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PÄIVI KANKKUNEN

Parents' Perceptions and Alleviation of Children's Postoperative Pain at Home After Day Surgery

Doctoral dissertation

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ABSTRACT

Background of the study: Children's pain alleviation has become an ethical and clinical challenge as our knowledge of children's ability to sense and suffer from pain has increased. In day surgery, alleviation of children's pain is a parental task after discharge from hospital. Little is known of the ways in which parents alleviate their children's postoperative pain at home and why children's pain may remain poorly alleviated.
Purpose of the study: The purpose of this study was to describe mothers' and fathers' perceptions of 1- to 6 -year-old children's pain and its alleviation at home after minor surgery. In addition, the purpose was to describe the relationship between these perceptions, parents' use of pain alleviation methods and children's pain intensity and pain behaviours after surgery. The final aim was to explain how parents' perceptions and their use of pain alleviation methods explains variation in children's postoperative pain by creating a path model describing the effects.
Data and methods: Methodological abduction was implemented in this study, which was conducted in four phases during 1999 - 2001. In the first phase in 1999, family interviews (N=17) with inductive content analysis were conducted to describe how parents assess and alleviate their 1- to 7-year-old child's postoperative pain at home and which factors are related to alleviation of children's pain. In the second phase in 2000, an instrument measuring parents' use of pharmacological and non-pharmacological pain alleviation methods and their perceptions of children's pain and analgesics was developed and pre-tested. Additionally, the Finnish version of Parents' Postoperative Pain Measure (PPPM) measuring children's pain behaviours was pre-tested with parents (N=85) of 1- to 6-year-old children who had undergone a day surgery in four Finnish hospitals. In the third phase in 2000-2001, questionnaires consisting of Visual Analogue Scale, the PPPM and the sub-scales measuring parents' perceptions of children's pain and its alleviation were used to collect data from 315 parents whose children had undergone day surgery in 19 wards in 10 central hospitals. Frequencies, cross-tabulation, chi-square test, t-test and ANOVA were used to analyse the data. In the fourth phase, a path model was developed to summarize the factors explaining children's pain intensity and pain behaviours at home.
Results: The results of the family interview study showed that parents used several methods to alleviate their children's postoperative pain at home. However, they described difficulties in identifying their child's pain and they had misleading perceptions of children's pain. The results of the survey showed that one third (36 %) of the children were assessed to have moderate or severe pain (VAS scores more than 30 mm), and several behavioural changes were identified in the children at home after discharge from day surgery. The parents had fairly adequate perceptions of children's pain. Yet, misleading perceptions of children's pain and analgesics were also found. These perceptions differed by the parent's and child's gender, and they were related to the parent's use of pain alleviation methods with children and children's pain intensity and pain behaviours. More than three quarters of the parents had given analgesics to their child. In addition, the parents used several non-pharmacological methods, such as holding the child in parent's lap, comforting the child and spending time with the child more than usual to alleviate the child's pain. According to the path model child's age, type of surgery and gender-related perceptions of children's analgesics explained parents' use of analgesics and non-pharmacological pain alleviation methods with their children. Children's postoperative pain behaviours were mostly explained by parents' use of non-pharmacological pain alleviation methods with their children.
Conclusions and implications: This study provided new knowledge of how parents' perceptions of children's analgesics explained their use of pain alleviation methods in children, which explained children's pain intensity and pain behaviours. The findings indicate a need to develop parental counselling in children's day surgery. The parents should be provided with accurate information of the safety and necessity of analgesics after the child's surgery. In addition, the expectations of especially boys' higher pain tolerance could be discussed with the parents. Additionally, intervention studies with experimental designs are needed to test the effectiveness of several types of instructions in guiding the parents whose child is undergoing day surgery. Cultural research is needed to understand how parents' perceptions of children's pain are developed and transmitted to the next generation in our culture. Finally, innovative methods are needed to explore young children's own experiences of postoperative pain and its alleviation at home.

National Library of Medicine Classification: WL 704, WS 100, WO 183
Medical Subject Headings: pain, postoperative; child; parents; analgesics; attitudes; surgical procedures, operative

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TIIVISTELMÄ

Tutkimuksen tausta: Lasten kivun lievittämisestä on tullut eettinen ja käytännön hoitotyön haaste, kun tietomme lapsen kyvystä tuntea kipua ja kärsiä kivusta on lisääntynyt. Päiväkirurgiassa lasten kivun lievittäminen on vanhempien tehtävä lapsen kotiutuessa sairaalasta. Vanhempien käyttämiä kivunlievitysmenetelmiä ja syitä lasten riittämättömään kivunlievitykseen ei ole juurikaan tutkittu Suomessa.
Tutkimuksen tarkoitus: Tutkimuksen tarkoituksena oli kuvata vanhempien käsityksiä 1-6 -vuotiaiden lasten kivusta ja sen lievittämisestä päiväkirurgisen leikkauksen jälkeen kotona. Tarkoituksena oli myös kuvata millainen yhteys on vanhempien käsityksillä, heidän käyttämillään kivunlievitysmenetelmillä ja lasten leikkauskivun voimakkuudella sekä lasten kipukäyttäytymisellä. Tavoitteena oli kehitetyn polumallin avulla kuvata, kuinka vanhempien käsitykset ja lapsilla käytetyt kivunlievitysmenetelmät selittävät lasten leikkauskipua.
Aineisto ja menetelmät: Neljässä vaiheessa vuosina 1999-2001 toteutetussa tutkimuksessa sovellettiin menetelmällistä abduktiota. Ensimmäisessä vaiheessa 1999 aineisto kerättiin haastattelemalla perheitä (N= 17) ja analysoitiin käyttäen induktiivista sisällönanalyysia. Tutkimuksen tarkoituksena oli kuvata miten vanhemmat arvioivat ja lievittävät 1-7 -vuotiaiden lastensa leikkauskipua kotona ja mitkä tekijät ovat yhteydessä lasten kivunlievitykseen. Toisessa vaiheessa vuonna 2000 kehitettiin ja esitestattin osamittarit mittaamaan vanhempien käsityksiä lasten kivusta ja kipulääkkeistä sekä heidän käyttämiään kivunlievitysmenetelmiä. Tutkimuksessa testattiin myös suomenkielisen Parents' Postoperative Pain Measure (PPPM) soveltuvuutta lasten kipukäyttäytymisen mittaamisessa. Aineisto kerättiin neljässä sairaalassa vanhemmilta (N= 85), joiden lapsi oli ollut päiväkirurgisessa toimenpiteessä. Kolmannessa vaiheessa vuosina 2000 - 2001 kerättiin aineisto 10 eri sairaalan 19 osastolla vanhemmilta (N=315), joiden 1-6 -vuotias lapsi oli ollut päiväkirurgisessa toimenpiteessä. Kyselylomake koostui visuaalisanalogisesta asteikosta (VAS), PPPM-mittarista sekä vanhempien käsityksiä lasten kivusta ja sen lievittämisestä ja heidän käyttämiään kivunlievitysmenetelmiä kuvaavista osamittareista. Aineisto analysoitiin käyttäen frekvenssejä, ristiintaulukointia, khiin neliötestiä, t-testiä ja varianssianalyysia. Neljännessä vaiheessa kehitettiin polkumalli kuvaamaan tekijöitä, jotka selittävät lasten leikkauskipua kotona.
Tulokset: Perhehaastattelujen tulokset osoittivat, että vanhemmat käyttivät monipuolisia menetelmiä lievittääkseen lapsen leikkauskipua kotona. Vanhemmat pitivät kuitenkin lapsen kivun tunnistamista vaikeana ja heillä oli osittain harhaanjohtavia käsityksiä lasten kivusta. Kyselytutkimuksen mukaan kolmanneksella (36 %) lapsista oli kohtalaista tai kovaa kipua (VAS yli 30 mm) ja käyttäytymismuutoksia leikkauksen jälkeen kotona. Vanhemmilla oli pääosin todenmukaisia käsityksiä lasten kivusta, mutta myös harhaanjohtavia käsityksiä lasten kivusta ja kipulääkkeistä. Näissä käsityksissä oli eroja lasten ja vanhempien sukupuolen perusteella ja ne olivat yhteydessä lasten kipuun ja sen lievittämisessä käytettyihin menetelmiin. Yli kolme neljännestä vanhemmista oli antanut lapselleen kipulääkettä kotona ja valtaosa heistä käytti myös ei-lääkkeellisiä kivunlievitysmenetelmiä, kuten lapsen sylissä pitämistä ja lohduttamista. Polkumallin mukaan lapsen ikä, tehty leikkaus ja vanhempien käsitykset lasten kipulääkkeistä selittivät heidän lapsilleen käyttämiään kivunlievitysmenetelmiä. Erityisesti ei-lääkkeellisten menetelmien käyttö selitti lapsissa havaittuja käyttäytymismuutoksia.
Johtopäätökset ja suositukset: Tutkimus tuotti uutta tietoa lasten leikkauskipua selittävistä tekijöistä. Vanhempien käsitykset lasten kivusta ja kipulääkkeistä selittävät heidän käyttämiään menetelmiä lasten kivun lievittämiseksi päiväkirurgisen toimenpiteen jälkeen kotona. Sekä kipulääkkeiden että ei-lääkkeellisten menetelmien käyttäminen selittää lasten kivun voimakkuutta ja käyttäytymismuutoksia. Tulosten perusteella päiväkirurgisessa toimenpiteessä olevien lasten vanhempien ohjaamista on syytä kehittää. Heille tulisi antaa tietoa kipulääkkeiden turvallisuudesta ja tarpeellisuudesta lapselle. Vanhempien kanssa tulisi myös keskustella heidän odotuksistaan poikien hyvästä kivunsiedosta. Jatkotutkimuksissa tulisi selvittää erityyppisten ohjausmenetelmien vaikuttavuutta käyttäen interventiotutkimuksen menetelmiä. Tarvitaan myös kulttuurisia tutkimuksia kuvaamaan kuinka vanhempien käsitykset lasten kivusta siirtyvät seuraavalle sukupolvelle kulttuurissamme. Tutkimuksia tarvitaan myös selvittämään lasten omia kokemuksia kivustaan ja sen lievittämisestä kotona päiväkirurgisen toimenpiteen jälkeen.

Yleinen suomalainen asiasanasto: kipu: lapset; kipu: hoito; vanhemmat: käsitykset; kipulääkkeet; leikkaushoito: kipu; lastenkirurgia: kipu: hoito; kirurgia

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Kuopio, January 2003

Päivi Kankkunen

LIST OF ABBREVIATIONS USED IN THE TEXT

COX = Cyclo-oxygenase enzyme

CGRS = The Children's Global Rating Scale

D.E.G.R. Scale = Douleur Enfant Gustave Roussy Scale

GFI = goodness of fit index

IASP = International Association for the Study of Pain

NSAIDs = non-steroidal anti-inflammatory drugs

PPPM = Parents' Postoperative Pain Measure

SSRIs = Selective serotonin reuptake inhibitors

STAKES = Sosiaali- ja terveysalan tutkimus- ja kehittämiskeskus (National Research and Development Centre for Welfare and Health)

TENS = Transcutaneous electrical nerve stimulation

VAS = Visual Analogue Scale

LIST OF THE ORIGINAL PUBLICATIONS

The results of this dissertation are based on the following original studies and referred to in the text by their Roman numerals:

I Kankkunen P, Vehviläinen-Julkunen K & Pietilä A-M 2002. Children's postoperative pain at home: Family interview study. International Journal of Nursing Practice 8, 32-41.

II Kokki A, Kankkunen P, Pietilä A-M & Vehviläinen-Julkunen K 2003. Validation of the Parents' Postoperative Pain Measure in Finnish children aged 1-6 years. Scandinavian Journal of Caring Sciences, in press.

III Kankkunen P, Vehviläinen-Julkunen K, Pietilä A-M & Halonen P 2003. Parents' perceptions of their 1-6-year -old children's pain. European Journal of Pain, in press.

IV Kankkunen P, Vehviläinen-Julkunen K, Pietilä A-M & Halonen P 2003. Parents' use of non-pharmacological methods to alleviate children's postoperative pain at home. Journal of Advanced Nursing, in press.

V Kankkunen P, Vehviläinen-Julkunen K, Pietilä A-M, Kokki H & Halonen P 2003. Parents' perceptions and use of analgesics at home after children's day surgery. Paediatric Anaesthesia, in press.

VI Kankkunen P, Vehviläinen-Julkunen K & Pietilä A-M 2002. Ethical issues in paediatric nontherapeutic pain research. Nursing Ethics 9(1), 80-91.

This doctoral dissertation also includes material that has not been published in the articles.

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

Management of symptoms, such as pain, is one of the priorities in nursing research (see eg. Vehviläinen-Julkunen & Paunonen 1998a, Gillis & Jackson 2002). Children's pain assessment and alleviation is an ethical and clinical problem in several scientific fields. From the ethical point of view, children have a subjective right to pain relief. On the other hand, consequences of untreated pain can be identified, especially in small children. The less mature the organism, the more plastic the nervous system. Thus, children's nervous system is more susceptible to factors that modify pain perceptions and structures. (Johnston 1993.) Therefore, for example, surgical pain in pediatric patients may lead to not only a short-time pain experiences (Cohen 1993), but to behavioural problems for up to four weeks postoperatively (Kotiniemi et al. 1997). Untreated acute pain may also lead to complications and thus to longer inpatient periods (Rawal 1998).

Adequate pain assessment and alleviation are essential after pediatric surgery. The use of day surgery among children has increased for several reasons, including economic, medical, family and child-related reasons. Day surgery is economically favoured, because its costs are lower compared to convential in-patient treatment (Burn 1992, Kristensson-Hallström et al. 1998, Lahtinen et al. 1998, Lander & Warnock 1999). From the medical viewpoint, the reasons include improvements in surgical technology and anaesthetic agents and the mechanisms and philosophies of pain relief (Holzman 1994). In addition, day surgery is said to decrease morbidity and mortality rates (Lander & Warnock 1999). Families' desire to avoid the inconvenience and potential pitfalls of staying in hospital has also influenced the increase of day surgery (Holzman 1994). Day surgery also interrupts family life less than in-patient surgery (Kristensson-Hallström et al.1997). In addition, the use of day surgery results in fewer behavioural disturbances in children compared to those who have to stay in hospital (Glazerbook & Sheard 1994).

Despite our increased knowledge of the pharmacological and non-pharmacological management of pain (Desparmet 1993, Goldman 1993, Vessey & Carlson 1996), several studies have shown that children's pain remains poorly managed (Tesler et al. 1994, Jorgensen 1995, Kachoyeanos

& Zollo 1995, Callery 1997, Kokinsky et al. 1999, Nikanne et al. 1999, Hamers & Abu-Saad 2002). There is also evidence to show that children have severe pain postoperatively even after minor surgery (Kokki & Ahonen 1997, Gauthier et al.1998, Munro et al. 1999, Nikanne et al. 1999). One challenge in children's poor pain alleviation is the role of parents.

The role of parents in the assessment and management children's post-operative pain has become more important when ambulatory and day-case surgery has become widely used among children. In Finland, three quarters of surgical procedures (N= 21650/year) are conducted on a day surgery basis among children under seven years old (STAKES Tieto 2000). Earlier findings of children's pain alleviation at home have shown that children still have moderate or severe postoperative pain at home and their pain is fairly poorly managed (Finley et al. 1996, Hamers et al. 1998) mainly because parents do not give enough pain-relieving medication to their children postoperatively.

Effective pain alleviation is based on adequate pain assessment (Gillies 1993). The assessment of children's pain may be difficult because of several reasons. First, most pain assessment tools have been developed for health care or research professionals and children older than three years (Vehviläinen-Julkunen et al. 1999), and therefore cannot be used by parents of small children. Secondly, some children may use distraction techniques, such as sleeping or being quiet, that may be interpreted as indicators of being painless (Hodges 1998). Thirdly, the most important factor may be children's poor ability to verbally express the intensity, quality and location of their pain. Increased anxiety and fear may also lead to increased pain in children (Rawal 1998), and it may, therefore, be difficult to determine if the child has pain or some other emotional distress. Finally, parents have described that their involvement in their child's pain management is superficial and limited at hospital (Simons et al. 2001), and they do not receive the necessary information of children's pain alleviation from the hospital staff (Pölkki et al. 2002).

Earlier studies of children's pain assessment and alleviation have mainly focused on the in-patient period (Coyne 1995, Naber et al. 1995, Pejaver & Russell 1995, Bauchner & Vinci 1996, Foertsch et al. 1996, Kristensson-Hallström & Elander 1997, Pölkki et al. 2002). The findings indicate that parents who were present during their child's painful procedures were less anxious

than parents who were not present (Bauchner & Vinci 1996). Opposite findings indicated higher levels of behavioural distress in children when their parents were present versus absent during burn debridement (Foertsch et al. 1996). However, it is suggested that nurses' encouragement of parents to be actively involved and physically close their child during painful treatments may result in less distress and discomfort to the child (Naber et al. 1995). A survey among pediatricians showed, however, that they tend to exclude the parents from certain procedures, especially if the parents are anxious and the procedure is difficult or painful (Pejaver & Russell 1995). In addition, parents have described lack of information and non-negotiation of roles as factors that limited their participation in their child's care (Coyne 1995).

With the increased use of day surgery among children, it is important to conduct family-oriented research focussing on parents' assessment and alleviation of children's postoperative pain. The focus can be on the competence of caregivers, which means having necessary knowledge, skills and recources to provide the required care. A competent caregiver is described to be able to assess the care receiver and changes in the caregiving situation, to recognize actual or potential problems, and to act in order to prevent or resolve problems. (Schumacher et al. 1996.) In the context of children's pain assessment and alleviation, it is necessary to examine the parental knowledge, skills and resources required for effective alleviation of children's postoperative pain.

Parents' competence to assess and alleviate children's postoperative pain is obviously not the only factor underlying their actions aiming at children's pain relief. It has been said that our perceptions, meanings, attitudes, expressions and care of pain are embedded in cultural context (Villarruel 1995). Therefore, these culturally modified parental perceptions of pain and pain alleviation may influence the assessment and alleviation of children's postoperative pain.

Gender issues and the role of gender have been largely ignored in nursing studies. Most of studies focusing on children's pain assessment and management have also been conducted among mothers (e.g. Gedaly-Duff & Ziebarth 1994, Forward et al. 1996) or fathers have been only a minority in the samples (e.g. Reid et al. 1995, Finley et al. 1996, Woodgate & Kristjanson 1996), even when the research problem is related to parents' perceptions and experiences.

However, some findings indicate that fathers participate equally much as mothers in the care of their child at hospital (Foertsch et al. 1996), which indicates that their opinions should be investigated more widely.

The purpose of this clinical and family-oriented nursing study was to describe mothers' and fathers' perceptions of 1- to 6 -year-old children's pain and its alleviation at home after minor surgery. In addition, the purpose was to describe the relationship between these perceptions, parents' use of pain alleviation methods and children's pain intensity and pain behaviours after surgery. The final aim was to explain how parents' perceptions and their use of pain alleviation methods explains variation in children's postoperative pain by creating a path model describing the effects. This study is part of a research project titled "Developing the child's pain assessment and management" at the University of Kuopio (Vehviläinen-Julkunen et al. 1999). The findings can be utilized to teach parents to assess and alleviate their children's postoperative pain at home and thus to achieve maximum pain relief in children following day surgery. The findings can be used to increase the knowledge and skills of pediatric nurses by developing the content of their professional education by highlighting the need to advice parents of issues related to children's pain. Finally, children's well-being and quality of life can be improved by encouraging parents to alleviate their children's pain systematically during the postoperative period.

2 PARENTS' ASSESSMENT AND ALLEVIATION OF CHILDREN'S PAIN AT HOME

2.1 Parents as the context of children's pain

2.1.1 Parents in children's nursing

Families have become a focus of interest in nursing practice, science and research. In accordance with the changes in society, the definitions and views of families have changed. Today families are defined based on their social interaction and association (eg. Marin 1999, Whall 1999) and considered complex units with attributes of their own containing component parts that are significant as individual units (Gilliss 1983). Family can also be defined as who they say they are (Robinson 1995, Wright & Leahey 2000). A family can be known only through its individual members (Bell 1995). Whall (1999) combines different views on families by defining family as " a self-identified group of two or more individuals whose association is characterized by special terms, who may or may not be related by bloodlines or law, but who function in such way that they consider themselves to be a family". Thus, the family form can be single-parent, extended, re-married and stepparent, gay and lesbian or augmented family (Friedman 1997).

In pediatric nursing the importance of families has been recognized and investigated since the 1950s (Rennick 1995). In this context, families can be understood as a "person" or an "environment". In addition, nursing care can focus on the individual in the context of the family or on the family with the individual as context (Wright & Leahey 1994). If we consider families as "persons", the focus in nursing care is on the family as a whole. On the other hand, considering family as "the environment" means focussing on individuals. (Friedemann 1999.) Both views are suggested to be equally important in nursing care in order to focus on both the individuals and on the whole family system (Friedemann 1989). In addition, a person should not be considered either an individual and independent of family or a family member, but both an individual and a family member. Thus, family can be defined as part of person and person can be defined as part of family. (Robinson 1995.) In nursing care, this means that the family can be a support for an individual or the main focus of interest (Paunonen & Vehviläinen-Julkunen 1999).

In this study, family is defined as a unit consisting of two generations: children and parents. Parents may be biological or adoptive parents or other adults that the family defines as parents. Thus, stepparents and parents' new spouses are included. Families are considered the environment of the child undergoing day surgery. Therefore, parents are considered the principal caretakers of their child after surgery.

2.1.2 Parents' role in children's postoperative pain alleviation

In this chapter, the role of parents in children's postoperative alleviation is discussed from the viewpoint of both parents and children. Family is the natural context of children after day surgery. Children's postoperative pain assessment can be discussed both from the viewpoint of children's learned behaviours or own characteristics and their cultural background. From children's viewpoint, family is the context where they learn their responses to pain. It has been suggested that parents' attitudes to their child's care at hospital, their child-rearing practices, children's pain threshold and their gender may influence the way in which they are encouraged to express their pain at home.

Hospitalization and surgery have been said to be threatening for both children and their parents (Kristensson-Hallström & Elander 1997), especially if the parents see the child in pain for the first time (Woodgate & Kristjanson 1996). Therefore, parents' expectations and attitudes towards the child's care may influence the child's behaviour at hospital. Parents may openly criticize the necessity of painful procedures or use such procedures as a threat of punishment, whereby while the child learns to be afraid of procedure-related pain (Lutz 1986).

Parents' child-rearing practices may also influence children's pain responses. Children whose mothers reported high levels of both control and warmth in their relationship were found to be less distressed during immunization than children of either permissive, authoritarian or non-responsive parents (Broome & Endsley 1989). Opposite findings by Gil and colleagues (1992) showed that adolescents from controlling but also conflicting families had higher pain ratings after surgery. In addition, Bournaki (1997) found no differences in pain behaviours among children aged 8 to 12 years during venipunctures when the comparison was done between

parental restrictiveness and nurturance. Parents may also use pain as a form of child-raring practice and as a punishment. Children may learn to consider any pain a punishment, regardless of the reason for pain. Thus, they may learn to feel guilty because of any type of pain. (Lindfors 2000.)

Children's own characteristics may influence the way their pain is assessed and managed at home. Pain threshold may influence children's pain behaviours. The lower the sensory pain threshold was, the more behavioural responses were seen in children aged 8 to 12 years during venipunctures (Bournaki 1997). It is also stated that pain threshold is lower in females than in males (Lindfors 2000).

Child's gender may also affect the way children are taught to express pain. It is suggested that boys usually show more controlled pain responses because of social and cultural expectations, while girls are expected to express their pain and to cry openly (Lutz 1986). Boys may be taught not to cry or act like a baby (Bonham 1996). In a study focussing on pain during venipunctures, differences were found in children's behavioural responses. Girls aged 8 to 12 years cried more than boys. (Bournaki 1997.) Gender differences have also been found in regard to the judgements about the intensities of mild, moderate and severe pain. Girls tended to give lower ratings than boys. (Gauthier et al. 1998.)

Values and learned myths may influence parents' perceptions of children's pain. Our perceptions of pain are said to be embedded in our culture (Villarruel 1995, Montes-Sandoval 1999), and family is described as the most important group that transmits pain-related cultural norms to children (Ludwig-Beymer 1999). Culture is stated to influence both children's pain behaviour and parents' understanding of children's pain. It influences both how people perceive and how they respond to pain (Helman 1994). The expectations, manifestations and management of pain (Ludwig-Beymer 1999) and the perceptions, meanings, attitudes, expressions and care of pain (Villarruel 1995) are embedded in the cultural context. Especially socioeconomic, ethnic and religious factors have been described to influence pain behaviour and perceptions (Huth & Moore 1998).

Children learn the patterns of behaviour and responses to pain based on their parents' cultural understanding of pain (Waddie 1996). For example, parents may value a child who tolerates pain and consider the child "good" compared to other children (Woodgate & Kristjanson 1996). Some cultures are described as verbal and demonstrative in expressing pain, while others are quiet and stoic. Children learn what behaviours are reinforced or discouraged and use that while learning to cope. (Bonham 1996.) Some children may have learned to use "bad" pain behaviours, such as complaining of pain verbally or behaviourally related to emotions of anger or depression. Children can become oversensitive in observing their bodies and interpreting different sensations as pain. (Maunuksela & Hamunen 2002.) In addition, parents may transmit their anxiety to their children (Lutz 1986). Some opposite findings have shown that parents' pain and distress are not transmitted to their children (Downey et al. 1999). However, higher levels of somatization among parents have been found to be associated with more somatization in children with recurrent abdominal pain (Walker et al.1994).

Myths about pain may influence how adults response to children's pain. The general myth that children do not experience pain as intensely as adults may lead to under-treatment of children's pain (Lutz 1986). However, there is scientific evidence to show that even infants sense pain, despite the fact that their physiological pain mechanisms are not fully developed (Maunuksela & Hamunen 2002). It is also widely believed that children tolerate discomfort well because they may increase their physical activity or sleep for long periods after painful procedures (Lutz 1986, Hodges 1998). However, this kind of behaviour may also indicate that children use increased activity or sleeping as methods of distraction to cope with the pain (Vehviläinen-Julkunen et al. 1999) and should thus be understood as pain indicators.

Cultural differences have been found in subjects' pain threshold and pain tolerance. Differences in pain tolerance may reflect different attitudes towards pain. (Ludwig-Beymer 1999.) Earlier studies have shown that adult subjects representing a European ancestral group reported less severe postoperative dental pain than Asians, black Americans or Latinos (Faucett 1994). A slight difference was found in the intensity levels of three terms (pain, ache and hurt) among Hispanics, American Indians and whites (Gaston-Johansson et al. 1990). However, it is possible that differences do not exist in pain threshold or pain tolerance, but that there are cultural norms

which determine how pain should be expressed (Villarruel 1995).

Fairly little is known about culturally transmitted parental perceptions of children's postoperative pain and pain medication. Findings from USA (Gedaly-Duff & Ziebarth 1994) and Canada (Finley et al. 1996, Forward et al. 1996) show that parents have some misleading perceptions of children's pain medication (see Table 1). In addition, parents' attitudes towards children's pain medication have been found to influence their use of analgesics with their children. It has been said that the attitudes affecting parents' use of pain medication in their children are based on a lack of knowledge and might rely on beliefs and myths (Gillies 1993, Finley et al. 1996). Parents have also expected their child to be in mild or moderate pain after surgery (Romsing & Walther-Larsen 1996), and the need for pain alleviation in children may therefore not be met. Thus, parents' teaching combined with correct information of analgesics are needed to develop children's pain management (Kokki & Nikanne 1999).

Research on parents' perceptions of children's pain and its alleviation has been very limited in Finland. Some evidence exists, however, showing that Finnish parents differ in their ways to take care of sick children compared to other European parents. Comparisons between European families showed that Finnish parents used to keep the children in bed during times of illness, while parents from several other cultures let the children play and invite their friends to visit them (Trakas 1996). Finnish parents were also likely to refuse pain medication (Ahonen et al. 1997) and they shared the opinion that painkillers should not be taken immediately and especially that they should not be given to the children at the first opportunity.

Table 1. Studies of parents' attitudes and perceptions of children's pain and its alleviation.

Researchers	Purpose of the study	Participants	N	Method	Main findings
Gedaly-Duff & Ziebarth 1994 USA	To describe mothers' experiences in managing children's pain after surgery	Children aged 4-8 Mothers	7 7	Interviews Grounded theory Constant comparative analysis	Children's request for pain medicine was interpreted as addictive behaviour to narcotics instead of a sign that the medication was insufficient for the child.
Finley et al. 1996 Canada	To evaluate parents' attitudes towards children's pain following short-stay and day surgery	Children aged 2-12 Mothers Fathers	189 185 4	Questionnaires Statistical analysis	31 % of the parents thought that children who have to take pain medication regularly may learn to use drugs to solve other problems. Half of the parents related that children can become addicted to narcotics when they are used to relieve pain.
Forward et al. 1996 Canada	To examine mothers' attitudes towards using acetaminophen to treat children's pain	Mothers of children aged 5-12 from elementary schools	298	Attitude scale Telephone interviews Statistical analysis	Mothers' attitudes were most negative toward tolerance and side effects of acetaminophen. Mothers with more positive attitude tended to medicate common childhood pain and give medication at lower levels of pain.

To conclude, family is the context where children learn their pain responses and expressions. Adults have the responsibility to alleviate their child's postoperative pain at home. However, myths and culturally embedded perceptions of children's pain may influence parents' use of pain alleviation methods. Research on this issue has been very limited, and earlier studies have been conducted in the USA and Canada, and, because of cultural differences, they cannot be directly generalized to Finnish parents.

2.2 Definitions and classifications of pain

Perceptions and definitions of pain have changed during the latest decades. An old, but still quite relevant definition to pain was given by Aristotle, who defined pain as the opposite of pleasure. Pain has also been described as punishment, and it was thus believed to have an educational influence (Sullivan 1953). Later views on pain have emphasized pain as a protective mechanism (Francis & Munjas 1975), because in children pain is a powerful stimulus that drives towards primitive survival behaviour and teaches young children to avoid danger (McGrath & McAlpine 1993). Sensation of pain can also be understood as a warning of threatening tissue damage (Kalso 2002).

Pain is a complex phenomenon that can be understood as an unpleasant sensation with reactive or emotional components (Lutz 1986). Pain can also be defined with the traditional definition in nursing: "Pain is whatever the experiencing person says it is, existing whenever he says it does". (McCaffery 1977). This definition is problematic with small children who are not able to verbally describe their pain. According to Montes-Sandoval (1999), eight critical attributes can be related to pain. Pain is an uncomfortable experience and a response to several stimuli as well as a sensation to injury or damage. It is also a form of communication but difficult to share with others. Pain also serves as a protective mechanism and it is in reciprocal interaction with anxiety. Finally, pain may lead to distressful thoughts.

Pain is also defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage (Merksey 1979). This definition accepted by the International Association for the Study of Pain (IASP) does not include the several factors influencing pain sensation, experience and expression. However, a given tissue trauma may produce different sensory messages in different people or even in the same person at different times (Tyrrell 1997). Four major components can be related to pain: *nociception* as a consequence of tissue injury, *pain* as a result of nociceptive input, *suffering* as a consequence of pain, and *pain behaviour* as a consequence of the earlier phenomena (Laurence & Bennett 1987). Table 2 summarizes the different definitions of pain.

Table 2. Different definitions of pain.

Theorist	Year	Definition of pain
Sullivan	1953	Punishment /educational characteristics
Francis & Munjas	1975	Protective mechanism
McCaffery	1977	Whatever the experiencing person says it is, existing whenever he says it does
Merksey	1979	Unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage
Lutz	1986	Unpleasant sensation including reactive or emotional components
Laurence & Bennett	1987	Components: nociception, pain, suffering and pain behaviour
Montes-Sandoval	1999	Uncomfortable experience, response to several stimuli, sensation to injury or damage, form of communication but difficult to share with others, serves as a protective mechanism in reciprocal interaction with anxiety and pain can lead to distressful thoughts
Kalso	2002	Warning of threatening tissue damage

Pain can be divided into physiological or clinical pain. Physiological pain is based on the activation of nociceptive afferent nerve fibres, which respond to tissue-damaging or noxious stimuli. This activity is then transmitted to the central nervous system and may lead to responses and a sensation of pain. Clinical pain is based on disease or trauma, and is therefore called nociceptive pain. Pain can also be termed neurogenic or neuropathic mainly if it is a result of an injury or lesion in the peripheral or central nervous system. (Ekblom & Rydh-Rinder 1998). Another classification is the division into acute, recurrent and chronic pain (Laurence & Bennett 1987). Acute pain refers to a major nociceptive input, while chronic pain is better regarded as a syndrome rather than a symptom. Pain can be classified as chronic when it is prolonged beyond the usual time of tissue improvement. One classification is to divide the pain based on its location into somatic or visceral pain. (Vainio 2002.) Based on the mechanisms of pain's origins, it can also be classified into nociceptive, neuropathic and idiopathic pain. Nociceptive pain occurs when nociceptors react towards a stimulation that may cause tissue damage. Neuropathic pain is due to problems in the nerve or the nervous system that intermediate pain. Idiopathic pain means that no explanatory damage can be identified. (Vainio 2002.)

Pain can also be classified into private and public pain based on how explicitly a person expresses pain (Helman 1994). Private pain refers to the situation where there may be no outward clue or sign that the person is experiencing pain, even when it is very severe. For example, Anglo-Saxon cultural norms may value stoicism that influences our pain expressions.

Public pain refers to pain behaviours that are influenced by social, cultural and psychological factors. In this study, the focus is on children's acute, trauma-based nociceptive pain caused by surgical procedures and explicitly expressed by the children.

2.3 Pain mechanisms

The main aspects of pain mechanisms are transduction, transmission, modulation and perception. Transduction is the phenomenon whereby stimulation causing tissue damage leads to electric activation of nerve endings. Transmission refers to the actions following transduction. Modulation means pain control in the nervous system. The last step is perception, which means the subjective response to a neuronal procedure. (Kalso 2002).

Peripheral, central and endogenous pain-controlling mechanisms influence our sensation of pain (Ekblom & Rydh-Rindler 1998). In the peripheral mechanism, the first cell that transmits information from the periphery to the spinal cord is the primary sensory neuron. Sensory nerve A- and C-fibres interact with glial cells, which support the nerve and participate in transmitter metabolism. Receptors that become activated by threatening stimuli (nociceptors) and nociceptive afferents can be stimulated by direct activation, pain-provoking substances and peripheral sensitisation.

The main component of the central pain mechanism is the spinal cord, which is divided into cervical, thoracic, lumbar and sacral parts (Ekblom & Rydh-Rindler 1998). Neurotransmitters and modulators are mediators in inflammatory and inhibitory processes. The first synaptic transmission occurs at the dorsal horn of the spinal cord, from where the activity is transmitted to the supraspinal areas. In the brain, the most important pathway in pain transmission is said to be the spinothalamic tract, which is responsible for the perception of well-localised pain sensations and for the affective component of pain perception. After surgical procedures, the wound area is sensitive to touch, which may lead to movement-related pain (Ekblom & Rydh-Rindler 1998). Secondary hyperalgesia is also believed to depend on spinal cord mechanisms.

Endogenous pain-controlling mechanisms can be divided into three categories: peripheral opioid mechanisms, segmental interaction and descending control (Ekblom & Rydh-Rindler 1998). Peripheral opioid mechanisms are based on the interaction between nociceptive afferents and surrounding tissues and opioid receptors in peripheral tissues. Endogenous opioids are released in the central nervous system during inflammation, after while they bind to opioid receptors, which leads to decreased excitability and reduced release of peptides. Segmental interaction refers to the gate control theory by Melzack and Wall (1965), which is based on the idea of modulation of pain within the nerve system. According to the theory, activity in myelinated afferents may lead to inhibition of nociceptive afferents or neurons. The theory explains why the same stimulus does not lead to similar responses in all people. Descending inhibitory control refers to the mechanisms in the brain. Stimulation of discrete brain areas can produce analgesia. This endogenous control system is operative eg. in placebo phenomena, where placebo treatment may lead to analgesia.

In children, the development of different pain mechanisms can influence pain experiences and management. Compared to adults, children's recovery is faster, possible due to their physiological responses, ability to adapt or differences in pain tolerance. Yet, this does not mean that children cannot feel pain at the same way as adults. Infants can sense pain even if their physiology and different reactions continue to develop. (Maunuksela & Hamunen 2002.) Research findings have demonstrated that pain can be transmitted even by unmyelinated C-fibres, and pain sensation is thus not dependent on the presence of myelination of sensory fibres (Fitzgerald & Anand 1994). Neonates have the neuronal apparatus to detect painful stimuli because the basic connections in nociceptive and pain pathways develop before birth (Fitzgerald 1993).

Contemporary understanding of the nervous system emphasizes the fact that even a brief period of pain can cause permanent changes in the dorsal horn of the spinal cord. In addition, pain receptors in the periphery become more sensitive after injury. (Loeser 1998.) In children, the plasticity of the nervous system refers to changes that can occur within the structural changes in the periphery in response to repeated tissue injury that results in a larger area of response, and

a hypersensitivity to the same stimulus (Johnston 1993). It is assumed that the nervous system of children is more susceptible to factors that modify perceptions and even structures.

The plasticity of the nervous system combined with the overwhelming quality of pain and the immature understanding of pain may have impacts on children with immediate problems. It may also have long-term consequences, such as somatization during painful procedures, complications, prolonged hospital stay and behavioural problems (Johnston 1993, Kotiniemi et al.1997, Rawal 1998).

In this study, it is assumed that children's nervous system is sufficiently developed to allow transduction, transmission, modulation and perception of pain. In addition, it is suggested that even minor pain, for example after day surgery, may cause severe damage in the brain. Thus, it is important to alleviate pain in small children, to avoid both immediate problems and long-term consequences of pain.

2.4 Assessment of children's pain

2.4.1 Pain responses in children younger than seven years

Accurate assessment of children's pain is the basis for diagnostic efforts, adequate pain management and determination of the most appropriate methods of pain treatment (Erickson 1990). Pain assessment is defined as "looking at the individual's experience of pain including identifying the occurrence, location, intensity and meaning of pain to individual patients" (Jorgensen 1995). Pain assessment consists of two main purposes: how much pain the child has (quantity of pain) and, what is the pain experience like for the child (quality of pain). In acute pain, the quantity of pain is considered more important than its quality (Johnston 1993).

Adults have the responsibility to assess children's pain to identify the need for pain alleviation. Yet, children's own descriptions should be the primary method in their pain assessment. However, the child's developmental stage influences the child's ability to express pain verbally, to locate the pain, to describe it's quality, and to learn to use different methods to alleviate pain

(Gillies 1993, McGrath 1993, Vessey & Carlson 1996). Additionally, children's pain responses and expressions are related to their gender, fears, learned reactions and earlier pain experiences (Bournaki 1997). Thus, assessment of developmental level (motor, language, personal, and social development) is essential to understanding children's pain responses in different age groups (Gedaly-Duff & Huff-Slankard 1998, Huth & Moore 1998).

Understanding of the rapid development in infancy (0-2 years) and at pre-school age (2-6 years) provides a basis for understanding children's pain responses. Children under two years old are at a sensorimotor stage in their cognitive development, as stated by Piaget (1983). At this stage, children create their perceptions by motor activity (Nummenmaa 1982, Atkinson et al. 1983, Beilin 1997). They learn to use language by naming objects and events. Children older than two years begin to combine words and to produce sentences. Additionally, children learn to describe meanings and to use symbols. (Lyytinen 1982.) Their cognitive skills are at the preoperational stage according to Piaget's theory of development, meaning that they use words and images to describe their perceptions (Atkinson et al. 1983, Beilin 1997). However, their thinking is still egocentric and they often have difficulty to see the viewpoint of others. Children also classify objects by a single feature. (Atkinson et al. 1983.)

The basic structures of children's personality (Bijou 1997) and their sexual identity (Atkinson et al. 1983, Dunderfelt 1991) develop during this period from two to five years. In addition, the process of separation and individualisation, also referred to as the emergence of the psychological self, begins at this age (Dunderfelt 1991, Vuorinen 1998). Similarly, children's moral development at this age is described as preconventional morality because their actions are evaluated in terms of whether they avoid punishment or lead to rewards (Atkinson et al. 1983). Even if children's development is fairly similar, it may be affected by their social context (Bandura 1997). For example, verbal development is based on genes and interaction with the environment.

Children's developmental stage should be known while assessing their pain. Their pain responses differ in different age groups. In the youngest children, facial changes (Desparmet 1993, Johnston 1993, Engel 1996, Vessey & Carlson 1996, Halimaa 2001), changes in sleep

(Gedaly-Duff & Huff-Slankard 1998) or crying (Desparmet 1993, Johnston 1993) may indicate pain. In addition, physiological changes, such as increased heart and respiratory rates (Engel 1996, Halimaa 2001), blood pressure (Engel 1996), skin sweating (Engel 1996), amount of oxygen or carbon dioxide (Engel 1996, Halimaa 2001), and cortisol changes (Engel 1996) usually indicate a stress response or pain.

Toddlers are prelogical in their thinking, which influences their ability to express and understand pain and the procedures causing it. Yet, they can express pain by changing their behaviour, verbally or staying immobile (Vehviläinen-Julkunen et al. 1999). Thus, their pain can be assessed by measuring physiological parameters, by observing their behavior and by observing their appearance (Desparmet 1993, Vessey & Carlson 1996.). In addition, drawings and dolls can be used to assess the existence and location of pain in small children (Hamunen 1998). However, even children as young as two years are said to be able to report the occurrence of pain, but they typically cannot rate the pain intensity (Engel 1996).

Preschool-age children are often able to talk about their pain. However, their reactions are still behaviourally oriented and imaginistic. (Vessey & Carlson 1996.) They do not have a clear sense of their body and how it functions. They have little understanding of what their pain is about. (Johnston 1993.) Children may also be unable to understand how painful procedures could promote their well-being (Hamunen 1998). In addition, young children do not understand time; they do not understand that acute pain will not last long (Johnston 1993). Thus, verbal report cannot be obtained from children less than three years old (Johnston 1993). Children older than four years can locate their pain e.g. by using a body outline (Van Cleve & Savedra 1993). An overview of children's pain responses in different age groups is presented in Table 3. Years of age were modified from Bonham (1996), and the ages of pre-school-aged an school-aged children are therefore different from Finnish children. In Finland, children go to pre-school at the age of six years and to comprehensive school at the age of seven. However, the classification suggested by Bonham (1996) was used to enable comparison of children's pain responses reported in the international literature.

Table 3. Children's pain responses in different age groups (modified from Bonham 1996).

Age	Nonverbal responses	Verbal responses
Premature babies 32-37 pregnancy weeks	Physiological changes Facial changes	Crying
Infant 0-1 years	Withdrawal of extremity Anticipatory fear Irritability Regression Body movement Changes in sleep Facial changes	Crying
Toddler 1-2 years	Withdrawal of extremity Nonspecific aggression Use of entire body to resist Regression	Crying Screaming Identifies pain location
Preschool 3-4 years	Goal-directed aggression Active physical resistance Regression	Attempts to postpone Aggressive statements Identifies pain location and intensity
School-aged 5-12 years	Passive resistance Regression	Denial of pain Identifies pain location and intensity in more detail

Several problems are implicit in children's pain assessment. Firstly, children's pain is usually very overwhelming (Johnston 1993). Thus, it may be difficult to separate pain from other emotional responses, such as anxiety or stress (Erickson 1990). Anxiety and distress are also related to higher levels of postoperative pain (Gil et al. 1992). Secondly, children may be reluctant to report pain, because they feel that pain is their fault, or they may be afraid of the consequences of reporting pain (Johnston 1993). Thirdly, calm behaviour may be a sign of given up protesting the pain, not a sign of having no pain (Johnston 1993). Additionally, one of the challenges in children's pain assessment is based on the statement that the relationship between pain intensity and tissue damage is not linear (Johnston 1993). Thus, it cannot be argued that similar tissue damage (a wound after surgery) will cause similar pain intensity in children.

In conclusion, children's physiological pain responses, their pain behaviours and verbal expressions can be identified to assess the quality and intensity of their pain. However, children's developmental status and their different coping strategies are a challenge to the parents who assess their children's postoperative pain at home.

2.4.2 Pain measurement instruments for 1- to 6-year-old children

Measurement of pain is defined as "looking at the commonalities of pain across groups" (Jorgensen 1995). Children's pain-measuring instruments are meant to be used by an observer or the children themselves. In very young children, the measurement of pain is based on observing pain indicators. Measurement of physiological parameters is also recommended among pre-verbal children (Desparmet 1993). Pain assessment tools based on children's self-report can be used with children who can quantify pain (Johnston 1993).

Several observational or self-rating measurement instruments have been developed for children aged 1-6 years. The Toddler-Preschooler Postoperative Pain Scale for children aged 1-5 years consists of seven items divided into three pain categories: vocal, facial and bodily pain expressions (Tarbell et al. 1992, Desparmet 1993). The Observation Scale of Behavioural Distress rates pain by 11 categories of distress-related behaviors in children older than three years (Elliott et al. 1987). The D.E.G.R. Scale containing 10 items describing pain signs can be used among children aged 2-6 years (Pichard-Leandri 1993, Gauvain-Piquard et al. 1999).

Faces scales, such as the Oucher Scale, can be used to measure pain in children three years and older (Desparmet 1993). In clinical use, two types of scale are used: a scale with a neutral face as a "no pain" anchor and a scale with a smiling face as a "no pain" anchor. Testing of the impact of the anchors in the scale showed that the faces scale with a smiling anchor may confound affective states with pain ratings (Chambers & Craig 1998). However, the Wong-Baker scale with six smiling, neutral or crying faces is described to be reliable in pain measurement and not to decipt any particular culture, age or sex (Pasero 1997).

The Washington DC Pediatric Objective Pain Scale was developed to be used among pre-verbal and school-aged children. A verbal evaluation of pain by the child is added to the pain rating. The child is asked to describe the location of the pain and whether the pain is mild or bothersome. (Desparmet 1993.) Visual Analogue Scale (VAS) is recommended to be used in children older than four years (Desparmet 1993). Typically, the VAS is a 10-cm line from "no

pain" to "severe pain" or "pain as bad as I can imagine", on which the degree of pain is indicated (Gillies 1993, Engel 1996).

Colour tools have been recommended for children of 4-7 years, because this age group associate colour with sensation (Gillies 1993). A Coloured Analogue Scale was found to be reliable in measuring headache in children aged 5-16 years (McGrath et al. 1996). The Children's Global Rating Scale (CGRS) can be used to assess pain in children aged four to eight years (Carpenter 1990). The instrument consists of five wavy lines. The wavier the line, the more intense the pain.

Parents' Postoperative Pain Measure (PPPM) is an instrument consisting of 15 items describing behavioural changes in children aged two to 12 years (Chambers et al. 1996). It provides information to parents about when they should medicate their child (pain rating six out of 15). The instrument has been validated in children aged seven to 12 years (Chambers et al. 1996, Finley et al. 1999) in Canada. Further validation in children aged two to six years showed that it correlated highly with child-reported pain scores and discriminated between pain from mild, moderate and severe (McGrath et al. 1999). It has been described to be internally consistent and strongly related to child-rated pain (Chambers et al. 1996), and sensitive to analgesia (Finley et al. 1999). Table 4. summarizes pain-measuring instruments for children aged one to six years.

Table 4. Summary of pain measuring instruments available for children aged one to six years.

User	Instrument	Recommended age group	Authors
Observer use	Observation Scale of Behavioral Distress	Older than 3 years	Elliott et al. 1987
	The D.E.G.R. Scale	2-6 years	Pichard-Leandri 1993
	Toddler-Preschooler Postoperative Pain Scale	1-5 years	Tarbell et al. 1992
	PPPM	2-12 years	Chambers et al. 1996
Self-rating use	Face scales	Older than 3 years	Desparmet 1993
	Visual Analogue Scale	Older than 4 years	Desparment 1993
	Colour tools	4-7 years	Gillies 1993
	The Children's Global Rating Scale	4-8 years	Carpenter 1990
	Coloured Analogue Scale	Older than 5 years	McGrath et al. 1996

Despite the growing number of children's pain measurement instruments, these instruments are not widely used in clinical children's nursing (eg. Colwell et al. 1996, Salanterä 1999). However, the correlations between nurses' and children's pain ratings appear to be fairly high (Colwell et al. 1996), which suggests that reliable assessment of children's pain could be promoted by the use of pain measurement instruments.

Some problems have been pointed out in the measurement of children's pain. Overrating or underrating of pain may occur because of the cultural instructions to be either stoic or very expressive (Douglas 1999). In addition, most of the children's pain measurement instruments are fairly time consuming and complicated. Thus, their use is mostly limited to clinical or research use. The PPPM seems to be the only instrument developed to be used by the parents at home after their child's surgery.

2.4.3 Parents' assessment of children's postoperative pain

Parental reports (Engel 1996) are described to be reliable in the assessment of children's pain, because pain assessments by children and parents have been quite similar (Schneider & LoBiondo-Wood 1992, Chambers et al. 1996, Colwell et al. 1996, Miller 1996, McGrath et al. 1999). It has even been claimed that parents have significant insight into their children's behaviour, and are thus better able to assess pain in their children than others (Rose 1998). However, recent studies have shown that parents tend to underestimate children's pain, and the correlations between parents' and children's pain reports do not accurately represent the relationship between these ratings (Chambers et al. 1998). Evaluation of the comparisons between children's and parents' pain ratings is limited because of the heterogeneity of the samples and instruments. Usually, data have been collected from mothers (Schneider& LoBiondo-Wood 1992, Miller 1996), and fathers' participation in the studies is said to influence the findings (Hinojosa 1997). Studies focussing on comparisons of children's and parents' pain ratings are presented in Table 5.

Table 5. Studies focussing on the comparison of parents' and children's pain ratings.

Researchers	Purpose of the study	Participants	N	Method	Main findings
Schneider & LoBiondo-Wood 1992 USA	To determine if children, mothers and nurses differ in their perceptions of pain	2-6 years old children Mothers	40 40	Oucher Scale ANOVA Pearson correlation	Pain scores related to immunization were similar (r=.72) among the children and mothers, while ratings of children and nurses differed significantly (r=.60).
Miller 1996 USA	To determine if mothers and nurses assess the child's pain intensity as determined by the child	School-aged children Mothers	20 20	VAS scale Pearson correlation	The correlations of pain ratings by children and mothers varied between weak (r=.46) and strong (r=.83) over time, while the correlations between children and nurses were between weak (r=.23) and moderate (r=.54).
Chambers et al. 1998 Canada	To examine the agreement between child- and parent-rated pain following minor surgery	Children (7-12 years) Mother Fathers Grandfather	110 106 3 1	Faces Scale Pearson correlation Kappa statistics T-test	Correlation seemed to be high (r=.76), but kappa statistic (kappa=.31) showed that parents underestimated children's postoperative pain.
McGrath et al. 1999 Canada	To determine the appropriateness of the PPPM as a parental measure of pain	Children (2-6 years) Parents	107 107	PPPM Faces Scale Correlation coefficient	Parents' ratings on PPPM and children ratings on Faces Scale measuring children's postoperative pain correlated strongly (r=.72).

According to earlier studies parents assess their children's pain by using versatile indicators (Tarbell et al. 1992, Reid et al. 1995, Woodgate & Kristjanson 1996). However, fairly little is known about the pain indicators or cues parents use to assess their child's pain. The pain indicators that parents have identified in their children in earlier studies are summarized in Table 6.

Table 6. Cues parents use to assess their child's pain according to earlier studies.

Cue/ pain indicator	Researchers
Activity	
- alertness	Reid et al. 1995
- tiredness	Gedaly-Duff & Ziebarth 1994
- level of activity	Reid et al. 1995
Eating/drinking	
- appetite	Reid et al. 1995
- refusal to drink	Gedaly-Duff & Ziebarth 1994
Emotional state	Reid et al. 1995, Woodgate & Kristjanson 1996
Restlessness	Nethercott 1994
Sleep quality	Reid et al. 1995
Physiological observations	Reid et al. 1995
Protective behaviour	Reid et al. 1995
Regressive behaviour	Reid et al. 1995
Request/refusal of medication	Reid et al. 1995
Verbal report/crying	Reid et al. 1995, Gedaly-Duff & Ziebarth 1994, Woodgate & Kristjanson 1996
Visible/audible discomfort	Reid et al. 1995
Body language	Nethercott 1994
Facial expressions	Gedaly-Duff & Ziebarth 1994, Nethercott 1994
Demand for contact	Callery 1997
Touching/pointing the painful area	Woodgate & Kristjanson 1996

Parents' underestimation of children's pain has been documented in earlier studies (Gedaly-Duff & Ziebarth 1994, Chambers et al. 1998). According to Finley and co-authors (1996), even when the parents assessed their child to have pain, most of them gave inadequate doses of medication to control the pain. Mothers have also expressed uncertainty as to whether they can trust their children's verbal report of pain (Gedaly-Duff & Ziebarth 1994). Additionally, parents have demonstrated low levels of sensitivity in identifying their children's clinically significant pain (Chambers et al. 1998) (Table 7.).

Table 7. Studies focussing on parents' assessment of children's postoperative pain.

Researchers	Purpose of the study	Participants	N	Method	Main findings
Gedaly-Duff & Ziebarth 1994 USA	To describe mothers' experiences in identifying children's pain after surgery	Children aged 4-8 Mothers	7 7	Interviews Grounded theory Constant comparative analysis	Children's refusal to drink, facial grimace, crying, tiredness and verbal reports were the cues mothers used to identify their children's postoperative pain. They described uncertainty as to whether they could trust their children's verbal report of pain.
Reid et al. 1995 Canada	To describe the cues parents use to determine how their children felt after surgery	Mothers Fathers Children (2-12 years)	172 4 176	Pain diary Deductive coding (number and type of cues, cue valence)	Parents used on an average 2.4 cues to assess their child's pain. The cues were categorized as change in normal behaviour, illness behaviours and cues lacking behavioural information.
Woodgate & Kristjanson 1996 Canada	To describe how parents and nurses respond to children's pain	Children aged 2-6 Mothers Fathers Nurses	11 20 2 24	Open interviews Observation Constant comparative analysis	The indicators of pain identified most often by the parents were facial expressions, change in personality or mood, rubbing or pointing the painful area, crying analysis and verbal expressions of pain. Interpretation of the child's pain behaviour was most difficult for the parents who saw their child in pain for the first time.

In conclusion, parents are said to use versatile cues to assess their children's pain. However, the assessment is described as not totally accurate. Parents appear to underestimate their children's pain and not to trust in children's verbal reports of pain. In addition, fathers' views on children's pain assessment have been almost ignored in research on children's pain alleviation.

2.5 Alleviation of children's pain

2.5.1 Pharmacological methods

Understanding the different pain mechanisms in peripheral, central and endogenous levels provides a basis for using drugs differing in their pharmacodynamics and -kinetics. In accordance with the peripheral and central mechanisms, drugs act on cell membranes and by metabolic processes within the cell and outside the cell (Laurence & Bennett 1987). The drug effect can also be classified based on the drug's mode of action. Agonists activate receptors or resist degradation. Antagonists prevent natural agonists from exerting their effects. Partial agonists have both antagonist and agonist characteristics.

With the increased knowledge of the effects of non-treated pain and the fact that patients undergoing surgery experience pain, it is essential to utilize pharmacological pain management methods even among children. Analgesics are drugs that relieve pain due to multiple causes. They can be classified as narcotic (effect on the central nervous system) and non-narcotic (peripheral effect) analgesics. Adjuvant analgesics or co-analgesics modify the perception of pain or the causes of pain. (Laurence & Bennett 1987.)

The drugs used in pain management can also be classified as opioid analgesics, non-steroidal anti-inflammatory drugs and paracetamol (NSAIDs), local anaesthetics, antidepressants, anticonvulsants and antiarrhythmics and other drugs (Atcheson & Rowbotham 1998). The classification of drugs is based on pharmacodynamics, i.e. the biological and therapeutic effects of the drug. Pharmacokinetics refer to the absorption, distribution, metabolism and excretion of drugs. (Laurence & Bennett 1987.) The most common analgesics are presented in Table 8.

Table 8. Commonly used analgesics in pain management.

Opioid analgesics	NSAIDs and paracetamol	Local anaesthetics	Anti-depressants	Anticonvulsants Antiarrythmics
Morphine	Salicylates	Lignocaine	Amitriptyline	Carbamazepine
Codeine	Proprionic acids	Prilocaine	Imipramine	Phenytoin
Hydromorphone	Indomethacin	Ropivacaine	Desipramine	Sodium valproate
Methadone	Sulindac	Bupivacaine	Nortriptyline	Mexiletine
Pethidine	Diclofenac		Doxepin	
Fentanyl	Nabumetone		SSRIs	
Buprenorphin	Piroxicam			
Tramadol	Coxibes			
Oxycodone	Paracetamol			

Opioids, NSAIDs and local anaesthetics are most commonly used for postoperative pain, and NSAIDs are commonly used at home (Rawal 1998). *Non-steroidal anti-inflammatory drugs* inhibit prostaglandin synthesis, but analgesia may also be mediated by a central mechanism. Cyclo-oxygenase (COX) enzyme has a major role in analgesia induced by the use of NSAIDs. Analgesia is reached by inhibition of prostaglandin synthesis, especially by inhibition of inducible COX-2 enzyme (Brooks et al. 1999, Hawkey 1999). Rapid and almost complete absorption and low apparent volume of distribution are common pharmacokinetic characteristics of NSAIDs. NSAIDs, however, might have side effects, such as gastric mucosal damage, effects on decreased platelet aggregation and renal insufficiency. Thus, NSAIDs should not be given to patients who have peptic ulcer disease, athma, risk for bleeding or renal impairment. (Atcheson & Rowbotham 1998.) Therefore, careful selection of analgesic is essential because, for example, in the United Kingdom, paracetamol overdose is still the commonest cause of acute liver failure (Bridger et al. 1998).

Several studies have shown that NSAIDs are effective in children's postoperative pain management (Baer et al. 1992, Maunuksela et al. 1992a, Maunuksela et al. 1992b, Kokki et al. 1994, Romej et al. 1996, Davis et al. 1999, Kokki et al. 1999). In addition, no increase in side effects has been found at higher doses (Kokki et al. 1998). Opposite to these findings, the dosage of intraoperative NSAIDs has not been found to decrease children's pain intensity (Romsing et al. 1998, Nikanne et al. 1999). In addition, even when children were given ketoprofen after adenoidectomy at home, 20 % of them had severe pain (Nikanne et al. 1999). Intravenous

ketolorac was also found to cause more bleeding in children (1-12 years) after tonsillectomy compared to children receiving i.v. morphine (Gunter et al. 1995, Splinter et al. 1996).

The drugs used to alleviate pain and the method of administration are critical in children's pain management (Gillies 1993). The choice between drugs is based on the individual characteristics of the patient, but also on the type of surgical procedure. An analgesia ladder for postoperative pain was presented by Rawal (1998). The lowest step of the ladder is minor surgery (inguinal hernia, varicose veins, gynecological laparotomy). The second ladder consists of moderate surgical procedures, such as hip replacement, hysterectomy and maxillofacial procedures. Major surgery with a grater need for analgesia consists of thoracotomy, upper abdominal and knee surgery. Pain scores (0-100 mm) on the Visual Analogic Scale (VAS) should be less than 30 mm. Laurence and Bennett (1987) proposed another classification for drug requirements. According to them, pain can be mild, moderate, severe or overwhelming. They suggest that non-narcotics should be used alone only in mild pain, low-efficacy opioids in moderate pain and high-efficacy opioids in severe or overwhelming pain. NSAIDs should be added to opioid use.

Children represent a special group of patients in regard to the administration of analgesics. The relative amount of water is higher in children than in adults. Fatty tissue and the amount of proteins in plasma increase with age, which affects the binding of several drugs. The metabolic process is relatively slow in newborns with marked individual variation. During the first year, the functioning of the kidneys is also quite slow. All these characteristics of children should be considered when deciding on pain medications. (Maunuksela & Hamunen 2002.)

Special attention should also be given to the methods used to administer pain medication. Postoperative analgesia techniques have their advantages and disadvantages that should be identified. For example, rectal opioid administration is commonly used among young children, but the absorption may be slow and variable. (Rawal 1998, McEvan et al. 2000.) Painful intramuscular injections that are children's worst fear at hospital should be avoided.

Inadequate postoperative pain relief in children has been explained by two reasons: inadequate prescription of medication and insufficient administration of prescribed medication (Hamers et

al. 1998). Inadequate prescription of medication refers both to too small doses and analgesics that are not strong enough. Insufficient administration of prescribed analgesics means that medication has been prescribed but not administered to the child. In the postoperative period, it is essential that medication is no longer prescribed on a prn (pro re nata) basis, but becomes a standard procedure, e.g. four times a day during the first 24 hours after surgery (Hamers et al 1998.) However, research findings have shown that one third of children have not received concurrent orders written for multiple analgesics on admission to the nursing unit. In addition, more than half of the physicians' orders fell outside the criteria for appropriate dosage and scheduling frequency. (Cox 1995.)

Several factors influencing medicine use have been found at the population, practice, physician and patient levels (Haaijer-Ruskamp 1997). For example, regulation, financing, availability of medicines and health, culture and beliefs regarding health and illness influence medicine use at the population level. In addition, patients' age, social circumstances, expectations, demands and compliance may influence medicine use at the individual level.

In conclusion, several analgesics, such as NSAIDs are available to be used at home after pediatric surgery. To guarantee the quality of children's pain alleviation at home, special attention should be given to adequate prescription of medication and sufficient administration of the prescribed medication.

2.5.2 Non-pharmacological methods in children's pain alleviation

Non-pharmacological methods are defined as a variety of approaches designed to relieve pain without using drugs (see Vessey & Carlson 1996). The use of non-pharmacological methods in children's pain management has its basis in pain mechanisms. Most often pain is processed by the nociceptive system. The pathway from painful stimuli to the perception of pain is influenced by the central nervous system. The effectiveness of non-pharmacological interventions is based on their effects on the nociceptive system. (Vessey & Carlson 1996.) Combinations of various pain alleviation methods seem to be effective at different levels of the peripheral and central nervous system and, thus, to minimize nociception (Edgar & Smith-Hanrahan 1992).

The non-pharmacological methods used in children's pain management (see Table 9.) can be classified into sensory (Engel 1996, Vessey & Carlson 1996) or physical (Engel 1996, Vessey & Carlson 1996, Pölkki et al. 2001), cognitive (Engel 1996, Vessey & Carlson 1996) and cognitive-behavioral interventions (Engel 1996, Vessey & Carlson 1996, Pölkki et al. 2001), emotional support (Pölkki et al. 2001, 2002), helping in daily activities (Pölkki et al. 2001, 2002) and creating a comfortable environment (Pölkki et al. 2001). Sensory interventions alleviate pain by stimulating sites of the body (Vessey & Carlson 1996) or skin (Edgar & Smith-Hanrahan 1992). Versatile examples of sensory methods are described in the nursing literature (Edgar & Smith-Hanrahan 1992, Engel 1996, Vessey & Carlson 1996, Huth & Moore 1998, Ludwig-Beymer 1999).

Cognitive methods (Engel 1996, Vessey & Carlson 1996, Huth & Moore 1998) make the child focus on something else than the pain. Their use is limited to older children, because they require skills of symbolic thinking and verbal communication. Thus, most cognitive interventions cannot be used before school age. Cognitive-behavioural interventions involving central pain control (Edgar & Smith-Hanrahan 1992) are a combination of cognitive and physical activities to alleviate pain. They work by increasing children's physical activity, decreasing anxiety and reducing maladaptive coping (Vessey & Carlson 1996).

Table 9. Commonly used non-pharmacological methods in pain alleviation.

Sensory	Cognitive	Cognitive-behavioural
Thermal regulation	Distraction	Environmental stimuli
- heat	Play	Voice/music
- cold	Hypnosis	Play therapy
Massage	Imagery	Exercises
Acupuncture	Intellectualization	Psychological preparation
Positioning	Prayers	Relaxation techniques
Hugging	Thought-stopping	Presence of parent
Holding	Cognitive restructuring	
Swaddling	Humour	
Sucking	Teaching the child/parents	
Electrical currents		
Transcutaneous electrical nerve stimulation (TENS)		
Cryotherapy		

The effectiveness of non-pharmacological interventions should always be verified by assessing children's pain after the interventions have been used (Vessey & Carlson 1996). They should not be used in place of analgesics or anesthetics, but as adjuvants to them (Johnston 1993). However, fairly little is known about the effectiveness of non-pharmacological pain alleviation methods in children. Behavioural interventions have been found to decrease children's fear of pain during insulin self-injections (Moore & Geffken 1995), but their effect on pain has not been investigated.

2.5.3 Parents' alleviation of children's postoperative pain

Parents are expected to continue the pharmacological alleviation of children's postoperative at home after day surgery. However, the findings of several studies have shown that parents do not use analgesics sufficiently (eg. Hamers & Abu-Saad 2002), and children may have even severe pain at home after surgery. Of the parents whose child had significant pain, 13 % gave no medication to the child, and almost half of them gave 1-3 doses daily (Finley et al. 1996). Opposite results were reported by Rose (1998). According to the results, 90 % of the parents had no difficulties to care for their children at home following surgery. Most parents also gave the child the prescribed pain medication. According to Kokki & Ahonen (1997), 80 % of children undergoing adenoidectomy received pain medication at home. For proactive analgesia, it is essential that pain medication is started before surgery and also continued for several days (Rawal 1998). Studies on parents' use of analgesics are summarized in Table 10.

Table 10. Studies on parents' use of analgesics in children's postoperative pain alleviation.

Researchers	Purpose of the study	Participants	N	Method	Main findings
Finley et al. 1996 Canada	To evaluate parents' management of children's pain following short-stay and day surgery	Children aged 2-12 Mothers Fathers	189 185 4	Questionnaires Statistical analysis	13 % of parents gave no pain medication to their child even when they assessed the child's pain to be significant. Almost half of the parents thought that pain medicine should be used as a last resort. 34 % of the parents did not give the child pain medication before the pain occurred, even when the child was expected to have pain.
Kokki & Ahonen 1997 Finland	To evaluate pain and pain-related outcomes after adenoidectomy	Children aged 1-7 Parents	167 167	Questionnaires Statistical analysis	83 % of the children had pain at home. Pain was moderate or severe in 17 % of them. 80 % of the children were given pain medication at home. The medication did not cause any major adverse effects.
Lander & Warnock 1999 Canada	To describe the impact of same-day surgery on families	Children aged 5-16 Parents	129 129	VAS Medication diary	Parents used to under-treat children's pain by not giving analgesics at regular intervals and not giving them during the night. Only few parents asked physicians to change the analgesic prescription even when they found the analgesic to be ineffective.
Kokki et al. 2000 Finland	To define the problems of pain treatment at home using ketoprofen tablets	Children aged 1-9 Parents	611 611	Questionnaires Statistical analysis	87 % of the children were reported to have pain at home. 94 % of them were given analgesic medication. 12 % of them had difficulty in swallowing the tablets and 5 % of the children complained the bad taste of tablets. 80 % of the children were reported to have no problems related to pain medication at home.

Parents have described several non-pharmacological methods to alleviate their children's pain at home. Cuddling (Gedaly-Duff & Ziebarth 1994, Nethercott 1994) , distraction (Gedaly-Duff & Ziebarth 1994, Nethercott 1994) and entertainment (Gedaly-Duff & Ziebarth 1994), and

monitoring and comforting (Woodgate & Kristjanson 1996) have been mentioned as the methods parents use to manage their children's pain. In addition, a firm approach (Nethercott 1994), stroking (Nethercott 1994), making the child comfortable (Nethercott 1994), controlling breathing (Nethercott 1994), bribery (Nethercott 1994), reassurance (Nethercott 1994), talking (Nethercott 1994) and massage (Nethercott 1994) have been used by parents to alleviate children's pain. Studies on parents' use of non-pharmacological methods in children's pain alleviation are presented in Table 11.

Table 11. Studies on parents' use of non-pharmacological methods in children's postoperative pain alleviation.

Researchers	Purpose of the study	Participants	N	Method	Main findings
Gedaly-Duff & Ziebarth 1994 USA	To describe mothers' experiences of managing children's pain after surgery	Children aged 4-8 Mothers	7 7	Interviews Grounded theory Constant comparative analysis	Cuddling, distraction and entertainment were used by mothers to treat children's postoperative pain.
Nethercott 1994 UK	To describe how nurses and parents manage children's postoperative pain	Parents Children, age not reported	8 4	Interviews Latent content analysis	Distraction, a firm approach, stroking, making the child comfortable, controlling breathing, bribery, reassurance, talking, cuddling and massage were used to alleviate children's postoperative pain.
Woodgate & Kristjanson 1996 Canada	To describe how parents and nurses respond to children's pain at hospital	Children aged 2-6 Mothers Fathers Nurses	11 20 2 24	Interviews Observation Constant comparative analysis	Parents used to supervise their children's pain experience. They observed for signs of pain and ensured that actions were taken to relieve the pain. Parents used comforting activities, such as assisting the child with activities, holding or rubbing a body part, talking to the child and distraction to alleviate the pain.

To summarize, the earlier findings on parents' use of analgesics with their children after day surgery are not consistent. Some findings indicate that parents have no problems in the alleviation of their child's pain by using analgesics, while some other findings suggest that analgesics are not used in the most effective and appropriate way. Parents seem to use several non-pharmacological methods of pain alleviation with their children postoperatively at home. However, the samples in these qualitative studies have been fairly small, and the relationship between the use on non-pharmacological methods and the intensity of children's pain has not been examined.

3 SUMMARY OF THE THEORETICAL BASIS OF THE STUDY

The main interest of this study was to describe how parents' perceptions and their use of pain alleviation methods affect children's postoperative pain by creating a path model describing the effects. Children's postoperative pain is defined as the intensity of pain and pain behaviours identified in children by their parents. In this study, day surgery means surgery for which children were admitted in the morning and discharged the same day. The age group of children between one and six years was chosen because older children can express their pain verbally and demand pain relief. Therefore, younger children may be more vulnerable, as their pain relief is mostly based on their parents' use of pain alleviation methods. In addition, premature babies and infants were excluded from this study because research among them has increased in Finland during the past few years (eg. Halimaa et al. 2001, Oksanen & Salanterä 2002). Neither, day surgery is not commonly implemented with the youngest children.

This clinical and family-oriented study is based on the definitions of family in family nursing as the context of the child (see Wright & Leahey 1994) who has undergone minor surgery. The child is considered the client in pediatric nursing, and parents are considered the adults who should assess and alleviate children's postoperative pain at home.

Assumptions underlying contemporary empiricism served as the philosophical basis for this study. Descriptive knowledge of parents' perceptions and their use of pain alleviation methods was acquired to understand the factors that could influence children's postoperative pain at home. In addition, exploratory knowledge was acquired to synthesize phenomena (factors influencing the intensity of children's postoperative pain) so that their properties (here occurrence) and relationships between properties (relationship between influencing factors and the intensity of children's pain) could be clarified more fully (see Weiss 1995). Therefore, the path model was developed to describe how parents' gender-related perceptions of children's pain and analgesics explain their use of pain alleviation methods with their children and, finally, the intensity of pain and pain behaviours in children.

Contemporary empiricism was chosen to guide the research because one of its basic propositions emphasizes the importance of different theories regarding a particular phenomenon (Weiss 1995). In addition, it highlights the importance of testing of more than one prediction, which is a logical consequence of the use of several theories underlying the study. In this study, the existing literature provided the theoretical basis of children's pain alleviation at home, which was further deepened and tested by using qualitative and quantitative research methods.

Based on the literature review, it can be said that children's pain alleviation is influenced by parents' competence to identify and assess children's pain (e.g. Gedaly-Duff & Ziebarth 1994, Finley et al. 1996, Chambers et al. 1998). In addition, parents perceptions of children's pain and analgesics may influence their way of using analgesics at home (e.g. Gillies 1993, Ferrell et al. 1994a,b, Finley et al. 1996, Hodges 1998). However, these relationships have not been tested in the same model by using statistical methods. Figure 1. summarises the main concepts of this study.

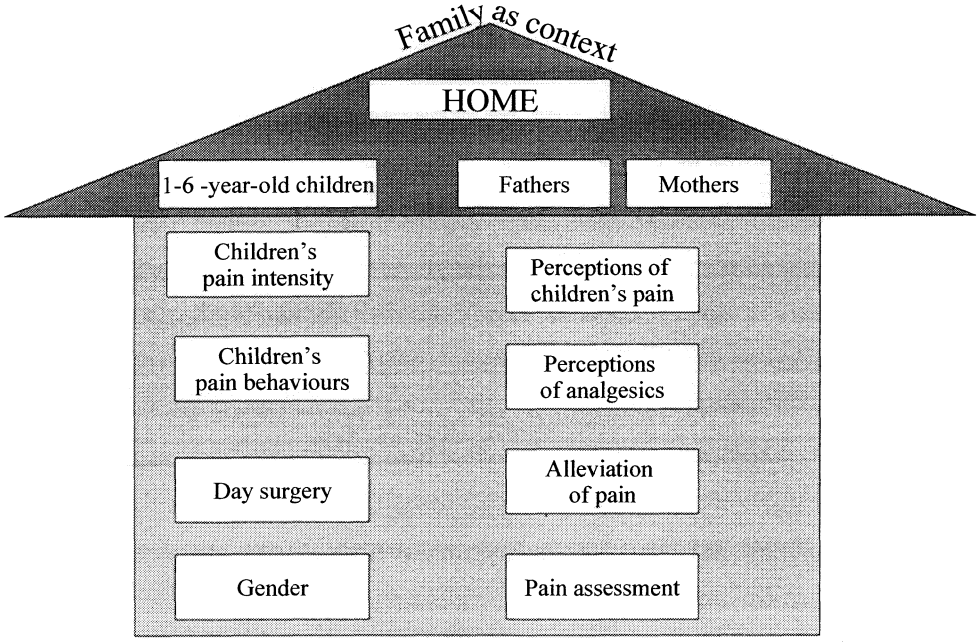

Figure 1. Summary of the main concepts of this study.

Analysis of the existing literature showed several gaps in our knowledge of children's pain assessment and alleviation at home after day surgery. First, the studies focussing on parents' assessment of children's pain and their use of non-pharmacological methods in children's pain alleviation have mainly been conducted using qualitative methods, which is a challenge for further research to produce knowledge that can be generalized to the Finnish population. Secondly, studies of parents' attitudes and perceptions of children's pain confirm each other, suggesting that several myths exist among parents, which may influence negatively children's pain alleviation at home. However, the studies have been conducted in the USA or Canada and thus cannot be generalized to Finnish parents.

Finally, from the view point of family nursing and family research, most of the studies related to children's pain assessment and alleviation from the parental perspective have been conducted among mothers alone. However, according to Lamb (1986), fatherhood roles have changed over the past two centuries. The "dominant motif" of fatherhood has shifted from "moral teacher", "breadwinner"or "sex role model" to "new nurturing father". The "new fathers" are expected to be actively involved in all aspects of parenting (Ishii-Kuntz 1995). Fathers often also view themselves as relatively inadequate caregivers compared to mothers. Yet, fathers' substitute caregiver role may be contingent on women's willingness to make room for fathers. (Hawkins 1995.) Children are described to benefit from the love, caring and economic support of fathers and fathers' involvement in children's life is important for children's development. (Ihinger-Tallman 1993.) Equality between mothers and fathers is highly emphasized in Finnish family policy and, therefore, especially the role of fatherhood is recommended to be empowered (Sääväla et al. 2001). Thus, it is important to include fathers in studies focussing on children's pain assessment and alleviation to create an adequate knowledge base for family-centred children's nursing.

To conclude, the theoretical basis of this study consists of knowledge from different scientific fields. Neurophysiological findings indicate that 1- to 6-year-old children are able to sense pain but, according to psychological theories, they may lack skills to express and describe their pain. Theories of family nursing highlight the role of parents in children's nursing, indicating that parents, as the environment of the children undergoing day surgery, are the primary caretakers

of children at home. Findings from several scientific fields have shown that parents may have both accurate and misleading perceptions of children's pain and its alleviation, which may influence their use of pain alleviation with their children. Insufficient use of pain alleviation methods may lead to unnecessary suffering and poor pain relief in children.

4 PURPOSE OF THE STUDY AND RESEARCH PROBLEMS

The purpose of this study was to describe mothers' and fathers' perceptions of 1- to 6 -year-old children's pain and its alleviation at home after minor surgery. In addition, the purpose was to describe the relationship between these perceptions, parents' use of pain alleviation methods and children's pain intensity and pain behaviours after surgery. The final aim was to explain how parents' perceptions and their use of pain alleviation methods explains variation in children's postoperative pain by creating a path model describing the effects.

The following research problems were adressed:

1. What kind of perceptions do parents have about 1-6-year -old children's pain and analgesics? (Articles I, III, and V)
2. What methods do parents use to alleviate their 1-6-year -old children's postoperative pain at home? (Articles I, IV, and V)
3. How do mothers and fathers differ in their perceptions of girls' and boys' pain and its alleviation? (Articles III, IV, and V)
4. How are parents' perceptions of children's pain and analgesics, their use of analgesics and their use of non-pharmacological pain alleviation methods related to the intensity of 1-6-year -old children's postoperative pain and their pain behaviours? (Articles I, III, IV, and V)
5. What type of model describes the factors explaining the variation in children's postoperative pain intensity and pain behaviours? (Path model presented in the summary of the thesis)

5 DATA, METHODS AND ANALYSIS

Methodological abduction was implemented by using inductive and deductive methods in four phases in this study (Figure 2).

PHASE 1. **FAMILY INTERVIEW STUDY 1999** (Articles I, VI)	**PHASE 2.** **TESTING OF INSTRUMENTS 2000** (Article II, III)	**PHASE 3.** **SURVEY WITH QUESTIONNAIRES 2000 -2001** (Articles III-V)	**PHASE 4.** **DEVELOPMENT OF PATH MODEL 2002** (Summary of doctoral dissertation)
Purpose: - to describe how children's, aged 1-7 years, post-operative pain has been assessed and alleviated at home after day surgery and which factors are related to their pain relief	Purpose: a) - to assess the validity and reliability of the Finnish version of PPPM b) to assess the face validity of the sub-scales measuring parents' perceptions of children's pain, its alleviation and underlying factors	Purpose: - to describe mothers' and fathers' perceptions of children's pain and the methods used to alleviate pain - to measure the relationships between parents' perceptions and use of pain alleviation methods and children's pain intensity and pain behaviours	Purpose: - to summarize the factors explaining children's postoperative pain (VAS / PPPM scores)
Setting: One university hospital, day surgery ward	Setting: Four hospitals	Setting: 19 wards of 10 central hospitals	
- family interviews (N=17) with parents, children and siblings	a) questionnaires to parents (N=85) of 1- to 6-year-old children undergoing day surgery - statistical analysis	- questionnaires to parents (N=315) of 1- to 6-year-old children undergoing day surgery	- data from the survey study
- content analysis	b) questionnaires to parents (N=27) in Central Finland Central Hospital - statistical analysis	- statistical analysis	- path model

Figure 2. Phases of the study.

In the first phase in 1999, family interviews (N= 17) were conducted to describe how parents identify and alleviate their children's (1-7 years) postoperative pain at home after minor day surgery (Articles I, VI). Factors influencing children's pain identification and management, such as parents' perceptions of children's pain and its medication and discharge instructions at home were also examined. A qualitative method was used to understand the meanings, interpretations and subjective experiences of family members (see Anderson & Anderson 1999). Qualitative interviews were also considered useful in letting the parents provide valuable information about health care services as they were given the opportunity to tell their story in full and to explain their reactions and responses (see Callery & Luker 1996).

The family interviews were analysed by using content analysis (see Catanzaro 1988, Cavanagh 1997, Kyngäs & Vanhanen 1999). The interviews were transcribed to 160 pages of text. First, the data from children, siblings and parents were separated. The text was then analysed line by line to identify the words and sentences describing pain identification and management and the influential factors in the families. The data were reduced to categories by combining the expressions that had the same meaning or were almost similar. The categories with original expressions were sent to the parents who assessed how well the categories reflected their own ideas and meanings. The categories were then compared to identify overlap and inconsistencies.

In the second phase, instruments measuring parents' alleviation of children's pain and the underlying factors related to children's pain relief at home were developed and tested (Articles II and III). The instrument was developed based on earlier studies and the findings of the family interviews. It consisted of background information of parents and children and four sub-scales. The sub-scale of parents' perceptions of their children's pain (e.g. Margolius et al. 1995, Forward et al. 1996, Woodgate & Kristjanson 1996, Tyrrell 1997, Hodges 1998, Douglas 1999, Ramer et al. 1999) measured perceptions on a Likert-scale with five alternatives from "Totally agree" to "Totally disagree". Parents' perceptions of their children's pain medication (Ferrell et al. 1994b, Margolius et al.1995, Finley et al. 1996, Forward et al. 1996) were measured on a similar Likert scale. Parents' use of analgesics was measured by asking them if they had given medication to the child and which medication they had given, and whether they had given more or less

medication than was instructed by the hospital staff. The route of administration was also asked. Parents' use of non-pharmacological methods in children's pain alleviation (e.g. Nethercott 1994, Engel 1996, Good 1996, Woodgate & Kristjanson 1996) was measured on a dichotomous scale with the alternatives "yes" or "not" to the questions of whether the parents used the suggested methods.

The intensity of children's postoperative pain was measured by using a 10 cm VAS scale. Children's pain behaviours were measured by using the Finnish version of Parents' Postoperative Pain Measure (PPPM). The instrument consists of 29 children's pain behaviours, which are measured on a dichotomous level with the alternatives "yes" or "no" depending on whether any of the behavioural changes were identified in the child (Table 12). The PPPM instrument was originally developed in Canada (Chambers et al. 1996) and it has been validated with children aged seven to 12 years (Chambers et al. 1996, Finley et al. 1999) and children aged two to six years (McGrath et al. 1999). The findings have shown that PPPM scores correlate highly with child-reported pain scores and discriminate between pain levels following mild, moderate and high- pain surgery. It is described to be internally consistent and strongly related to child-rated pain and sensitive to analgesia.

In Finland, the Finnish version of PPPM was validated for children (N=85) aged one to six years and their parents from four hospitals (Article II). The parents filled in a questionnaire including PPPM at home during the day of operation and on the first and second postoperative days. The response rate was 58. Criterion validity appeared to be high when tested by comparing the ratings of the PPPM and VAS scores (r=.60 - .65). Internal consistency also seemed to be high when assessed using Cronbach's alpha coefficient (alpha= .81 - .88). Because of the fairly low response rate in the pilot test and the observed weaknesses in construct validity, the full version of the PPPM with 29 items was used in this study.

While comparing the findings on the Canadian and Finnish parents, it was obvious that the full version of PPPM included pain behaviours that were not identified by Finnish parents. Therefore, to reduce the items of PPPM by dropping out the variables that did not measure children's pain behaviours in this sample, correlation co-efficiencies for each of the 29 PPPM variables were

computed. Three reduced versions of PPPM with different numbers of variables were tested by using correlation coefficients of 0.20, 0.30 and 0.40 within the PPPM scores. Based on correlations within the PPPM variables higher than 0.40, the version with 15 items seemed to be most appropriate because all of its variables strongly correlated with each other, which indicated that they measured the same phenomenon. In addition, fairly high item-scale correlations were found between the scale and each of the items included in PPPM15. (See Table 12.)

Table 12. Frequencies, item-scale correlations and items included in the 15-item version (marked with*) of PPPM (N=315).

Behavioural change	%	PPPM15	Item-scale correlation
Sleep more than usual	50		
Have more trouble getting to sleep than usual	14	*	0.319
Not sleep as well as usual	22		
Act crankier than usual	33	*	0.514
Whine or complain more than usual	38	*	0.617
Cry more easily than usual	39	*	0.632
Want to be more alone than usual	5		
Play less than usual	41	*	0.563
Not do the things s/he normally does	28	*	0.499
Act more worried than usual	12		
Act quieter than usual	34	*	0.323
Have less energy than usual	37	*	0.554
Refuse to eat	22	*	0.377
Eat less than usual	52	*	0.422
Eat more then usual	10		
Refuse to wear certain clothes that touch sore spot	5		
Hold the sore part of his/her body	26		
Try not to bump the sore part of his/her body	32		
Cry more than usual	32	*	0.636
Groan or moan more than usual	33	*	0.629
Cry less than usual	6		
Look paler than usual	34		
Look more flushed than usual	18		
Look more swollen than usual	9		
Not let you out of his/her sight	31	*	0.392
Want to be close to you more than usual	60	*	0.497
Act more difficult to comfort than usual	18	*	0.541
Refuse medication when you offered it	19		
Take medication when s/he normally refuses	10		

A summarised variable of the variables that correlated with each other at a higher than 0.40 level was developed. Thus, the original variables included in PPPM15 were summarised to be handled as a continuous variable in further analysis. Kolmogorov-Smirnov one-sample test was used to explore the distributions for further analysis. It showed that the distributions of VAS and summarised PPPM15 scores were normal. Independent samples t-test was used to examine the differences in mothers' and fathers' ratings of VAS and PPPM scores. The samples were analysed independently, because it was assumed that single parents would be included in the samples. In addition, as described by the contact nurses in the wards, both parents wanted to participate in the study in only a few families. Therefore, most of the parents are not parents to the same child. Cross-tabulation was used to determine the cut-off point of the clinically significant scores of PPPM15. The cut-off point of seven scores out of 15 differentiated the children with no/low pain (VAS less than 30 mm) and those with moderate/severe pain (VAS more than 30 mm) (eg. Finley et al. 1996).

All of the sub-scales including scales measuring parents' perceptions of children's pain and pain alleviation were tested with parents of 1-6 -years-old children (N=27) who had undergone day surgery in Central Finland Central Hospital. Children's age was limited to 1-6 years because in the family interviews the parents described that pain assessment in school-aged children was based on child's self-assessment rather than parents's assessment of child's postoperative pain. Therefore, it was suggested that parents role would be more significant in the assessment of pain in younger children. Based on the parents' comments, the variables measuring the identification of children's pain were removed, because the parents considered them too difficult to respond to. In addition, the open-ended questions concerning parents' education and line of activities were replaced by structured questions. (Article III.)

In the third phase, the pilot-tested questionnaires were used to collect data from mothers (N=500) and fathers (N=500) whose child had undergone minor day surgery in non-randomly selected 19 wards in 10 Finnish central hospitals (Articles III - V). Out of the 840 questionnaires given to the parents by August 2001, 397 were returned (response rate 49 %). Out of them, 82 questionnaires were excluded from analysis because of missing data, child's age less than one or more than six years or because the questionnaires were returned too late. The hospitals were

selected non-randomly based on their geographical location, to cover the whole country. In the wards, the questionnaires were given by the nurses to all parents of children aged 1-6 years undergoing day surgery. The inclusion criteria were that the parents had to speak Finnish, the child did not have any other medical conditions or developmental delay, and the parents stayed at home with the child at least during the day of surgery.

The questionnaires were given to both parents, to identify the possible differences in the responses of the parents. In earlier studies, the data have mostly been collected from mothers. However, it is possible that certain tasks are gender-neutral or are performed differently by males or females. Therefore, based on the above statements and comments form fathers participating in the family interview study, it was assumed that fathers assess and alleviate their children's postoperative pain at home as much as mothers do. The individual-level data from mothers and fathers were considered to reflect the individual family member's perceptions of his or her own behaviour (see Sullivan & Fawcett 1991), and, therefore, the parents did not have to be members of the same family.

Descriptive analysis of the data was conducted by using frequencies, percentages and modes. Pearson correlation coefficient, parametric and non-parametric tests of mean differences and cross-tabulation with chi-square test were used in the analysis. Kolmogorov-Smirnov one-sample test was used to examine the distributions of original and summarized variables.

In the fourth phase, the technique of path analysis using the generalized least squares estimation method of multiple regression was used to test the tenability of the proposed model (see Kline 1998, Musil et al. 1998, Quintana & Maxwell 1999). Based on findings of parents' perceptions and alleviation of children's postoperative pain (Articles I, III - V) it was assumed that children's pain would be explained by parents' use of pain alleviation methods with their children. In addition, it was assumed that the use of these methods would be explained by parents' perceptions of children's pain and analgesics which might be explained by parents' (age,

education, gender) and child's (age, gender) background factors. It was also assumed that type of the child's surgery would explain parents' perceptions of children's pain and analgesics.

In the preparatory phase of the model, the original variables measuring parents' perceptions of children's pain (n=2) and perceptions of analgesics (n=3) were recoded in the opposite direction, so that all variables with the value "5" meant "totally disagree" (Appendix table 1.). In this direction, maximum disagreement with the statement indicated the most accurate perception. Later, the scores of the instruments measuring parents' perceptions of children's pain, perceptions of analgesics and use of non-pharmacological pain alleviation methods were summarized. The variables correlating with each other with a coefficient higher than 0.30 were included in each sub-scale. The included variables are listed in Appendix table 1. Disturbance terms for each endogenous variables were included in the model (labelled as er1 - er6). Cases with missing values were excluded from the analysis.

The initial model of variables explaining children's postoperative pain intensity and pain behaviours was specified based on the results of the studies I and III - V and the findings in the available literature (eg. Gedaly-Duff & Ziebarth 1994, Finley et al. 1996, Forward et al. 1996, Kokki & Ahonen 1997, Lander & Warnock 1999). New, theoretically relevant, parameters were included by using a modification index in determining their significance for the model. The following regression paths were included in the model: from parents' gender to their perceptions of analgesics and use of non-pharmacological pain alleviation methods, from parents' basic education to their perceptions of analgesics, from parents' vocational education to PPPM-scores, from child's age to parents' use of analgesics with their child and PPPM-scores, from type of surgery (throat, ear, eye, circumcision) to parents' use of non-pharmacological pain alleviation methods and analgesics, from parents' perceptions of children's pain to their use of non-pharmacological pain alleviation methods and analgesics, and from parents' use of non-pharmacological pain alleviation methods to VAS- and PPPM-scores and from the use of

analgesics to VAS-scores. Regression coefficients with the critical ratio higher than 1.96 were included in the model.

After the preliminary analysis of data, paths with non-significant effects with critical ratio lower than 1.96 (from parents' use of analgesics to PPPM-scores, from parents' peceptions of children's pain to their use of pain alleviation methods with children, from children's age and parents' vocational education to their perceptions of children's pain and analgesics, from type of surgery to VAS-scores) were excluded from the model based on parameters. Yet, the theoretical assumptions of possible relations were retained in the model.

The covariance between the disturbance terms of parents' use of pharmacological and non-pharmacological pain alleviation methods (r = -0.25) was added to the model. Also, the covariance between the disturbance terms of the VAS-scores and PPPM scores (r= 0.45) was added to the model. Additionally, covariance was added between parents' gender and basic education (r= 0.13) and basic and vocational education (r= 0.36) and child's age and circumcision (r= 0.22) (Figure 3.).

GFI (goodness of fit index) and χ^2 were used as measures of the model fit. Unstandardized direct, indirect and total effects of the predictors (type of the child's surgery, parents' and child's gender and age, parents' education, perceptions of children's pain and analgesics, their use of non-pharmacological pain alleviation methods and analgesics) were examined on children's pain intensity and pain behaviours. Squared multiple correlations (R^2) of endogenous (dependent) variables were calculated as a coefficient of determination. The higher the squared multiple correlation was (0- 1.0), the stronger was the effect of the explanatory variable on the endogenous variable. Amos 4.01 software (SmallWaters Corp., Chigaco, IL) was used to specify and modify the path model (Arbuckle & Wothke, 1999). P-values of regression coefficients lower than 0.05 were considered statistically significant.

6 STUDY ETHICS

Each of the studies was approved by the ethical committee at the hospitals. Participation in the study was voluntary and based of informed consent. Three of the 20 invited families refused to participate in the family interview study. However, it was obvious that one family member, usually the mother, had signed the consent paper but had not informed the other family members about the interview. In addition, some children were afraid of the researcher and thought that she might take them back to the hospital. The ethical issues were discussed more widely in the original article VI.

In the survey study, the parents were informed about the study first by the contact persons in the wards. In addition, a cover letter was provided to them. They were told about the purpose of the study, the sample and the publication of the findings in the information sheet. The parents were advised how to fill in the questionnaire and they were provided with an opportunity to contact the researcher if they had any further questions. The parents responded anonymously and sent the stamped enveloped to the researcher. (Burns & Grove 2001.) Therefore, no reminders were sent to the parents to improve the response rate. The hospitals were not named here because of the fairly small samples from some of them. For the same reason, no comparisons were made between the hospitals. Data from the sample collected with three wide sub-scales were reported in three separated articles because the large amount of information that could not be included in one article.

The strike of Finnish physicians during 12.03. - 17.08.2001 appeared to be an ethical challenge for this study. Several surgical procedures had been cancelled during the strike and the number of children waiting for surgery had increased. Therefore, after the strike the wards were fairly overloaded when the children were admitted. For that reason, to avoid extra pressure for the hospital staff, the data collection was finished when 840 of the 1000 questionnaires had been handed out.

7 RESULTS

7.1 Parents' perceptions of 1-6-year -old children's pain and analgesics

The parents described several perceptions of children's pain and analgesics that promoted their use of pain alleviation in children (Articles I, III, V). However, they also had some negative attitudes towards especially analgesics, and had therefore failed to give pain medication to their child after surgery. The parents were found to value pain tolerance and they described analgesics as something to be avoided by all family members. Most parents suggested that adults have the responsibility to alleviate their child's pain and that alleviation of the child's postoperative pain prevents the child's fears during future visits in the child welfare clinic (Article III). However, the majority of parents also pointed out that postoperative pain decreases every day or that pain is an inevitable part of surgery.

The parents had both accurate and misleading perceptions of children's analgesics (Articles I, V). Most of them suggested that analgesics should be given to the child regularly to alleviate postoperative pain, and two thirds described that analgesics should be given to the child before the pain becomes severe. Half of the parents stated that mild analgesics (e.g. paracetamol) are effective enough to alleviate children's pain. A minority of the parents suggested that giving analgesics to children means that the parents are not capable of listening to child's crying, that the use of analgesics in childhood may lead to use of drugs in adulthood, and that analgesics in home care may have dangerous adverse effects. Fathers, more than mothers, suggested that analgesics should only be used in severe pain and that children's analgesics may have dangerous effects. The role of sufficient discharge instructions was important in the implementation of analgesics with children. Some parents doubted the correctness of the discharge instructions related to children's analgesics. The parents thought that the higher dose of analgesics recommended for post-operative pain was a mistake by the physicians or nurses, and they relied more on the dosage instructions on the packages. Therefore, many parents had reduced the amount of children's postoperative medication because they were afraid of overdosage. Additionally, several parents said that no other analgesics than paracetamol could be used to alleviate children's pain at home. (Article V.)

7.2 Parents' use of pain alleviation methods with their 1-6-year -old children at home

One third of the children participating in this study seemed to have moderate or severe postoperative pain at home measured by Visual Analogue Scale and Parents' Postoperative Pain Measure (Articles III-V). The parents described that they had implemented non-pharmacological methods, such as touching, special feeding, limiting the playing, pain-specific methods, balancing the child's emotions, natural health products and establishing joy to manage children's postoperative pain (Article I). The most commonly used non-pharmacological pain alleviation methods were holding the child in parents' lap, comforting the child and spending more time with the child than usual (Article IV).

Parents had also given analgesics to their children, but they described insufficient dosage and problems in administering the medication (Article I). Paracetamol and ibuprofen were most commonly given to children. One fifth of the parents had given their child analgesics in lower doses than was advised by the hospital staff. A minority (8%) of the parents described that they had not received any instructions for the use of children's analgesics at home, and some parents had been advised to give their child analgesics as prescribed, but no prescription had been given to them. (Article V.)

7.3 Differences in mothers' and fathers' perceptions of girls' and boys' pain and its alleviation

Differences in the parents' perceptions of children's pain were obvious by both the parents' and the child's gender (Article III). Boys, more than girls, were expected to learn to tolerate pain. Additionally, fathers, more often than mothers, claimed that their child should learn to tolerate pain and the child should cope with the pain by her/himself. In addition, more than two thirds of the fathers considered the child's postoperative pain acceptable because of benefits in the child's health in future. Fathers, more than mothers, considered their child capable of pretending to have pain. Similarly, fathers, more than mothers, considered children's analgesics to have dangerous effects. They also suggested that analgesics should be used only in severe pain. (Article V.)

Gender differences were also found in the parents' use of non-pharmacological pain alleviation methods with their children. Mothers reported having used several methods, including spending time with the child more, helping the child in the everyday activities and carrying the child more than fathers. Holding the child in parents' lap, reading and watching TV or videos were more often used with the girls than with boys. (Article IV.) No differences were found in the administration of analgesics with boys and girls (Article V).

7.4. Relationships between parents' perceptions and use of pain alleviation methods and children's postoperative pain

Parents' use of pain alleviation methods and their perceptions of children's pain and its medication were related to children's pain intensity and pain behaviours. Children were reported to have less pain when the parents comforted the child, spent time with the child more than usual, held the child in lap or cuddled the child more than usual (Article IV). The intensity of children's pain and the prevalence of pain behaviours were higher among the children who had received analgesics at home. The finding indicates that analgesics are given to those children who actually need pain relief after day surgery. (Article V.)

The intensity of pain was assessed to be lowest among the children whose parents did not expect their children to cope with their pain by themselves. Yet, less pain behaviours were identified in the children whose parents said that children do not feel as much pain as adults. Additionally, the parents who thought that their child would not remember the pain after a few days identified less pain behaviours in their children. (Article III.)

7.5. Path model describing the factors that explain children's postoperative pain intensity and pain behaviours

The path model showed several indirect and direct effects explaining children's pain intensity and pain behaviours (Figure 3). Bidirectional arrow represents correlation between variables and one-way arrow describes that one variable explains variation in the target variable which the arrow is pointing at. Disturbance terms are labelled as "er1" to "er5". Standardized coefficients

that describe relative effect between variables and adjusts different standard deviations in the variables were used in the figure. Unstandardized variables are described in the tables to present how the original variables explain variation in the target variables.

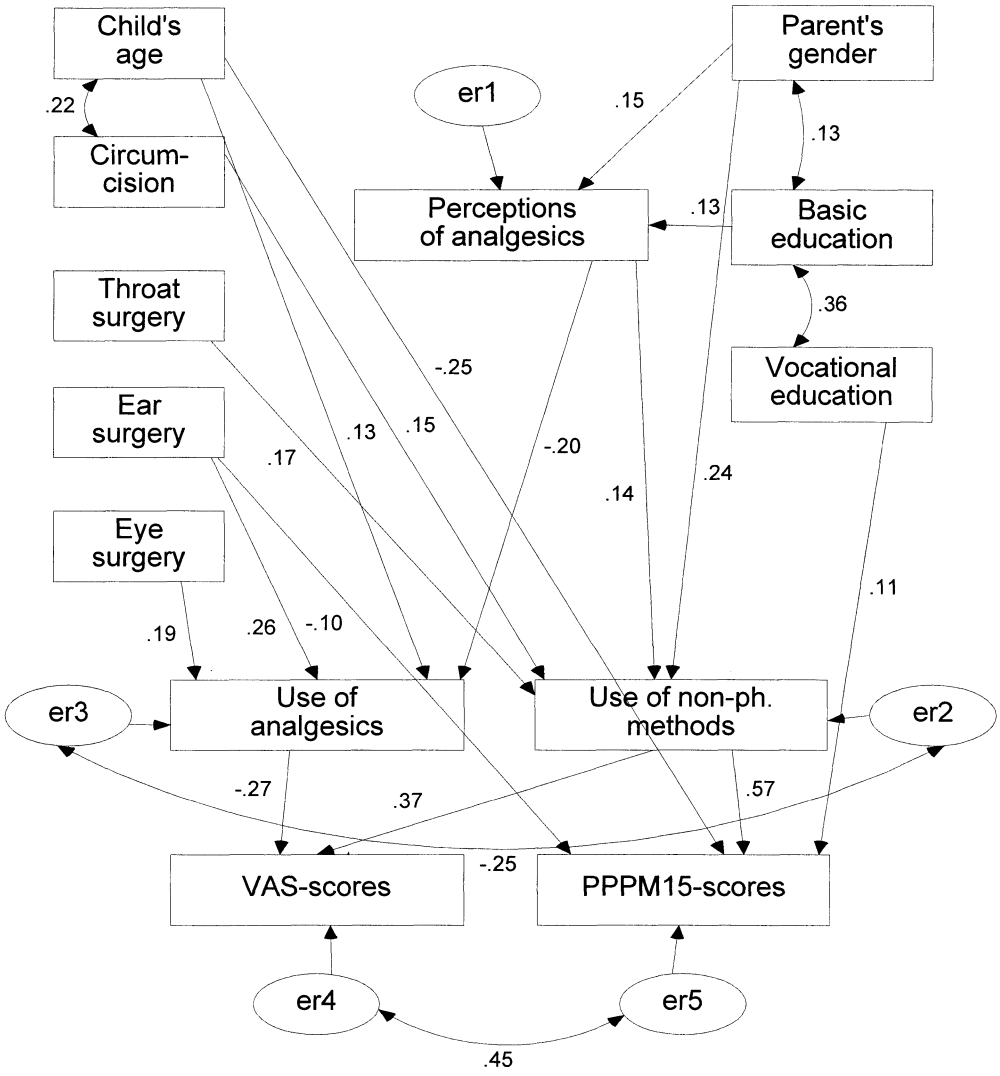

Figure 3. A hypothetic path model of variables explaining the variation in children's postoperative pain intensity and pain behaviours.

Coefficient of determination (R^2) was computed to examine the rate of explanation in each target variable. Rate of explanation was highest in PPPM-scores ($R^2 = 0.39$) and VAS-scores ($R^2 = 0.26$). Lower rates of explanation were found in parents' use of analgesics ($R^2 = 0.16$), their use of non-pharmacological pain alleviation methods ($R^2 = 0.14$), and their perceptions of analgesics ($R^2 = 0.05$).

Both children's (age) and parents' (use of non-pharmacological pain alleviation methods and analgesics, gender, perceptions of children's analgesics, basic education) variables and type of surgery (eye/ear/throat surgery/circumcision) were found to have effect on the intensity of children's postoperative pain (Table13).

Table 13. Direct, indirect and total unstandardized effects of parents' and children's variables and type of surgery on the intensity of children's postoperative pain.

Type of effect on VAS-scores expressed in regression coefficients	Total	Indirect	Direct
Child's age	-0.04	-0.04	0.00
Parents' use of non-pharmacological pain alleviation methods with children	0.29	0.00	0.29
Parents' use of analgesics with children	-1.52	0.00	-1.52
Child's age	-0.04	-0.04	0.00
Parent's gender	0.50	0.50	0.00
Parents' perceptions of children's analgesics	0.01	0.01	0.00
Parents' basic education	0.05	0.05	0.00
Eye surgery	-0.46	-0.46	0.00
Ear surgery	-0.57	-0.57	0.00
Throat surgery	0.28	0.28	0.00
Circumcision	0.64	0.64	0.00

Type of surgery (throat, ear, circumcision), parents' use of non-pharmacological pain alleviation methods, parents' gender and education, their perception of children's analgesics and child's age were found to have effect on variation in children's pain behaviours (Table 14).

Table 14. Direct, indirect and total unstandardized effects of parents' and children's variables and type of surgery on children's pain behaviours.

Type of effect on PPPM-scores expressed in regression coefficients	Total	Indirect	Direct
Ear surgery	-1.38	0.00	-1.38
Throat surgery	0.76	0.76	0.00
Circumcision	1.71	1.71	0.00
Parents' use of non-pharmacological pain alleviation methods	0.77	0.00	0.77
Parents' vocational education	0.37	0.00	0.37
Parents' basic education	0.07	0.07	0.00
Parents' gender	1.22	1.22	0.00
Parents' perceptions of children's analgesics	0.02	0.02	0.00
Child's age	-0.54	0.00	-0.54

Throat surgery and circumcision, parents' perceptions of children's analgesics, their gender and basic education were found to have effect on the variation in parents' use of non-pharmacological pain alleviation methods (Table 15).

Table 15. Direct, indirect and total unstandardized effects of parents' and children's variables and type of surgery on parents' use of non-pharmacological pain alleviation methods with children.

Type of effect on parents' use of non-pharmacological pain alleviation methods with children expressed in regression coefficients	Total	Indirect	Direct
Throat surgery	0.98	0.00	0.98
Circumcision	2.21	0.00	2.21
Parents' perceptions of children's analgesics	0.02	0.00	0.02
Parents' gender	1.58	0.14	1.44
Parents' basic education	0.09	0.09	0.00

Parents' perceptions of children's analgesics, their gender and basic education, child's age and ear and eye surgery were found have effect on parents' use of analgesics with their children (Table 16).

Table 16. Direct, indirect and total unstandardized effects of parents' and children's variables and type of surgery on parents' use of analgesics with their children.

Type of effect on parents' use of analgesics with their children expressed in regression coefficients	Total	Indirect	Direct
Parents' perceptions of analgesics	-0.01	0.00	-0.01
Parents' gender	-0.03	-0.03	0.00
Parents' basic education	-0.02	-0.02	0.00
Child's age	0.03	0.00	0.03
Ear surgery	0.37	0.00	0.37
Eye surgery	0.30	0.00	0.30

Parents' gender and their basic education were found to have effect on their perceptions of children's analgesics (Table 17).

Table 17. Direct, indirect and total unstandardized effects of parents' gender and basic education on their perceptions of children's analgesics.

Type of effect on parents' perceptions of children's analgesics expressed in regression coefficients	Total	Indirect	Direct
Parents' gender	7.06	0.00	7.06
Parents' basic education	4.75	0.00	4.75

To summarize, variation in children's postoperative pain was directly explained by child's age, ear surgery, parents' vocational education and their use of both non-pharmacological pain alleviation methods and analgesics. Regression coefficient was negative between parents' use of analgesics and children's VAS-scores and positive between parents' use of non-pharmacological pain alleviation methods and VAS-scores. Parents' use of non-pharmacological pain alleviation methods with their children was directly explained by their perceptions of analgesics, parents' gender and type of child's surgery. Parents' perceptions of children's analgesics, child's age and type of surgery had direct effect on their use of analgesics with their children. Parents' perceptions of children's analgesics were directly explained by parents' gender and their basic education.

8 DISCUSSION

8.1 Discussion of the results

The results of this study confirm the earlier findings that children still have moderate or severe postoperative pain at home after day surgery. Similar results have been reported in several Finnish studies (eg. Kokki & Ahonen 1997, Kokki et al. 2000). These results show that even though day surgery is recommended for small children, the need for pain relief is not fully met. The reasons for poor pain alleviation among children have not been widely discussed in previous studies. However, this study showed that parents' misleading perceptions of children's analgesics and insufficient use of pain alleviation methods are reasons for children's poor pain management at home after day surgery.

According to the findings of this study, parents assessed children's pain by observing children's verbal expressions, changes in everyday activities and changes in behaviour and by relying on their own knowledge of their child. These results conform with earlier findings from the USA (Gedaly-Duff & Ziebarth 1994), United Kingdom (Nethercott 1994) and Canada (Reid et al. 1995, Woodgate & Kristjanson 1996). It seems that parents are able to identify children's postoperative pain and that they assess their children's pain in a fairly similar way in most Western countries and that cultural differences between these countries may be small. Therefore, the reason for inadequate pain alleviation in children is obviously not poor parental skills in identifying and assessing the children's pain.

Mothers, more than fathers, had identified several pain behaviours in their children. This finding indicates that mothers may know their children better than fathers, or they may be more sensitive to minor changes in their child's behaviour. Also, misleading perceptions of children's pain and analgesics were more common among fathers, which may indicate that fathers may not be sufficiently able to assess their children's pain because their own beliefs and appreciation of pain tolerance. These differences have not been found in earlier studies, mainly because fathers have not usually been included in the data and no comparison has been made between the parents.

Parents had implemented several non-pharmacological pain alleviation methods to manage their child's pain, as found in earlier studies (Gedaly-Duff & Ziebarth 1994, Nethercott 1994). Several methods were implemented mostly by mothers, which may indicate that children's pain alleviation may be considered a maternal task or a natural part of mothers' nurturing interaction with their children. It is possible that mothers, who were found to identify more pain in their children, also used non-pharmacological pain alleviation methods to control the child's pain. On the other hand, the fathers who responded in this study seemed to accept their child's pain more often than mothers, which may partly explain why fathers do not use non-pharmacological pain alleviation methods as often as mothers.

Holding the child in parents' lap, reading and watching TV or videos were more often used with girls than with boys. Similarly, boys, more than girls, were expected to learn to tolerate pain. These findings indicate that men's appreciation of pain tolerance may be transmitted to the next generation especially with small boys. It seems that boys are encouraged to tolerate their pain and, maybe therefore, non-pharmacological pain alleviation methods are not implemented to control their pain as actively as with the girls.

Most of the parents had given analgesics to the child, as found in earlier Finnish studies (eg. Kokki & Ahonen 1997, Kokki et al. 2000). Opposite to Canadian parents (Finley et al. 1996), Finnish parents said that analgesics should be given to the child before the pain becomes severe. On the other hand, one fifth of parents had given their child less analgesics than was advised by the hospital staff, and some parents believed that paracetamol is the only analgesic available to be used with children. Similarly, half of the parents stated that mild analgesics (e.g. paracetamol) are effective enough to alleviate children's pain. Some parents also considered children's analgesics to have dangerous adverse effects. These findings indicate that parents may not receive sufficient instructions from the hospital staff prior to their child's discharge from day surgery. It is also obvious that prescriptions are not written to all children, which may lead to under-treatment of their postoperative pain at home. Parents' perceptions of the safety and effectiveness of paracetamol may be based on the common recommendation to use it for children's minor symptoms, such as fever and flu. This recommendation may be the reason why

some parents doubted the correctness of the discharge instructions related to their children's analgesics and relied more on the dosage instructions on the packages.

The findings of the path model indicated that children's postoperative pain intensity was explained to a notable extent by parents' use of both pharmacological (standardized regression coefficient= -0.27) and non-pharmacological pain alleviation methods (standardized regression coefficient = 0.37). Positive coefficient between VAS-scores and parents' use of non-pharmacological pain alleviation methods reflects that the more pain the child had, the more these methods were used by the parents. Similarly, negative coefficient between VAS and parents' use of analgesics with their children indicates that analgesics were used mostly with children who had severe pain. Negative coefficient is explained by coding of the original variables (1 = analgesics given, 2 = analgesics not given). Additionally, children's pain behaviours were mostly explained by parents' use of non-pharmacological pain alleviation methods (standardized regression coefficient = 0.57). Positive coefficient may indicate that the more pain behaviours are identified in the children, the more non-pharmacological pain alleviation methods are implemented to control their pain. Surprisingly, only ear surgery had direct effect on children's postoperative pain even if type of surgery explained variation in parents' use of both analgesics and non-pharmacological pain alleviation methods. It is obvious that the effect of type of child's surgery on parents' use of pain alleviation methods is indirect in this model.

The implementation of pain alleviation methods was directly explained by child's age, type of surgery, parents' gender and parents' perceptions of children's analgesics. These perceptions were found to differ by parents' gender and basic education. These findings indicate that the culturally transmitted perceptions of pain control differ between mothers and fathers, which may prevent or promote the use of pain alleviation methods in children's postoperative pain at home.

The focus of this study was on children's postoperative pain intensity and pain behaviours that were explained by several factors. However, it is possible that the relationship between pain and

pain alleviation methods is bidirectional rather than one-way. Possibly the parents are more active in controlling pain in children who are observed to have severe pain. It is also possible that parents' perceptions of children pain and analgesics do not only explain their use of pain alleviation methods and, in that way also children's postoperative pain. Instead, it may be possible that parents' perceptions alter while they see their child suffering from postoperative pain.

A negative correlation (r= -0.25) was found between disturbance terms of parents' use of analgesics and non-pharmacological pain alleviation methods with their children. This result is based on coding of the original variable measuring parents' use of analgesics with their child. Therefore, the result reflects that both analgesics and non-pharmacological methods are used at the same time to achieve maximum pain relief in children during the postoperative period.

This study provided information of ethical challenges in children's pain research (Article VI). It was found that ethical challenges occured during all stages of qualitative research. Avoiding children's and parents' emotional distress and obtaining informed consent from all family members seemed to be main issues in study ethics. Additionally, reporting the findings in an unbiased manner was challenging especially when the parents described their misleading perceptions of children's pain.

In conclusion, the findings of this study provided new knowledge of factors explaining children's postoperative pain at home after day surgery. The parents were found to have both accurate and misleading perceptions of children's pain and its alleviation. Misleading perceptions tended to be related to men's culture because fathers had more misleading perceptions than mothers, and boys were expected to tolerate pain more than girls. These perceptions seemed to influence parents' use of both non-pharmacological pain alleviation methods and analgesics to control children's postoperative pain at home. In addition, parents seemed to be more active in alleviating girls'

pain. Additionally, the implementation of pain alleviation methods was found to explain children's postoperative pain intensity and pain behaviours.

8.2 Validity and reliability of the study

The reliability of the data, the analysis and the reporting of the findings are discussed while assessing the reliability of the family interview study (eg. Nieminen 1998). The reliability of the family interview study was increased by minimising the constant error by encouraging the participants to be honest and to tell their opinions as sincerely as possible. It can be stated that the parents told honestly about their experiences and attitudes, because they expressed some values that cannot be considered socially desirable (Morse 1991). In addition, two pre-interviews were conducted to test how the method of family interview works in research on children's postoperative pain. Data collection was continued until no new information came up. A research diary was used to make notes of the data collection, the interview situations and the data analysis. With a sample of three randomly selected interviews, inter-rating was used to test the classification of the original statements. A pediatric nurse (MSc in nursing) conducting research on children's pain experiences coded the data, and the agreement percentage was 93. Original citations translated in English were used as examples in the article (Article I) to describe the process of data analysis.

The characteristics of the researcher were also essential in the evaluation of the reliability of a qualitative study. The interviewer had been working as a pediatric nurse on several wards and thus had experience of interaction with families. On the other hand, the professional background combined with being mother to children of the same age group as the participants was a challenge to let the families tell their stories without leading the discussion in accordance with the researcher's experiences.

The validity and reliability of the instruments (Carter & Porter 2000) and the internal and external validity of the findings (Vehviläinen-Julkunen & Paunonen 1998b, Carter & Porter 2000) are discussed while assessing the reliability of the survey study. The validity of the

instruments was the main issue in the quantitative study. The content validity of the instruments (Vehviläinen-Julkunen & Paunonen 1998b, Carter & Porter 2000, Burns & Grove 2001) measuring parents' perceptions and their use of pain alleviation methods was increased by using the existing literature on pain alleviation (eg. Gedaly-Duff & Ziebarth 1994, Finley et al. 1996, Forward et al. 1996, Kokki & Ahonen 1997, Lander & Warnock 1999) and the findings from the family interview study. In addition, the PPPM instrument and the whole questionnaire were tested in a pilot study (Waltz et al. 1991). According to the parents, the questionnaire was easy to fill in, but it took a lot of time to read the statements carefully. Additionally, the criterion validity tested by examining correlation with VAS and internal consistency of PPPM15 was found to be good (Alpha .816) (Carter & Porter 2000).

The path model seemed to be valid in measuring the effects in the target variables. A goodness of fit index (GFI) was computed to explain how well the model described the variation in the target variables. A Jöreskog-Sörbom GFI value higher than 0.90 is excellent (Kline 1998), and in this study it was 0.933. The similarity between the covariances generated by the model and computed from the data was tested using the χ^2 test. It seemed to indicate that this model is not valid ($\chi^2 = 160.91$, df=57, p=0.000). However, GFI is less sensitive to the sample size than the χ^2 statistics (Kline 1998). So, it is more suitable in that case.

The path model was developed based on earlier findings on factors influencing the intensity of postoperative pain and pain behaviours. However, it is possible that some other factors, such as accuracy and sufficiency of discharge instructions, could explain part of the variation in parents' use of pain alleviation methods and, thus, children's postoperative pain. Inclusion of these explanatory variables could be used to further elaborate the model describing the alleviation of children's postoperative pain at home after day surgery.

The external validity of the study (Vehviläinen-Julkunen & Paunonen 1998b, Burns & Grove 2001) was decreased because of the low response rate (49 %). The results cannot be generalized to all parents whose child has undergone day surgery in Finnish central hospitals. Additionally, the researcher does not have information of the characteristics of those parents who received the

questionnaire but did not fill or return it. It is possible that the strike of physicians in 2001 had some influence on nurses' motivation and resources to encourage the parents to participate in the study. In addition, many parents had been irritated because the procedures had been cancelled during the strike. Therefore, it is possible that participation in the study was considered too demanding while the parent had to take care of the sick child. In addition, only a few children were reported to have no pain, which indicates that data from this group may be missing. It is also possible that the first few days after the day surgery of their child are busy for the parents, which is why they may not have had time to fill in the questionnaire. Only biological parents filled in the questionnaires, and the views of parents' new spouses are therefore missing.

The large variety in children's age (1-6 years) may have influenced the findings of PPPM. Children's cognitive and emotional development is very fast in early childhood, which influences their pain responses and pain behaviours. On the other hand, children's responses to pain have been described to be fairly variable, and parents' assessment of children's pain behaviours is therefore necessary even at the age of six years.

8.3 Conclusions and implications for children's day surgery

This study provided new knowledge of 1- to 6-year-old children's pain alleviation at home after day surgery. 1) Parents' gender-related perceptions of children's pain and analgesics were found to be partly accurate and partly misleading. 2) Parents used several non-pharmacological pain alleviation methods and analgesics with their children. 3) Mothers and fathers had different perceptions of girls' and boys' pain. 4) These perceptions explained parents' use of pharmacological and non-pharmacological pain alleviation methods with their children at home after day surgery. 5) Children's postoperative pain intensity and pain behaviours were explained by their parents' implementation of pain alleviation methods.

The findings of this study can be used to develop children's day surgery. The parents should be provided with accurate information of children's analgesics and the need to use them with children. A prescription should be provided to all children prior to surgery in order to make sure

that pain medication is available at home when the child is discharged from hospital. In addition, the appreciation of pain tolerance especially in Finnish men's culture could be discussed with the parents to emphasize the need for pain relief also in boys.

8.4 Suggestions for further research

This study showed several challenges for further research. 1) The sub-scales measuring parents' perceptions and their use of pain alleviation methods should be developed further. 2) Research is needed to examine the adequacy of the discharge instructions provided to the parents whose child is undergoing day surgery. 3) Different types of educational interventions should be tested to develop parental teaching of children's pain relief after surgery. 4) Cultural research is needed to understand how the perceptions and myths of children's pain and its alleviation are developed and transmitted to the next generation in Finnish culture. 5) Other possible predictors, such as sufficiency of discharge instructions, should be added to the model explaining children's pain intensity and behaviours. 6) Bidirectional effects in the relationship between parents' use of pain alleviation methods with their children and children's postoperative pain intensity should be included and tested in the model.

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Appendix Table 1. The original variables included in the summarized variables (parents' perceptions of children's pain and analgesics and parents' use of non-pharmacological pain alleviation methods).

Original item	Correlation with other items of sub-scale	Item-scale correlation
Parents' perceptions of children's pain (Alpha = 0.695)		
My child should learn to tolerate pain	.037 - .417	.475
My child must cope with the pain by herself	.035 - .384	.360
My child's organs are not developed enough to feel pain	.004 - .445	.172
My child does not feel pain as much as adults	.001 - .421	.467
Adults have the responsibility to alleviate my child's pain *	.001 - 422	.163
I respect my child if she does not complain of pain	.022 - .384	.303
My child tolerates pain more than adults	.013 - .789	.490
Pain is always part of surgery	.013 - .301	.132
The pain threshold of my child is higher than of adults	.031 - .789	.449
Postoperative pain decreases every day	.031 - .301	.119
Postoperative pain is acceptable because of benefits in my child's health in the future	.020 - .368	.359
Pain is a normal part of my child's life	.040 - .417	.411
I always try to protect my child from pain *	.017 - .332	.152
I permit my child to hurt herself during every-day activities, such as playing, because pain belongs to these activities in childhood	.012 - .332	.317
Parents' perceptions of children's analgesics (Alpha= 0.784)		
A child becomes easily dependent on analgesics	.038 - .322	.404
Analgesics should not be given to the child before the pain becomes severe	.135 - .431	.533
Analgesics are the final alternative to alleviate the child's postoperative pain	.135 - 310	.430
Analgesics should be given to the child regularly to alleviate postoperative pain *	.109 - .582	.286
Analgesics for home use may cause depression of breathing in the children	.006 - .621	.486
Analgesics for home use may be dangerous for children	.109 - .582	.540
Analgesics must be given to the child before the pain becomes severe *	.010 - .438	.207
Analgesics for home use may have dangerous adverse effects	.055 - .428	.526
Use of analgesics in childhood may lead to use of drugs in adulthood	.095 - .537	.519
Analgesics should be used in children's ear- or headache *	.015 - .301	.216
The amount of analgesics given to the child should be smaller at home than in hospital	.062 - .329	.384

To be continued...

Appendix Table 1 continues. The original variables included in the summarized variables (parents' perceptions of children's pain and analgesics and parents' use of non-pharmacological pain alleviation methods).

Original item	Correlation with other items of sub-scale	Item-scale correlation
Analgesics can be given to the child only if the reason for pain is known	.019 - .344	.364
Giving analgesics to children means that the parents are not capable of listening to the child's crying	.019 - .301	.274
In my family we usually avoid the use of analgesics both in adults and children	.098 - .344	.321
Parents' use of non-pharmacological pain alleviation methods (Alpha = 0.738)		
Teaching the child to relax	.021 - .505	.284
Videos / TV	.017 - .315	.213
Focussing on something else than pain	.061 - .313	.361
Comforting the child	.022 - .377	.480
Spending more time with the child than usual	.027 - .480	.489
Helping the child in everyday activities more than usual	.061 - .363	.459
Carrying the child more than usual	.033 - .361	.298
Teaching the child to breathe calmly	.014 - .505	.265
Helping to arrange a comfortable position, e.g. by using pillows	.066 - .337	.378
Applying warm packs	.020 - .337	.083
Massage	.058 - .317	.140
Holding the child in lap	.007 - .369	.412
Cuddling the child more than usual	.039 - .480	.521
Letting the child eat "goodies" more than usual	.027 - .315	.249
Keeping the child inside the house	.031 - .315	.359
Limiting wild play	.035 - .315	.343

*** variable recoded in the opposite direction**