2001, Dahl & Kehlet 2006). According to Lipman and Hayman (2000), pain management has had a long history in pediatric nursing research with most studies being related to pain assessment, and nurses have developed a variety of pain scales. Dalton and McNaul (1998) conducted a literature review of different pain scales and they called for standardizing the clinical rating of pain intensity using a 0 to 10 rating scale. One of the challenges remaining in acute pediatric pain management is the development of a simplified yet valid multidimensional pain assessment tool that addresses the entire postoperative pediatric pain experience (Vetter & Heiner 1996). Platt and Reed (2001) developed a new global pain score, Multidimensional Pain Score, which is a composite of the patient’s bedside entry of pain intensity, pain relief, mood and side effects. However, the validity for measuring postoperative pain has not been reported.

2.2.1 Different instruments for assessing children's postoperative pain

Children's pain is a subjective, private event that can only be measured indirectly with one of the three strategies: self-report measures, behavioural measures and physiological/biological measures (McGrath & Unruh 2006). Self-report measures of pain have been well developed and well validated in children's pain measurement. Behavioural measures are becoming more widely used and well validated. Physiological measures are not well validated except for the measurement of short, sharp pain. Children above 6 years old can use self-report faces scales. Children above about 8 years old can rate their pain on a 0-10 scale and can indicate descriptors of pain. Behavioural and physiological parameters can be employed to assess pain of infants, preverbal children (Hayman 1999, Howard 2003) or those who cannot undertake self-report (Ashburn *et al.* 2004), like children who have serious cognitive impairment (McGrath & Unruh 2006).

(1) Self-report measures: Self-report is the most reliable indicator of the existence and intensity of pain as pain is a subjective experience (Ludwig-Beymer 2003). It is the principle method unless a patient's age or condition makes its application impossible (Carr & Mann 2000). Children who have attained a certain degree of cognitive ability are able to provide information this way (Champion *et al.* 1998). It is possible for children as young as 3 years of age to report the location and severity of pain themselves using words appropriate to their development stage (Morton 1999). Pölkki *et al.* (1999) revealed that school-aged children (aged 7-11 years) were able to describe their pain experiences. There are now many adequate measures of short, sharp pain for all children and excellent measures for children who can undertake self-report (McGrath & Unruh 2006).

The methods of self-report include direct questioning, adjective pain descriptors, self-rating scales, numerical rating scales (NRS) and non-verbal methods (McGrath *et al.* 1993, McGrath & Unruh 2006). Among them self-rating scales, including Visual Analogue Scales (VAS) and category rating scales, were used most frequently in the immediate postoperative period, at least after major surgical procedure.

VAS is either a horizontal (Figure 1) or a vertical line, usually 10 cm in length, with verbal or pictorial anchors from ‘no pain’ to ‘worst possible pain’, on which the degree of pain is indicated (Gillies 1993, Engel 1996). Many researchers (Rose *et al.* 1999, Lee Calvin 2000, Bi *et al.* 2000, Pölkki *et al.* 2002b, LaMontagne *et al.* 2003b) have used VAS to measure children’s postoperative pain. When a 10-cm VAS was used to assess children’s worst postoperative pain, the intensity of pain fell into no pain (0 cm), mild pain (0.5–3 cm), moderate pain (3.5–6.5 cm) and severe pain (7–10 cm) (Alex & Ritchie 1992). Children over 5 or 6 years old can properly use a VAS and produce reliable and valid results. Visual analogue ratings also are correlated with behavioral measures of pain (Maunuksela *et al.* 1987) and with a verbal 11-point scale (DeLoach *et al.* 1998). Some have suggested that a vertical scale is more appropriate than a horizontal scale because children may find it easier to conceptualize the notion of greater or less intensity of pain with up and down rather than left or right (McGrath & Unruh 2006). As such an assessment is clearly highly subjective, these scales are of more value when we intend to look at the change within individuals and are of less value when we intend to compare across a group of individuals at one time point (Gould *et al.* 2001). In addition, Colored Analogue Scale (CAS) was also proved a practical visual analogue instrument for routine clinical use for 5-16-year-old children’s pain assessment (McGrath *et al.* 1996).

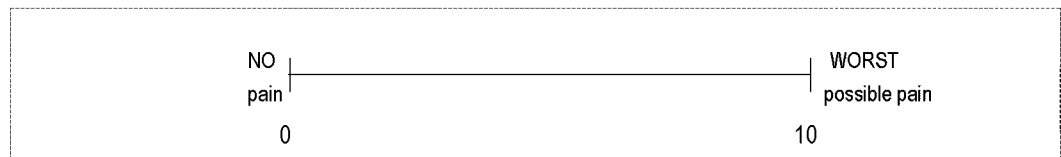


Figure 1 Visual analogue scale (pain intensity scale)

Category rating scales: in these scales, words like “no”, “mild”, “moderate” and “severe” are employed to describe the magnitude of the pain. Word-Graphic Rating Scale and Poker Chip Tool (PCT) are category-rating scales. PCT has been used to assess children’s postoperative pain (Jordan-Marsh *et al.* 2004). Faces scales are another form of category rating scale, which is inexpensive and easily understood by children, and several scales have excellent psychometric

characteristics. The Oucher scale is a good example, which is a variant of the faces scale designed to measure pain intensity in children aged 3-12 years (Beyer & Knott 1998, Beyer *et al.* 2005). Variants of the Oucher have been designed and validated for the measurement of the pain in Caucasian, African-American and Hispanic children (Beyer & Knott 1998). The Oucher scale has been used to assess the intensity of children's pain (Van Julle Vincent 2005). As the original size of Oucher was very large and the three simplified versions of the Oucher have been introduced, which was demonstrated adequate alternate forms reliability (Beyer *et al.* 2005). Beyer *et al.* (2005) believed that the smaller size of the poster would make it more accessible and easier for nurses and children to use in practice settings. A study manifested that a greater number of children and nurses preferred the Oucher scale since it was easier to use (Ramritu 2000). However, the Oucher scale has its limitations: females are not represented and nor are several other cultures.

Bieri *et al.* (1990) developed a faces scale using children's drawings of faces to assess pain intensity in children aged 6-8 years. A new version (Faces Pain Scale - Revised, FPS-R) of this scale has been developed and validated by Hicks *et al.* (2001). FPS-R is proved appropriate for use in assessment of the intensity of children's acute pain from age 4 or 5 onward (Hicks *et al.* 2001). However, a recent study revealed that over half of the 6-year-old children had difficulties using the FPS-R in response to the vignettes (Stanford *et al.* 2006). Different faces scales are available, starting with either smiling or neutral "no pain" face. A recent study that compared ratings using different faces scales (Chambers *et al.* 2005) shows that nurses' and 5-13-year-old children's ratings on the CAS were generally more similar to their ratings using scales with neutral "no pain" faces. It is also found that parents and nurses rated significantly more pain when using scales with a smiling rather than a neutral "no pain" face (Chambers *et al.* 2005). Wong-Baker FACES Pain Rating Scale is described to be reliable in pain measurement and not to depict any particular culture, age or sex (Pasero 1997). A study conducted in China showed that Wong-Baker FACES Pain Rating Scale was good for nurses to assess children's procedure pain (Zhang & Shen 2003). In addition, Chinese researchers demonstrated that Five-Finger Measure was a simpler and better way for patients to assess their postoperative pain, compared with NRS, Verbal Descriptive Scale (VDA) and FPS-R (Zhang *et al.* 2005). In this measure, the little finger, ring finger, middle finger, forefinger and thumb means "no pain", "mild pain", "moderate pain", "severe pain" and "worst pain" respectively.

(2) Behavioral measures: Behaviors such as vocalization, facial expression and body movement are often associated with pain. Many behavioral scales for postoperative pain assessment have been developed in past decades. For example, the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) was typically developed to measure postoperative pain in children and has been validated in the immediate postoperative period (McGrath *et al.* 1985). CHEOPS involves six behaviors: crying, facial expression, verbal expression, torso position, touch position and leg position. The scale is sensitive in reflecting the changes after intravenous applications of opioids and is correlated with independent pain ratings by nurses. Moreover, Objective Pain Scale (OPS) measures systolic blood pressure, crying, movement, agitation (confused excited), and complains of pain (may not be possible in younger children), which is developed for postoperative pain assessment (Wilson & Doyle 1996). Another scale, Faces, Legs, Activity, Cry and Consolability (FLACC) Behavioral Pain Assessment Scale, has been validated as an objective measure of postoperative pain in 4-18-year-old children with cognitive impairment (Voepel-Lewis *et al.* 2002) and in 3-7-year-old healthy children (Willis *et al.* 2003). It was also used by nurses, doctors and parents to assess 0-8-year-old children's postoperative pain (Leoni *et al.* 2004). A revised version of FLACC is available and its simplicity may further facilitate easy assimilation into clinical practice (Malviya *et al.* 2006). Furthermore, the Toddler-Preschooler Postoperative Pain Scale (TPPPS) has been validated for use in children aged 1-5 years undergoing surgery (Tarbell *et al.* 1992). Parents can use TPPPS to assess their young children's postoperative pain (Morgan *et al.* 2001). Children's and Infants' Postoperative Pain Scale (CHIPPS), which measures crying, facial expression, posture of the trunk, posture of the legs and motor restlessness, can be used to determine postoperative analgesic demand in the low age group of children (Buttner & Finke 2000). Other behavioral scales for children's postoperative pain assessment include Child Facial Coding System (CFCS) (Breau *et al.* 2001) and Neonatal Facial Coding System (NFCS) (Peters *et al.* 2003). NFCS has been proved to be reliable, feasible and valid. In addition, Behavioral Pain Scale (BPS) (Aissaoui *et al.* 2005) was proved to be valid and reliable for measuring pain in non-communicative patients in intensive care, especially nonverbal patients. The Individualized Numeric Rating Scale (INRS) is a useful tool to assess and reveal pain in children with cognitive impairments. INRS is an adaptation of the NRS that asks parents (and/or caregivers) to identify an individual patient's typical pain behavior and asks them to stratify that behavior on a scale from 0 to 10 (Solodiuk & Curley 2003).

The Parents' Postoperative Pain Measure (PPPM) was developed by Canadian researchers, which was based on parents' reports of what behaviours of children they used to determine whether their children was in pain (Reid *et al.* 1995). It consists of 15 items describing behavioural changes in children aged two to 12 years (Chambers *et al.* 1996) and it has been validated for the measurement of pain in children aged 7 to 12 years (Chambers *et al.* 1996, Finley *et al.* 2003) and children aged 2 to 6 years (McGrath *et al.* 1999) in Canada, as well as children aged 1 to 6 years in Finland (Kokki *et al.* 2003). Parents should medicate their child if pain rating is more than six in 15. The scale has been described to be internally consistent and strongly related to child-rated pain (Chambers *et al.* 1996) and has high sensitivity and specificity in detecting clinically significant pain.

(3) Physiological/biological measures: Pain is measured by sampling of physiological or electrical potentials and assaying body fluids or other biological responses. Heart rate, blood pressure, pulse, respiration rate, transcutaneous oxygen, sweating, nausea and the stress response are well reported to be valid as measures of pain in some circumstances. However, the utility of physiological measures is diminished by homeostatic mechanisms, which tend to oppose such changes and reduce their value over time (Howard 2003).

Several multidimensional pain assessment tools that measures both physiological and behavioral responses to pain are available. For example, CRIES (Crying-Requires increased oxygen administration-Increased vital signs-Expression- Sleeplessness) is developed for postoperative pain assessment and it has been proved to be reliable and valid for assessing neonatal pain (Pasero 2002, McNair *et al.* 2004). Moreover, the Cardiac Analgesic Assessment Scale (CAAS) measures both physiological (papillary size, heart rate, blood pressure) and behavioral (respiratory and motor response) responses to pain (Suominen *et al.* 2004). They demonstrated that CAAS can be used to assess postoperative pain in sedated and intubated children. Alder Hey Triage Pain Score (AHTPS), which observes cry or voice, facial expression, posture, movement and color, was proved to be valid and reliable to assess 0-16 years old children's pain in the accident and emergency settings (Stewart *et al.* 2004). Pain Assessment Tool (PAT) and Premature Infant Pain Profile (PIPP) were also shown as valid and reliable pain assessment tools for infants since they showed strong correlation with CRIES scores (McNair *et al.* 2004, Jonsdóttir & Kristjansdóttir 2005, Spence *et al.*

2005). In addition, Non-communicating Children's Pain Checklist- Postoperative Version (NCCPC-PV), which includes subscales of vocal, eating/sleeping, social, facial, activity, body/limb, and physiological signs, displayed good psychometric properties when used for the assessment of postoperative pain of children with severe intellectual disabilities (Breau *et al.* 2002a,b).

Many reliable and valid tools are available for use with children over 4 (Rutledge & Donaldson 1998). Children over 4 years old are better able to report pain and are able to use color scales, pictures of varying facial expression and often use VAS (Charlton 1997). Among different pain assessment tools, VAS (e.g. Bi *et al.* 2000, Pölkki *et al.* 2002b, Coll *et al.* 2004), Faces scales (Pasero 1997, Demyttenaere *et al.* 2001, Hicks *et al.* 2001, Bosenberg *et al.* 2003) and CHEOPS (Rose *et al.* 1999, Lieh-Lai *et al.* 1999) are widely accepted and validated tools for measuring children's postoperative pain. However, no single pain assessment tool is clinically and developmentally appropriate for all children. Table 1 summarized the commonly used instruments appropriate for school-aged children's postoperative pain assessment.

Table 1 Summary of common instruments appropriate for school-aged children's postoperative pain assessment

Category	Pain assessment instrument	Recommended age group
Self- report measures	1. Visual Analogue Scale (VAS)	Children aged 5 years and older
	2. Oucher scale	Children with concept of order, age 3 to 12 years
	3. Faces Pain Scale- Revised (FPS-R)	Children aged above 4 or 5 years old
	4. Wong-Baker Faces Pain Rating Scale (6 faces)	Children with concept of order, 3 years of age and older
	5. Colored Analogue Scale (CAS)	Children aged 5 to 16 years
	6. Numerical Rating Scale (NRS)	Children over 6, who understand the concepts of rank and order
	7. Eland Color Scale (ECS)	Children with concept of order
	8. Poker Chip Tool (PCT)	Younger children with concept of order, 4-8 years old
	9. Word-Graphic Rating Scale	Verbal children with concept of order
Behavioral measures	1. Children's Hospital Eastern Ontario Pain Scale (CHEOPS)	Toddlers and older children
	2. Objective Pain Scale (OPS)	Children of 8 months to 13 years
	3. Faces, Legs, Activity, Cry and Consolability (FLACC) Behavioral Pain Assessment Scale	Children aged 3 months to 7 years, or children aged 4 to 18 years with cognitive impairment
	4. Parents' Postoperative Pain Measure (PPPM)	Parents with children aged 2 to 12 years

The VAS seems to be most suitable for measuring the intensity of postoperative pain as it was found to be methodologically sound, conceptually simple, easy to administer and unobtrusive to the respondent (Coll *et al.* 2004). However, Perrott *et al.* (2004) suggested that Faces Pain Scales and Facial Affective Scale would be the most appropriate choice among currently available measures for helping children over a wide age range (5-15 years old) because they can be used to estimate the sensory and affective components of their postoperative pain separately. Previous studies have compared the correlation and preferences among different scales in children's pain assessment. For example, Robertson (1993) reported that very good correlation was found between the ratings of VAS and faces scales in children. Children, parents and nurses prefer faces scales, not VAS or NRS, to measure children's procedure pain (Keck *et al.* 1996). When the Wong-Baker Faces Pain scale, Oucher scale and the VAS were compared, the faces and Oucher scale were the most valid and reliable, while among the entire sample and in each age group studied the faces scale was the most preferred (Luffy & Grove 2003). Suraseranivongse *et al.* (2005) reported that Faces scale is a more valid, reliable and practical tool compared with Verbal Rating Scale (VRS), CAS and PCT. Among the pain scales of CHEOPS, OPS, TPPPS and FLACC, CHEOPS was proposed as a valid, reliable and practical tool (Suraseranivongse *et al.* 2001).

Several pain assessment tools have been translated into Chinese, such as NRS (McCaffery & Pasero 1999), Wong-Baker Faces scale (Davidhizar & Giger 2004) and FPS-R (von Baeyer *et al.* 2005). Several Chinese researchers have conducted literature review concerning pain assessment in children (Wang & Li 2000, Yu & Tu 2003). For example, Yu and Tu (2003) concluded that tools of OPS, TPPPS, FLACC, CRIES and CHEOPS were appropriate for children's postoperative pain assessment. However, only few studies have reported the use of pain assessment tools in children's postoperative pain assessment in Chinese hospitals (Li & Gan 2002, Zhang & Shen 2003, Yan 2005).

With the development of new technology, computer-assisted pain assessment tool has been introduced to help with the assessment of children's postoperative pain (Calam *et al.* 2000, Watson *et al.* 2002). This tool offers a number of advantages for pain assessment. For example, it can be used to assess postoperative pain of children who have difficulties in communication and who cannot

describe pain using conventional approaches. From the child's point of view, it is a novel and entertaining way of describing experiences (Calam *et al.* 2000).

2.2.2 Pediatric pain assessed by nurses, children and their parents

Nurses play a key role in the assessment of children's pain. Nevertheless, the pain assessed by the child and their parents are crucial for effective pain management in children (McArthur & Cunliffe 1998, Lee Calvin 2000). Adults have the responsibility to assess children's pain to identify the need for pain alleviation (Vessey & Carlson 1996). Although advances have been made in the assessment of postoperative pain in young children over the past decades, the assessment remains a major challenge for pediatric nurses (Hayman 1999).

Nurses believed that assessment is the first step toward alleviating children's pain. However, documentations from nurses did not show clearly that they used developmentally appropriate tools for assessment or for evaluation of children's responses to pain management strategies (Facob & Puntillo 1999). Caty *et al.* (1995) reported that verbal reports, behavioral responses and physiological signs are three major criteria frequently used by nurses to first assess and then draw inferences about pediatric pain, but verbal report supplemented by observations of behavioral and physiologic indicators for pain assessment is emphasized. However, a Finnish study suggested that only half of the nurses believed that a calm child who says she is in pain really is in pain, nurses assessed pain mainly by observing the child's behavior and changes in physiology, and therefore nurses' assessment of pain is limited and often being inaccurate (Salanterä *et al.* 1999a). Introducing the pain and symptom assessment record (PSAR) to the hospital settings has been manifested to be effective to improve nurses to assess patients' pain (Bouvette *et al.* 2002).

Nurses commonly underestimate children's pain (Romsing *et al.* 1996, Solomon 2001, Sloman *et al.* 2005) when they do not rely upon children's self-reports (Rutledge & Donaldson 1998). Most nurses thought that children over report their pain (Van Hulle Vincent 2005). The correlation between nurses' and children's pain rating appears to be fairly high if the same pain rating scale

was used to assess pain (Colwell *et al.* 1996) or when children used Poker Chip Tool while nurses used VAS to assess children's postoperative pain (Rømsing *et al.* 1996). However, contradictory findings were reported that health professionals scored pain lower than do children or guardians using both linear and Faces scales (Maciocia *et al.* 2003).

It has been claimed that parents have significant insight into their children's behaviour, and thus are better able to assess their child's pain than others (Rose 1998, Simons *et al.* 2001). Parental reports are described as reliable in the assessment of children's pain (Engel 1996) since pain assessment by children and parents has been quite similar (Chambers *et al.* 1996, Colwell *et al.* 1996, Miller 1996, McGrath *et al.* 1999, Ellis *et al.* 2002, Benini *et al.* 2004, McGrath & Unruh 2006). However, contradictory findings were also reported showing that parents tend to underestimate children's pain and that the correlations between parents' and children's pain report do not accurately reflect the relationship between these ratings (Chambers *et al.* 1998, Kelly *et al.* 2002) especially when the child reports a higher VAS score (Kelly *et al.* 2002). Recent findings also show that children's ratings of pain were only in moderate agreement with those of their parents and were in poor agreement with those of the physicians (Garcia-Munitis *et al.* 2006). Parents are said to use versatile cues to assess their children's pain. However, children's developmental status and their different coping strategies are a challenge to the parents who assess their children's postoperative pain (Kankkunen 2003).

2.2.3 Factors influencing pain assessment in children

Health care providers, children and their parents are all involved in the assessment of children's pain. Allcock (1996) conducted a literature review that described factors affecting the assessment of postoperative pain. The factors are closely related to nurse and patient characteristics and they are well grouped: nurse characteristics included experience, age, ethnic background, personal experience of pain and educational experience; patient characteristics included socio-economic status, illness severity, gender, age, evidence of pathology and ethnic variation.

Thorn (1997) found that whilst nurses were aware of the importance of postoperative pain assessment, they showed negative attitudes, inadequate knowledge and misplaced beliefs in relation to postoperative pain assessment. Nurses' personal attitude influences the intention to perform pain assessment (Nash *et al.* 1993). Health care providers tend to assess and manage children's pain in accordance with their own belief systems, assumptions and intuitions (Coty *et al.* 1995); they at least subconsciously believe that they can judge a child's pain experience accurately, and they may attribute a child's distractibility to absence of pain (Gerik 2005). Lack of knowledge of pain assessment amongst nurses suggests that continuing education may improve pain assessment (Allcock 1996). However, Nash *et al.* (1993) pointed out that unless nurses themselves perceived the deficits in the knowledge, skills and resources that they possess, interventions aimed at improvement in these areas may have little effect. Health care providers expect patients to react to pain with some predictable and visible signs (e.g. crying, muscle tension) and the absence of these typical signs may indicate adaptation on the part of the patient (Gerik 2005). All these aspects may lead to the ineffective pain assessment for many children.

A review study shows that health professionals tend to underestimate pain when performing clinical assessment (Solomon 2001). Sloman *et al.* (2005) also revealed that nurses significantly underestimated all dimensions of pain. Nurses' age, education, experience, place of work, and field of practice have very little effect on nurses' attitudes toward and knowledge of measured aspects of pain (Salanterä 1999a). Similar findings were reported by other studies. For example, nurses' professional work experience and age had little influence on the pain assessment (Coty *et al.* 1995); nurses' expertise did not influence assessment of children's pain intensity (Hamers *et al.* 1997); the types of clinical area where nurses worked and nurses' level of nursing education had no influence on their assessment of patients' surgical pain (Sloman *et al.* 2005). However, contradictory findings were reported. Solomon (2001) found that the more clinical experience a nurse has, the greater his/her underestimation of pain will be. In addition, Wilson and McSherry (2005) reveal that education and clinical experience influence nurses' knowledge of, attitudes toward and beliefs about pain and they even found that the specialist nurses tended to infer lower levels of pain than the general nurses did.

Idvall *et al.* (2002) suggested that the reason why the levels of nurses' assessment of pain intensity are usually lower than patients' may be that they subconsciously know they have no time to take actions or they feel inadequate on what actions to take to relieve the pain. According to Treadwell *et al.* (2002), previously demonstrated poor compliance with pain assessment may be in part due to inadequacies of one-dimensional tools which are used to measure pain intensity for the assessment of complex pain. Pain assessment by nurses should be standardized (Hamers *et al.* 1998). Standardized guidelines for pain assessment using tools appropriate to children's developmental ages and assessing multiple dimensions of pain where possible can result in improved pain assessment and staff's response to patient's pain (Treadwell *et al.* 2002). The use of a variety of standardized measures will help to alleviate some of the inherent bias in the assessment of a subjective and personal experience. Behavioral measures of pain may complement self-report measures, particularly when patients have difficulty expressing their pain by self-report. Tools should be selected according to the setting, the patient population and the purpose of the measure (Solomon 2001). Puntillo *et al.* (1997) suggested that when subjective reports are unavailable, the employment of a standardized, systematic method such as the Pain Assessment and Intervention Notation tool to assess behavioral and physiological indicators of pain may make treatment decision easier and increase comfort for patients in pain. Puntillo *et al.* (2002) has identified many advantages of using this tool for pain assessment and treatment.

It could be a real challenge to assess postoperative pain of children since verbal reports of pain and behavior demonstrated may be incongruous (Norman 1998, Tesler *et al.* 1998). The pain report is influenced by physiological, social and environmental factors. Reports of pain severity have been found to vary with ethnic and cultural background factors and with such factors as age, gender, education, socio-economic class and previous experience of pain (Faucett *et al.* 1994, Allcock 1996, Carr & Mann 2000, Logan & Rose 2004, Cucchiario *et al.* 2006). Adaptation, difficulties in verbalizing pain, beliefs and attitudes, personality, stress associated with hospitalization causing fear, anxiety and loss of control, a wish to protect parents, a desire to please others, a desire to get home sooner, extreme illness, weakness and depression are also factors that might influence the person's expression of pain and behavioral responses to pain (Hawthorn & Redmond 1998). In addition, the deficiency existing in pain severity reports was also found to be a factor that influences

pain assessment (Green *et al.* 2003). When pain severity is reported to be low, patients' rating and health care providers' rating of pain show good agreement; however, when high pain severity is reported, health care providers typically underestimate the pain. Hamers *et al.* (1996) also found that nurses tended to attribute the most pain to the child when the diagnosis was severe.

With regard to the influence of age on the pain report or behavioral responses, Norman (1998) found that younger children might respond to short-term, procedural pain by crying or becoming rigid, while the older ones showed a calm demeanor, maintained a single position and flexed their limbs during the first three postoperative days. Gauthier *et al.* (1998) found gender differences in the judgments of the intensities representing mild, moderate and severe pain, with girls rating these lower than boys. Recent findings confirm this finding, which indicate a more frequent prevalence of acute and chronic pain among girls with lower pain thresholds and tolerance in girls compared with boys (Perquin *et al.* 2000, Logan & Rose 2004, Cucchiario *et al.* 2006). While in pain, girls tended to shut their eyes, sleep, remain immobile and report more than boys, while boys tended to be silent, kept their eyes open, and grasped the pain sites (Norman 1998).

Although verbal reports are largely dependent on an individual child's developmental level, fluency of language and willingness to describe pain, the results of the reports as well as behavioral responses and physiological signs are also subject to the child's non-pain emotional state. Emotions such as fear, anxiety, sadness and separation have been associated with children's behavioral signs of pain (Cady *et al.* 1995). This result was supported by Pölkki *et al.* (1999); it was demonstrated that the children described their experiences of pain as both physiological (e.g. poking, stinging, aching) and psychological feelings (unpleasant feelings, anxiety, and fear). However, children may be reluctant to report pain because they feel that pain is their fault or because they may be afraid of the consequences of reporting pain (Johnston 1993). Many children will deny pain because of fear of an injection or fear of disappointing caregivers (Ashburn *et al.* 2004, Gerik 2005). Moreover, school-aged children also exhibit self-control when they are experiencing pain. They may not report pain in an attempt to show bravery (Rivera 1991). In addition, pain threshold may influence children's pain behaviors. The lower the sensory pain threshold was, the more behavioral responses were observed in children aged 8 to 12 years during venipunctures (Bournaki 1997).

The above description indicates that pain assessment through self-report and observing behaviors might not be so accurate and nurses should be aware of the problem when making pain assessment. However, nurses tended to attribute the most pain to the child when the child vocally expressed his pain (Hamers *et al.* 1996). When clear evidence of physical pain is not observed, or when there is no report of pain from the children, health care providers tend to assume that pain is not present and this influences the assessment of pain and defer treatment (Gerik 2005).

In addition, parents' lack of knowledge and skills in using different pain assessment instruments as well as lack of clear defined roles in their children's pain care might also be factors influencing their ability to help to assess their children's pain. Some investigators (Zacharias & Watts 1998, Lee Calvin 2000) demonstrated that parents tend to underestimate pain intensity because they have difficulty in estimating the degree of children's pain and they don't get any instruction in how to assess pain. There is a need to provide education to parents in pain assessment of children.

2.3 Postoperative pain management in children

It is increasingly being recognized that a multidisciplinary approach to pain management is the most appropriate way to help patients (Hall & Bowden 1996). Nurses and other health professionals should be aware of the complex nature of each patient's pain and of the fact that relief can only be effective if the treatment aims at controlling all the factors involved (Sofaer 1998). Pain control is a basic element of good nursing care and improved control of acute pain is a big challenge for nurses worldwide (Hegyvary 2004). Both pharmacological and non-pharmacological strategies appropriate for the age of the child can be utilized to reflect the multidimensional nature of pain in order to plan effective pain interventions (Ashburn *et al.* 2004)

2.3.1 Pharmacological interventions

Pain management is an interdisciplinary process. The nurse plays central role in the assessment, administration of interventions, and the evaluation of the impact of interventions on an individual (Pellino *et al.* 2005). Nurses spend most time with patients and is responsible for monitoring and reporting the effects of given treatments to ensure that an acceptable level of pain relief is achieved (Carroll 1993). In addition to the unique role of nurses in the use of non-pharmacological methods for pain relief, nurses also play an important role in the use of pharmacological interventions, including especially administering pain medication (whether to give and when to give), monitoring and preventing the side effects of analgesic agents and advising patients on the use of analgesics (McCaffery & Beebe 1994, Hawthorn & Redmond 1998). Therefore, nurses must have knowledge of pharmacology like the knowledge of analgesia in terms of dose, effectiveness, and side effects and of how drugs can be combined to give balanced analgesia and they must be able to apply this knowledge critically to their practice (Carr & Mann 2000). Furthermore, the widely used 'as needed' analgesic prescriptions in clinical settings gives nurses some flexibility when they are to decide the most appropriate dose of analgesic agent at a particular time (Hawthorn & Redmond 1998).

Commonly used analgesics in postoperative pain management in children are opioids, non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol. Table 2 presents the common drugs for children's postoperative pain relief with the reference of earlier studies (e.g. Atcheson & Rowbotham 1998, Rawal 1998, Edwards *et al.* 1999, Power & Barratt 1999, Prescott 2000, Hyllested *et al.* 2002, Rømsing *et al.* 2002, Møiniche *et al.* 2003, Moore *et al.* 2003, Hamunen & Kontinen 2005, Dahl & Kehlet 2006, McQuay & Moore 2006, Schug & Gandham 2006). The dose and dosage intervals presented in Table 2 are based on three literature review studies (Wang & Li 2000, Berde & Sethna 2002, Lundeberg & Lönnqvist 2004). However, the dose must be adjusted according to the individual needs (Lundeberg & Lönnqvist 2004) and the dosage interval should be determined according to the effect duration of each drug, which will commonly be 3-4 hours for opioids and 4-6 hours for NSAIDs (Tempest 1993).

Table 2 Summary of common drugs for children's postoperative pain relief

Types of analgesics	Indications, side effects, contraindications, and available routes of administration	Common drugs	Suggested route of administration, dose and dosage intervals (hours)		
1. Opioids	Indications: For moderate and severe pain relief, except codeine that is used for mild or moderate acute pain relief. Side effects: Nausea, vomiting, constipation, drowsiness, sedation, cognitive impairment, cough suppression, urinary retention, respiratory depression, tolerance and dependence. Contraindications: Patients with respiratory depression or raised intracranial pressure. Routes of administration: PO, IV, IM, subcutaneous, rectal, epidural, sublingual, oral transmucosal, transdermal and intranasal, among them IV (PCA) is the ideal one. Oral opioids are used early in the course of recovery. Epidural administration of opioids, in combination with local anesthetics, is a way to provide excellent postoperative analgesia.	Morphine	IV injection	0.05-0.15 mg.kg ⁻¹	2
			PO	0.3-0.6 mg.kg ⁻¹	12
			IM	0.1-0.15 mg.kg ⁻¹	3-4
			IV infusion	10-40 µg.kg ⁻¹ .h ⁻¹	
			Fentanyl	IV injection	0.5-2 µg.kg ⁻¹
		Pethidine	IV injection	0.8-1 mg.kg ⁻¹	2
		Codeine	PO	0.5-1 mg.kg ⁻¹	4
2.Non-opioids					
(1) NSAIDs	Indications: For mild to moderate acute pain relief. Side effects: Allergic reaction, nausea, vomiting, drowsiness, sedation, anxiety, dyspepsia, indigestion, gastrointestinal and surgical site bleeding, acute renal failure or congestive heart failure. (They are seldom seen if NSAIDs are used less than 5 days postoperatively.) Contraindications: Patients with a history of gastric ulceration, asthma, renal and hepatic disease, hypertension, cardiac failure, and patients at risk from bleeding such as undergoing tonsillectomy. Routes of administration: PO, IV, IM, rectal.	Ibuprofen	PO	4-10 mg.kg ⁻¹	6-8
		ketoprofen	IV injection	0.3-0.5 mg.kg ⁻¹	6-8
		Naproxen	PO	5-7.5 mg.kg ⁻¹	8-12
		Clonidine	PO, IV	1-3 µg.kg ⁻¹	8-12
		Ketamine	IV infusion	25-100(-200) µg.kg ⁻¹ .h ⁻¹ (Starting from the low dose range and titrating to optimal effect)	
(2) Paracetamol	Indications: For mild to moderate acute pain relief, It is of value for patients NSAIDs are contraindicated like gastrointestinal complications. Side effects: Nausea, dizziness or drowsiness. Overdosage can cause hepatic failure. (Paracetamol is recommended as a basic analgesic component in most operations due to its limited side effects.) Contraindications: It is contraindicated for use in patients with known hypersensitivity or idiosyncratic reaction to paracetamol. Routes of administration: PO, rectal and IV ^a . Orally administered paracetamol is more effective than the same dose rectally.	Paracetamol	PO	20-25 mg.kg ⁻¹ (15-20 mg/kg if it is used for longer than 2-3 days)	6
			Rectal	20-40 mg.kg ⁻¹	8
		Propacetamol	IV injection	30-40 mg.kg ⁻¹	6
		Paracetamol (in the mannitol solution)	IV injection	15-20 mg.kg ⁻¹	6

PO= oral, IM= intramuscular, IV= intravenous, PCA= patient-controlled analgesia. ^aIntravenous paracetamol is available in only a few countries at present, but it seems inevitable that it will be marketed much more widely in the future (Prescott 2003).

The ideal analgesic should be effective, safe, easy to administer, and free from respiratory depression (Finkel & Hannallah 2002). Pain after minor surgery is usually managed with oral or rectal NSAIDs and opioids (e.g. codeine) analgesics singularly or in combination. Pain after major surgery is managed with parenteral or regional opioids until the child can tolerate oral intake (Finkel & Hannallah 2002). While opioids are frequently prescribed for children with severe pain postoperatively, NSAIDs (Kokki *et al.* 1994, Romej *et al.* 1996, Kokki *et al.* 1999) and paracetamol (Rømsing *et al.* 2002) are nowadays more frequently used for postoperative pain treatment and their effect has been manifested. A recent review study reports that paracetamol is the most widely used analgesic drug in pediatric practice (Lundeberg & Lönnqvist 2004). The combination of paracetamol and codeine (Moore *et al.* 2003), ketoprofen (Salonen 2002) or NSAIDs (Rømsing *et al.* 2002) is far more effective than either drug alone.

The pain relief itself should not be painful (Salanterä 1999b, Pölkki 2002b). Painful intramuscular injections that are children's worst fear at hospital should be avoided (Kankkunen 2003) and thus it is better to use intravenous, oral or rectal routes of administration (Charlton 1997). According to Sepponen *et al.* (1999), since some children disliked suppositories, the use of small tablets or mixtures is worth considering. However, the main problems in administering ketoprofen tablets to children lie in the difficulty for children to swallow tablets and the terrible taste of tablets. Considering the above problem, we can see that solution could be more pleasant and accurate formulation of analgesic for small children than tablet or suppository (Nikanne 1999). Techniques such as patient-controlled analgesia can be used to children older than 5 years old (Monitto *et al.* 2000, Birmingham *et al.* 2003), and nurse-controlled morphine infusions that allow more flexibility in administering analgesia are commonly used to those too young to use patient-controlled analgesia (Doyle *et al.* 1993, Lloyd-Thomas & Howard 1994). With proper education and supervision, patient- and nurse-controlled continuous opioid infusions in children are considered excellent methods of pain control (Kokinsky & Thornberg 2003). Intravenous patient-/nurse-controlled analgesia are safe and effective for pediatric patients who have moderate to severe pain after operations (Monitto *et al.* 2000, Shin *et al.* 2001).

Many studies have examined nurses' use of pharmacological interventions in children's pain relief (e.g. Hamers *et al.* 1994, Broome *et al.* 1996, Clarke *et al.* 1996, Hamers *et al.* 1996, Ljungman *et al.* 1996, Rømsing 1996, Coffman *et al.* 1997, Hamers *et al.* 1997, Pederson & Parran 1997, Hamers *et al.* 1998, Rheiner *et al.* 1998, Jacob & Puntillo 1999, Rush & Harr 2001 Karling *et al.* 2002, Van Hulle Vincent 2005). Most of the studies indicated that nurses administered insufficiently the prescribed medication to relieve children's pain. Nurses' lack of knowledge in pharmacological pain management was also frequently reported (e.g. Read 1994, Clarke *et al.* 1996, Pederson & Parran 1997, Salanterä 1999b, Van Niekerk & Martin 2001). Nurses' lack of knowledge, their attitudes toward and myths in children's pain and pain medication are closely related to the inadequacy of pain relief in children. Moreover, the deficit of the documentation of pain management process might be related to the inadequate administration of analgesics (Briggs & Dean 1998, Idvall & Ehrenberg 2002).

Studies related to parents' role in pharmacological methods (Gedaly-Duff & Ziebarth 1994, Finley *et al.* 1996, Woodgate & Kristjanson 1996a, Rømsing & Walther-Larsen 1996, Kankkunen *et al.* 2002b) showed that parents also gave inadequate dose of medication to control their children's pain and their lack of knowledge and their misconceptions about pain medication have been recognized. Several studies have examined pharmacological methods in pain relief from children's viewpoint (Cummings *et al.* 1996, Gauthier *et al.* 1998, Rheiner *et al.* 1998, Ellis *et al.* 2002). Results showed that children complained of pain; they were under-medicated for postoperative pain and they endure unacceptable levels of pain.

The previous findings indicate that in order to achieve optimal pain management in children, there is a need to improve nurses' and parents' knowledge in pharmacological methods for pediatric postoperative pain alleviation and to clarify their misconceptions on children's pain and pain medication. However, education alone will not improve the administration of analgesia (Willson 2000). The study recommends that the voice of patients should be heard more clearly, that the administration of analgesia should be separated from the routine drug round, that attention should be paid to how decision-making by nurses is supported in clinical settings and that education should be organized on a multidisciplinary basis. More discussion will be presented in Section 2.3.6.

2.3.2 Non-pharmacological interventions

Non-pharmacological interventions can enhance activity in descending inhibitory systems and thereby decrease pain perception. Attenuation of transmission of impulses to the spinal cord can be achieved by stimulation of large sensory nerve fibers mediating sensations of touch and heat/cold. These interventions may also modulate pain sensation and response to pain through changes in attention and decreasing apprehension (Mathew & Mathew 2003) and thus altering or suppressing painful sensations. The most convincing explanation of how the psychological factors affect our perceptions of pain is the “gate control theory” first put forward by Melzack and Wall (1965). They proposed that sensory information coming from the body’s periphery may be transmitted through the spinal cord to the brain directly. As the result of certain emotions or other cognitive factors, however, the brain may send a signal down the spinal cord that “closes a gate” and prevents that information from ever getting into sensory awareness. Many subsequent versions and modifications of the theory have been published, but Bowsher (1993 p. 11-12) gave an essential interpretation: imagine the central nervous system as a field surrounded by a fence which can be entered through a gate. Pain enters through the gate from outside and the more pain, the wider the gate opens. There are two ways in which the gate can be closed: it can be pulled to close from the outside (by the activation of large peripheral A β nerve fibers carrying impulses generated by light mechanical stimuli such as touch, rubbing/massage, TENS, or vibration) or push to close from the inside (by the activation of various inhibitory systems descending from higher centers in the brain. These inhibitory systems can be activated by the use of cognitive-behavioral methods such as distraction and relaxation, or acupuncture.

Non-pharmacological methods comprise a variety of approaches that do not involve the use of drugs but make pain tolerable and give children a sense of control over the situation (Catty *et al.* 1995, Pederson 1996). Considering the patients’ audits and earlier research findings, Pellino *et al.* (2005) believe that non-pharmacological methods may be more acceptable to patients than increasing analgesics and, together with analgesics, may provide better pain relief. These methods provide an additional strategy that may be used independently for mild pain management or in

conjunction with medication administration for moderate or severe pain management (Cady *et al.* 1995). These techniques are useful and often indispensable adjuncts to procedural sedation and analgesia (Krauss 2001). The advantages of using these methods include that most of them are simple to use, require minimal training and equipment, allow patients to become active participants in their own care, and families can be very involved and actually provide many of the therapies (Doody *et al.* 1991, Turner 2005). Recent study shows that a comprehensive non-pharmacologic postoperative pain management program in children receiving a liver transplant was associated with decreased pain scores, improved parent perception of pain, and an increased number of pain assessments per 12 h shift (Sharek *et al.* 2006). The goal of non-pharmacological interventions for pain management is to reduce pain, minimize adverse effects from opioids (Good *et al.* 1999).

Non-pharmacological methods are also called psychological interventions (Sclare & Waring 1995, Kazak *et al.* 1996, Rawal 1998, Shipton 1999, Kazak & Kunin-Batson 2001, O'Donnell *et al.* 2002), cognitive-behavioral interventions (McCarthy *et al.* 1996, Powers 1999, Turk & Flor 2006), non-drug approaches (Jonas *et al.* 1998), non-invasive pain-relief measures (McCaffery & Beebe 1994, Sofaer 1998), alternative methods (Rusy & Weisman 2000), mind-body therapies (Gerik 2005), or complementary and alternative medical therapies (Lin *et al.* 2005). Some researchers have divided these methods into categories (Vessey & Carlson 1996, Pölkki *et al.* 2001, Gerik 2005), but a given classification is not exclusive of the others (Vessey & Carlson 1996). For example, Gerik (2005) categorized these techniques as kinesthetic, behavioral, imaginable, sensory, cognitive and cognitive-behavioral. In this study we used Pölkki *et al.*'s (2001) classification (Table 3), where non-pharmacological methods are divided into five categories: (1) Cognitive-behavioural methods, such as preparatory information, imagery, distraction, relaxation, breathing technique and positive reinforcement; (2) Physical methods, such as thermal regulation, massage, positioning and TENS; (3) Emotional support, such as presence, comforting/reassurance and touch; (4) Helping with daily activities; and (5) Creating a comfortable environment. Pölkki (2002b) made a very good synthesis of the descriptions of the above methods. Table 3 also presents similar descriptions according to Pölkki's (2002b) and other literatures (Mobily *et al.* 1993, McCaffery & Beebe 1994, Kleiber & Harper 1999, Kazak & Kunin-Batson 2001, O'Donnell *et al.* 2002, Ludwig-Beymer 2003, Gershon *et al.* 2004, Pellino *et al.* 2005, Barlas & Lundeberg 2006).

Table 3 Classification and descriptions of non-pharmacological methods for children's pain relief

Non-pharmacological methods	Descriptions
<i>Cognitive-behavioral methods</i>	Involving the child's cognition, expectancies or appraisals and resulting in a modification of his/her behavior. These methods can affect children's perceptions of pain by leaving less attention or focus available to perceive pain and thus altering or suppressing painful sensations.
Preparatory information	Providing systematic cognitive information (about the procedure, what will be done) and sensory information (what it may feel like) to help children develop realistic expectations for the procedure.
Imagery	The use of one's imagination to develop sensory images that either can decrease the intensity of pain or can become a nonpainful or pleasant substitute for pain. Guiding children to focus intensely on a pleasant, vivid mental image (with auditory, visual, and kinesthetic components). Imagery distracts children from pain. Imagery may be used for distraction from pain, to produce relaxation and to produce an image of pain relief. Research suggests that pleasant imagery can effectively reduce the perception of post-surgical pain.
Distraction	Focusing attention on the distracter rather than the pain sensation. Stimulates the major sensory modalities of hearing, vision, touch, smell, movement. Distraction may increase the client's tolerance for pain by placing pain at the periphery of awareness. Strategies include watching TV/video, listening to music, reading books, playing games, telling a story, humor, doing hobby crafts, or virtual reality. To be effective, the distraction must be interesting to the child, consistent with the child's energy level and ability to concentrate.
Relaxation	Resulting in an altered state of consciousness and producing a decrease in sympathetic nervous system activity. It causes relative freedom from anxiety and skeletal muscle tension.
Breathing techniques	Teaching the child to take deep and slow breath.
Positive reinforcement	Giving specific labeled praise and tangible rewards (e.g. sticks) after completing a painful procedure.
<i>Physical methods</i>	Stimulating physically different sites of the body.
Thermal regulation	Providing heat (e.g. warm pillow/towel) or cold application (e.g. cold drink, cold towel, ice bag) to the painful sites.
Massage	Manipulating soft tissue to reduce muscle spasms and tension. Endorphin release, neural gate control, reduction of ischemia through local circulatory stimulation, and skeletal muscle relaxation via parasympathetic stimulation are believed to be mechanisms underlying the usefulness of massage in decreasing pain.
Positioning	Helping the child to find a comfortable position.
TENS	Stimulating primary afferents by low-voltage controlled electrical pulses through electrodes applied to the skin. Stimulation need not be applied directly to the painful site to be effective.
<i>Emotional support</i>	Providing emotional support to the child.
Presence	Just being with the child (e.g. sitting beside the child).
Comforting/reassurance	Comforting the child by talking to the child in a reassuring voice or telling him/her that everything will be all right and so on.
Touch	Touching the child, like stroking the child's head or holding his/her hand.
<i>Helping with daily activities</i>	Assisting the child with daily activities, such as helping to eat, move or wash after the surgical procedure.
<i>Creating a comfortable environment</i>	Paying attention to the comfort level of the hospital environment. Comfort can be achieved by minimizing noise problems, maintaining a comfortable temperature and air conditioning, providing favorite belongings to the child and improving the interior decoration of the ward.

Cognitive-behavioral methods were well reported to be effective in pediatric pain relief and among the methods are distraction (Vessey *et al.* 1994, Kleiber & Harper 1999, Lambert 1999, Carlson *et al.* 2000, Kleiber *et al.* 2001, Laurie 2001, Sparks 2001, Sander Wint *et al.* 2002, Tse *et al.* 2002, Press *et al.* 2003, Gershon *et al.* 2004), imagery (Lambert 1996, Lambert 1999, Huth *et al.* 2004, Pölkki *et al.* 2005), relaxation (Seers & Carroll 1998, Good *et al.* 2001, Schaffer & Yucha 2004), breathing technique (Pasero & Smith 1997) and preparatory information (Engel 1996, Kolk *et al.* 2000). Children's individual factors and developmental needs should be considered when these interventions are designed to prepare them for surgery (LaMontagne *et al.* 2003a). We can see that recent studies show much interests in the use of imagery (Huth *et al.* 2004, Pölkki *et al.* 2005, Huth *et al.* 2006) and distraction (e.g. Sander Wint *et al.* 2002, Tse *et al.* 2002, Press *et al.* 2003, Gershon *et al.* 2004) for school-aged children's postoperative pain relief. Huth *et al.* (2006) revealed that children most often imagined going to the park when they used the audiotape provided. The effectiveness of music (as a strategy of distraction) in postoperative pain relief has been widely reported (Good *et al.* 2001, Nilsson *et al.* 2003, Ikonomidou *et al.* 2004).

Among physical methods, TENS was a method whose effectiveness for pain relief has been examined in many studies (Lander & Fowler-Kerry 1993, Mobily *et al.* 1994, Carroll *et al.* 1996, Kubsch *et al.* 2000, Lee *et al.* 2002); its analgesic effects (Bjordal *et al.* 2003) and dosage effect (Chesterton *et al.* 2002, 2003) have been recognized for postoperative pain alleviation. The effectiveness of massage was also found in the relief of postoperative pain (Wilkinson 1996, Nixon *et al.* 1997) and in the increasing level of "calm" when used after the cardiac surgery (Hattan *et al.* 2002). Other methods like emotional support, helping with daily activities and creating a comfortable environment were reported to have been used by nurses (Vessey & Carlson 1996, Pölkki *et al.* 2001) and parents (Pölkki *et al.* 2002b), among which only the effects of presence of family members and friends were well reported by previous studies (Bauchner *et al.* 1996, Wolfram & Turner 1996, Kain *et al.* 1998, Powers & Rubenstein 1999, Rush & Harr 2001). Wiroonpanich and Strickland (2004) revealed that children attributed the cause of "getting hurt" postoperatively to many conditions, such as daily activities (e.g. walking, sitting, laying down and change their body position), interacting with others, medical procedures (e.g. injections, and blood drawing), and the environment (e.g. noise, light, separating the child from favorite teddy bears, dolls, or children's

games). The results indicate that more attention should be paid to the use of methods of helping with daily activities and creating a comfortable environment to the hospitalized children.

In addition to the methods included in Pölkki *et al.*'s categories (2001), desensitization, reframing beliefs/changing memories, modeling/behavioral rehearsal are also cognitive-behavioral methods for procedure pain management (Kazak & Kunin-Batson 2001, Song *et al.* 2005). Desensitization means gradually exposing children to stimuli associated with the procedure. Reframing beliefs/changing memories means to help children to realistically appraise the situation and evaluate their ability to cope with it in order to increase self-efficacy and reduce anticipatory anxiety. Modeling/behavioral rehearsal means letting children to observe another child undergoing a mock procedure but demonstrating positive coping behaviors (a video can help with this). Children can then practice these strategies by rehearsing with the therapist, staff or parents. Other interventions such as hypnosis and biofeedback have been used for children undergoing painful medical procedures (Lambert 1999, Kazak & Kunin-Batson 2001). Acupuncture (Ludwig-Beymer 2003), acupressure (Chen 2003) and manual pressure (Chung *et al.* 2002) are also useful non-pharmacological pain-relieving methods. Moreover, special feeding techniques, limited playing, pain-specific methods, balancing the child's emotion, administration of nature health products and re-establishing joy are identified as the common non-pharmacological methods that parents may use at home to manage their child's pain (Kankkunen *et al.* 2002b).

A review of the Chinese literature shows that the concept of non-pharmacological methods for pediatric postoperative pain, including distraction, relaxation, imagery and positioning, has been introduced in a review study for about 10 years (Deng 1997). However, only a few studies have focused on nurses' use of different non-pharmacological methods in pain relief in the past decade and, among the non-pharmacological methods, giving preparatory information has been most often mentioned for postoperative pain relief (Chen & Shao 1998, He 2000, Song *et al.* 2005). Besides, relaxation (Wei 2002), music as a method of distraction (Chen 2003) and pressing ear acupoints (Chen 2003) were also reported to be effective methods in postoperative pain alleviation. Moreover, few studies have reported the use of psychological methods or cognitive-behavioral methods for children's pain alleviation caused by surgery (Yu *et al.* 2002, Liang *et al.* 2005, Song *et al.* 2005) or

by medical treatment (Li & Zhang 1999). For example, Yu *et al.* (2002) demonstrated the effectiveness of using a combination of different methods including touch, distraction, creating a comfortable environment and positioning to relieve children's postoperative pain. Liang *et al.* (2005) also showed that the use of combined methods like distraction, guided imagery, suggestive therapy and music could relieve children's pain when children were undergoing urethra dilation after hypospadias surgery. Song *et al.* (2005) provided psychological nursing intervention to children who had undergone viable liver transplantation and the intervention included providing modeling, giving preparatory information, distracting children and creating a comfortable environment; it was revealed that these interventions were effective in reducing the children's postoperative pain and uncomfortable feelings. Recently, Xiao & Zhao (2005) conducted a literature review on pediatric postoperative pain management, where the influences of postoperative pain on children, misconceptions about pediatric postoperative pain, postoperative assessment tools and pharmacological methods in pain relief were described. However, the contents about non-pharmacological methods only concerned the preparatory information for children and their parents. Another recent review study revealed that distraction, hypnosis and positive reinforcement were useful techniques for children's postoperative pain relief (Wang *et al.* 2005).

2.3.3 Nurses' expertise in children's postoperative pain alleviation

As a member of the multi-disciplinary team, nurses play an important role in the management of pain, since they spend most time with the patient and are responsible for the administration of analgesic drugs, assessment, monitoring and reporting the effects of the given treatments to ensure that an acceptable level of pain relief is achieved (Carroll 1993). The nurse may make a significant contribution to pain control by being able to offer a variety of non-pharmacological methods of pain relief for the patients to use in combination with the more traditional methods of analgesia or local anaesthesia (McCaffery 1990).

The number of researches focused on nurses' use of non-pharmacological methods for relief of children's pain has been on the rise in recent years. Researchers from Europe (Salanterä *et al.* 1999b, Pölkki *et al.* 2001) and North America (Coty *et al.* 1995) report that nurses frequently use these

methods, especially those easy to apply and do not require any special equipment (Salanterä *et al.* 1999b). Nurses' most frequent use of non-pharmacological techniques is with children undergoing painful procedures (Pederson & Harbaugh 1995). Emotional support, helping with daily activities and creating a comfortable environment were methods used routinely by Finnish nurses (Pölkki *et al.* 2001). Providing relaxation, positioning, distraction, company, and explanation of pain were most commonly used non-pharmacological interventions methods for 7-year-old children's pain relief (Coty *et al.* 1995). Many factors affect nurses' use of pain-relieving methods for children. For example, Finnish nurses' age, education, year of graduation and the unit in which they worked were found to be significantly associated with the type of methods they used (Salanterä *et al.* 1999b). Pölkki *et al.* (2001) demonstrated that Finnish nurses' age, education, professional work experience, the number of his/her own children, and experiences of earlier hospitalizations of his/her children as well as the hospital and ward where nurses worked, were statistically significantly related to their use of some non-pharmacological methods. On the other hand, the study conducted by Coty *et al.* (1995) in Canada showed that nurses' professional work experience and age had little influence on the pain management process of children.

In addition to using pain-relieving methods for children's pain alleviation, nurses are also responsible for educating children's parents to use these methods for their children's pain management in order to achieve an optimal result. Although the importance of and the need for parental participation in their child's pain management are acknowledged, parents lack related information of and instructions in their expected roles (e.g. Kristensson-Hallström 1999, Tönz *et al.* 1999, Kankkunen *et al.* 2002b, Pölkki *et al.* 2002a, Simons & Roberson 2002, Franck *et al.* 2004, Hug *et al.* 2005). Salanterä (1999a) revealed the fact that nurses were not satisfied with their opportunities to work together with parents. This fact may have the result that nurses do not involve parents in the assessment and decision-making process when they manage the child's pain. Steps should be taken to encourage closer cooperation between nurses and parents and to identify the main obstacles to cooperation.

Nurses play a key role in improving parents' knowledge of pain management. Some studies (Naber *et al.* 1995, Pederson 1996, Simons & Roberson 2002) have indicated that instructing parents to use

non-pharmacological techniques could help to achieve the goal to reduce their child's procedural pain. Pölkki (2002a) reported that nurses informed parents mostly about their child's surgical procedure on both cognitive and sensory information as well as the non-pharmacological methods employable for relieving their child's surgical pain based on the nurses' perceptions. Moreover, nurses' own experience of earlier hospitalization of their children appeared to affect strongly the extent of their reports of provision of parental guidance for pain relief. Written instructions (Pölkki *et al.* 2001, Simons *et al.* 2001, Kankkunen *et al.* 2003a) such as booklets and educational videotape (Greenberg *et al.* 1999, Wisselo *et al.* 2004) can be applied in conjunction with an oral explanation to reinforce the information given to parents (Bellew *et al.* 2002).

An integrative research review confirms that children and their parents need preparation before the surgical experience (O'Conner-Von 2000). It is the responsibility of nurses, therefore, to develop and evaluate preparation strategies that will enhance children and parents' ability to cope with surgery. Three key components of preparation were suggested: firstly, providing information about the experience for children; secondly, encouraging emotional expression of concerns and thirdly, establishing trust between the children and the health care provider.

2.3.4 Parental participation in their children's pain alleviation

Concepts of parental participation have evolved from parental involvement to partnership in care and finally to family-centred care (Coyne 1996). In this study, parental participation means more than parents' accompanying with their children in hospitals. Parental participation also means parents' involvement in decision-making and performing some tasks related to their child's pain care. The success of increased parental involvement depends on two factors: the willingness of the nursing staff and the enthusiasm of the parents (Palmer 1993). Daneman *et al.* (2003) revealed that health care providers welcome parent participation, but they tend to draw the line on what they believe are suitable parent activities.

Traditionally, parents or other family members play a very important role in taking care of their hospitalized children in most of the hospitals in mainland China, which is similar to an earlier research finding that parents in developing countries were expected to care for their children postoperatively (Alsop-Shields 2000). Parents are also encouraged to participate more actively in the care of hospitalized children in developed countries (Kristensson-Hallström 1999, American Academy of Pediatrics 2001b, Daneman *et al.* 2003). However, parents' wishes to be involved in caring for their children are not being fulfilled in either developed or developing countries (Alsop-Shields 2000). Parents are in a strong position to support their children's use of these non-pharmacological methods (Pederson 1996), but they need to be active participants and co-operators with the staff to make these methods effective.

Involving parents in the assessment and management of children's pain would improve the effectiveness of pain management strategies because parents have an existing trust relationship with their children and because they have knowledge of and experience in detecting subtle changes in their children's behaviour (Pederson 1996, Woodgate & Kristjanson 1996b, Simons *et al.* 2001, Simons & Roberson 2002, Kankkunen *et al.* 2003b). Parents can define the terms their children use to describe pain or how a prior experience with pain might influence a child's outward behavior (Rush & Harr 2001). On some occasions like when the child has impaired speech or motor disability resulting in impaired or a typical physical movement, parents will be very helpful in recognizing children's communication of pain (McGrath *et al.* 1993). Generally, children are ready to let their parents know their feeling of pain but hesitate to let a nurse know that. Therefore, parents are the best advocates for their children when their pain is poorly managed and then parents can bring their children's concerns to the nurses' attention (Simons & Roberson 2002). In addition, involving parents in their child's care can enhance their feelings of usefulness and competency (Greenberg *et al.* 1999). Therefore, parental participation is beneficial both for the child and the family (Kristensson-Hallström 1999, Rush & Harr 2001).

However, as revealed by earlier studies concerning parental participation (Kristensson-Hallström & Elander 1994, Coyne 1995a, b, Neill 1996a, Kristensson-Hallström 1999, 2000, Franck *et al.* 2005, Tourigny *et al.* 2005), parents desire to participate in their children's care by performing many of

their usual care-giving tasks. However, they often lack information of and instructions in their expected roles (Coyne 1995b, Kawik 1996, Callery 1997, Kristensson-Hallström 1999, 2000, Tönz *et al.* 1999, Kankkunen *et al.* 2002b, Pölkki *et al.* 2002a, Simons & Roberson 2002, Franck *et al.* 2004, Hug *et al.* 2005) although contradictory finding was also found (Bellew *et al.* 2002), which was realized as a challenge in children's pain alleviation (Pölkki *et al.* 2002a, Kankkunen *et al.* 2003b). A high expectation among parents for perioperative information has been reported (Kain *et al.* 1997, Bellew *et al.* 2002). Some research findings concerning parental participation in their child's pain management (Simon & Roberson 2002, Franck *et al.* 2004) demonstrated that besides their lack of information, parents experienced other difficulties such as feeling of isolation or poor communication with nurses. In addition, Carter *et al.* (2002) revealed that parents often felt ignored in pain management and under-used as a resource by health professionals. All the difficulties experienced by parents may be regarded as factors that influence the extent of parents' participation in their children's care.

Some investigators (Zacharias & Watts 1998, Lee Calvin 2000) demonstrate that parents tend to underestimate pain intensity and under-medicate children for pain because they have difficulty in estimating the degree of children's pain, because they do not have instruction in how to assess pain and because they lack knowledge of what appropriate actions to take. Parents have a number of misconceptions concerning the pain treatment and they worry about side effects of medication, tolerance and addiction of their children. Hence, they often use as little medication as possible or only as a last resort (Nikanne 1999). Moreover, parents have also expected their children to be in mild or moderate pain after surgery (Rømsing & Walther-Larsen 1996) and then the need for pain alleviation in children may therefore not be completely met. In addition, myths and culturally embedded perceptions of children's pain may influence parents' use of pain alleviation methods (Kankkunen 2003). Lee Calvin (2000) reveals that when parents have a clearer understanding of pain management, there is a decrease for their child in preoperative anxiety, greater patient satisfaction and fewer missed school days. Parents with more knowledge about pain assessment and management might have less upset and cope more effectively with a variety of coping measures (LaMontagne *et al.* 1997a). McArthur and Cunliffe (1998) also found that knowledge of pain management could contribute greatly to families' confidence in their children's treatment.

Furthermore, it is helpful to include parents by awakening them to the importance of their roles in reinforcing coping behaviors of their children during the recovery period.

Parents expressed their need for more information and support in pain management from the nursing staff (Woodgate & Kristjanson 1996b, Ashburn *et al.* 2004, Franck *et al.* 2004, Kankkunen *et al.* 2004). If parents received systematic information, instruction and clear guidelines about postoperative care, they could take a greater part of the care of their children and manage their child's pain better (Kristensson-Hallström *et al.* 1997, Bishop-Kurylo 2002, Jonas 2003). Some studies (Powers *et al.* 1993, Naber *et al.* 1995, Pederson 1996, Christensen & Fatchett 2002, Simons & Roberson 2002) have indicated that teaching parents to use non-pharmacological techniques to their children could reduce the child's procedural pain. Parents can coach their child in use of non-pharmacological methods, such as breathing skills (Powers 1999) and distraction (Kleiber *et al.* 2001, McCarthy & Kleiber 2006). Well prepared parents and parents showing confidence in their parental role could possibly transmit security to their child and cause their child to experience less pain (Kristensson-Hallström 1999, Kleiber *et al.* 2001). However, there is a gap between nurses' and parents' perceptions on the support provided to parents by health care providers. That is, nurses held the conviction that parents had received many support from them while parents felt they had not received so much support from the nurses (Simons 2002a).

Earlier studies have demonstrated that parents can assess pain in young children after surgery by using a behavioural observational scale (Morgan *et al.* 2001) and parents' ratings of their children's pain are closer to the children's than nurses' ratings are (Jylli & Olsson 1995, Craig *et al.* 1996, Maciocia *et al.* 2003). Several studies focused on parental roles in providing pain-relieving interventions for children in hospital (Woodgate & Kristjanson 1996a, Kleiber *et al.* 2001, Pölkki *et al.* 2002b) or at home (Gedaly-Duff & Ziebarch 1994, Kankkunen *et al.* 2003a, b). Most of the findings indicate that parents use pain intervention strategies familiar to them in everyday life for alleviating their children's surgical pain, such as emotional support including comforting, holding and presence, as well as helping with daily activities. McCarthy and Kleiber (2006) found that distraction might be more appealing to parents because it takes fewer practice sessions and is more like natural way. In addition, several studies have explored parents' recommendations to health care

providers about their hospitalized children's pain alleviation (Rhiner *et al.* 1994, Selare & Waring 1995, Pölkki *et al.* 2002a), where the recommendations mostly related to areas such as the continuity of care, the use of medication, health care providers' listening to the child/ parents, negotiating staff, parents' defined roles in the child's care and information needs.

In the participation in their children's postoperative care, parents may experience many feelings facing with their child's surgical procedures and pain, such as worry, distress, anxiety, fear, helplessness, depression, frustrated and angry as well as guilty (Dixon 1996, Thompson *et al.* 1996, Kristensson-Hallström 2000, Cimete 2002, Pölkki *et al.* 2002a, Thomlinson 2002, Franck *et al.* 2004, Hug *et al.* 2005). Many of the feelings appeared to be expected natural components of the parents' experiences during their child's hospitalization (Coyne 1995b). However, the negative feelings might cause parental stress and decrease parents' ability to take care of their child in pain (Pölkki *et al.* 2002a, Hug *et al.* 2005). The transmission of anxiety to the child has been recognized (McGraw 1994). Therefore the negative feelings among parents call for more attention in clinical practice.

In conclusion, although parents are ready to take an active role in their children's pain care, they need more knowledge relevant to pain management, including pain medication and non-pharmacological methods for pain relief. A review of the literature shows that most of the previous studies in relation to parental participation in pediatric pain management were conducted in Europe and North America but no research has been conducted in mainland China. This indicates that more researches are needed to explore Chinese parents' use of pain-relieving methods for their children's postoperative pain and to find out factors that might influence their participation. Moreover, it is very important to examine parents' recommendation to health care providers on how to improve their children's pain management.

2.3.5 Children's role in their postoperative pain alleviation

In addition to the efforts of health care professionals and parents, children themselves also play an important role in their pain alleviation postoperatively. Children are the most important source of evidence on how their lives are experienced (Coyne 1998). Children can express opinions about preferred postoperative outcomes and provide useful input about their care (Cucchiario *et al.* 2006). Salanterä *et al.* (1999b) suggested that nurses should be encouraged to use non-pharmacological pain-relieving methods that let the children be active participants of their own care. Earlier findings report that children are able to describe their pain and the methods for relieving pain (Bossert *et al.* 1996, Pölkki *et al.* 1999, Pederson *et al.* 2000) although the ability to do this is affected by their development level (Pederson *et al.* 2000, Pölkki *et al.* 2003b). School-aged children have reached a certain level of cognitive maturity and therefore a broad array of non-pharmacological methods could be implemented in their pain management. The children themselves may administer many of the methods although effective relief or appropriate preparation often requires the assistance of their parents and nurses (Vessey & Carlson 1996). LaMontagne *et al.* (2003b) demonstrated that instructing children (aged 11 to 14) to use different coping strategies, such as deep breathing, imagery and relaxation, is effective for reducing their postoperative pain.

Owing to the individualized nature of the pain experience, school-aged children's self-reports would be the most reliable source on how their pain is managed (Pölkki *et al.* 2003b). Only few studies have explored children's use of methods to relieve their surgical pain (LaMontagne *et al.* 1997b, Pederson *et al.* 2000, Pölkki *et al.* 2003b) or children's use of coping strategies to deal with pain (Reid *et al.* 1997). For example, Pederson *et al.* (2000) who interviewed 20 children aged from 5 to 17 years old found that several children used non-pharmacological techniques to relieve pain, and the techniques include distraction, play, relaxation tapes, breathing exercises, massage and music. Pölkki *et al.* (2003b) conducted an interview with 52 children aged 8-12-year-old in Finland, exploring their experiences with their own use of, their parents' and nurses' use of postoperative pain-relieving methods. They found that all of the children used at least one pain-relieving method like distraction or resting/sleeping in addition to receiving assistance in pain relief from nurses (e.g.

giving pain killers) and parents (e.g. distraction, presence). Some demographic factors, especially gender and age, seem to affect children's ability to describe and use of typical pain relief or coping strategies (Sharrer & Ryan-Wenger 1995, LaMontagne *et al.* 2000)

According to Pölkki (2002b), knowledge concerning children's experiences of how their parents and nurses manage their pain during hospitalization and how they could relieve it even better is important for improving pain management in children. However, only few studies have been conducted in this aspect (Hester 1993, Woodgate & Kristjanson 1996c, LaMontagne *et al.* 1997b, Pölkki *et al.* 2003b). The most commonly reported nursing actions involve administration of analgesia (Hester 1993, Pölkki *et al.* 2003b) and helping with daily activities (Pölkki *et al.* 2003b), whereas parents' role is often more psychologically oriented (Woodgate & Kristjanson 1996a) such as distraction and presence (Hester 1993, Pölkki *et al.* 2003b).

2.3.6 Factors influencing the adequacy of pediatric pain management

Inadequate pain management affects people of all diagnostic groups, ages and cultures (e.g. Boström *et al.* 1997, Watt-Watson *et al.* 2000, Costantini *et al.* 2002, Botti *et al.* 2004, Hegyvary 2004). Many studies have examined the factors influencing the effectiveness of children's pain management (Caty *et al.* 1995, McGrath *et al.* 1995, Brockopp *et al.* 1998, Rawal 1998, Twycross 1999, Simons & Roberson 2002, Pölkki *et al.* 2003a). The most commonly reported influencing factors are nurses' lack of knowledge and skills (of pain assessment and pain relief methods), lack of resources (like the lack of time and staff, limited access to equipments, inadequate educational materials), and caregivers' and patients' misconceptions (e.g. misconception that pain is an inevitable consequence of surgery, that non-pharmacological methods are ineffective, that opioids can easily lead to severe side-effects and addiction) (Caty *et al.* 1995, Broome *et al.* 1996, Pederson *et al.* 1997, Rheiner *et al.* 1998, Howell *et al.* 2000, Watt-Watson *et al.* 2000, Ashburn *et al.* 2004, Tapp & Kropp 2005). Moreover, institutional factors such as lack of policies about underlining pain management as a nursing priority and about pain measurement for children in pain (Brockopp *et al.* 1998) can also contribute to the inadequacy of pain management. Furthermore, poor communication

among nurses, patients and doctors can also be a barrier to the pain management (Brockopp *et al.* 1998, Sofaer 1998). Health professional's attitude as well as children's and their parents' cultural and religious biases may influence the pain management provided to children (Brockopp *et al.* 1998).

Among the above mentioned factors contributing to the ineffective acute pain management, nurses' lack of knowledge in pain management is widely and repeatedly demonstrated by researchers in Europe (Salanterä *et al.* 1999b, Simons & Roberson 2002, Pölkki *et al.* 2003a), North America (Kubecka *et al.* 1996, Brockopp *et al.* 1998), Australia (Heath 1998, Van Niekerk & Martin 2001) and China (He *et al.* 2003). The above literatures demonstrated that nurses lack knowledge in such areas as pain assessment (Brockopp *et al.* 1998, He *et al.* 2003), pharmacological management of pain (Salanterä *et al.* 1999b, Van Niekerk & Martin 2001) and non-pharmacological interventions for pain (Brockopp *et al.* 1998; Salanterä *et al.* 1999b, He *et al.* 2003). Nurses' knowledge and experience with pediatric pain can directly affect their decision-making and interventions (Rush & Harr 2001).

Historically, children have often had no pain medication prescribed after surgery (Tesler *et al.* 1994, Kart *et al.* 1996b, Helga 2000). Inadequate pain medication for children's pain is also widely reported (Tesler *et al.* 1994, Kart *et al.* 1996a, Rømsing 1996, Rheiner *et al.* 1998, Van Hulle Vincent 2005), and the inadequacies were reported to include inadequate prescription of medication (too small doses and/or analgesics that are not strong enough) and insufficient administration of prescribed medication (medication has been prescribed but not administered to the child) (Gauthier *et al.* 1998, Hamers *et al.* 1998, Rush & Harr 2001, Van Hulle Vincent 2005). The intramuscular route has been popular, in particular in the form of the standard prescription "10 mg i.m. p.r.n. 4 hourly" (Schug 1999). This approach is possibly one of the major causes for poor outcome of postoperative pain management (Rawal 1998, Schug & Gandham 2006). Routine orders for intramuscularly injections "as needed" leave more than half of postoperative patients in unrelieved pain due to under-medication (Campese 1996), and therefore a standard prescription of pain medication instead of PRN is recommended in order to provide more effective relief of pain (Hamers *et al.* 1998, Higgins *et al.* 1999). Hamers *et al.* (1997) demonstrated that experienced nurses were most confident and were most inclined to administer analgesics.

It is widely regarded that many myths direct nursing interventions. The myths may be as following: children are neurologically immature and cannot experience pain; children do not remember pain; children tolerate pain better than adults and are more able to become accustomed to pain (Rush & Harr 2001). As is reported in a study about Finnish nurses' attitudes to pain in children (Salanterä 1999a), one-third of the nurses thought children have a lower tolerance of pain than adults. Other myths such as children easily become addicted to narcotic analgesics and they were sensitive to the respiratory depressant of narcotics are reasons why analgesics were withheld from children by nurses and parents (Hamers *et al.* 1998, Anand 2001, Ashburn *et al.* 2004). A research conducted in Iceland shows a significant positive relationship between the child's self-reported pain intensity and analgesic administration in the hospital and at home (Helgadóttir & Wilson 2004). However, An American researcher reported that the amount of analgesic administered was not always based on the child's pain level (Van Hulle Vincent 2005). In the absence of a clear source of pain or obvious pain behaviour, caregivers may assume that pain is not present, and therefore can defer treatment (Schafheutle *et al.* 2001, Ashburn *et al.* 2004).

According to Caty *et al.* (1995), health care providers tend to assess and manage children's pain according to their own opinion, assumptions and intuitions and it is revealed that nurses' professional work experience and their age had little influence on the pain management process. However, Pölkki *et al.* (2001) reported that the older and more educated nurses and nurses with longer professional work experience prepared the children more carefully for surgery procedure than younger, less educated nurses and nurses with shorter professional work experience. In addition, the nurses had children of their own and had earlier experiences of being in hospital with their children had positive effects on the use of some strategies like breathing techniques and distraction. Kankkunen *et al.* (2003b) conducted a study on children's pain relief managed by their parents at home after day surgery and it was found that parents' implementation of pain relief strategies seemed to be gender-related and are limited to methods that were familiar to parents from everyday life.

Salomäki *et al.* (2000) demonstrated that introducing a nurse-based pain service on the ward, providing educational program to health care providers and implementation of regular pain intensity

measurement and recording can improve the quality of postoperative pain relief. Hegyvary (2004) proposed some strategies to improve the situation: (1) enriching patients' and health care providers' knowledge and understanding of pain (cause, sensations and interventions); (2) correcting the beliefs that pain is an unavoidable result of illness, health care procedures and aging; and (3) implementing policies to promote the use of evidence-based interventions for managing pain. Bruce and Franck (2005) suggested the use of worldwide web to improve children's pain care.

2.4 Impact of pain education on nurses' roles in pediatric pain management

The view of the inadequate or inappropriate pain education for nurses has been supported by many earlier studies (e.g. Twycross 2000, He 2002, Simons & Roberson 2002, Pölkki *et al.* 2003a). According to He (2002), there was no specific pain education provided to nurse students at different levels of educational institutes in mainland China and the continuing education concerning pain management provided to clinical nurses was very limited. Previous studies suggested the need for continuing education in pain management among nurses (Francke *et al.* 1996, Lebovits *et al.* 1997, Pederson *et al.* 1997, Twycross 1999, Simons 2002b, He *et al.* 2003, Probst *et al.* 2005), which was considered as an appropriate way to convey pain education (Simons & Roberson 2002). Furthermore, nurses' attitudes towards pain management and towards learning different pain alleviation methods are positive (Salanterä 1999a, Pölkki *et al.* 2003a, Van Hulle Vincent 2005). However, Salanterä (1999a) indicated that there is much variation in how they feel they can actually provide high-quality care to control pain and therefore more attention should be paid to training of nurses and to providing knowledge about the treatment of pain in children to them.

Many studies examined the effectiveness of the educational programs on the changes of nurses' pain knowledge and behaviour changes (e.g. Francke *et al.* 1996, Knoblauch & Wilson 1999). For example, Francke *et al.* (1996) assessed the effectiveness of 12 studies about educational programs for nurses in relation to pain management. They concluded that it was often difficult to evaluate the effectiveness of the programs on changing behaviour because the post-measurements were usually taken within some days or weeks after the program being completed. Among the 12 articles reviewed by Francke *et al.* (1996), only four undertook measurements after months or years.

Francke *et al.* (1996) also suggest that educational programs need to consider a greater range of pain topics but many of the studies concentrate simply on pain assessment (Francke *et al.* 1997) and the administration of analgesics (Coleman & Booker-Milburn 1996, Harmer & Davies 1998). Finally, they conclude that continuing pain education for nursing staff can have an impact on both nurses and patients and it is important to ensure that the education provided is appropriate and effective. Horbury *et al.* (2005) found in their study that although staff had access to regular in-service education about pain management but the attendance of these in-service sessions was poorly low, so they advocated the need for innovative teaching strategies and approaches in the clinical context to heighten nurses' awareness of their lack of knowledge of pain assessment and management. Videotaped role play was proved to be an effective staff development strategy used as an initial exercise in a five-part class to update the pain management skills of experienced nurses (Daroszewski & Meehan 1997). Simons and Roberson (2002) highlight that nurses' views of their learning needs should first be elicited and then used to guide the content development of the education program. However, very few Chinese nurses reported that they had received continuing pain education after their graduation (He *et al.* 2003), and no study has been conducted to compare the differences of nurses' use of non-pharmacological methods cross years and the possible reasons of the changes in China.

2.5 Cultural influences on pediatric pain management

“... everyone has a cultural heritage which is part and parcel of an individual's health practices. The practical answer is not to learn in detail the infinite varieties of culture but to be aware of these varieties and how they might affect one's health practices.” (Zola 1983 p. 227)

Culture plays an important role in parents' and staff members' convictions on pediatric perioperative care (Alsop-Shields 2000). Culture significantly affects the assessment and management of pain (Davidhizar & Giger 2004). Cultural sensitivity must always be a component of pain assessment (Ludwig-Beymer 2003) with the increasing multicultural society. Our perceptions, meanings, attitudes, expressions and care of pain are embedded in cultural context (Villarruel 1995). Cultural differences have been found in subjects' pain threshold and pain

tolerance and cultural norms might determine how pain should be expressed (Villarruel 1995, Davidhizar & Giger 2004). It is believed that the patients' culture does influence their pain experiences (Thomas & Rose 1991, MacLachlan 1997, Davidhizar & Giger 2004), pain behaviour (MacLachlan 1997), pain tolerance level (Beck 2000, Edwards *et al.* 2001), pain perception or expression (Villarruel 1995, MacLachlan 1997, Ramer *et al.* 1999, Beck 2000, Davidhizar & Giger 2004) as well as treatment preferences (McCaffery & Pasero 1999). A pharmaceutical research shows that there are significant differences in drug metabolism, dosing requirements, therapeutic response and side effects in different racial and ethnic groups (Salerno 1995).

The differences of pain experience in different cultures are thought to be based upon modeling and social comparison processes, which involve testing the validity of one's judgments in ambiguous conditions (Thomas & Rose 1991). Kim *et al.* (2004) demonstrated ethnicity is one of the factors contributing to individual variation in thermal and cold pain sensitivity. Thomas and Rose (1991) found significant difference in pain rating after ear piercing, with ratings from high to low for Asians, Anglo-Saxons, and Afro-West Indians living in England. Faucett *et al.* (1994) revealed that subjects of European descent reported significantly less severe postoperative dental pain than those of Black American or Latino descent did; they also reported less pain than Asians did although this finding did not have statistical significance. However, overrating or underrating of pain may occur because of the cultural instruments to be either stoic or very expressive (Douglas 1999).

Children learn the patterns of behavior and responses to pain based on their parents' cultural understanding of pain (Kankkunen *et al.* 2002b). They revealed that the Finnish parents explicitly expressed how they desired to teach their children to avoid pain medication based on their own value. According to Salanterä (1999a), it is widely believed by the Finnish nurses (95%) that parent's attitudes have a major impact on children's experience of pain, and 88% of nurses believed that culture influenced children's experience of pain. Parents' attitudes towards pain as a child's learning task and the need to avoid pain medication might reflect the Calvinistic value placed upon pain tolerance in Finnish culture (Kankkunen *et al.* 2002b). De Trill and Kovalcik (1997) also noted that the cultural life of the community and family values might influence reports of pain by children. Cultural aspects affect especially school-aged children, who try to behave according to the social

norms (Pölkki 2002b).

In Chinese culture, the tolerance of pain is even encouraged. Usually health professionals, children and their parents regarded postoperative pain as an inevitable phenomenon which should be tolerated to some extent (Xia 2004). This means that Chinese culture expects and accepts pain, which is different from some western cultures in that people there expect pain but don't accept pain (Hawthorn & Redmond 1998). Health care providers have not paid adequate attention to children's postoperative pain relief in hospital settings. Although 'as needed' pain medication is often prescribed, usually no pain assessment is performed and only when the patient ask for the medication prescribed 'as needed' will the nurse give the medication to him/her. However, asking the nurse for pain medication by a Chinese client may be viewed as distracting the nurse away from more important duties (Giger & Davidhizar 1999). A client may view the nurse as a professional who knows client needs without being told and therefore may wait passively for pain medication in a belief that if it is needed, it will be provided (Davidhizar & Giger 2004). As a result, postoperative pain has been poorly managed.

A literature review study (Green *et al.* 2003) shows that the sources of pain disparities among racial and ethnic minorities are complex, involving patient (e.g. patient/health care provider communication, attitudes), health care provider (e.g. decision making), and health care system (e.g. access to pain medication) factors. Therefore culture phenomena relative to the client, health care provider and health care system must be considered when culturally sensitive strategies to the client in pain are to be designed (Davidhizar & Giger 2004). Davidhizar and Giger (2004) proposed seven strategies that assist in culturally appropriate assessment and management of pain: (1) utilizing appropriate assessment tools, (2) appreciating variations in affective response to pain across cultures, (3) being sensitive to variations in communication styles across cultures, (4) recognizing that communication of pain may not be acceptable in a certain culture, (5) appreciating that the meaning of pain varies between cultures, (6) utilizing knowledge of biological variations, and (7) promoting personal awareness of values and beliefs which may affect responses to pain. Health care providers must work closely with the client and family in order to obtain accurate information about pain and then to provide culturally appropriate care (Davidhizar & Giger 2004).

Health care providers are more likely to be responsive to the communication concerning pain by an individual from the same culture (Davidhizar & Giger 2004), so there is a need to improve training of health care providers in cultural differences related to pain management. As most of the previous studies that examined the impact of culture on pain expression were conducted in North America (Hawthorn & Redmond 1998), what is needed is a comprehensive pain research agenda to address pain disparities among different cultures, which is of potential importance to the more effective control of pain in all cultures.

2.6 Summary of the literature and gaps in the existing literature

Pain is a complex, subjective experience and is unique to each individual. Pain has physiological, sensory, affective, cognitive, behavioural and socio-cultural components. Emotional component in pediatric pain is very important. Children's pain perception might be influenced by the cultural heritage. Verbal reports, behavioral responses and physiological signs are three major criteria frequently used by nurses to first assess and then draw inferences about pediatric pain. Many studies have indicated that school-aged children are able to describe their pain and methods for relieving pain, therefore self-report should be the primary approach to school-aged children's pain assessment. Self-report measures of pain have been developed and well validated, among which VAS and faces scales are regarded as valid and reliable tools in measuring children's postoperative pain by school-aged children themselves, their parents and health care providers.

Although much progress has been made on pharmacological and non-pharmacological approaches to postoperative pain relief, their use has not been maximized and children still suffer from significant postoperative pain in many cultures. Commonly used analgesics for postoperative pain management in children are opioids, NSAIDs and paracetamol. Opioids are the most common drugs to treat moderate and severe postoperative pain and NSAIDs for mild to moderate acute pain. Paracetamol is of particular value in the treatment of patients in whom NSAIDs are contraindicated. Many non-pharmacological methods are effective for relieving children's postoperative pain and the methods include cognitive-behavioural methods, physical methods, emotional support, helping with daily activities and creating a comfortable environment.

Earlier studies have addressed nurses' use of different non-pharmacological methods for pain relief, most of which focus on the short term and minor procedure. Systematic examination of nurses' use of these methods for pediatric postoperative pain has been limited. Moreover, parents play an important role in their children's pain care in hospitals. Parents have the most intimate knowledge of their children and are sensitive to changes in their child's pain behaviours. Children may be more likely to tell to a parent than to a nurse the fact that they have pain. Therefore, topics regarding how nurses guide parents to use non-pharmacological methods and how parents use these methods for hospitalized children's postoperative pain alleviation should arouse more concerns. Previous studies mostly focused on parental participation in the children's care in a general view and on the administration of pain medication. Parents desire to participate in their child's care, but they often meet difficulties like lack of information and support, poor communication with health care providers. More studies are needed to explore factors that affect parental participation in children's postoperative pain care.

In addition to the efforts of health care professionals and parents, children themselves also play an important role in their pain alleviation postoperatively. Only few studies have explored children's use of some methods to relieve their surgical pain or use of coping strategies to deal with pain. Knowledge concerning children's perceptions on how their parents and nurses manage their postoperative pain is very limited although it is an important topic.

Among factors contributing to the ineffective acute pain management, nurses' lack of knowledge is widely and repeatedly demonstrated by researchers worldwide, which suggested the need for continuing education in pain management among nurses. The effectiveness of the educational programs on the changes of nurses' pain knowledge and of their practice has been examined by many earlier studies. However, no similar study has been conducted in mainland China.

It has been widely accepted that patients' culture does influence their pain experiences, pain behaviour, pain perception or expression, attitudes to pain and care of pain. Most of the previous studies concerning pediatric pain management, either from health care providers', parents' or from children's point of view, were conducted in Europe and North America. This adds to the limitation when they were used as the literature background of this study. The tolerance of pain is encouraged

in Chinese culture and Chinese culture expects and accepts pain, including postoperative pain. As a result, it can be premised that postoperative pain is even poorly managed in Chinese culture than Western cultures.

Figure 2 illustrates the summary and gaps in existing literature. The gaps in the existing literature indicates the importance to conduct the relative studies in mainland China, which will enrich knowledge in nursing society and give evidence-based instructions to nurses to improve their clinical practice in children's pain management in Chinese hospitals.

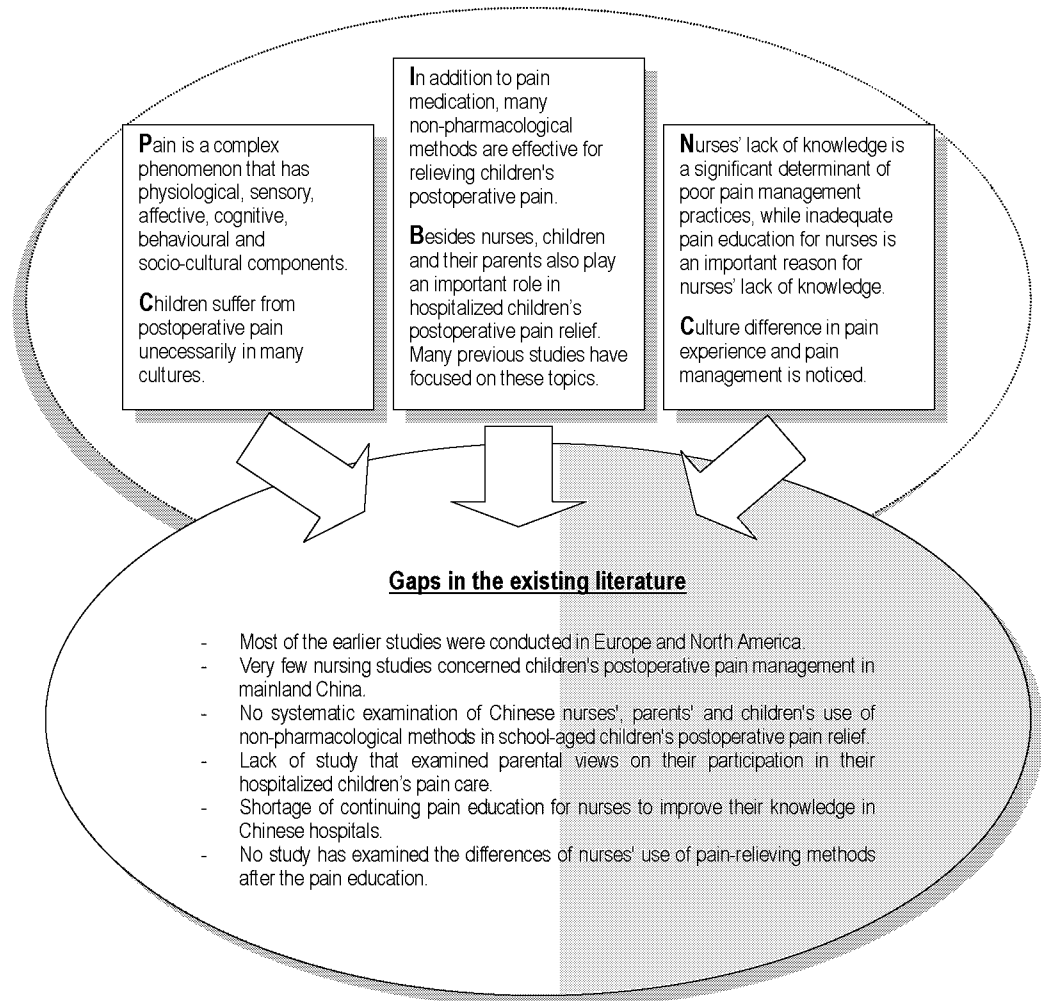


Figure 2 Summary and gaps of the existing literature

3 PURPOSES OF THE STUDY AND RESEARCH QUESTIONS

The purpose of this study was to describe Chinese nurses' and parents' use of non-pharmacological methods in school-aged children's postoperative pain relief, nurses' perceptions on providing guidance to parents, children's experience of their use of pain-relieving methods and children's perceptions on their parents' and nurses' use of methods for relieving their surgical pain. Parents' views on their participation in their children's postoperative pain management and their recommendations to health care providers were explored. In addition, the purpose was to provide pain education to nurses and the differences in their use of these methods in practice were examined. The aim was to improve pain management in children by maximizing the use of non-pharmacological methods in hospital. The results of the study will provide the research-based knowledge for managing children's postoperative pain more effectively.

Research questions are as following:

Part 1 Nurses' role in hospitalized children's postoperative pain relief

The following research questions were addressed:

1. What non-pharmacological methods do Chinese nurses use to relieve children's (6 to 12 years old) postoperative pain in hospital?
2. What non-pharmacological methods do nurses guide parents to use for their child's postoperative pain relief?
3. How nurses' background factors (age, education, nursing position, professional work experience, number of their own children and experiences of earlier hospitalizations of their children) are related to their use of non-pharmacological methods for relieving school-aged children's postoperative pain in hospital and their provision of guidance to parents in children's postoperative pain relief in China?
4. What are the individual and institutional factors that limit Chinese nurses' use of non-pharmacological methods for relieving children's postoperative pain in hospital?

Part 2 Parents' role in their hospitalized children's postoperative pain relief

1. What non-pharmacological methods do parents use for their children's (6 to 12 years old) postoperative pain relief in hospital?
2. How are parents' backgrounds (father/mother, age, education, employment status, earlier hospitalization of their children and frequency of taking care of their children in the hospital) and children's backgrounds (gender, age, manner of hospital admission, duration of postoperative hospitalization and worst postoperative pain intensity) related to parents' use of non-pharmacological methods for their children's pain relief?
3. What are Chinese parents' views on factors promoting and hindering their participation in their children's postoperative pain management in hospital?
4. What recommendations do Chinese parents have to health care providers to improve the management of their children's postoperative pain?

Part 3 Children's role in their postoperative pain relief in hospital

1. What pain-relieving methods do the children (8 to 12 years old) use to reduce their postoperative pain?
2. What pain-relieving methods do nurses and parents use to relieve children's postoperative pain according to children's perceptions?
3. What suggestions do the children have to their parents and the nurses on how to manage their postoperative pain better?

Part 4 Pain education for nurses and comparison of nurses' use of methods in children's postoperative pain alleviation in 2002 and 2004

1. What are the non-pharmacological methods used by nurses in children's postoperative pain alleviation in 2002 and 2004?
2. What are the differences between nurses' use of non-pharmacological methods in 2002 and 2004?

4 METHODOLOGY

4.1 Study design

The study consists of four parts. Part 1, 2 and 4 described nurses' and parents' use of non-pharmacological methods, whereas Part 3 examined children's experiences on the implementation of pain-relieving methods. The study design is illustrated in Figure 3.

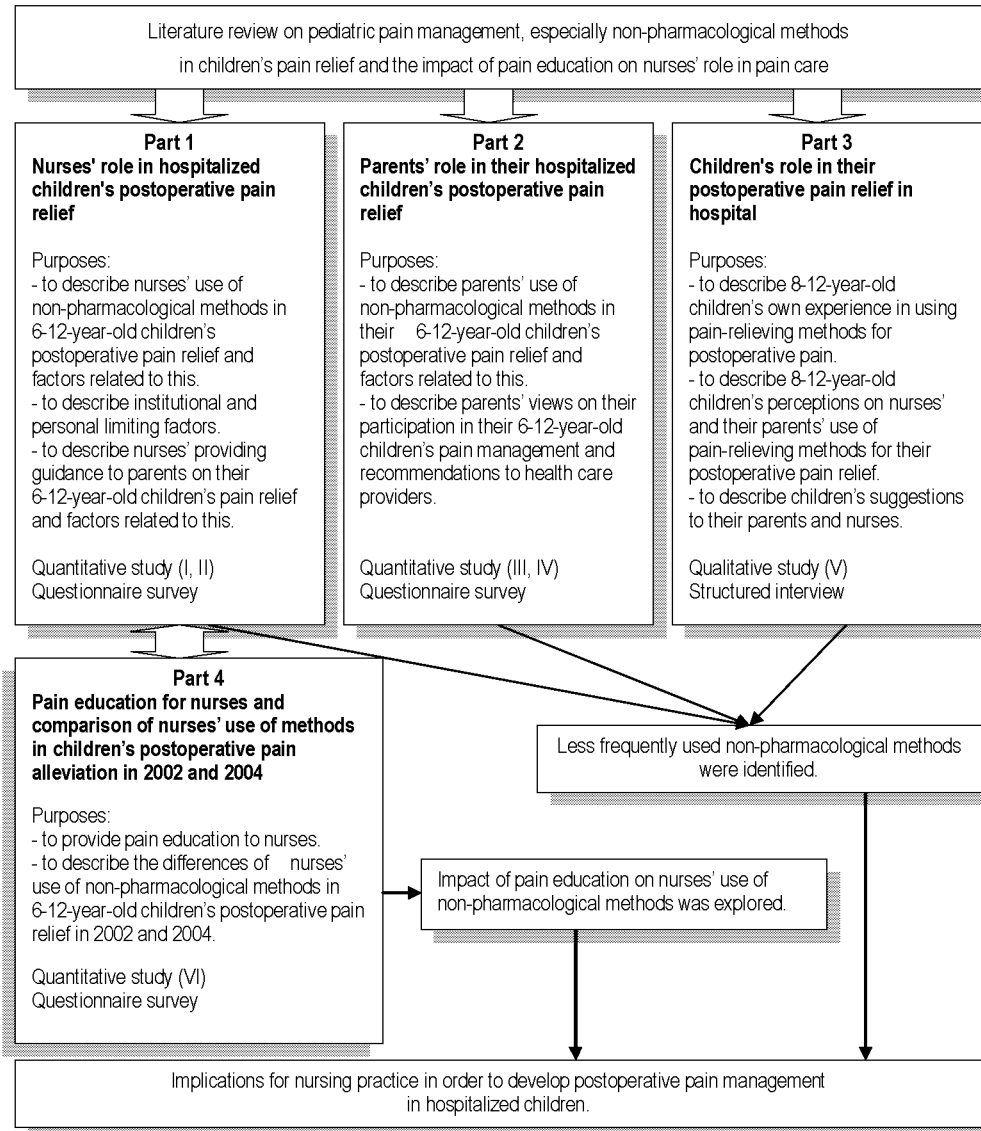


Figure 3 Study design

The original publications, subjects, methods and period of data collection, as well as methods of data analysis are summarized in Table 4. Questionnaire surveys were used in Part 1, 2 and 4, whereas structured interview was used in Part 3.

Table 4 Original publications, subjects, methods and period of data collection and methods of data analysis

Study	Original publications	Subjects	Methods and period of data collection	Methods of data analysis
Part 1	Paper I Chinese nurses' use of non-pharmacological methods in children's postoperative pain relief	Nurses (n=178) working at 12 surgical wards in five hospitals of Fujian Province, China.	Questionnaire survey - Demographic data - Likert-type questions - Open-ended question June-July 2002	- Descriptive statistics, - Reliability test - Non-parametric Kruskal-Wallis ANOVA, - Chi-square test - Content analysis
	Paper II A survey of Chinese nurses' guidance to parents in children's postoperative pain relief	Nurses (n=178) working at 12 surgical wards in five hospitals of Fujian Province, China.	Questionnaire survey - Demographic data - Likert-type questions June-July 2002	- Descriptive statistics, - Reliability test - Chi-square test
Part 2	Paper III Chinese parents' use of non-pharmacological methods in children's postoperative pain relief	Parents (n=206) with a child hospitalized at 12 surgical wards in five hospitals of Fujian Province, China	Questionnaire survey - Demographic data - Dichotomous questions February-October 2004	- Descriptive statistics, - Reliability test - Chi-square test
	Paper IV Parents' views on participation in their hospitalized 6-12-year-old children's postoperative pain management in China	Parents (n=206) with a child hospitalized at 12 surgical wards in five hospitals of Fujian Province, China	Questionnaire survey - Demographic data - Likert-type questions - Open-ended questions February-October 2004	- Descriptive statistics, - Factor analysis - Reliability test - Content analysis
Part 3	Paper V Children's perceptions on the implementation of methods for their postoperative pain alleviation: an interview study	Children (n=59) who were inpatients in five surgical wards of three hospitals of Fujian Province, China	Structured interview - Demographic data - Structured questions - Open-ended questions July-October 2004	- Descriptive statistics, - Content analysis
Part 4	Paper VI Comparison of nurses' use of non-pharmacological methods in children's postoperative pain alleviation in 2002 and 2004	Nurses (n=181) working at 12 surgical wards in five hospitals of Fujian Province, China.	Questionnaire survey - Demographic data - Likert-type questions October 2004	- Descriptive statistics, - Reliability test - Mann-Whitney test

4.2 Methodological assumptions of this study

In order to get a whole picture of school-aged children's postoperative pain relief, this study took a triangulation approach. Triangulation of paradigms has been suggested as a way forward for nurse researchers (Dootson 1995), and according to Murray (1999), this approach is becoming increasingly popular in nursing studies. Triangulation refers to the use of different vantage points and allows elucidation from multiple standpoints, reflecting a commitment to thoroughness, flexibility and differences of experiences (Morse 1991). Triangulation involves the combination of at least two or more theoretical perspectives, methodological approaches, data sources, investigators, or methods of data analysis within the same study (Thurmond 2001, Halcomb & Andrew 2005). Therefore, it ensures depth and completeness of the data (Begley 1996, Tobin & Begley 2004), overcomes deficiencies inherent in data collection methods and allows apparent contradictions to be explored (Williamson 2005), and it enables the researcher to interpret the findings better (Thurmond 2001). The purpose of triangulation is to provide completeness and confirmation, consequently increasing the validity and reliability of studies through increasing trustworthiness of the data and its interpretation (Breitmayer *et al.* 1993, Risjord *et al.* 2002). Thurmond (2001) also emphasized that if different philosophical and research traditions help to answer a research question more fully, the researcher should use triangulation. In this study, methodological triangulation, data sources triangulation and methods of data analysis triangulation were used (Figure 4).

Methodological triangulation is a method of obtaining complementary findings that strengthens research results and therefore contributes to theory and knowledge development (Morse 1991). It involves the use of more than one research method or data collection techniques, which are selected because each taps a different aspect or dimension of the problem being studied (Shih 1998). The advantage of methodological triangulation is that, through methodological triangulation, the weakness of one method or theoretical approach can be compensated for by the strengths of the other (Thurmond 2001). The various methods used should be recognized as springing from different epistemological traditions which, when combined, add new perspectives to the phenomenon under investigation (Foss & Ellefsen 2002). In this study, between-methods triangulation was used. That is, both quantitative (I, II, III, IV, VI) and qualitative methods (V) were used (Begley 1996, Thurmond

2001, Magnusson *et al.* 2005) (Figure 4). The data were collected through questionnaire surveys from nurses and parents and through structured interview of children. In addition, the questionnaires for nurses and parents also included a few open-ended questions, which allow the subjects to express their personal opinions. *Data source triangulation* involves the use of multiple data sources to obtain diverse views on the topic or on the purpose of validation (Shih 1998). In this study, data were collected from nurses (I, II, VI), parents (III, IV) and children (V) in order to obtain multiple information about non-pharmacological methods in children's postoperative pain alleviation (Figure 4). This is better than a single perspective and can be easily considered as a truth (Sandelowski 2000). In terms of *data analysis triangulation*, the data of the present study was analysed using both statistical analyses and qualitative content analysis.

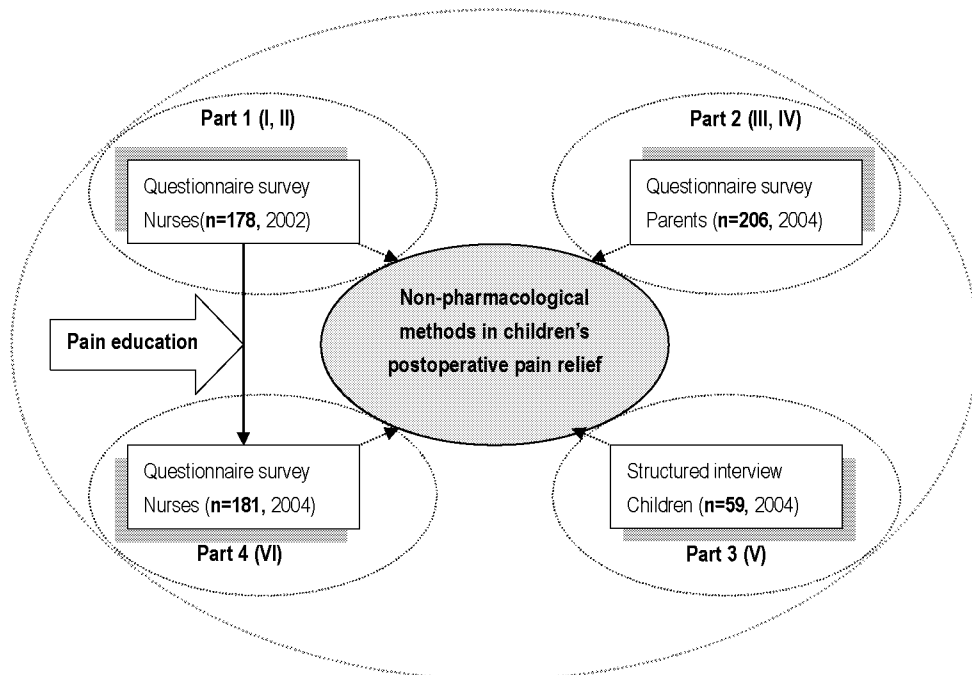


Figure 4 Methodological and data sources triangulation

4.3 Quantitative data and methods (I, II, III, IV, VI)

Quantitative data were collected from nurses (I, II, VI) and parents (III, IV) by using questionnaire surveys.

4.3.1 Samples

Sample of nurses in 2002 (n=178, I, II) and in 2004 (n=181, VI)

Convenient samples were drawn from all nurses working at 12 surgical wards of five provincial hospitals (four in Fuzhou and one in Quanzhou) in Fujian Province, China, both in 2002 and 2004. Figure 5 shows the Map of China and Fujian Province as well as the two cities where data collection took place. The five hospitals included: (1) The First Affiliated Hospitals of Fujian Medical University (FAHFMU), (2) The Second Affiliated Hospitals of Fujian Medical University (SAHFMU), (3) The Affiliated Union Hospital of Fujian Medical University (AUHFMU), (4) Fujian Provincial Hospital (FPH), and (5) Fujian Provincial Maternity and Child Health Hospital (FPMCHH).

The administrative organizations of the health care system in mainland China include the Ministry of Health (National level), the Department of Health (Provincial level) and the Bureau of Health (District or City level). There are two types of hospitals in China, western medicine hospitals and traditional Chinese medicine hospitals. Although western medicine is effective in the treatment of acute conditions and emergencies, traditional Chinese medicine more effectively addresses chronic conditions and those that result from the patient's life-style, diet and environment (He 2002). Hospitals are classified into different levels: provincial hospitals (including university-affiliated hospitals), hospitals of city, hospitals of district, hospitals of county, and hospitals of town and village clinics. In 1989, the Ministry of Health People's Republic of China issued the Regulation for Management of Hospitals at Different Levels (RMHDL 1989). The main aim was to set up a three-level health care preventive system and to utilize the health care resources adequately and reasonably. According to the regulation, the hospitals can be classified as primary hospitals (Class A, Class B and Class C), secondary hospitals (Class A, Class B and Class C), and tertiary hospitals

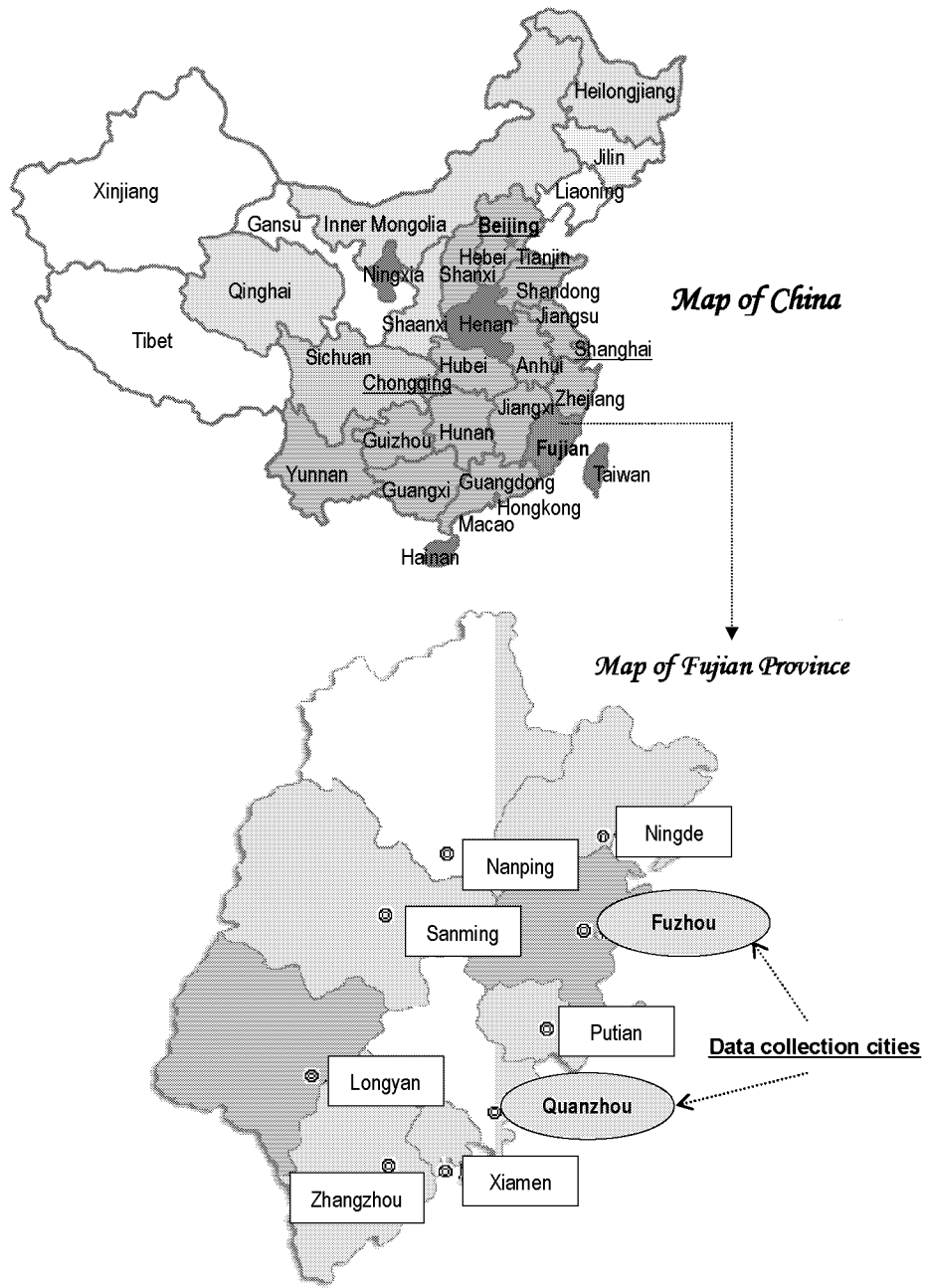


Figure 5 Map of China, Fujian Province, Fuzhou and Quanzhou (data collection cities)

(Special Class, Class A, Class B and Class C) based on the differences of functions and responsibilities of the hospitals. Primary hospitals are the local hospitals and health care centers, which provide services of prevention, medical treatment, health care and rehabilitation to a certain community. Secondary hospitals are the district hospitals, which provide services of general medical treatment and health care to several communities and assume some responsibilities of teaching and research. Tertiary hospitals are those hospitals that provide high-level services of medical treatment and health care to several districts and carry out tasks of higher education and research.

All the five participating hospitals are provincial hospitals and belong to Class A tertiary hospitals. All hospitals adopt a care delivery method called primary nursing, where a therapeutic relationship is established between a registered nurse and an individual patient and his or her family. Primary nursing focuses on the nurse-patient relationship, strengthens accountability for care, and facilitates patient and family involvement in the planning of care. The general information of approximate numbers of staff members, nurses, beds and yearly inpatients of all the participating hospitals are presented in Table 5 (He 2002). According to the regulation issued by Ministry of Health People's Republic of China in 1978, the ratio of beds to nurses should be 1: 0.4 in all hospitals (Cheng *et al.* 2003). However, the ratio of beds to nurses in more than 90% of the hospitals is lower than the suggested ratio (Wang 2002, Tan & Zhang 2004).

Table 5 General information of all participating hospitals (n=5)

General information	Participating hospitals				
	FAHFMU	SAHFMU	AUHFMU	FPH	FPMCHH
Staff members	1299	894	1693	1680	466
Nurses	500	300	568	573	200
Beds	1200	670	1020	1000	400
Inpatients (year)	25,000	20,000	20,000	16,000	21,000

All participating wards had performed operations for 6-12-year-old children, which included pediatric surgical wards (n=4, the pilot test was done in one of these wards in 2002), cardiac and thoracic surgical wards (n=3), ear, nose and throat surgical wards (n=4) and a general surgical ward (n=1). The questionnaires were distributed to 187 nurses in July 2002 and 195 nurses in October 2004. 183 and 185 questionnaires were returned in 2002 and 2004, respectively, obtaining a response rate of 98% and 95% respectively. Five questionnaires in 2002 and four in 2004 were excluded because of data missing or being returned empty; and thus 178 questionnaires in 2002 and 181 in 2004 were included for final data analysis.

Table 6 presents nurses' demographics in 2002 and 2004. All factors were divided into two groups. As a result, nurses' education level included two groups. Group one covers nursing schools (with three or four years of education after graduation from a junior high school, or with 2 years of education after graduation from a senior high school); group two covers junior colleges (with three years of education in a college after graduation from a nursing school or a senior high school) and universities (four or five years of education after graduation from a senior high school). Nurses' nursing position included five levels in mainland China, from lowest to highest: assistant nurse, primary nurse, attending nurse, associate senior nurse and senior nurse.

In the data collected in 2002, all subjects (n=178) were female. Their age ranged from 20 to 54 years (mean=30.7, SD=6.94). Seventy-three percent of the nurses (n=130) graduated from nursing schools and only 27% of them (n=48) graduated from junior colleges. The nursing position varied. Among 57% of the respondents (n=102) who were qualified as primary, attending, associate senior and senior nurse, 48% (n=85) were qualified as primary nurse and 9% (n=17) were qualified as attending, associate senior and senior nurse. Their professional work history ranged from 3 months to 32 years, with a mean of 10.8 years (SD=6.35). Forty-six percent of them (n=82) had over 10 years of professional experience. In detail, 20% of them had less than 5 years of experience and 80% of them over 5 years of working experience. More than half (58%) had their own children, but most (88%) had no experience of hospitalization of their own children.

All participants in 2004 (n=181) were female and their age ranged from 19 to 54 years (Mean=31.7, SD=7.55). About two-thirds of them (n=124) graduated from nursing schools, 28% (n=50) graduated from junior colleges and only 4% (n=7) graduated from the university. Seventy percent of them were qualified as primary nurse, attending nurse, associate senior nurse and senior nurse (sum variable). Nurses' professional work history ranged from 3 months to 31 years (Mean=11.4, SD=7.11) and about half of them (n=54) had more than 10 years of work experience. The result shows that more nurses were in the group of higher nursing position in 2004 than in 2002 (Mann-Whitney U test, $p < 0.001$).

Table 6 Nurses' demographics (n=178, 2002; n=181, 2004)

Demographic variables	2002		2004	
	n	%	n	%
Sex				
Female	178	100	181	100
Male	-	-	-	-
Age (years)				
20-30 (2002), 19-30(2004)	102	57	92	51
31-54	76	43	89	49
Education				
Nursing school	130	73	124	68
Junior college and university	48	27	57	32
Nursing position				
Assistant nurse	76	43	54	30
Primary nurse, attending, associate senior and senior nurse	102	57	127	70
Experience in health care (years)				
Less than 10	96	54	84	46
More than 10.01	82	46	97	54
Number of own child				
No child	74	42	64	35
One or more children	104	58	117	65
Earlier hospitalization(s) of own children				
No earlier hospitalization	157	88	158	87
One or more earlier hospitalizations	21	12	23	13

Sample of parents (n=206, III, IV)

The sample of parents consists of 97 fathers and 109 mothers whose children had undergone surgery in one of the 12 wards of five hospitals in Fujian province in China. These 12 wards included pediatric surgical wards (n=4), cardiac and thoracic surgical wards (n=3), ear, nose and throat surgical wards (n=4) and a general surgical ward (n=1). All the possible cases were collected during February to October of 2004. The questionnaires were distributed to 260 parents and 229 were returned, an average response rate 88%. Twenty-three returned questionnaires were excluded from the final analysis for the following reasons: returned empty (n=5), substantial data missing (n=15) and not meeting the inclusion criteria (n=3). Two hundred and six questionnaires were included in the final analysis. Inclusion criteria for parents included: (i) they were either the child's father or mother, who took on the main responsibility to take care of their child in the hospital; (ii) their child was 6-12-year old; (iii) their child had undergone a surgical procedure; (iv) they had cognitive ability to understand and answer the questionnaire.

Parents' background information is presented in Table 7. Their age ranged from 26 to 45 years (mean 35 years, SD =3.76). More than half of the participants (n=110) had lower level of education (no education/primary school/junior high school), and 47% of them had higher level of education (senior high school and vocational school/college and university).

Table 7 also shows children's background information. About two-thirds of their children were boys (n = 128) and 38% were girls (n =78). The mean age of children was 9.5 (SD=1.7 years) with a range of 6–12 years. The duration of postoperative hospitalization ranged from 1 to 48 days (median = 4 days). The classification of the procedure that children had undergone is described as follows: gastrointestinal (32%), ear, nose and throat (29%), cardiac (21%), orthopaedic (10%), urological and other procedures (8%).

Table 7 Parents' and their children's background information (n=206)

Background information	n	%
Parents' background		
Responding parent		
Father	97	47
Mother	109	53
Age (years)		
26-35	119	58
36-45	87	42
Education		
Lower level of education	110	53
Higher level of education	96	47
Employment status		
Employed	130	63
Other employment status (e.g. unemployed, full-time stay at home)	76	37
Earlier hospitalizations of children		
No earlier hospitalizations	123	60
One or more earlier hospitalizations	83	40
Frequencies of parent's taking care of their children in the hospital		
Everyday	123	60
Not everyday (almost everyday or limited time)	83	40
Children's background		
Gender		
Boys	128	62
Girls	78	38
Age (years)		
6-9	109	53
10-12	97	47
Manner of admission		
Elective	168	82
Emergency	38	18
Duration of postoperative hospitalization (days)		
1-3	94	46
4 and more	112	54
Classification of the procedure that children had undergone		
Gastrointestinal	65	32
Ear, nose and throat	60	29
Cardiac	44	21
Orthopaedic	21	10
Urological and other procedures	16	8

4.3.2 Data collection

Data collection from nurses (2002, I, II)

The questionnaires for nurses were handed out or mailed to the chief nurses to be forwarded to the nurses in charge of the 12 wards and then to the nurses in June 2002. A cover letter, which described the study briefly, guaranteed anonymity, indicated voluntary participation, and gave the researcher's contact information, was attached to the questionnaires. All questionnaires were returned to the researcher in sealed envelopes.

The structured questionnaire used in this study was developed by Pölkki *et al.* (2001) and used with permission in this study. Translation and back-translation between English and Chinese were performed in order to reduce the risk of misinterpretation. Background questions were modified considering the difference of Chinese culture (sub-categories of education were revised and nursing position was added as one of background questions), and questions about limiting factors were added. Finally, the instrument was structured as four sections. Section one inquired about the respondent's background (7 items). Section two elicited information about nurses' use of non-pharmacological methods to relieve children's postoperative pain (15 items, the first item, preparatory information, consisted of 21 sub-questions). Section three comprised information about how nurses guided parents in their children's surgical pain relief in hospital, which consisted of two categories: (i) what kind of preparatory information (15 items), including both cognitive and sensory information, was provided to parents; (ii) what non-pharmacological methods were recommended to parents for their child's surgical pain relief (14 items). This category included five sub-categories: cognitive-behavioral methods, physical methods, emotional support, helping with daily activities and creating a comfortable environment. The answers of section two and three were given on a 5-point Likert-type scale ranging from "not at all" to "very seldom" to "sometimes" to "nearly always" and finally "always". Section three consisted of one multiple-choice question (4 items) and an open-ended question, which inquired about factors that limited nurses' use of non-pharmacological methods for pediatric pain relief.

Data collection from nurses (2004, VI)

The same validated Chinese version of questionnaire used in 2002 was used to collect data in October 2004. In between a pain education program was developed and conveyed to the nurses. The questionnaires were handed out or mailed to the chief nurses to be forwarded to the head nurses of the 12 wards and then to the nurses in October 2004. A cover letter, which described the study briefly, guaranteed anonymity, indicated voluntary participation, and gave the researcher's contact information, was attached to the questionnaires. All questionnaires were returned to the researcher in sealed envelopes.

The permission to use the Chinese version in this study was granted by Pölkki *et al.* (2001). The questionnaire consists of two categories. The first focused on demographic items such as sex, age, education, nursing position, experiences in health care, number of children and earlier hospitalization of their own children. The second category covered information about nurses' use of non-pharmacological pain-relieving methods, including 15 items. The first item, preparatory information, consisted of 21 sub-questions. The answers ranged from "not at all" to "very seldom" to "sometimes" to "nearly always" and finally to "always".

Data collection from parents (III, IV)

The data were collected using a questionnaire. All chief nurses of participating hospitals and the head nurses of the 12 wards were informed about the study in February 2004. A nurse in each ward was invited to help with the data collection and all the invited nurses were informed of the contents of the questionnaire and inclusion criteria in detail by the researcher. They could help the parents who were illiterate to fill in the questionnaires (The illiterate parents could also get help from others). Questionnaires were distributed to parents by them. All questionnaires were returned in sealed envelopes by the chief nurses.

The structured questionnaire used in the study was earlier developed by Pölkki *et al.* (2002a, b), which was validated in Finland. The permission of usage was granted. The provided English questionnaire was translated into Chinese, and back-translation was performed in order to reduce the risk of misinterpretation. The background questions were revised considering the difference of Chinese culture (subcategories of education were revised and the question inquiring number of children was removed because of its policy-sensitive nature). Finally, the instrument was structured into four sections. Section one enquired about parents' and their children's demographic data, which included parents' gender, age, education, employment status, earlier hospitalizations of children and frequencies of parents' taking care of their children in the hospital, as well as their children's gender, age, manner of admission for operation, duration of postoperative hospitalization, name of the procedure the child had undergone. Moreover, a VAS was provided for parents to assess their child's worst postoperative pain. Section 2 elicited information regarding parents' use of non-pharmacological methods to relieve their children's postoperative pain. This section included 13 items, which were divided into: (i) cognitive-behavioural methods (providing preparatory information that consisted of 12 subquestions, imagery, distraction, breathing technique, positive reinforcement and relaxation); (ii) physical methods (positioning and massage); (iii) emotional support (presence, touch and comforting/reassurance); (iv) helping with daily activities and (v) creating comfortable environment. Replies were given by a dichotomous scale with the alternatives "yes" or "no". Section three comprised 33 questions dealing with factors that might promote and hinder parental participation in their children's postoperative pain management. The questions were all in the form of statement. The responses were given in Likert-type alternatives ranging from "totally agree" to "agree to some extent" to "don't know" to "disagree to some extent" and finally to "totally disagree". This section also included an open-ended question asking reasons for parents' anticipated feelings during their children's hospitalization. Section four was an open-ended question, where parents were asked what recommendations they had for health care providers to improve the management of their children's postoperative pain.

4.3.3 Data analysis

All statistical analyses were conducted with the help of SPSS for Windows 10.0 or 11.5. Descriptive statistics were used to summarize the demographic characteristics of nurses, parents and their children, nurses' and parents' use of selected non-pharmacological methods, factors limiting nurses' use of these methods in practice as well as parents' views on their participation in their children's pain management (I, II, III, IV, VI). The methods used by nurses in 2002 were divided into three categories: "seldom", "sometimes", and "always", where "seldom" represented "not at all/very seldom" and "always" represented "nearly always/always" (I). When the guidance provided to parents was presented (II) and when nurses' use of these methods in 2002 and 2004 were compared (VI), two categories were grouped: "seldom" and "always", where "seldom" represented "not at all/very seldom/sometimes" and "always" represented "nearly always/always". When percentages of promoting and hindering factors were presented (IV), three categories ("agree", "don't know" and "disagree") were used since some values in the original five categories were too small to give informative explanation, where "agree" represented "totally agree" and "agree to some extent", "disagree" represented "disagree to some extent" and "totally disagree".

Sum variables were formed from the variables that correlated with each other using internal correlation and Cronbach's alpha test. They were preparatory information (I, II, III, VI), cognitive and sensory information (I, VI), the ways of giving information (I, VI), non-pharmacological methods (II), factors promoting (IV) and hindering (IV) parental participation in their children's pain management.

Differences between the groups in the mean values of the variables were tested with nonparametric Kruskal-Wallis (K-W) ANOVA test because the data distributions were skewed (I). In addition, differences between the background factors and nurses' use of non-pharmacological methods and guidance to parents were tested by chi-square test (χ^2 test), with the five dimensions divided into two classes ("not at all/very seldom/sometimes" and "nearly always/always") to differentiate "non-regular users" from "regular users" (I, II). Differences between background factors and parents' use of non-pharmacological methods were tested by chi-square test (III). Mann-Whitney U

test was conducted to examine the differences between nurses' background factors in 2002 and 2004 and their use of non-pharmacological methods in children's postoperative pain relief in 2002 and 2004 (VI). P-values of <0.05 were interpreted as statistically significant in Kruskal-Wallis ANOVA test, χ^2 test and Mann-Whitney test.

Since the questionnaire developers did not conducted factor analysis to form the sum variables in their study (Pölkki *et al.* 2002a), the 33 questions regarding factors that might promote and hinder parental participation in children's pain management were analyzed by exploratory factor analysis (IV). Four questions having inter-item correlation less than 0.3 were excluded from the analysis according to correlation test. Factors with Eigenvalues over 1 were extracted; yielding 8 factors explaining 45.6% of the total variance (see Table 1, Paper IV). Original factor solution was rotated applying Varimax rotation. The final interpretations were made from the rotated factor matrix. The variables were included into the factors according to the highest loadings and consequently sum variables were formed according to the results of the factor analysis.

The questionnaires also included open-ended questions: factors limiting nurses' use of pain-relieving methods (I), factors leading to parents' anticipated feelings and parents' recommendations to health care providers for the improvement of their children's postoperative pain management (IV). The data provided by the open-ended questions were analyzed inductively using the basic principles of content analysis (Burns & Grove 2001, Polit & Hungler 2001). Examples of forming the categories from open-ended questions using content analysis are shown in Appendix 1.

4.4 Qualitative data and methods (V)

Qualitative data were collected from children by using structured- interview (V).

4.4.1 Subjects and data collection

Fifty-nine hospitalized children participated in this study. They were hospitalized in five surgical wards of three provincial hospitals in Fujian Province, China between July and October 2004. The

five surgical wards included two pediatric surgical wards (n= 29) and three cardiac and thoracic surgical wards (n= 30). The following patient inclusion criteria were applied: (a) children aged 8 to 12; (b) children having undergone a surgical procedure; (c) children capable of verbal communication in mandarin (the official national standard spoken language of China); (d) children and their parents willing to participate in this study.

Table 8 lists children's background information. Over half of the subjects were boys. The children were 8 to 12 years old, with the mean age of 9.6 years (SD=1.43). Most of them (85%) were admitted to the hospitals for elective surgeries. The duration of postoperative hospitalization ranged from one to 30 days (median=7 days). Most of the children (86%) received general anaesthesia. About half of them (51%) had undergone cardiac surgical procedures. Sixty-one percent of them had no previous hospitalization experience.

Table 8 Children's background information (n=59)

Children's background information	n	%
Gender		
Boys	35	59
Girls	24	41
Age (years)		
8-9	29	49
10-12	30	51
Manner of admission		
Elective	50	85
Emergent	9	15
Duration of postoperative hospitalization (days)		
1-7	34	58
8 and more	25	42
Type of anaesthesia		
General	51	86
Local	8	14
Classification of surgical procedures		
Cardiac	30	51
Abdominal	15	25
Other procedures (e.g. orthopaedic, urological)	14	24
Previous hospitalization experience		
Yes	23	39
No	36	61

The data were collected through structured interviews which conducted by five interviewers selected from the participating wards. Structured questions for interview were devised according to previous studies (Vessey & Carlson 1996, Pederson *et al.* 2000, Kankkunen *et al.* 2003b, Pölkki *et al.* 2001, 2002b, 2003b). The questions were divided into four sections. The first section inquired about the children's background information, including gender, age, manner of admission, duration of postoperative hospitalization, way of anesthesia, type of surgical procedure and previous hospitalization experience. At the end of this section, children were asked to assess their worst postoperative pain using a 10-cm Visual Analogue Scale (Coll *et al.* 2004). In this study, the pain intensity was measured at the interval of 0.5 cm and was defined as no pain (0 cm), mild (0.5-3 cm), moderate (3.5-6.5 cm) and severe (7-10 cm) pain (Alex & Ritchie 1992). Section 2 inquired about children's use of pain-relieving methods (see Table 1, Paper V). In Section 3, the children were asked about their perceptions on their parents and nurses' use of methods for the postoperative pain (see Table 2, Paper V). Section 4 concerned children's suggestions to their parents and nurses' on how to manage their postoperative pain better. The structured questions were pilot tested with five children who had undergone surgical procedures in a children's hospital in Fuzhou. After the pilot study, the questions were revised in order to be more understandable and finally the questions were sequenced in a better order.

All chief nurses of participant hospitals and head nurses of the five wards were informed about the study in June 2004. After that, a nurse from each ward was selected as an interviewer to help with the interview. The five interviewers were selected by the chief nurses of the three hospitals according to the following criteria: 1) the nurse had received higher education in nursing science; 2) the nurse had more than 3 years of professional working experience; and 3) the nurse showed interest in the research and was willing to take on the responsibility to conduct the interview for this study. Researcher explained the questions item by item to the five interviewers. The interviewers were also informed that they were allowed to further explain the meaning of the questions so that the children could understand them better. The interviewers visited the potential participants before the interview was conducted and made appointment for the interview. Each child was interviewed at a quiet place in the ward 1-2 days prior to his/her discharge. The interviews lasted approximately 40 to 60 minutes. Data obtained from interviews were recorded in the form of handwritten notes during

the interviews (Burns & Grove 2001). Finally, all interview results were returned to the researcher directly by the interviewers.

4.4.2 Data analysis

Descriptive statistics and content analysis were used to analyze the data. Descriptive statistics were used to describe the children's background information, their own use of and their perceptions on their parents and nurses' use of pain-relieving methods. Thematic content analysis was conducted to analyze children's suggestions to their parents and nurses for managing their postoperative pain better (Burnard 1991, Downe-Wamboldt 1992, Burns & Grove 2001). During the process, the researcher firstly took several in-depth readings of the interview notes for underlying meanings, identifying all the ideas conveyed even in one word. Then "open-coding" was conducted. That is, the researcher looked for common words, statements and passages and then the similar descriptions were color-coded. After that, the coded data were clustered into related categories (category derivation) and the categories were labeled respectively. For example, "telling a story to the child", "playing games with the child" and "chatting with the child" were clustered into a subcategory of "Distraction"; "reducing noise of the room" and "making the environment of the ward more beautiful" were clustered into a subcategory of "Creating a comfortable environment". "Distraction" and "Creating a comfortable environment" were grouped into a category named "Applying non-pharmacological pain-relieving methods". Finally, the data of content analysis were quantified within these categories and subcategories. The process of content analysis is illustrated in Appendix 2.

4.5 Pain education provided to nurses

During 2002 and 2004, a pain education program was developed, which included 3 stages: developing an education booklet, booklet distribution and lecturing. At the first stage, a review of the literature was conducted during May 2003 to March 2004 (e.g. Fordham & Virginia 1994, Pölkki *et al.* 2001, Zhao 2002, He *et al.* 2003, Kankkunen *et al.* 2003b, Song & Fu 2003), then a booklet was developed accordingly and finalized in March 2004, which was titled “Postoperative Pain Management in Children- Emphasis on the Use of Non-Pharmacological Methods” (Appendix 3). The booklet consists of four parts and each part includes several sections, in total 42 pages (see Table 1, Paper VI).

At the second stage, the booklets were distributed, either by handed-out or by mail, to all chief nurses of the 5 hospitals in July 2004. The booklets were then given to head nurses of the 12 wards to be forwarded to all nurses. Nurses were encouraged to read the booklets at their convenience.

At the final stage, lectures were given to the nurses by the principle researcher in August 2004. The lecturing was scheduled by the chief nurses of the hospitals and the head nurses of the wards. Six lectures were ward-based and three were hospital-based (Appendix 3). The lectures were given at the time assigned for professional education by the wards or hospitals so that as many as nurses could attend the lectures. One lecture was given for each ward (in total 6) or hospital (in total 3), lasting one to two hours and a total of 15 hours’ lectures were given. The lectures covered mainly postoperative pain assessment, non-pharmacological and pharmacological interventions. Nurses’ roles in children’s postoperative pain management were emphasized and nurses’ use of the non-pharmacological methods in their practice was encouraged. Finally, a questionnaire survey was conducted to examine nurses’ use of non-pharmacological methods for relieving children’s postoperative pain in October 2004.

4.6 Ethical considerations

Ethical approval followed the rules practicing in the participating hospitals. Permission to conduct the study was granted by the chief nurses of all participating hospitals. Permission to use and translate the questionnaires for nurses and parents were received by the author (Pölkki *et al.* 2001, 2002a, b, Pölkki 2002a). According to Lowes (1996), it is unethical to undertake a study that is poorly designed and unlikely to result in any useful information. This study process was planned carefully and the study results were conveyed to the nursing society through publications. In addition, the process of data collection and analysis are reported by the researcher honestly and openly, and the respondents or the hospitals cannot be identified in the discussion of the results.

In surveys, return of a completed questionnaire was viewed as consent to participate from both nurses (I, II, VI) and parents (III, IV), since it is not common to use written consent in nursing researches in the five participating hospitals. The subjects who participate in a study have rights of self-determination, assurance of anonymity and confidentiality, as well as protection from discomfort and harm (Burns & Grove 2001). In the survey studies, a cover letter was attached to each questionnaire, where purpose of the study and brief introduction of the study was explained in order to help the respondent to make the decision to whether or not to participate (Salanterä 1999b), subjects were guaranteed anonymity, and voluntary participation (in the surveys to parents, parents were assured that refusing participation would not affect the care provided to their child in the hospital) was emphasized. The cover letter also stressed that all the information obtained would be handled anonymously and that only the researcher would access to the completed questionnaire. In addition, respondents were also given a chance to contact the researcher by telephone or e-mail. All questionnaires were returned in sealed envelopes. Nurses and parents who participated in the study could probably benefit from their participation: they will apparently know more about and pay more attention to children's future pain relief in relation to non-pharmacological interventions than before their participation in the study (Kankkunen *et al.* 2002a, Pölkki 2002b). In addition, the pain education booklet distributed to nurses and lectures provided to them enriches their related knowledge, from which they can borrow some ideas to lay out pain education program to parents and children in their nursing practice in the future.

The parents' or guardians' consent is required for children of all ages to participate in a study, and the children's assent should be sought whenever the children are seven years old or older (Lindeke *et al.* 2000), even though all the children aged 7 to 15 years old felt that their consent was sufficient and questioned the need for parental consent (Coyne 1998). Parents need to be truly informed about the study in order to help them to decide whether to allow their child to participate in a study (Tait *et al.* 2003). At the beginning of the interview in the study, the interviewers met each child and his/her parents, explained the purpose of the study, and emphasized the confidentiality of the study, ensuring that the data were collected for the research use and would not be revealed to the nurses or the child's parents. Finally, the children were invited to participate in the study but were told that their refusal of participation would not affect the care they will receive. Oral permissions were obtained from both children and their parents, which meets the ethical rules in participating hospitals. Voluntary participation after full explanation of the purpose of the study was considered evidence of participants' consent (Chiu *et al.* 2003). However, during the interview, the children might have felt discomfort when they were expected to recall and measure their pain and the methods for relieving pain, and, as a result, full protection of the children from potential discomfort and harm in this respect was difficult to avoid (Kankkunen *et al.* 2002a, Pölkki 2002b).

5 RESULTS

5.1 Nurses’ role in hospitalized children’s postoperative pain relief (I, II)

Nurses’ role in children’s postoperative pain alleviation is discussed in three sections as follows: (1) nurses’ use of non-pharmacological methods; (2) nurses’ perceptions on providing guidance to parents regarding children’s postoperative pain relief; and (3) relationship between nurses’ background factors and their roles in children’s pain relief. The results are based on paper I and II.

5.1.1 Nurses’ use of non-pharmacological methods in children’s pain relief

Nurses used many non-pharmacological methods in 6-12-year-old children’s postoperative pain relief. The percentages of reported use of non-pharmacological methods for relieving children’s postoperative pain are shown in Figure 6 (see also Table 2, Paper I).

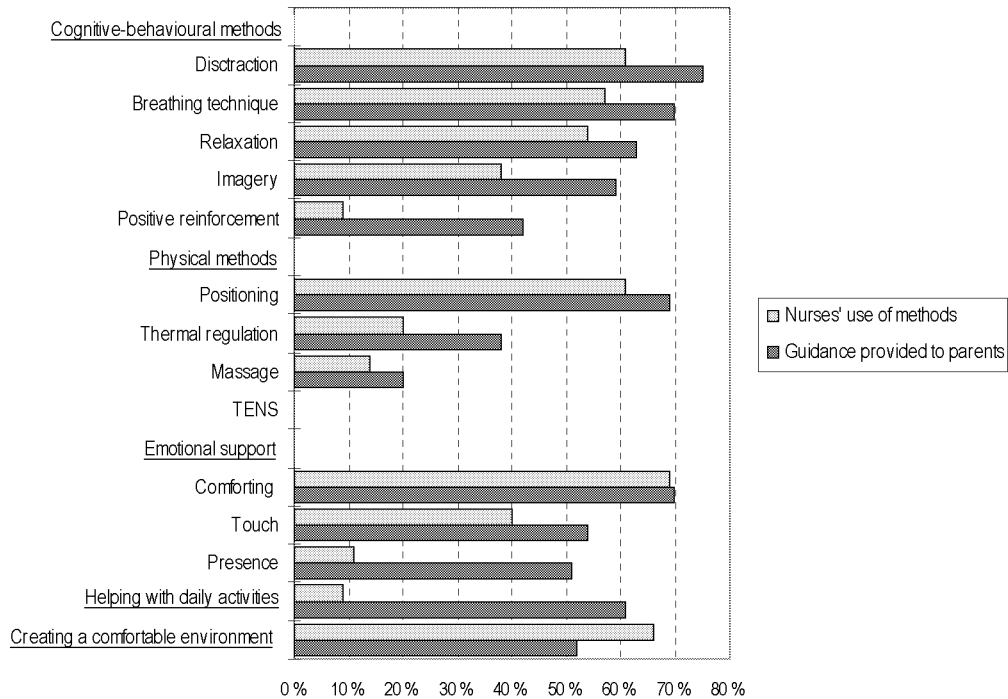


Figure 6 Nurses’ “always” use of non-pharmacological methods to children and providing guidance to parents (n=178)

Among *cognitive-behavioural methods*, most commonly used methods were preparatory information (75%), distraction (61%), breathing techniques (57%) and relaxation (54%). Imagery (38%) and positive reinforcement (9%) were less frequently used when compared with other cognitive-behavioural methods.

Percentages for *preparatory information* to children are shown in Figure 7 (see also Table 3, Paper 1). Most commonly provided cognitive information were information about preoperative procedures (85%), postoperative limitations (76%), postoperative observation (65%) and postoperative placement (60%). Six questionnaire statements were related to ways of giving information and more than half of the alternatives were, in most cases, reported as being “always” used. However, only about one-third of the nurses reported “always” making sure routinely that the child understood the information given, and one-quarter reported “always” encouraging the child to ask about misconceptions.

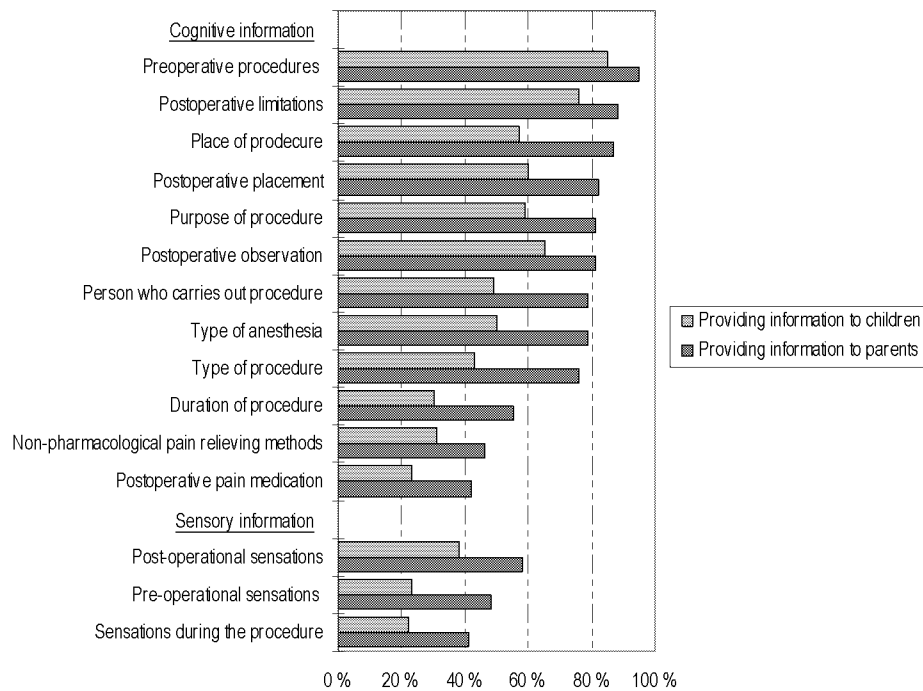


Figure 7 Preparatory information “always” provided to children and parents by nurses (n=178)

As far as preparatory information was concerned, the nurses were asked what alternative ways they used to inform children. Many nurses stated that they “seldom” used videos (91%), demonstrations (84%) and books/instruction folders (63%) to convey the information. Furthermore, nurses who reported using imagery were asked what they urged the children to imagine while they were in pain. Forty-two percent of the respondents reported they “always” urged the children to think of pleasant activities, whereas very few nurses “always” urged the children to think of a pleasant place (15%) and a pleasant trip (11%) for imagery.

Strategies “always” used by the nurses to distract children from pain included humor (40%), playing games (35%), reading books /magazines (24%), talking about the child’s hobbies (22%), talking about the child’s daily lives (21%), listening to music (20%) and watching TV/video (7%).

Among *physical methods*, the most commonly used method was positioning (61%). However, thermal regulation (20%) and massage (14%) were used much less often. No nurse claimed that she had ever used TENS as a pain-relieving method.

With regard to *emotional support and other methods*, more than two-thirds of the nurses reported they always use comforting/reassurance and creating a comfortable environment. However, only about one-tenth reported they “always” use the methods of presence and helping with daily activities respectively. Strategies for the creation of a comfortable environment include minimizing noise in order to provide a quiet environment for the child to sleep well, maintaining a comfortable temperature and air conditioning in the room, providing the child’s favorite belongings and paying attention to the interior decoration of the room, where 78%, 69%, 60% and 19% of the nurses reported they “always” used the above strategies respectively.

About *factors limiting* nurses’ use of non-pharmacological methods, the most important limiting factor was that there were too few nurses, and they therefore did not have enough time to pay attention to children’s surgical pain (94%). The second factor was nurses’ lack of knowledge about pain management (63%). The third was that non-pharmacological methods were not part of conventional postoperative practice (60%). Almost half reported that ignorance of pain management

because of the traditional culture was a limiting factor. In addition, 20 nurses reported other limiting factors such as: (1) the slow effect or inefficacy of these methods for pain relief (n=13); (2) lack of parental support and cooperation (n=8); and (3) less ideal conditions in the hospital environment (n=6) (see Table 4, Paper I).

5.1.2 Nurses' guidance to parents in their children's pain relief

Percentages for guidance of non-pharmacological methods are shown in Figure 6 (see also Table 1, Paper II). Cognitive-behavioral methods most often suggested to parents "always" were distraction (75%), positive reinforcement (70%), relaxation (63%) and breathing techniques (59%). The only physical method that was "always" instructed to parents was positioning (69%). More than two-thirds of the respondents "seldom" provided guidance to parents in the use of massage and thermal regulation. No nurse said they had provided TENS to parents as a pain relief method. In the category of emotional support, comforting/reassurance (70%) was the most commonly suggested method for relieving children's surgical pain. Moreover, helping with daily activities and creating a comfortable environment were suggested to parents by about half of the respondents.

Figure 7 demonstrates preparatory information provided to parents by nurses. Most aspects of cognitive information were "always" provided by more than three-fourths of the respondents and the provided cognitive information include preoperational procedures (e.g. abstaining from food, pre-medication), postoperative limitations (e.g. limitations of activities and food), place of procedure, postoperative placement (e.g. intensive care unit, recovery room, or inpatient ward), postoperative observations of the child's condition, purpose of procedure, person who carries out the procedure, type of anesthesia and type of procedure. In the category of sensory information, the postoperative sensations (e.g. pain and nausea) were "always" provided by about three-fifths of the respondents, whereas less than half of them claimed that they "always" provided information of preoperative sensations (e.g. fear, anxiety) and sensations during the procedure (e.g. pain) to parents.

5.1.3 Relationship between nurses' background factors and their roles in children's pain relief

Statistically significances were found between nurses' background factors and their use of non-pharmacological methods (Paper I). *Older nurses* (age group 32-43 and 44-54, n=64) used the following methods more than nurses aged 20-31 (n=114): giving preparatory information about preoperative procedures, about postoperative placement and about postoperative limitations; methods of verbal rewarding and positioning. *More educated nurses* (n=48) prepared children more carefully than less educated nurses did (n=130) and the preparation was achieved by giving information about preoperative preparations and making sure that the children understood the information given. *Nurses in a high staff position* (primary nurse; attending, associate senior and senior nurse, n=102) used the following methods more frequently than nurses in the lowest position (assistant nurse, n=76): positioning, massage, and giving information of non-pharmacological pain-relieving methods. *Nurses with 10-20 years' experience* in health care (n=67) provided information on postoperative positioning, postoperative limitations and used positioning most frequently. However, *nurses with 5-10 years' experience* (n=60) paid more attention to creating a comfortable environment than nurses in the other four groups. *Respondents with children of their own* (n=104) used the following methods more often than those without children (n=74): giving information about the type of procedure, verbal rewarding, and positioning. *Nurses who had experience of earlier hospitalization of their own children* (n=21) took into account the child's age and development when preparing patients for a procedure more often than those without this experience (n=157).

Table 9 shows the relationship between nurses' demographic variables and their providing guidance to parents (Paper II). *Older nurses* (31-54 years old, n=76) provided the following methods more than younger nurses (20-30 years old, n=102): information of postoperative placement, purpose of procedure and person who carries out procedure; positive reinforcement, breathing technique and relaxation. *Less-educated nurses* (graduated from Nursing Schools, n=130) suggested parents use presence more frequently than more-educated nurses (graduated from Junior Colleges, n=48) did. *Nurses with higher position* (Senior, Associate senior, Attending and Primary nurse, n=102) provided the following guidance more frequently than nurses with lower position (Assistant nurse, n=76):

preparatory information regarding purpose of procedure and person who carries out procedure; breathing technique. *More-experienced nurses* (More than 10.1 years, n=82) provided the following methods more frequently than less-experienced nurses (Less than 10 years, n=96): information of postoperative placement, purpose of procedure and person who carries out procedure; breathing technique. *Nurses with children of their own* (One or more children, n=104) provided the following guidance more often than those without child (n=74): giving information of the purpose of procedure and non-pharmacological pain-relieving methods; positive reinforcement.

Table 9 Relationship between nurses' demographic variables and their providing guidance to parents (n=178)

Nurses' providing guidance to parents	Nurses' demographic variables				
	Age	Education	Nursing position	Professional working experience	Nurses' own children
	Younger / Older (%)	Less-educated / More-educated (%)	Lower / Higher (%)	Less experienced / More-experienced (%)	None / One or more (%)
Cognitive-behavioral methods					
<i>Preparatory information</i>					
Postoperative placement	76/91**			76/89*	
Purpose of procedure	74/92**		71/89**	73/92**	72/89**
Person who carries out procedure	72/88**		68/86**	71/88*	
Non-pharmacological pain-relieving methods					37/52*
<i>Positive reinforcement</i>	62/80**				60/77*
<i>Relaxation</i>	57/72*				
<i>Breathing technique</i>	51/70*		49/67*	51/68*	
Emotional support					
<i>Presence</i>		57/35*			

Values are expressed as percentages. Chi-square tests were used to compare the difference nurses' demographic variables and their providing guidance to parents about non-pharmacological methods for their children's postoperative pain relief.

Only statistically significant results are presented (*p< 0.05, **P<0.01).

5.2 Parents' role in their hospitalized children's postoperative pain relief (III, VI)

Parents' role in their children's postoperative pain alleviation is discussed in the following sections: (1) parents' use of non-pharmacological methods; (2) the relationship between background factors and parents' roles in children's pain relief; and (3) parents' views on their participation in their children's pain relief. The results are based on paper III and IV.

5.2.1 Parents' use of non-pharmacological methods in their children's pain relief (III)

The most commonly used *cognitive-behavioural methods* by parents were distraction (85%), imagery (80%) and preparatory information (76%) (see Table 2, Paper III). About two-thirds of the respondents reported to have used techniques such as positive reinforcement and relaxation. Breathing technique (37%) was the only method not commonly used among parents.

Concerning parents' *giving preparatory information* to their children (see Figure 2, Paper III), more than half of the parents provided the following information: preoperative procedures (e.g. pre-medication, abstaining from food, 62%), type of procedure (59%), place of procedure (57%), purpose of procedure (56%) and preoperational sensations (56%). The remaining preparatory information was provided to children by less than half of the parents.

As for parents' use of *physical methods and other pain alleviation methods*, sixty-nine percent of the parents used both positioning and massage for alleviating their children's pain. Most of the parents claimed to have used all the following strategies for emotional support: presence (93%), touch (90%) and comforting/reassurance (84%), as well as helping their children with daily activities (87%). Furthermore, about three-fourths of the parents claimed they had paid attention to the creation of a comfortable environment for their children.

In addition, parents were asked to use VAS to assess their children's worst postoperative pain (mean= 5.06, SD = 2.53). About three-quarters (76%) of the parents assessed their children's worst pain to be moderate (50%) or severe (26%) (see Figure 1, Paper III).

5.2.2 Relationship between background factors and parents' roles in children's pain relief (III)

Many parents' background factors were related to their use of non-pharmacological methods for relieving their children's postoperative pain with statistical significance (see Table 3, Paper III). *Fathers* (n =97) used some methods more frequently than mothers (n = 109), among which are imagery, as well as the methods of positive reinforcement and creating a comfortable environment. Parents in the *older age group* (n = 87) provided information about preoperational sensory and use presence for pain relief more frequently than those in the 'younger age group' (n=119). However, the respondents in the younger age group used imagery more frequently than those in the older age group. *More-educated* parents (n = 96) applied some methods more frequently than 'less-educated' ones (n = 110), among which are distraction, imagery, information concerning type of procedure, place of procedure and purpose of procedure, sensations during the procedure, as well as methods of positive reinforcement and creation of a comfortable environment. Parents who were *employed* (n = 130) used the following methods more often than those at 'other employment status' (n =76): imagery, information concerning type of procedure and place of procedure, positioning, touch, as well as methods of creating a comfortable environment. Respondents *with previous experience of hospitalization* with their children (n = 83) provided information concerning type of anaesthesia to children more often than those without such experience (n =123). Parents *who were not in the hospital taking care of their children everyday* (n = 83) used several methods more frequently than those 'who were in the hospital everyday' (n = 123), and the methods include imagery and giving information of preoperational sensations.

Moreover, children's background factors also are related to parents' use of some non-pharmacological methods with statistical significance (see Table 4, Paper III). Parents used massage more often to *girls* (n=78) than to boys (n=128). However, the method of positive

reinforcement was applied more frequently to *boys* than to girls. They used the method of creating a comfortable environment more often to *younger* (n=110) than to older (n=96) group of children. Furthermore, they provided information concerning preoperative procedures and the place of procedure to children admitted for *selective operations* (n=168) more often than to those for 'emergency operations' (n=38). In addition, parents provided information concerning type of procedure, method used for creating a comfortable environment more frequently to children of *shorter hospitalized duration* (n=94) than those 'of longer one postoperatively' (n=112). Moreover, parents used the following methods more frequently to children having *moderate pain* (n = 102) than to those having 'severe' (n=54) and 'no/mild pain' (n=50): providing information concerning place of procedure, positive reinforcement and massage.

In addition, the relationship between father/mother and their other background variables is shown in Table 10. More fathers were in the older age group, employed and took care of their children in the hospital less frequently than mothers.

Table 10 Relationship between father/mother and their other background variables (n=206)

Backgrounds		Responding parent		χ^2	P
		Father (%)	Mother (%)		
Age (years)	26-35	46	68	9.7	0.002
	36-45	54	32		
Employment status	Employed	81	47	26.5	<0.001
	Other employment status	19	53		
Frequencies of parent's taking care of their children in the hospital	Everyday	44	73	18.0	<0.001
	Not everyday	56	27		

In summary, fathers and parents who were older, more educated, employed and with earlier hospitalization experience with their children used pain alleviation methods more frequently than mothers and parents without these characteristics. Moreover, parents used some methods more frequently with boys, younger children, and children admitted for selective operations, with longer duration of hospitalization and with moderate or severe pain.

5.2.3 Parents' views on their participation in their children's pain management (IV)

Parents' views on their participation in their children's postoperative pain management were obtained through 29 questions. Eight sum variables (factors) were formed by factor analysis (see Table 1, Paper IV): five are regarded as positive factors that might promote parental participation in their children's pain management (see Table 3, Paper IV) and three are regarded as negative factors that might hinder parental participation (see Table 4, Paper IV).

Five promoting factors included: adequate information about surgical procedure, sufficient opportunities to get emotional and information support, adequate communication with health care providers in pain care, adequate information concerning pain management and being understood if parents do not participate in their children's care (see Table 3, Paper IV). Most of the parents agreed that they had received adequate information on the success of the procedure (85%) and the recovery process after the procedure (84%). Most of the parents agreed that information helped them to participate in their child's pain management in the ward (93%) and they had received sufficient support from health care providers (83%). Moreover, the same amount of the parents agreed that they had opportunities to consult nurses about what they did not know concerning pain management (82%) and they had been instructed the methods for relieving their children's pain (82%). However, only about half of the parents agreed that they had a clear idea about what they could do to help with their child's pain relief. In addition, less than two-thirds of the respondents agreed that they had received adequate information about the duration of the child's possible pain (65%), pain-relieving methods other than medication (59%) and pain medication (51%).

Three hindering factors were: lack of understanding of information provided, being under-used as a potential in pain management and parents' negative feelings relative to their children's hospitalization (see Table 4, Paper IV). In detail, more than half of the respondents agreed that they did not always understand the information provided by the physicians (55%) and the nurses (53%). About one third of the parents agreed that nurses often underestimate parents' importance in their child's pain management (30%) and parents' expertise was not appreciated sufficiently (29%).

Distress was the most common negative feeling experienced by the parents during their children's hospitalization (59%). Sixty percent of the parents (n=123) answered the open-ended question concerning reasons for those feelings. The most commonly mentioned reason was procedure-related issues (n=62), such as risk of complications, risk of failure of the procedure and side effects of the anesthesia. Other reasons included the nature feelings related to parenthood (n=30), uncertainty of their children's condition and the prognosis of the procedure (n=19), lack of knowledge or capability to help their children (n=14), as well as seeing their children in pain (n=9).

Sixty-one percent of the parents (n=126) gave their recommendations regarding what health care providers could do to improve their children's pain care. Five themes emerged (see Figure 1, Paper IV). Two-thirds of the respondents (n=84) recommended that health care providers could apply non-pharmacological methods for their children's pain relief, and thirty-eight percent of them expressed the need for more information and instructions, especially those concerning pain-relieving methods, continuing care postoperatively, and their children's disease and condition. Thirty-one percent of them expressed their expectation that nurses could spend more time with them and their children for more communication.

5.3 Children's role in their postoperative pain relief in hospital (V)

Children's role in their postoperative pain alleviation is discussed in two sections: (1) their use of pain-relieving methods and (2) their perceptions on their parents and nurses' use of methods for their postoperative pain relief and their suggestions to caregivers.

5.3.1 Children's use of methods for their postoperative pain relief

Children used different methods to relieve their surgical pain (see Table 4, Paper V).

Cognitive-behavioral methods. The cognitive-behavioural methods most commonly used by the children were relaxation (61%) and distraction (61%). Other methods in this category were used less frequently. As far as the ways of distraction were concerned, more than two-fifths of the

children used reading books, eating/drinking and listening to the music to distract them from postoperative pain.

Physical methods. In this category, positioning was used by 81% of the children, whereas only 9 % of them applied thermal regulation to their pain relief.

Emotional support and other methods. Eighty percent of the children required the presence of their parents while they were in pain. Most of the children (86%) preferred rest/sleeping to cope with postoperative pain and more than half of them (56%) said that they tolerated the surgical pain. However, only one-third of the children reported that they would ask nurses for help, such as asking for pain killers.

About half of the children (49%) reported that they felt postoperative pain on the day when the surgical procedure was performed, 37% the next day, 12% two days later and 2% other time. According to VAS, the children's mean pain intensity of the worst pain postoperatively was 5.9 (SD=2.30). In this study, the pain intensity were measured at the interval of 0.5 cm and were defined as no pain (0 cm), mild (0.5-3 cm), moderate (3.5-6.5 cm) and severe (7-10 cm) pain. Figure 8 illustrates that most of the children (88%) reported that their worst postoperative pain was moderate (47%) or severe (41%).

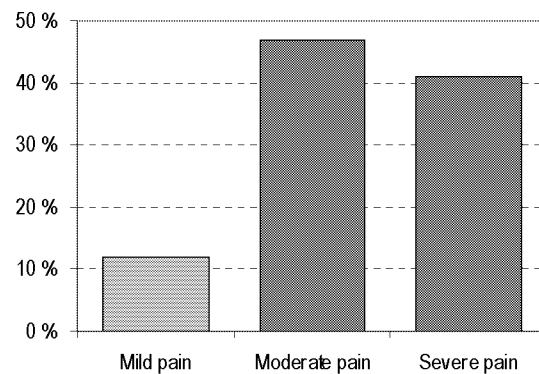


Figure 8 Children's assessment of their worst postoperative pain using a 10-cm-VAS (n=59)

5.3.2 Children's perceptions on their parents' and nurses' use of methods for relieving their postoperative pain

Children's perceptions on their parents' and nurses' use of pain-relieving methods are presented as follows (see Figure 1, Paper V).

Cognitive-behavioral methods. The most commonly reported cognitive-behavioural methods used by their parents were positive reinforcement (75%), relaxation (61%) and distraction (61%). The most commonly reported cognitive-behavioural methods used by nurses included giving preparatory information (70%), relaxation (70%) and distraction (66%).

Physical methods. About two-thirds of the children reported that parents used positioning and massage while they were in pain, whereas 78% of them reported that the nurses used positioning for their postoperative pain relief. Thermal regulation was seldom used by both parents and nurses.

Emotional support. The children reported that their parents used emotional support strategies very often while they were in pain. The strategies included comforting (88%), presence (86%) and touch (83%). However, the nurses used mostly only comforting (80%). Touch and presence were less frequently used by the nurses.

Other methods. Other methods included helping with daily activities, creating a comfortable environment and applying pain medication. Most of the children (90%) reported that their parents helped them with daily activities while they were in pain. Seventy-one percent of the children claimed that the nurses used the method of creating a comfortable environment for their pain relief.

5.3.3 Children's suggestions to their parents and nurses

Most of the children had suggestions to both their parents and nurses on how to better manage their postoperative pain (see Figure 2, Paper V). Sixty-one percent of the children (n=36) gave suggestions to their parents, which were synthesized into 4 categories: applying non-pharmacological pain-relieving methods; giving pain medication; providing help in the light of the child's wishes and communicating with nurses more often. Fifty-six percent of the children (n=33) gave suggestions to nurses, which were also synthesized into 4 categories: applying non-pharmacological pain-relieving methods; showing friendly attitude and providing better service; providing more information and giving pain medication.

5.4 Comparison of nurses' use of methods in children's postoperative pain alleviation in 2002 and 2004 (VI)

Concerning nurses' use of *cognitive-behavioral methods*, similarities were found on nurses' commonly use of some non-pharmacological methods in 2002 and 2004 (see Figure 3, Paper VI), and the similarities lie in the methods of providing preparatory information, distraction, comforting/reassurance, creating a comfortable environment and positioning. However, there is a difference: only small number of nurse "always" used imagery (38%) and positive reinforcement (9%) in 2002 while about two-thirds of the respondents used imagery and positive reinforcement to relieve children's postoperative pain in 2004.

Concerning nurses' *providing preparatory information* to the children, most of the cognitive information and all sensory information were provided more frequently by the nurses in 2004 (see Figure 4, Paper VI). The most common provided information both in 2002 and 2004 included preoperative procedures and postoperative limitations. Six statements were related to ways of giving information and more than half of the alternatives were reported as being "always" used. However, only one-quarter reported both in 2002 and 2004 that they "always" encourage the children to inquire about their misconceptions.

The most common used *physical pain-relieving method* both in 2002 and 2004 was positioning (see Figure 3, Paper VI). Thermal regulation and massage were used by less than one-fifth of the nurses. No nurse claimed to have used TENS as a pain-relieving method in 2002 while in 2004, three nurses reported to have used the method to relieve children's pain.

With regard to nurses' use of *emotional support and other pain-relieving methods*, comforting/reassurance and creating a comfortable environment were "always" used by about two-thirds of nurses both in 2002 and 2004, whereas touch, presence and helping with daily activities were used more frequently by the nurses in 2004 than in 2002 (see Figure 3, Paper VI).

Statistically significant differences were found between 2002 and 2004 in nurses' use of following non-pharmacological methods in children's postoperative pain alleviation: imagery, positive reinforcement, TENS, touch and presence (see Figure 3, Paper VI). In addition, statistically significant differences also existed between 2002 and 2004 in nurses' providing following information to the children: duration of procedure, non-pharmacological pain-relieving methods, pre-operational sensations, and sensations during the procedures, as well as making sure that the information provided has been understood (see Figure 4, Paper VI).

6 DISCUSSION

6.1 Discussion of validity and reliability

Both quantitative and qualitative methods were used in this study in order to achieve the depth and completeness of the data (Begley 1996, Tobin & Begley 2004). Internal and external validity are used to evaluate the adequacy of research control mechanisms and overall research design. Internal validity is the extent to which the effects detected in the study are a true reflection of reality, which is the center of validity in both quantitative and qualitative approaches (Cutcliffe & McKenna 1999, Burns & Grove 2001, Polit & Hungler 2001). External validity is the extent to which the study findings can be generalized beyond the sample used in the study (Burns & Grove 2001). In quantitative research, external validity is a proper term to refer to the generalizability of the research findings to other settings or samples, whereas in qualitative research, the term transferability is used to refer to the same meaning (Polit & Hungler 2001).

The focus on the contents of validity and reliability in quantitative and qualitative researches varies because these two approaches represent fundamentally different epistemological frameworks for conceptualizing the nature of knowing and social reality (Shih 1998, Cutcliffe & McKenna 1999). The validity and reliability of the instrument are emphasized in the quantitative research; whereas the interviewer's role is emphasized in the qualitative research (Pölkki 2002b) since there is no hard and fast rule for the assessment of the validity and reliability of qualitative research (Porter 1996). The validity and reliability of this study are discussed separately for the quantitative and qualitative research through the research process since each phase of the process may include threats to the validity and reliability of the study (Pölkki 2002b).

6.1.1 Quantitative research (I, II, III, IV, VI)

Samples

The data were collected from nurses in 12 wards that had performed operations for school-aged children both in 2002 and 2004 and from parents whose 6-12-year-old child had undergone surgical procedures in the same 12 wards. In the study, the response rates were high in the samples (nurse 98% in 2002 and 95% in 2004, parents 88%). If the response rate to a questionnaire is lower than 50%, the representation of the sample is seriously doubtful (Burns & Grove 2001), so in this respect the samples in this study could be considered representative in the target groups.

Instruments and data collection

Among strategies created to determine the validity and reliability of the measurements in quantitative research, the instrument's validity and reliability were the main issues. A valid instrument should actually measure what it intends to measure (McBurney 1997). Both instruments for nurses and parents used in this study were developed by Pölkki *et al.* (2001, 2002a, b) and validated in Finland. These instruments were developed and designed based on earlier literature and clinical experiences concerning children's pain, non-pharmacological pain-relieving methods and parents' role in their child's pain alleviation (Pölkki 2002b). The translation of the questionnaires has been verified through back-translation and they have been modified considering the difference of Chinese culture. Content validity assesses the degree to which the items in an instrument adequately represent the universality of content (Polit & Hungler 2001). In this study, a group of experts were involved in the revision process of the Chinese questionnaires (Grant & Davis 1997); a statistician and two nurses specialized in pediatric surgical nursing were asked to revise the instrument for nurses, whereas a statistician, two nurses specialized in pediatric surgical nursing, and a mother with previous hospitalization experience with her child were invited to participate in the discussion of the questionnaire to parents. The researcher discussed the contents item by item with each expert.

In addition, in order to improve the content and construct validity, pilot tests were conducted with eight nurses working at a pediatric surgical ward in one provincial hospital and 20 parents whose children had undergone surgeries at a pediatric surgical ward of a children's hospital in Fuzhou. An assessment letter was attached to each questionnaire inquiring about their opinion on what they do not understand and about their suggestions on the revision of the questionnaire. There were no critical comments on the contents and the translation of the questionnaire from nurses. Some parents raised some questions about the background items.

Based on the discussion with expert panel and the results of pilot tests, revisions were made and some explanations were added behind some methods in order to make the methods easier to be understood by nurses and parents. For example, with regard to nurses' background question items, subcategories of nurses' education were modified according to the educational system in China and nursing position was added as one item of questions according to the health care system in China. Each nurse has a professional title (assistant nurse, primary nurse, attending nurse, associate senior nurse and senior nurse) in Chinese hospitals and the responsibilities of nurses with different title might be different to some extent, which might influence their clinical practice concerning pain management. As to parents' backgrounds, subcategories of education were revised and the question related to number of children was deleted because of its policy-sensitive nature and the possibility of influencing parents' participation in the study. Moreover, in the questionnaire for nurses, under the method of thermal regulation (including cold and heat application), "icy bag, icy pillow, icy hat and icy towel" were added behind "cold application", whereas "warm mattress, warm pillow and warm towel" were added behind "heat application". The same practice was used when the expert panel was conducted to examine the questionnaire for parents. For example, an explanation of "praising that the child behaves very well and very brave" was added behind the method of "oral rewarding". The purpose was to transform the concepts derived from theoretical definitions into the operational definitions of the study so that the respondents could understand the questions (Burns & Grove 2001, Polit & Hungler 2001).

Although the questionnaires cover most of the contents related to non-pharmacological methods available for nurses' and parents' use in children's pain alleviation, the instruments developers

(Pölkki *et al.* 2001, 2002 a, b) questioned whether the questionnaires (I, III) adequately represented the phenomenon of children's postoperative pain management (Pölkki 2002b). To eliminate the doubt in this aspect, an open question was added at the end of each instrument, inquiring about nurses/parents' use of other methods for children's postoperative pain alleviation. This study showed some nurses also used acupressure and modeling to deal with children's postoperative pain and some parents used modeling to their child (they have not been reported in the results). Some researchers (Kazak & Kunin-Batson 2001, Chen 2003, Song *et al.* 2005) have reported the use of acupressure and modeling in children's postoperative pain relief. Therefore, these methods could possibly be added when we develop the instrument in the future: putting modeling into the category of cognitive-behavioral methods and acupressure into the category of physical methods.

Factor analysis was performed to evaluate the construct validity (Burns & Grove 2001); the result showed that two common factors were consistent with two components (preparatory information and non-pharmacological methods) in both instruments (I, III), which indicated high discriminate validity of this instrument.

The reliability of an instrument is the degree of consistency with which it measures the attributes supposed to be measured (Polit & Hungler 2001). Stability, equivalence and internal consistency are important attributes in the assessment of reliability. In this study, Cronbach's alpha test was used to assess the internal consistency of the questionnaires and the coefficient between 0.8 and 0.9 indicates the instrument can reflect more richly the fine discrimination in the levels of the construct (Burns & Grove 2001). In the present study, the following alpha values were obtained: preparatory information (I: $\alpha=0.92$; II: $\alpha=0.90$; III: $\alpha=0.87$; VI: $\alpha=0.91$), cognitive and sensory information (I: 0.90, VI: $\alpha=0.89$), ways of giving information (I: $\alpha=0.84$; VI: $\alpha=0.83$), non-pharmacological methods (II: $\alpha=0.90$), factors promoting (IV: $\alpha=0.72$, $\alpha=0.70$, $\alpha=0.60$, $\alpha=0.77$ and $\alpha=0.53$) and factors hindering (IV: $\alpha=0.92$, $\alpha=0.73$ and $\alpha=0.72$) parental participation in the implementation of methods in their child's pain relief. Most of the alpha values obtained in the study are more than 0.7 and are comparable to the values of Finnish studies (Pölkki *et al.* 2001, 2002a, b, Pölkki 2002). This indicated good reliability (internal consistency) of the instruments when they were used in Chinese context.

Instructions on how to fill in the questionnaires were provided and each item was written very clearly, which might reduce the measurement errors (Nunnally & Bernstein 1994). There was no problem with the questionnaire for nurses, since there were very few missing values. However, it was problematic when parents were asked whether they had used certain method in relieving their child's pain (III): some parents might just leave the question unanswered to express that they did not use the method (Pölkki 2002b). In addition, the form of some questions (IV) might be problematic. For example, it might be difficult for parents to assess whether they have received "adequate" information or not (IV) (Chang 1997), e.g. "I have received sufficient support and help from nurses".

Although there are some advantages of using questionnaire to collect data, like allowing anonymity and helping to obtain information on a large scale, some limitations do exist and the limitations may threaten the validity and reliability of the study. For example, the respondents might act differently from what they claimed to have acted. Result based on nurses' replies could be exaggerated in reported frequencies, for the replies may be influenced by what effect the respondent hoped the results would have. In study VI, although the results show statistically significant differences on nurses' use of many non-pharmacological methods, it is possible that variation occurred simply because the study took place and their pain management practices were evaluated. The use of the observation of nurses and parents' actual use of pain-relieving methods in hospitals may increase the face-validity of the results (Polit & Hungler 2001, Pölkki *et al.* 2003b). In study III and IV, positive response bias might have occurred especially when the parents perceived that their answers might affect the care provided to their children (Foster & Varni 2002, Pölkki *et al.* 2003b). Moreover, using a five-point Likert scale (I, II, IV, VI) and a dichotomous response alternative (III) might simplify the task of reply (Pölkki 2002b). The simplification of the task of replying by using a dichotomous response alternative gave no chance to parents to suggest the frequency or intensity with which non-pharmacological methods were used (Pölkki *et al.* 2002b).

In the parents' study, the fact that parents were asked to fill in the questionnaires during their child's hospitalization (III, IV) ensured the collection of current information from parents (Pölkki 2002b), but doing so might have biased the results because the "halo effect" of information collection in

hospital causes a tendency to give positive responses (Kawik 1996, Neill 1996a). In addition, the possibility that many parents were reluctant to criticize the treatment received in the hospital settings might be another threat to the validity (Kawik 1996, Neill 1996a, Pölkki *et al.* 2002a). Rating the children's pain intensity using VAS might be difficult for some parents (III) (Kankkunen *et al.* 2003).

Data collection of the comparison study (VI) was conducted only two months after the completion of the education program. Therefore, the results might not be very informative. The situation might be different if it had been conducted half a year or one year after the education (Francke *et al.* 1996). Furthermore, it would be better if another questionnaire survey had been conducted just before the pain education given. In this case, we could draw a conclusion concerning whether the pain education has had effects on nurses' use of non-pharmacological methods or not more confidently.

Data analysis and results

The quantitative data from the questionnaires were input into SPSS 10.0 (I, II) or 11.5 (III, IV, VI) software. The researcher herself input the data (I, II) and her colleagues helped to input the data (III, IV, VI) into the statistical software. The researcher instructed her colleagues how to input the data, including the quantitative and qualitative data, and they were asked to input the data carefully. After the data were input, the researcher selected some questionnaires randomly and double-checked the data input to avoid errors. The researcher chose the data analysis methods in collaboration with two statisticians. The open-ended questions were analyzed inductively using the basic principles of content analysis (Burns & Grove 2001, Polit & Hungler 2001, Bowling 2002). Results of open-questions inquiring about factors limiting nurses' use of non-pharmacological methods (I) and suggestions parents have to nurses for the improvement of their children's pain management (IV) were reported in the study. Some examples of the categories (IV) formed by using content analysis in open-ended questions are demonstrated in Appendix 1. However, results of other open questions were not reported in this study but they were in the data input and taken into account in the interpretation of the results (Pölkki 2002b). For example, when nurses were asked "besides the above mentioned alternatives, what other things you ask the child to think of or imagine", if the nurse gave answers like "a favorite food" or "interesting TV program or stories", the researcher

coded that the nurse used imagery as a pain relief method. The same practice was used with open-ended questions for parents (III, IV). In addition, the researcher read all of the returned questionnaires for parents (III; IV) before her colleagues input the data into SPSS software.

Since the data from nurses and parents were only from one province, the results cannot be generalized to apply to all nurses who work at wards that had performed operations for school-aged children, and to all parents whose children had undergone surgical procedures nationwide. China is a big country, the economical development varies greatly, and therefore the quality of nursing care is different among hospitals in different areas. The variety may exist between coastal city and interior city, between city and countryside, between big cities and small cities or between provincial hospitals and district hospitals in the same city. Nevertheless, the results of the study addressed to nurses and parents can be generalized to the whole target group: nurses working on the 12 wards in the five provincial hospitals in Fujian Province of China and parents whose children had undergone surgery in one of the aforementioned wards (Polit & Hungler 2001). In addition, the wide variety of children's age (6–12 years) might have influenced the findings as nurses and parents might use different strategies for pain alleviation to children of different age groups.

6.1.2 Qualitative research (V)

Subjects

The central question of assessing the validity and reliability of a qualitative research is whether the data collected by the researcher reflect the truth (Cutcliffe & McKenna 1999). There are no closely defined rules for sample size (Baum 2002); sampling in qualitative research usually relies on small numbers with the aim of studying in depth and detail (Patton 1990). Purposeful sampling attempts to select research participants according to criteria determined by the research purpose (Tuckett 2004), which was used in this interview study. The data were collected from 59 hospitalized 8-12-year-old children, who were able to tell about their experiences on postoperative pain-relieving methods and therefore they were assumed as the best informants (Pölkki 2002b).

They had undergone surgical procedures at one of the cardiac and thoracic surgical wards (n=3) or pediatric surgical wards (n=2) and they meet the aforementioned inclusion criteria.

Data collection

Considering the subjects' age, the interviews were regarded as appropriate to achieve the purpose of the study (Pölkki 2002b). However, children often have difficulty ascertaining what interviewers want to know from them (Docherty & Sandelowski 1999) and they often responded to wh-questions by "I don't know" or "I can't remember" (Peterson 1999). Bowling (2002) stated that a carefully designed structured interview can yield highly accurate data, therefore structured questions were used to inquire of children's perceptions on their own use of as well as their parents' and nurses' use of pain-relieving methods in pain alleviation and to record the data in this study. However, the use of structured-questions might have restricted the obtaining of the children's views on the research topic. Two open-ended questions were devised to inquire about children's suggestions to their parents and nurses for the improvement of their pain management, which allow children to reply in their own words and therefore produce information from the subjects' own perspective. Although the questions were formulated based on previous research findings (Pölkki *et al.* 2001, 2002b, 2003b, Pederson *et al.* 2000, Vessey & Carlson 1996, Kankkunen *et al.* 2003a), they may not bring adequate information from the Chinese children's own perspectives. The results might be different if open-ended questions but not forced-choice questions were asked about children's own use of and their perceptions of nurses' and parents' use of pain-relieving methods. In addition, rating the pain intensity using VAS might be difficult for some children especially younger ones (Kankkunen *et al.* 2003b).

The reliability of interview study was increased by minimizing the constant error by encouraging the participants to be honest and to tell their opinions as sincerely as possible (Kankkunen 2003). Children were told that there was no right or wrong answers and the negative answers would not affect the care they would receive (Coyne 1998). However, positive response bias might be a threat to the validity, especially when the children believe that their answers may affect the care they receive (V) (Foster & Varni 2002, Pölkki *et al.* 2003b). Moreover, some of them might have tried to

give favorable answers which they assumed to be socially acceptable (Pölkki 2002b) or they just tended to answer “yes” to the questions so that they appeared to be positive in nature, though they did not actually use or receive the help mentioned in the questions from the caregivers. “Yes/no” questions were particularly problematic because they were both leading and suggestive (Peterson *et al.* 1999). Nevertheless, it can be assumed that the children told honestly about their experience of postoperative pain alleviation since the results of the study are consistent with the results from the studies of nurses (I) and parents (III). In addition, five pre-interviews were conducted in a children’s hospital in Fuzhou to test how well the structured questions were understood by the children. After that, the questions were revised in order to make the questions more understandable to the school-aged children and the questions were sequenced in a better order.

In the study, five interviewers, who have received higher education and showed interest in the research, were chosen to help with the data collection. The characteristics of the interviewer can be biasing. The characteristics of the researcher were essential in the evaluation of the reliability of a qualitative study (Kankkunen 2003). Two of the interviewers had been working in pediatric surgical wards and three had been working in cardiac and thoracic surgical wards. As we know, interviewing children requires some special knowledge of the art of asking children questions. Children may respond differently to interviewers of different characteristics. For example, older and more-educated interviewers might obtain fuller and more reliable information than younger and less-educated interviewers might. However, most researchers accept that these biases are inevitable. In addition, the use of the structured questions could reduce the variation in interview administration across interviewers. However, subject bias is always a threat to the validity of the findings, as is inconsistency in data collection from one subject to another.

To reduce variability in research procedures, the researcher educated the interviewers, maintained direct contact with the five interviewers and provided further instructions to them when necessary. The researcher explained the questions item by item to the five interviewers. The interviewers were also told that they were allowed to further explain the meaning of the questions so that the children could understand them better. The interviewers visited the potential participants before the interview was conducted and made appointment for the interview. Each child was interviewed at a

quiet place in the ward 1-2 days prior to his/her discharge. The interviews lasted until there was no new information coming up. However, only 36 children gave suggestions to their parents and 33 to the nurses and their suggestions were all expressed in short sentences. This is similar to Pölkki *et al's* (2002b) findings in that some children had difficulties to provide suggestions to nurses and parents. The reason might be that most of them had no desire to complain about their treatment (Kawik 1996, Neill 1996a, Chang 1997, Pölkki 2002b). Most of Chinese children and their parents do accept certain degree of postoperative pain and parents often expect and encourage their children to be brave and tolerate the pain. Data obtained from interviews were recorded during the interviews in the form of handwritten notes (Burns & Grove 2001) with the help of the structured questions. Considering the use of tape recorder might cause the children to be nervous and uneasy, the interviews were not audio recorded. Finally, all interview data were returned to the researcher directly by the interviewers.

Data analysis and results

Descriptive statistical method was used to analyze children's background factors, their initiate use of and their perceptions on their parents' and nurses' use of pain-relieving methods. Content analysis was used to analyze children's suggestions to nurses and parents on how to manage their postoperative pain more effectively. Firstly, the researcher read the interview notes, identifying complete thoughts ranging from one word to several sentences. Secondly, similar descriptions were grouped into categories. Finally, the data of content analysis were quantified within these categories. Quantification is appropriate to use in content analysis in order to provide the reader a tangible basis for assessing what the analyst claims are the important patterns in the data and to improve on impressionistic judgments of the frequencies of categories (Morgan 1993). Some examples of the categories formed by using content analysis for the interview data are demonstrated in Appendix 2. The researcher talked with the interviewers after the data collection to inquire about the detailed process of the interviews. Face validity would be increased if the interviewers had talked with the children after the data had been collected (Polit & Hungler 2001).

Transferability in qualitative research refers to the extent to which the findings from the data can be transferred to other settings or groups (Polit & Hungler 2001). The results of this study indicated the pain management practices in one of the five surgical wards in the three provincial hospitals. Children undergoing different types of procedures, from minor to major, might have different degrees of pain intensity; more pain is expected after certain surgeries than others (Helga 2000, Henzler *et al.* 2004). Level of pain appears to influence the type of coping strategies used (Reid *et al.* 1997). However, the type of surgery in this study was not controlled, therefore the findings are not specific enough to reflect children's, their parents' and nurses' use of pain-relieving methods to children who underwent certain type of surgical procedures.

6.2 Discussion of the results and comparisons of the results with previous research

Nurses, parents and children themselves used different non-pharmacological methods for children's postoperative pain relief. Nurses' use of many non-pharmacological methods has been improved in 2004, compared to the results in 2002. The details are discussed in the following sections.

6.2.1 Nurses' role in hospitalized children's postoperative pain relief

Chinese nurses' use of non-pharmacological methods for children's postoperative pain relief as well as how they provide guidance to parents on the same topic were examined. The research questions made the respondents aware of the necessity and importance of the use of non-pharmacological methods for postoperative pain relief, and the high response rate (98%) indicated that they found the topic important and interesting. Furthermore, the study makes the nurses aware of the importance of involving parents in their children's pain management.

The results indicate that the most commonly used non-pharmacological methods was giving preparatory information, comforting/reassurance, creating a comfortable environment, distraction and positioning and the results largely parallel to some of previous research results. Similarly,

Pölkki *et al.* (2001) reported that Finnish nurses used emotional support, helping with daily activities and creating a comfortable environment routinely. In addition, according to Caty *et al.* (1995), providing company, distraction, positioning and deep breathing exercises were the non-pharmacological interventions most commonly used with 7-year-old children by Canadian nurses. However, our results were contradictory to those of some other studies. For example, a study in Canada (Woodgate & Kristjanson 1996a) showed that comforting children was not a major activity carried out by nurses, and Coffman *et al.* (1997) showed that very few nurses mentioned using a quiet environment as a pain management method.

The effectiveness of TENS for pain relief has been confirmed (Lander & Fowler-Kerry 1993, Mobily *et al.* 1994, Carroll *et al.* 1996, Kubsch *et al.* 2000, Lee *et al.* 2002). Its analgesic effects (Bjordal *et al.* 2003) and dosage effect (Chesterton *et al.* 2002, 2003) have been recognized for postoperative pain alleviation. However, no nurse in our study used this method for relieving pain and lack of knowledge and no TENS instrument available in the study wards probably account for this. In addition, positive reinforcement, helping with daily activities and presence were used less often than other non-pharmacological methods, which indicates the cultural difference: the way Chinese people use to convey encouragement is implicit rather than explicit, and since it is common for parents to accompany their child in hospital, it is possible that nurses relied on parents to help their children with daily activities. This result is consistent with earlier finding in that parents in developing countries were expected to care for their children postoperatively (Alsop-Shields 2000).

Concerning preparatory information given to children, the results reveal some similar deficiencies to earlier findings (Pölkki *et al.* 2001): all kinds of sensory information, as well as information about postoperative pain medication and non-pharmacological pain-relieving methods, were much less commonly provided than other cognitive information. Therefore, more attention should be paid to the provision of information in these aspects. Moreover, our results imply that encouraging children to inquire about their misconceptions and making sure that they understand the information need more attention.

With regard to nurses' providing guidance to parents concerning non-pharmacological methods for relieving their children's pain, most cognitive information was well provided to parents based on the nurses' perceptions. However, all sensory information and some cognitive information including pain medication and non-pharmacological methods in pain relief were provided much less in reality. Therefore, more attention should be paid to these aspects while information is given to parents.

Results show that guidance in non-pharmacological methods was not very well provided to parents, especially physical strategies and the results were similar to results of earlier study conducted in Finland (Pölkki 2002a). The results show that the five most commonly guided non-pharmacological methods were distraction, positive reinforcement, comforting/reassurance, positioning and relaxation. Besides, over half of the nurses reported they "always" guided parents to use positive reinforcement, helping with daily activities and presence as pain relief methods, a fact implying that Chinese nurses most likely to rely on parents to use these methods other than by themselves. The effectiveness of imagery for postoperative pain relief has been reported (Huth *et al.* 2004, Pölkki *et al.* 2005). However, similar to Pölkki's (2002a) report, imagery was the least frequently provided method to parents although it was regarded as a suitable method especially for school-aged children because of their developing maturity (Vessey & Carlson 1996).

The only physical method that was always provided to parents was positioning. The efficiency of TENS in postoperative pain management has been verified (Kubsch *et al.* 2000). However, the results show that no nurse had ever provided guidance about the use of TENS to parents. The reasons might be as following: this strategy was less-known to nurses and no equipment was available in those wards. Therefore, contents about the use of TENS can be part of the educational program provided to nurses in the future and hospitals can import the facility so as to obtain one more efficient way to relieve children's surgical pain.

The findings indicate that nurses' age, education, nursing position, professional work experiences, number of their own children and experiences of earlier hospitalizations of their own children were statistically significantly related to their use of several non-pharmacological methods. Other

researchers (Abu-Saad & Hamers 1997, Salanterä *et al.* 1999b, Pölkki *et al.* 2001) have reported similar results. However, one phenomenon that should be noted is that it was not the nurses in the highest staff position and with the longest experience in health care who most frequently provided non-pharmacological pain relief methods for children. The reason for this might be that these nurses had more non-clinical work such as dealing with documentation and administration.

The findings also indicate nurses' background factors were significantly related to their perceptions regarding parental guidance. Older nurses, nurses with higher nursing position, more experienced in health care and with children of their own provided parental guidance more frequently than those without these characteristics. Other researchers (Johnson & Lindschau 1996, Pölkki 2002a) have also reported similar results. For example, Pölkki (2002a) revealed that nurses' age, education and working experience influenced the degree of their providing parental guidance. Besides, Johnson and Lindschau (1996) suggested that nurses who were married, educators, older, more experienced and/or who had a higher level of education and took parental participation into consideration in a hospitalized child's care were more positive than other nurses. The results of this study also indicate that young nurses who just graduated from the school need more relative continuing education; meanwhile, colleagues with more experience could provide more instructions to them and help them in their practice in order to improve surgical pain management.

In addition, some institutional factors limited Chinese nurses' use of non-pharmacological methods in practice, the most common being the shortage of nurses and heavy workload, which is consistent with previous findings (Pederson & Harbaugh 1995, Woodgate & Kristjanson 1996a, Rheiner *et al.* 1998). The present ratio of beds to nurses should be 1: 0.4 in Chinese hospitals according to regulations established by Chinese Ministry of Health in 1978 (Cheng *et al.* 2003). However, in the study wards the ratio of beds to nurses was only 1: 0.3, which is lower than the required ratio and even much lower than the ratio in USA (1: 2) and other developed countries (Wang 2002). This means that an increase is needed in the number of nurses in the hospitals. The reasons for nurses' lack of knowledge might be that a specific educational course on pain management is not offered at all levels of nurse education and pain management is not one of the areas of interest in continuing education for nurses. If nurses use a task-oriented approach to their work, including pain

management as part of their routine work might be a helpful way to encourage them to implement of pain relief measures. Moreover, traditionally, surgical pain is considered inevitable by both health professionals and patients themselves (Warfield & Kahn 1995, Rawal & Allvin 1998, Xia 2004), and children are encouraged to tolerate pain, which might limit nurses' motivation to use pain-relieving methods (Xia 2004).

6.2.2 Parents' role in their hospitalized children's postoperative pain relief

The study attempts to reveal parents' use of non-pharmacological methods for their children's postoperative pain relief and their views on factors promoting and hindering their participation in 6-12-year-old children's pain management in the hospital. Moreover, parents' recommendations to health care providers were also enquired. The response rate was high (88%). The fact that many parents' provided recommendations to health care providers indicated that parents were interested in this topic and they had a desire to be actively involved in their children's pain care. The study gives hints for nurses to educate parents in various non-pharmacological pain alleviation methods available for postoperative pain and to give understandable information to parents. This study also provides an opportunity for parents to become aware of their roles in their children's pain management. With the knowledge that they might acquire through the participation, they might start to use different methods to help with their children's pain alleviation.

Parents utilized various non-pharmacological methods for children's pain relief, especially those easy to be used. The most commonly used methods were emotional support strategies, helping with daily activities, distraction and imagery. They were used by more than 80% of parents. Physical methods and some cognitive-behavioural methods including breathing technique, relaxation and positive reinforcement were used less frequently than other non-pharmacological methods. These results are in line with previous findings (Neill 1996b, Tait *et al.* 2001, Pölkki *et al.* 2002b). The reason might be that non-pharmacological methods that parents carried out are limited to those that were familiar to them in everyday life (Kankkunen *et al.* 2003b). Furthermore, the fact that most parents used emotional support and helping with daily activities may explain why Chinese nurses seldom used

these methods in children's postoperative pain relief (Paper I). For example, very few Chinese nurses used presence (11%) and helping with daily activities (9%) as pain-relieving methods (Paper I), but more than half of them guided parents to use these methods (Paper II). This result manifests that many times Chinese nurses don't provide much direct care for patients and the family is expected to oversee the direct care (Matocha 1998, Alsop-Shields 2000). The findings imply that in order to achieve an optimistic effect on children's pain relief, parents need to be given more instructions concerning their children's pain alleviation. Moreover, Chinese nurses need to more frequently apply the methods that were seldom used to children's pain management in their practice.

Parents made inadequate preparation for their children. All cognitive and sensory information were provided by less than two-thirds of the parents. The result is contradictory to previous findings (Pölkki *et al.* 2002b) in that this information was provided by more than 70% of the Finnish parents. The reason might be that Chinese parents themselves lack the related information, although nurses reported that they provided much cognitive information to parents (Paper II). The fact implies that effective communication between parents and nurses needs to be emphasized. Written guidelines in conjunction with an oral explanation could be used to reinforce the information (Simons *et al.* 2001).

More than three-quarters of parents assessed their children's worst postoperative pain to be moderate or severe, a result similar to earlier findings from Finland (Pölkki *et al.* 2002b). However, in another Finnish research where parents were asked to assess their children's postoperative pain at home after day surgery, the percentage doubled (Kankkunen *et al.* 2003a). The results support many previous studies in that hospitalized children still suffer from significant pain postoperatively in many different cultures (Gauthier *et al.* 1998, McCaffery & Pasero 1999, Munro *et al.* 1999, Huang *et al.* 2001, Dolin *et al.* 2002, Ellis *et al.* 2002, Hamers & Abu-Saad 2002, Karling *et al.* 2002, Paik & Ahn 2002, Apfelbaum *et al.* 2003, Pölkki *et al.* 2003b). This finding offers Chinese health professionals evidence and a reason to manage children's postoperative pain more aggressively by using various strategies, both pharmacological and non-pharmacological.

Differences in parents' use of non-pharmacological methods for pain relief were found and the differences are derived from both parents' and children's different background factors. Fathers or the

parents who were in the older age group, more educated, employed and with earlier hospitalization experience of their children used some non-pharmacological methods more frequently than mothers or parents without these characteristics. The results are consistent with earlier findings regarding the correlation between nurses' attributes and their utilization of pain-relieving methods in pediatric patients (Salanterä *et al.* 1999b, Pölkki *et al.* 2001). However, it is somewhat different from another research finding (Pölkki *et al.* 2002b) in that Finnish parents' level of education was not related to any of these methods. It was found that parents used certain methods more frequently to boys, younger children, children admitted for selective operations, with longer duration of hospitalization and with moderate or severe postoperative pain than children otherwise. Most of these findings are coincident with those of Pölkki *et al.* (2002b) except that Finnish parents utilized more pain-alleviating methods to girls than to boys, which might reflect the cultural difference between Finland and China. However, further researches of issues concerning the relation between pain management and culture is needed.

One interesting finding was that the parents who took care of their children less frequently used certain methods more often than those staying in the hospital everyday did. It was also found that most of the respondents who were employed and took care of their children less frequently were fathers. These might indicate that fathers used certain methods more often than mothers did. The reasons might be: firstly, these parents felt sorry for their children for they were too busy with their work to accompany their children everyday and thus they would like to provide as much as care for their children they can; secondly, in Chinese traditional culture, it is mothers' role to take care of the family and children but usually it is fathers' responsibility to make important decisions like signing the consent for the child's procedure. Considering this fact, we can understand that fathers inquired about and received more information concerning their children's surgical procedure and therefore they are more capable of using non-pharmacological methods for relieving their children's postoperative pain.

Earlier studies reported that the extent of parental participation depended on many factors such as how much information staff members provided about the parents' expected roles or how much support staff members provided to the parents (Coyne 1995b, Kawik 1996, Callery 1997,

Kristensson-Hallström 1999, 2000, Simons & Roberson 2002, Franck *et al.* 2004, Hug *et al.* 2005). The results of the study show that concerning the 5 factors promoting parental participation, most of the parents agreed to have received adequate information about surgical procedure and had good opportunities of emotional and information support. However, parents have not received adequate information concerning pain management. Many parents reported that they had opportunities to consult the nurses about what they did not know in pain management, and they were instructed the methods for relieving their children's pain. Nevertheless, only half of them had a clear concept about what they could do to help their children to relieve pain. The contradictory findings indicate a gap between information given by health care providers and information understood by the parents. This is similar to similar to Simons and Roberson's finding (2002) that nurses believed parents were well informed whilst parents were still anxious about pain related issues. Hallström *et al.* (2002) indicated it is not enough to tell parents what to do, simply to give them information. Parents received more information than they could absorb and they were still uncertain about their role (Hallström *et al.* 2002, Hopia *et al.* 2005). In addition, it seems that parents did not get adequate opportunities to enquire about what they did not know. The reason might be that they thought nurses were too busy, so they did not want to disturb them.

Regarding the factors hindering parental participation, more than half of the parents reported that they lacked the understanding of information provided. This reminds health care providers that only providing information to parents is not enough and they must make sure that parents have understand the information or instruction provided. Wisselo *et al.* (2004) pointed out the importance to provide information to parents according to parental attitude what they actually want to know. They found that more than two-thirds of parents sought information about premedication, induction of anesthesia, side-effects of anesthesia and postoperative pain management. A variety of methods can be used to help the parents to understand the information such as verbal discussion between parents and health care providers, videotapes, written information or picture books (Greenberg *et al.* 1999, Kankkunen *et al.* 2003c, Lee *et al.* 2003, LeRoy *et al.* 2003, Wisselo *et al.* 2004). Distress was the most commonly negative feeling experienced by the parents. The negative feelings were mostly related to the surgery and anaesthesia, which is consistent with Shirley *et al.*'s findings (1998). Many of negative feelings appeared to be expected natural components of parents'

experiences during their children's hospitalization (Coyne 1995b). These feelings may hinder parents' supporting their children in pain and therefore keeping parents well-informed is very important since doing so might reduce their negative feelings (Hug *et al.* 2005). In addition, information given to parents can significantly contribute to the success in their child's care in the postoperative period (Jonas & Worsley-Cox 2000). Careful, relevant and concurrent preoperative information from surgeons, anesthetists, and nursing staff about the surgical procedure, anticipated sensory experiences, analgesic treatment and the recovery period is expected to reduce anxiety and promote recovery (Dahl & Kehlet 2006).

In order to give the parents an opportunity to express their views in an open way and thus give a more realistic picture of their opinions (Mansson & Dykes 2004), parents were asked to answer an open-ended question on their recommendations to health care providers. The content of the recommendations partly confirmed the results of the quantitative data. Among the parents who gave recommendations to health care providers, 67% recommended the nurses' application of non-pharmacological pain-relieving methods to their children's pain relief. The commonly mentioned methods were comforting, positive reinforcement and distraction. This result implies that the parents were familiar with these three methods, which were most frequently informed and demonstrated to the parents by nurses (Paper II). However, earlier findings indicated that Chinese nurses seldom used positive reinforcement as a pain-relieving method (Paper I) and the fact awakens nurses to the importance and necessity to use positive reinforcement while providing pain care to children. In addition, although 60% of the parents agreed to have received adequate information concerning pain management, they expressed the need for more information and instructions, especially information and instructions concerning pain-relieving methods and continuing postoperative care. This result is in line with Wisselo *et al.*'s (2004) findings that more than half of the parents wanted more extensive preoperative information. The parents also expressed the need for more time to communicate with health care providers. These findings are consistent with previous ones (Woodgate & Kristjanson 1996a, Kristensson-Hallström 2000, Pölkki *et al.* 2002a, Simons & Roberson 2002). The result indicates that parents were still not confident enough while dealing with their children's postoperative pain, which should attract more attention from the health care providers. As LeRoy *et al.* (2003) revealed, information processing was affected by

various factors such as anxiety and developmental or cognitive level, thus ongoing ensuring of parents' understanding of information given is needed. LeRoy *et al.* also suggested that information given to parents should be individualized based on their cultural and intellectual background, their previous hospital experience, their knowledge and their emotional needs. In addition, as parents were often reluctant to express outright criticism of the service (Callery & Luker 1996), maybe an interview of parents' experiences about their participation in their children's pain care will contribute to further related information as they may describe their experiences in a direct and moving way during an interview (Callery & Luker 1996).

Since similar study has been conducted in Finland (Pölkki *et al.* 2002a), it is of significance to compare Chinese and Finnish parents' views on their participation. Comparison of the main findings shows some similarities: (1) parents from the two countries have received adequate information about surgical procedure; (2) they had good opportunities of emotional support; (3) regarding the recommendations, both Chinese and Finnish parents expressed the need for more information, especially that concerning pain management. However, there are some differences. More Chinese parents reported the underestimation of their importance and expertise than Finnish parents did. Besides, more than half of the Chinese parents reported their lack of understanding of the information provided by the physicians and the nurses, while less than one-fifth of the Finnish parents reported this problem. The comparison implies that Chinese parents are not so optimistic about their participation in their children's pain management as Finnish parents.

6.2.3 Children's role in their postoperative pain relief in hospital

The structured-interview study expands our knowledge about how Chinese children aged 8-12 perceived the implementation of pain-relieving methods for their postoperative pain relief by themselves, their parents and nurses. The findings give alerts to health care professionals that many children still suffer from unnecessary postoperative pain. Moreover, the study reminds the children, their parents as well as health professionals that, in addition to pain medication, there are various non-pharmacological methods that could be used to relieve pain.

Methods most commonly used by the children themselves included rest /sleeping, positioning as a physical method, requiring the presence of their parents as a strategy of emotional support, as well as relaxation and distraction as cognitive-behavioural methods. This result is consistent with earlier findings (Pederson *et al.* 2000, Pölkki *et al.* 2003b). The other methods were much less frequently used. The reason might be that children were lack of related knowledge. Pellino *et al.* (2005) demonstrated that the provision of a kit of non-pharmacological strategies, such as music and relaxation tape, massager, stress ball, and instructions in using other techniques, could increase the patients' use of these methods for postoperative pain and decrease the amount of opioid taken. Their findings give us an evidence-based knowledge that similar practice can be used in the future clinical nursing to improve children's use of non-pharmacological methods. Smith and Callery (2005) demonstrated that children needed preoperative information related to pain from health professionals. They found that children obtained information from a variety of sources including leaflets for parents, television and the experiences of relatives and friends. Our results reveal the need for providing education in pain relief to hospitalized children.

Based on the children's perceptions, we found that methods most frequently used by their parents included helping with daily activities, all strategies of emotional support and positive reinforcement as a cognitive-behavioural method, which are similar to the methods that the Finnish children listed used by their parents for pain relief (Pölkki *et al.* 2003b). It is notable that most of these methods were guided to parents by Chinese nurses (Paper II), from which we can infer that parents are able to use the methods recommended by nurses to relieve their children's pain. Since parents play a very important role in their hospitalized children's care in Chinese culture, and since parents are encouraged to participate more actively in the care of hospitalized children in Europe (Kristensson-Hallström 1999), it is of importance that parents are provided with sufficient instructions regarding their children's pain management.

The findings also show that according to the children's perceptions, nurses applied comforting as a strategy of emotional support and positioning as a physical method more frequently than other methods for relieving children's postoperative pain. It is in line with an earlier study examining

Chinese nurses' use of non-pharmacological methods in children's postoperative pain (Paper I). The reason for the frequent use of these two methods might be that they are easy to carry out, and positioning postoperative patients is actually nurses' routine work. Moreover, most of the cognitive-behavioral methods and physical methods were less frequently used by the nurses, which indicates that there is a room for nurses to implement those methods more often in clinical practice.

This study also demonstrates that according to the children's perceptions the nurses used the cognitive-behavioral methods (except positive reinforcement) and physical methods (except massage), creating a comfortable environment and pain medication more frequently than parents did, whereas parents used strategies of emotional support and helping with daily activities more often than nurses did. This result reflects the fact that in Chinese hospitals nurses rely on parents to accompany their children and help with the daily activities (Paper I). The results also manifest previous findings that pain-relieving methods used by parents are limited to those familiar to them in everyday life (Kankkunen *et al* 2003b). Our findings suggest that nurses should give more instructions to the parents on the use of cognitive-behavioural methods and physical methods in pain relief and nurses could provide more emotion support and helping with daily activities.

More than half of the children had suggestions to caregivers. The suggestions mostly concerned their parents' and nurses' applying of non-pharmacological pain-relieving methods for their postoperative pain relief. Among this category, requiring their parents and nurses' presence was the most commonly suggested method, which is similar with earlier findings (Pölkki *et al.* 2003b). In addition, children hoped nurses to show a friendly attitude and provide better services to them. These suggestions need to be taken into account seriously in nursing practice. When the information leaflet is developed to provide parents with the knowledge of pain management, children's suggestions to parents regarding their pain management can be added as part of the information.

The subjects were drawn from different surgical wards and they had undertaken varied surgical procedures, which affected children's pain intensity. Those undergoing more invasive surgical procedures may experience more intense pain than those undergoing minor surgery or minimally invasive procedures (Helga 2000, HENZLER *et al.* 2004), which may remind us that different

anticipatory pain management should be carried out considering the varying procedures.

The majority of the children reported that the worst postoperative pain they experienced was moderate or severe, which is a finding similar to the results of many earlier studies (Gauthier *et al.* 1998, Pölkki *et al.* 2003b). The result might indicate that the analgesic treatments were insufficient and postoperative pain was poorly controlled (Woodgate & Kristjanson 1996a, Hamers *et al.* 1998, Rheiner *et al.* 1998, Jacob & Puntillo 1999, Karling *et al.* 2002, Van Hulle Vincent 2005). Children themselves believe that when the pain intensity is above 3/10, it should be treated pharmacologically (Gauthier *et al.* 1998, Demyttenaere *et al.* 2001). In the wards involved in the study, the pain assessment instrument was rarely used by health care providers, which limited the evaluation of the postoperative pain relief effects. Hospitalized children's pain should be recorded on pain flow sheets on a regular basis of every few hours in order to improve pain management (Stevens 1990). This aspect calls for health professionals' attention in the future practice of pain management. Variable strategies available for relieving pain should be applied more with pediatric patients. In addition to pain medication, an array of non-pharmacological methods is appropriate to use for school-aged children's pain alleviation (Vessey & Carlson 1996).

6.2.4 Comparison of nurses' use of methods for children's postoperative pain alleviation in 2002 and 2004

This part of the study was intended to describe and compare nurses' use of non-pharmacological methods to 6-12-year-old children's postoperative pain alleviation in 2002 and 2004. This study expand nurses' knowledge of pain management and invites nurses growing awareness and more active use of non-pharmacological methods for children's postoperative pain relief. Moreover, this study might also give nurses the clue to provide pain education to children and their parents.

According to He *et al.* (2003), more than two-thirds of the nurses reported that they had never received any continuing education in pain management since they graduated. Inadequate or non-existent educational material was frequently cited as a resource issue, which had a negative

impact on pain management (Brockopp *et al.* 1998). In this study a pain education program including booklet development and distribution to nurses and lectures was conveyed to the nurses. Special attention was paid to some practical aspects, such as offering booklets, considering the heavy workload of the nurses and combining the lecturing time with the scheduled professional education time of the participating wards or hospitals. The contents were developed on the basis of literature review, which means they were appropriate and relevant, and nurses' needs for pain education were considered.

More than two-thirds of the nurses "always" used the following methods in 2002: providing preparatory information, comforting/reassurance, creating a comfortable environment, distraction and positioning, whereas about two-thirds of the nurses "always" used the following methods in 2004: distraction, providing preparatory information, imagery, positive reinforcement, comforting and creating a comfortable environment. Therefore the most commonly used methods used by nurses in 2002 and 2004 were similar to a large extent, except that imagery and positive reinforcement were used more frequently in 2004 than in 2002. The results were also consistent with Pölkki *et al.*'s finding (2001) in that routinely used non-pharmacological methods were emotional support, helping with daily activities and creating a comfortable environment.

Results show that the number of nurses who "always" used imagery to relieve pain in 2004 almost doubles the number in 2002. Moreover, the number who used positive reinforcement has been increased dramatically, from 9% of the nurses in 2002 to 67% of the nurses in 2004. The reason might be that this method was easy to apply in practice when nurses realized that it also served as a pain-relieving method. Physical methods such as thermal regulation, massage and TENS were still used by only few nurses. Presence and helping with daily activities were still used less often than other non-pharmacological methods, which indicate the cultural factor in mainland China: there is lack of nurses in the hospitals in mainland China (Wang 2002) and nurses count on the parents to accompany their own child and helping with the daily activities (Paper II).

Concerning preparatory information given to children, most of the information was provided more frequently in 2004. However, there is still a room for nurses to provide more information to the

children, especially the information of postoperative pain medication and sensory information. The contents presented in this booklet can be used to develop a leaflet or videotape for children that can prepare them for surgery (Wisselo *et al.* 2004). The provision of the leaflet or videotape in conjunction with an oral explanation would reinforce the information (Simons *et al.* 2001).

Earlier studies demonstrated that education had a positive effect on nurses' knowledge (McCaffery & Ferrell 1997). However, the education on pain does not always result in a change of behaviour (Twycross 2002) and education alone may not be sufficient to change behaviour (Czurylo *et al.* 1999). In this study, booklet distribution and lectures provided nurses with the opportunity to gain knowledge in pain management. In addition to the education program, the questionnaire survey conducted in 2002 may also be regarded as acquainting the respondents with the contents about using non-pharmacological methods for children's postoperative pain alleviation and the study might have awakened the respondents' to the necessity and importance to gain related knowledge intentionally (He *et al.* 2003, Paper I, II).

Results show that the frequency of nurses' use of most of the non-pharmacological methods, especially imagery, positive reinforcement, TENS, touch and presence and the providing of some information has increased with statistical significances. The reason for the improvement might be that the pain education program conducted has had a positive effect on nurses' use of pain-relieving methods. Besides, nurses' awareness of the non-pharmacological methods applicable and their being encouraged to use these methods in practice might also be the reasons. However, there is still a room for nurses to use the pain-relieving methods more actively. Czurylo *et al.* (1999) pointed out that nursing practice changes as an outcome of education are influenced by organizational, administration and environmental factors, which indicates that nursing administrators also play an important role on improving pain management. The organizational issues include: (1) introducing acute pain services in addition to ensuring the use of optimal and evidence-based analgesic techniques in each well-defined procedure, and (2) a demand for improved collaboration on the pain issue among health professionals to provide the full benefit to the patients (Dahl & Kehlet 2006).

6.3 Implications for nursing practice

Although there is a need for further research in this area, there are many clinical implications worthy of consideration. Our results indicate that more attention needs to be paid to the following aspects in order to achieve optimal pain management in children.

1. Nurses should give school-aged children more information about peri-operative sensory, pain medication and non-pharmacological methods for pain relief. Previously less frequently used non-pharmacological methods, especially positive reinforcement, helping with daily activities and physical methods should be used more actively in clinical practice. Nurses should take a more active role in seeking for new information (Salanterä *et al.* 1999b) or evidence-based knowledge in pain management to improve their skills of managing pain. Health professionals should have adequate and effective communication among themselves, with children and their parents.
2. Parents' role in their children's pain care in hospital should be clarified and they should be encouraged to make use of their expertise to help with their children's pain alleviation. For example, they can use more non-pharmacological methods to their children's pain relief, not just the methods familiar to them in daily life. Parents need to be given more information concerning pain management and their understanding of the provided information should be ensured. With the reference of the booklet developed in this study, leaflets or video tapes can be produced to give pain management instructions to parents. Parents' negative feelings should be paid more attention to since those feelings may affect parents' ability to support their children who are in pain.
3. Children should also be involved in the alleviation of their postoperative pain more effectively. Information about their postoperative pain and instructions on the use of non-pharmacological methods for their pain relief should be provided.
4. Specific course concerning pediatric pain management could be offered to nurse students at universities in China. More continuing education on pain management should be provided for nurses in hospitals. Children's pain management should be a priority in postoperative care in China. In addition, there is a call for multidisciplinary collaboration in children's pain management in future clinical practice in order to achieve an optimal effect.

6.4 Recommendations for future research

The study was conducted only in Fujian province and in order to get an overall picture at country level, it is of importance to conduct the similar study in other provinces on nurses, parents' and children's use of non-pharmacological methods for children's postoperative pain relief. Nurses' use of pain assessment instrument in practice needs to be explored. The tool most appropriate for the postoperative pain assessment of different age groups needs to be examined. Moreover, intervention studies examining the effectiveness of different non-pharmacological methods in alleviating children's postoperative pain need to be conducted in China.

Pain-relieving methods varies when used in children of different age groups, therefore, future studies can focus on examining reliable, age-specific and developmentally sensitive non-pharmacological approaches for postoperative pain alleviation. Moreover, methods used to relieve pain caused by different surgical procedure might be different. For example, pain-relieving methods used to children who undergo tonsillectomy might be different from those used to children who undergo cardiac surgery. It is worthwhile examining nurses' and parents' use of non-pharmacological methods in children's pain after certain type of surgical procedure. In addition, the management of children's pain caused by other factors other than postoperative pain like cancer pain also needs to be examined.

This study has examined parent's views on their participation in their children's pain care, it is essential to examine nurses' attitudes towards parental roles in children's pain management. Moreover, parents' knowledge of children's pain management, as well as their viewpoints on the guidance provided by the nurses about non-pharmacological methods in children's surgical pain relief also need to be explored. Strategies need to be developed in order to help hospitalized children and their parents to acquire the knowledge of pain management and to direct their using of pain-relieving methods.

Different strategies most appropriate and effective to improve nurses' knowledge need to be developed. It is essential to involve all health professionals (nurses, surgeons and anaesthetists), children and parents in a meaningful dialogue to achieve optimal postoperative pain alleviation.

7 CONCLUSIONS

This study generates new knowledge about how nurses, parents and children themselves managed school-aged children's postoperative pain in Chinese culture. This study also provides information of the differences in Chinese nurses' use of non-pharmacological methods in children's pain alleviation in 2002 and 2004, with pain education program conveyed in between. The evidence-based knowledge can be regarded as a basis for achieving optimal pain management in children. The study not only enriches nurses', parents' and children's knowledge in pain management, especially the knowledge in using non-pharmacological methods for pain relief, but also gives clues for nurses to improve their clinical practice in children's pain relief and to provide information and instructions in pain management to children and their parents in Chinese culture.

1. Nurses most commonly used the methods of giving preparatory information, comforting, creating a comfortable environment, distraction, and positioning, whereas they mostly guided parents to use methods of distraction, positive reinforcement, comforting, positioning and relaxation. In order to provide optimal pain management to children, nurses should apply the previously less often used methods in clinical practice more actively. They should involve children and their parents in the planning and implementation of children's pain management in hospitals. There is a need to provide more education in pain management to nurses in the light of their needs. Cultural and institutional factors that might influence nurses' role in children's pain management needs to be considered more seriously.
2. Emotional support strategies, helping with daily activities, distraction and imagery were well utilized by parents. Parents need more guidance from nurses and their roles in the child's pain care should be clarified. Parents' understanding of the provided information needs to be ensured. Oral information and written guidelines can be of help. Adequate and efficient communication among parents, their children and health professionals needs to be emphasized.
3. School-aged children are able to describe their experiences of pain management. They commonly used rest/sleeping, positioning and requiring presence of their parents to deal with their pain, whereas their parents used helping with daily activities and emotional support strategies and the nurses mostly used comforting and positioning. Pain-relieving methods were not sufficiently used by both parents and nurses according to the children's perceptions.

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Appendix 1

Examples of the formed categories in the open-ended question

- "In your opinion, what can nurses do to relieve your child's pain?" (IV)

Original examples	Categories
<p>The comforting words given by health care providers are more effective than those given by the parents.</p> <p>Health care providers can encourage the children more often in order to relieve their worries, fears and pain, e.g. telling that the child is very smart and brave.</p>	<p>Comforting (n=19)</p> <p>Positive reinforcement (n=28)</p>
<p>Nurses can tell a story to my child while giving injections, which might distract his attention from pain.</p>	<p>Distraction (n=19)</p>
<p>I hope that nurses can create relaxing and comfortable environment. A place for children to play should be arranged.</p>	<p>Creating a comfortable environment (n=7)</p>
<p>Touching my child more often.</p>	<p>Touch (n=3)</p>
<p>Accompanying my child more often.</p>	<p>Presence (n=3)</p>
<p>Using relaxation techniques, massage and positioning to my child.</p>	<p>Relaxation (n=2)</p> <p>Massage (n=1)</p> <p>Positioning (n=1)</p>
<p>Before the operation, health care providers may tell my child the importance of undertaking the operation and the possible pain. Other children who had undergone similar operation can be introduced as models for their braveness and smooth postoperative recovery process. These may help my child to build up his self-confidence and therefore to cooperate with the health care providers better.</p>	<p>Children need more information (n=7)</p>
<p>Nurses can teach me how to manage my child's pain since they are more experienced.</p>	<p>Parents need more instructions in pain relief (n=8)</p>
<p>It would be nice if nurses can give me more information about my child's condition and how to take care of my child after the operation.</p>	<p>Parents need more information about the disease and caring skills (n=33)</p>
<p>Nurses can spend more time to communicate with the child and their parents.</p>	<p>Spending more time with children and parents (n=27)</p>
<p>The hospital can employ more nurses to work in the ward. They are too busy to communicate with us.</p>	<p>Lack of nurses, therefore they lack of time to stay with children and parents (n=12)</p>
<p>Nurses should always show smiling faces to children in order to relieve their fear of nurses and the operation.</p>	<p>Smile to children since it is useful for pain relief and fear (n=28)</p>
<p>Smile and understanding are the best 'medicine' for the patients.</p>	<p>Showing friendly attitude to the child</p>
<p>Nurses' smiling face can relieve children's pain.</p> <p>I hope that health care providers can visit my child more frequently, and treat them like their own child.</p>	<p>More concerns and care (n=26)</p>
<p>Nurses can give more concerns and care to my child.</p>	<p>Giving more concerns to the child</p>

Examples of forming the categories of interview data using content analysis

- Children's suggestions to nurses on how to manage their postoperative pain better (V)

Original examples		Categories
I hope nurses can visit me and stay with me more often.	Presence (n=14)	Applying non-pharmacological pain-relieving methods
I hope nurses can tell stories to me, chat with me, or play games with me when I am in pain.	Distraction (n=13)	
I wish nurses could make the environment of the ward more beautiful and it would be better if there are TV and toys in the room.	Creating a comfortable environment (n=12)	
I hope the nurse can comfort me in gentle voice and warm tune when I am suffering from pain.	Comforting (n=8)	
I need their oral rewards.	Positive reinforcement (n=2)	
I hope nurses can always show their best attitude to me.	Friendly attitude (n=7)	Showing a friendly attitude and providing better service
I hope nurses can treat me with the best service.	Better service (n=2)	
I want to know more about my disease.	Lack of knowledge regarding the disease (n=2)	Providing more information
I hope the nurse can give me pain medication while I am in pain.	Pain medication needed (n=1)	Giving pain medication
I hope their action is gentle when they give injections to me.	Pain medication and skills (n=1)	

Appendix 2(2)

- Children's suggestions to parents on how to manage their postoperative pain better (V)

Original examples	Categories
I hope my parents can stay beside me all the time.	Presence (n=23)
I hope my parents can bring me something to play or eat or take me to a park after I recover. I need my parents' encouragement.	Positive Reinforcement (n=11)
I hope my parents can tell me many stories while I am in pain.	Distraction (n=10)
I need my parents' comforting.	Comforting (n=3)
I hope that my parents can hold my hand, showing their love to me.	Touch (n=3)
I hope my parents can massage my body when I feel pain.	Massage (n=2)
I hope my parents can give me some pain killers if it is possible.	Pain killer (n=4) _____ Giving pain medication
I hope my parents can help me in the light of my wishes.	Parents' help (n=2) _____ Providing help according to the child's wishes
I hope my parents can communicate with the nurses more often so that they have enough knowledge to deal with my pain.	Parents communicate with nurses (n=1) _____ Communicating with nurses

Applying
non-pharmacological
pain-relieving methods

Appendix 3
Booklet distributed and some pictures of lectures provided to nurses



Appendix 4 Original publications I-VI

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Kuopio University Publications E. Social Sciences

- E 116. Lammintakanen, Johanna.** Health care prioritisation: evolution of the concept, research and policy process.
2005. 141 s. Acad. Diss.
- E 117. Hintsala, Arjaterthu.** Autonomia ammatista poistumisen ennakoijana hoitotyössä: nais- ja mieshoitajien arviointia ja vertailua päätöksenteosta, pätevydestä, työn tärkeydestä ja johtamisesta hoitotyössä.
2005. 199 s. Acad. Diss.
- E 118. Virtanen, Ritva.** Sairaanhoidajat Suomen sota-ajan lääkintähuollon tehtävissä 1900-luvulla.
2005. 275 s. Acad. Diss.
- E 119. Ryynänen, Ulla.** Sairastamisen merkitys ja turvattuustekijät aikuisiässä.
2005. 224 s. Acad. Diss.
- E 120. Jyrkinen, Anna Riitta.** Mielisairaanhoito Kellokosken piirimielisairashoitolassa vuosina 1915-1918: hoitoalan ensimmäisten potilaiden dokumentteihin perustuva analyysi.
2005. 182 s. Acad. Diss.
- E 121. Jakonen, Sirkka.** Terveyttä joka päivä: itäsuomalaisen peruskoulun oppilaiden näkemyksiä ja kokemuksia terveyden oppimisesta.
2005. 209 s. Acad. Diss.
- E 122. Tirronen, Jarkko.** Modernin yliopistokoulutuksen lähtökohdat ja sivistyskäsitys.
2005. 148 s. Acad. Diss.
- E 123. Silén-Lipponen, Marja.** Teamwork in operating room nursing.
2005. 108 s. Acad. Diss.
- E 124. Itäpuisto, Maritta.** Kokemuksia alkoholiongelmaisten vanhempien kanssa eletystä lapsuudesta.
2005. 153 s. Acad. Diss.
- E 125. Sinkkonen-Tolppi, Merja.** Maailma kutsuu, katkeavatko juuret? Nuorten kotiseudulle kiinnittyminen ja sen yhteys nuorten sosiaaliseen pääomaan.
2005. 130 s. Acad. Diss.
- E 126. Taskinen, Helena.** Oikeudenmukaisuus ja kulttuurien kohtaaminen sosiaali- ja terveysalojen organisaatioiden yhdistämisessä.
2005. 228 s. Acad. Diss.
- E 127. Korhonen, Heikki.** Tietojärjestelmät suun terveydenhuollon ohjauksessa ja johtamisessa Suomessa 1972-2001.
2005. 219 s. Acad. Diss.
- E 128. Ryttyläinen, Katri.** Naisten arvioinnit hallinnasta raskauden seurannan ja synnytyksen hoidon aikana: naisspesifinen näkökulma.
2005. 216 s. Acad. Diss.
- E 129. Kinnunen, Juha & Lindström, Kari (toim.).** Rakenteellisen ja toiminnallisen muutoksen vaikutukset HUSin johtamiseen ja henkilöstön hyvinvointiin.
2005. 278 s.
- E 130. Pättiniemi, Pekka.** Social enterprises as labour market measure.
2005. 50 s. Acad. Diss.