Knowledge, Attitudes, and Clinical Practice of Nurses in Pediatric Postoperative Pain Management

ABSTRACT

Background: Despite readily available evidence to guide practice, children continue to experience moderate to severe pain in hospital postoperatively. Reasons for this may include attitudes of nurses toward pain management and their lack of knowledge in key areas.

Aims: To identify nurses' knowledge and clinical practice of pediatric postoperative pain management, and whether there is a link between knowledge and practice.

Design and setting: A descriptive cross-sectional study including a questionnaire and observations was conducted in postanesthesia care (recovery) units in six university hospitals in Norway.

Methods: Nurses completed the "Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain Questionnaire-Norwegian version" (PNKAS-N). We observed their clinical practices using a structured observational tool and field notes.

Results: Nurses completed the PNKAS-N (n=193) and were observed (n=138) giving postoperative care to 266 children (70 hours per unit, 416 hours in total). The mean PNKAS-N score was 29 (SD 4.2) of 40. We identified knowledge deficits, mainly in pharmacological management, such as in risk of addiction and respiratory depression. We found that overall, pain was assessed using validated tools in 19% of the children: this fell to 9% in children aged <5 years. More than 66% of children received an inadequate dose of morphine postoperatively.

Conclusion: Nurses have knowledge deficits about pediatric pain management and do not

always use their knowledge in practice, particularly in relation to pain assessment. There is a need to improve nurses' knowledge of pediatric pain management and to test interventions that support the use of that knowledge in practice.

Key words: pediatric pain, postoperative pain, pain assessment, pain management, knowledge, children

INTRODUCTION

Pain in children and adolescents is underestimated and undertreated (IASP, 2011, 2017; Twycross, Forgeron, & Williams, 2015), and children report moderate-to-severe pain after surgery (Sng et al., 2013; Twycross & Finley, 2013). Stevens et al. (2012) found that one third (33%) of the hospitalized children experienced moderate to severe pain. This high number of children experiencing pain after surgery persists despite readily available evidence to guide practice (Hauer, Jones, Poplack, & Armsby, 2017; Howard et al., 2012). As late as the 1980s, premature and newborn children underwent surgery without pain medication (Olsson & Jylli, 2001). Peters et al. (2005) showed that preterm infants are hypersensitive to pain. Surgery in neonates can lead to prolonged pain and hypersensitivity in the surgical area (Anand, Gracia-Preats, & Kim, 2017; Vinhall & Grunau, 2014), and deleterious effects on pain response and neurodevelopmental outcome have been described (Anand et al., 2017). Undertreated pain causes unnecessary suffering, an increased risk of complications, and increased risk of morbidity, as well as potentially leading to longer hospital stays (IASP, 2011). In the longer term, inadequate acute pain relief in children may lead to the development of chronic pain (Batoz et al., 2016; Fortier, Chou, Maurer, & Kain, 2011; Kristensen, Ahlburg, Lauridsen, Jensen, & Nikolajsen, 2012; Nikolajsen & Brix, 2014).

Nurse undertreatment of pain in children and adolescents is a consequence of pain management knowledge deficits, at least in part (Twycross, Forgeron, et al., 2015). The knowledge and attitudes of nurses regarding pediatric pain management has been identified in several studies using the Pediatric Nurses' Knowledge and Attitude Survey Regarding Pain Questionnaire (PNKAS) (Ekim & Ocakcı, 2013; Hovde, Granheim, Christophersen, & Dihle, 2012; Lobete Prieto, Rey Galán, & Kiza, 2015; Lunsford, 2015; Omari, 2016; Ortiz et al.,

2015; Stanley & Pollard, 2013; von Lutzau, Hechler, Herzog, Menke, & Zernikow, 2011). Findings from these studies demonstrated knowledge deficits in pharmacological issues, such as the risk of respiratory depression (Omari, 2016; Stanley & Pollard, 2013; von Lutzau et al., 2011), risk of addiction (Ekim & Ocakcı, 2013; Omari, 2016; Ortiz et al., 2015; Stanley & Pollard, 2013), and the conversion of morphine doses from intravenous to oral administration (Ekim & Ocakcı, 2013; Omari, 2016). Knowledge deficits in pain assessment issues were also identified, such as a belief that children overreport their pain (Ekim & Ocakcı, 2013; Stanley & Pollard, 2013) and the efficacy of adjunct nonpharmacological methods of pain management (von Lutzau et al., 2011).

Knowledge deficits offer only a partial explanation for suboptimal practices. Underestimation of pain in children, for example, can be related to less than optimal pain assessment, and the lack of routine use of pain assessment tools in some units (Simons & Macdonald, 2004; Smyth, Toombes, & Usher, 2011). There are several pain assessment tools that can be used for children (behavioral scales, faces scales, numerical scales) (Chou et al., 2016; Keels et al., 2016; Royal College of Nursing, 2009; Stinson & Jibb, 2014), but no single tool is suitable for children of all ages (Ghai, Makkar, & Wig, 2008). Patient self-reports or the use of observational pain assessment tools should be used to assess pain in children depending on their age (Hauer et al., 2017). Smyth et al. (2011) found nurses, in their study, were largely unaware of the pain assessment tools used on pediatric wards and did not use formal pain assessment guidelines with some nurses emphasizing physical indicators of pain. Pediatric pain management clinical practices do not always conform to current best practice, and this lack of conformity is a challenge (Smyth et al., 2011; Twycross, 2007a; Twycross & Collis, 2013; Twycross, Finley, & Latimer, 2013).

Dihle, Bjølseth, and Helseth (2006) observed and interviewed nine nurses about pain assessment, giving information to, and pain management for, adults on surgical wards. They found difference between what nurses said they did and what they did in practice. Pediatric nurses behaved similarly (Twycross, 2007b), but this inconsistency has not been explored in pediatric pain management in postanesthesia care (recovery) units (PACUs). Children are still experiencing unrelieved moderate-to-severe pain postoperatively and so it is important to identify the cause of this unrelieved pain. The purpose of the present study was to identify nurses' knowledge, attitudes, and clinical practices of pediatric postoperative pain management in PACUs and to determine whether there is a link between knowledge and actual practice, using a combination of various methodological approaches to obtain new information in this context.

METHODS

Before the study started we obtained approval from the Regional Committee for Medical Research Ethics (REK South-East, Norway, id: 399805), the Head of Research at each hospital and from the privacy ombudsman. We collected data from August to October 2014. The researcher met with unit managers to present the study and to discuss the study process, and all unit managers were happy for their nursing staff to participate in the study. All the nurses working in these units were then invited to participate. They received an information letter that included information about the study and explained that participation was voluntary and that responses would be treated anonymously. We obtained written informed consent to participate from the nurses completing the questionnaire. We also obtained informed consent from the participants (nurses, children, and their parents) during the collection of observational data.

Sample and Setting

The study was conducted in all six university hospitals in Norway. Nurses (n=259) working with children at the six largest PACUs were invited to complete a questionnaire (PNKAS-N) about knowledge and attitudes toward pediatric pain management. The same nurses who were invited to complete the questionnaire were also observed in clinical practice if they were on duty in the selected observational period. Five of these units have both children and adults. Each unit had 30 to 60 nurses, and usually between 5 and 15 children underwent surgery daily (Monday to Friday).

Data Collection

We used a combination of methodological approaches in the present study. Data were collected about nurses' knowledge and attitudes using a questionnaire (Norwegian version of Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain or PNKAS-N), while observational data about clinical practice was collected using a structured tool (checklist), and field notes.

We distributed a paper version of the PNKAS-N to all the nurses with an information letter and a return envelope. Participants also received verbal information about the study. The researcher observed the same nurses in clinical practice over a two-week period in each unit. The researcher observed the children from the time they arrived until the time they left the unit, and recorded which nurse cared for each child. The researcher sat in a corner of the room during the observations without disrupting the nursing care. The same researcher (the first author, AHS) undertook all the observations.

Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain

We collected data regarding nurses' knowledge and attitudes toward pediatric pain

management using the PNKAS-N. The original survey, the PNKAS, was developed by Manworren in 1998 (Manworren, 2001) and revised in 2002 (Rieman, Gordon, & Marvin, 2007).

The PNKAS was derived from best practice standards of pain management recommended by the World Health Organization, the Agency for Health Care Policy and Research, and the American Pain Society (Manworren, 2000; Rieman et al., 2007). The items in the survey cover general pediatric pain management, pain assessment, and pharmacological and nonpharmacological pain management. The PNKAS-N comprises 40 items, of which 23 are true or false statements, 13 are multiple choices, and four are based on two patient cases. Each item in the questionnaire is equivalent to one point, giving a scoring range from 0 to 40. The higher the score, the more correct answers were given. The revised PNKAS (Manworren and Shriners Hospitals for Children Version, 2002) was translated into Norwegian, tested, and validated according to Norwegian conditions by Hovde and colleagues in 2009 (Hovde et al., 2012). For the present study, an additional section was added to the questionnaire about the nurses' age, level of education, working experience and full-time equivalent, and use of pain assessment tools, and whether the hospitals or units had guidelines for pediatric pain assessment and pediatric pain management.

Observational Data

The first author collected data regarding nurses' pediatric postoperative pain management practices using a structured observational tool (checklist) and field notes. The checklist was developed based on an extensive literature review (Twycross, Forgeron, et al., 2015) and current best practice guidelines (Hauer et al., 2017; Howard et al., 2012; Royal College of Nursing, 2009), and included the PNKAS-N themes (pain management, pain assessment, and

pharmacological and nonpharmacological treatment of pain in children). The field notes included descriptions of what occurred during the period of non-participant observation, and nurses' comments relating to pediatric pain management. The field notes were recorded while on the ward, or directly afterwards depending on the situation at the unit. No identifying data about the children was recorded in the field notes, except weight, age, and type of surgery. The other data collected were situational, and care was taken to ensure patient confidentiality. The checklist was piloted on two occasions (observing for 3–4 hours each day for two days). Following this, the structure of the checklist was adjusted to focus on the child rather than the nurse, because some children were cared for by more than one nurse.

Data Analysis

Descriptive and correlative statistics were used to describe and summarize the data from PNKAS-N using SPSS (IBM SPSS Statistics for Windows, version 24.0. IBM Corp, Armonk, NY, USA). Means, standard deviations, medians, and interquartile ranges were calculated for continuous data. Frequency counts and proportions were calculated for categorical data. A one-way ANOVA was used to determine whether significant variation existed among subgroups. Results were considered to be significant if $p < .05$. The observational data were analyzed using NVivo (NVivo11) and Excel (Excel 2016), and frequency counts and proportions were calculated to summarize the data. For example, the number of times nurses used pain assessment tools was calculated and summarized in a table.

RESULTS

A total of 193 nurses completed the PNKAS-N (74.5% response rate). The mean age of the nurses was 42.9 years (SD 10.0), and the mean number of years working as a nurse was 17.6 (SD 9.4). More than half were intensive care nurses (Table 1).

Observational data was collected for two weeks at each of the six hospitals and included that from management of 266 children who underwent surgery. A total of 416 hours was spent observing the pain management of these children. The main surgery groups were general (28%), orthopedic (27%), or ear/nose/throat (21%) surgery. More than half of the nurses (n=138, 53%) working in the PACUs were observed on one shift or more. None of the nurses, parents, or children refused to participate in this observational study.

Total PNKAS-N Scores and the Association between PNKAS-N and Education and Years in Clinical Practice

The mean PNKAS-N score was 28.8 (72% correct answers) with a range from 14 to 40 (range of 35% to 100% correct answers). The 10 items most often answered incorrectly are listed in Table 2. Most of these items answered incorrectly related to pharmacological management. The questions relating to risk of the child developing clinically significant respiratory depression was one of the most often answered incorrectly. The 10 items most frequently answered correctly are listed in Table 3. The item most frequently answered correctly (99.5%) was that the child or adolescent with pain should not be encouraged to endure as much pain as possible before resorting to pain relief.

As outlined in Table 4, specialist nurses scored significantly higher than nurses with only a bachelor's degree (p= .020). Furthermore, nurses who had worked in clinical practice for 15–27 years had significantly more correct scores on the PNKAS-N than nurses with less than 15 years' work experience (p= .014).

Pain Assessment

More than 90% of the nurse participants correctly answered four of the 13 items from the PNKAS-N about pain and pain assessment (Table 3). Questions often not answered correctly

included: observable change in vital signs must be relied upon to verify a child's/adolescent's statement that he or she has severe pain (42%), children may sleep in spite of severe pain (55%), children overreport pain (58%), and children younger than eight years can report pain intensity (72%).

Over half of the nurses reported their units had written guidelines for pediatric pain assessment (55%) or pediatric pain management (59%). About 84% of the nurses reported they used pain assessment tools for children and adolescents. The Visual Analog Scale (VAS) (51%) and the Face, Legs, Activity, Cry, Consolability Scale (FLACC) (24%) were reported as the most commonly used. However, we found that only 22% (31 of 138) of the nurses were observed using validated pain assessment tools with 19% (51 of 266) of the children. This was reduced to 9% (8 of 89) for children aged 0–5 years, and zero for children with cognitive impairment (Figure 1). The most commonly used tool was the Numeric Rating Scale (NRS) (23%; 31 of 136). One nurse used NRS on an eight-year-old child who was not able to answer due to cognitive impairment. The correct pain assessment tool for this child would have been Revised Face, Legs, Activity, Cry, Consolability Scale (r-FLACC).

Nonpharmacological Pain Management

Four items from PNKAS-N were about nonpharmacological pain-relieving interventions. Almost all participants (98%) correctly answered that parents should be present during painful procedures, and 91% correctly answered that the child or adolescent should not be advised to use nonpharmacological techniques alone rather than concurrently with pain medications.

Nurses most frequently used 'being present' (81%), 'creating a comfortable environment' (69%), 'preparatory information' (53%) and 'distraction' (47%) as nonpharmacological pain-relieving interventions. Parents most frequently used 'being present'

(96%), ‘creating a comfortable environment’ (54%) and ‘touching’ (37%), while children were observed to use relaxation and distraction (Table 5).

Nurses was observed using distraction techniques including giving a bravery certificate (24%), small gift (11%), or hospital mascot (7%), or talking about other things. Two of six units routinely gave the children ice cream (lollipop ice) (12%) after surgery, and some gave children ice cubes to suck. Four of six units did not have toys or books/magazines, tablets, or a television available in the PACU. A summary of the observational data is presented in Table 5.

Pharmacological Pain Management

More than half of the items from PNKAS-N were about pharmacological pain management. Eight of the 10 items most frequently answered incorrectly (Table 2) related to pharmacological issues. Most frequently answered incorrectly were items concerning risk of respiratory depression (20% answered correctly), useful drugs for treatment of pain (29%), and risk of opioid addiction (35%). When an adolescent patient said he was in pain, 42% of the nurses ‘believed’ him, and only 36% would have provided adequate pain medication.

The pharmacological treatment given before, during, and after the surgery (in the PACU) was recorded. Acetaminophen (paracetamol) was administered to 85% of the children, an NSAID to 26%, and both to 25%. An opioid was administered to less than half of the children (110 of 266; 41%) in the PACU. Morphine was administered intravenously in the range of 0.015–0.095 mg/kg (Table 5). The recommended intravenous dose of morphine for acute and postoperative pain in children is 0.05-0.1 mg/kg and repeated doses might be required to achieve adequate effect (Howard et al., 2012).

Over two-thirds (49 of 80; 61%) of the children who were administered morphine

intravenously were given doses <0.05 mg/kg, and 49% (24 of 49) of these were given ≤0.03 mg/kg. Most children who were given a dose <0.05 mg/kg (35 of 49; 71%) needed repeated doses, sometimes three to six times, before their pain was relieved, which could take up to one hour. By contrast, only 4 of 21children (19%) who were given a dose ≥0.05 mg/kg needed three or more repeated doses of morphine. In 31% (25 of 80) of the children, the prescribed dose of morphine was <0.05 mg/kg. If morphine or ketobemidone was prescribed on a sliding scale, for example as 0.05–0.1 mg/kg, 75% of the nurses gave the smallest amount of the prescribed opioid dose. In 63% of these cases, nurses needed to give repeated doses of opioid to relieve the child's pain. Nurses used pain assessment tools on 51 children, and 32 of these children received opioids, and 18 received opioids more than once. None of the children developed clinical respiratory depression during the observation periods. A summary of these observational data is presented in Table 5.

DISCUSSION

One important finding in the present study was that nurses had knowledge deficits in relation to pediatric pain management. There were inconsistencies between their knowledge and their observed pain assessment practices. The nurses in the present study had a mean PNKAS-N score of 72%, which is 13% lower than the level of knowledge accepted by most nursing standards (Omari, 2016; Stanley & Pollard, 2013). This level of knowledge is comparable to results found in some studies (Hovde et al., 2012; Johnston et al., 2007; Manworren, 2000; Rieman & Gordon, 2007; von Lutzau et al., 2011), but lower than in others (Le May et al., 2009; Rieman & Gordon, 2007; Smart, 2005; Vincent, 2005) that reported total mean PNKAS scores of 77%–81%. Importantly, when examining the range of scores, nurses in the present study scored from 35% to 100%. This means some nurses caring for children after surgery

have a wide gap of knowledge in this context. Recent studies conducted by researchers from Mongolia (Lunsford, 2015) and Turkey (Ekim & Ocakcı, 2013) reported total mean scores of 26% and 38%, respectively, but a variety of factors, such as different health care systems and cultures, and differences in the role of the nurses may account for this. It is crucial to determine the nature of the knowledge deficit more precisely.

Pain Assessment

Most of the knowledge and attitude items concerning pain assessment were answered correctly by the nurses. Similar results were found in two other studies (Hovde, Granheim, Christophersen, & Dihle, 2011; Rieman & Gordon, 2007). However, we found a gap between nurses' responses in the PNKAS-N and what they were observed practicing in relation to the use of pain assessment tools. Based on the PNKAS-N, 85% of the nurses reported using pain assessment tools and 55% responded that their units had written guidelines for pain assessment. About 80% of the nurses answered that the child is the best person to judge his or her pain intensity. However, only 22% of the nurses were observed using a valid pain assessment tool in practice, and only 19% of the children were assessed with a pain assessment tool in the PACU. Furthermore, most nurses (89%) answered that children who are less than eight years old can report their pain intensity, but the observational data revealed that only 10% of the children aged 5–7 years were assessed with a pain assessment tool.

Nurses' limited use of pain assessment tools is consistent with findings from other studies (Smyth et al., 2011; Taylor, Boyer, & Campbell, 2008; Twycross, 2007a; Twycross & Collis, 2013). This shortcoming has been attributed to a lack of knowledge and skills, attitude, absence of pain assessment tools, lack of time, or lack of evidence-based guidelines (Simons & Macdonald, 2004). One reason for this may be that nurses lack knowledge about children in

general, and in particular in relation to communication with children. Effective communication with children requires using language appropriate to the child's age (Stinson & Jibb, 2014). Pain assessment will be influenced by how the nurses communicate with the child about pain, how they ask the child, and whether they expect the child to tell them when he or she is in pain. Furthermore, pain assessment and communication will be influenced by whether nurses are able to gain the child's trust, and if they are aware of preschoolers' highly literal interpretation of words and inability for abstract thought (Hazinski, 2013).

Another reason for the difference in nurses' reported and observed practices may be a lack of knowledge about pain assessment and pain assessment tools for children, especially for small children. In the present study, nurses working in five of six units cared for both children and adults, and were mainly intensive care nurses. Only 8% of the participants were pediatric nurses. There is minimal focus on children and on pediatric pain management in the standard curricula for nurses and intensive care nurses in Norway.

In the present study, the researcher observed that very few pain assessment tools were in use in the units, and only a few nurses had their own pain assessment tools. None of the children with cognitive impairment were assessed by a Revised Face, Legs, Activity, Cry, Consolability (r-FLACC) scale (Malviya, Voepel-Lewis, Burke, Merkel, & Tait, 2006) or another appropriate pain assessment tool in the PACU. Pain in these children can be very difficult to assess because they may have different pain behaviors, and therefore need a specific pain assessment tool, such as the r-FLACC (Pedersen, Rahbek, Nikolajsen, & Møller-Madsen, 2015). The r-FLACC is a behavioral tool that must be individualized for each child's pain behavior before the surgical procedure (Malviya et al., 2006). Thus, for the PACU nurses to be able to use the r-FLACC, they are dependent on the ward nurses to individualize it

before the children arrive at the PACU, which was not done to our knowledge.

Limited use of pain assessment tools can also indicate that nurses think pain assessment tools do not reflect the complexity of managing pain in children in clinical practice (Franck & Bruce, 2009; Voepel-Lewis, 2011; Voepel-Lewis, Burke, Jeffreys, & Malviya, 2011) or that nurses emphasize physical indicators of pain (Smyth et al., 2011; Vincent & Denyes, 2004; Vincent & Gaddy, 2009; Vincent, Wilkie, & Szalacha, 2010). In the present study, there was a gap in knowledge concerning the use of vital signs to assess pain in children alongside a lack of pain assessment tools available in the units. Almost half of the nurses believed children overreported their pain. These issues may be barriers to optimal pain assessment and may provide an explanation for why pain assessment tools are not used in practice. The difference between knowledge and attitude scores, and observational data in this context may mean that nurses know that using a tool helps assess pain but for some reason do not use the tool in practice. Some researchers suggest that this could be attributable to organizational culture (Lauzon & Laurie, 2008; Twycross et al., 2013).

Nonpharmacological Pain Management

In the present study, nurses had higher scores on items about the use of nonpharmacological methods for management of severe pain than those found in similar studies (Chiang, Chen, & Huang, 2006; Manworren, 2000; Smart, 2005; Vincent, 2005). The best practice of having parents present during painful procedures was identified correctly by 98% of the nurses. This finding is consistent with those of similar studies (Hovde et al., 2012; Manworren, 2000; Rieman & Gordon, 2007; Smart, 2005). Furthermore, the use of distraction was correctly identified by 72% of the nurses, which is higher than reported in studies by Ekim and Ocakcı (2013) (53% answered correctly) and von Lutzau et al. (2011) (67% answered correctly).

The PNKAS-N data in the present study corresponded to the observational data that nurses in the PACU were often observed using nonpharmacological techniques. This finding is somewhat different from those of studies conducted in two pediatric wards in England (Twycross, 2007a; Twycross & Collis, 2013; Twycross et al., 2013), where the investigators found that the reason for nurses' seldom using nonpharmacological techniques was that they considered this to be the parents' role (Twycross & Collis, 2013). This difference may be the result of a greater focus on the use of nonpharmacological pain-relieving strategies in Norway or because nurses' knowledge and attitudes have improved in recent years. In addition, nurses working in the PACU may see their role differently from nurses working in surgical wards and thus may approach the use of nonpharmacological strategies differently.

In the present study, the most commonly used nonpharmacological methods were emotional support, such as being present and touch, creating a comfortable environment, providing information, and distraction. Parents were allowed to be present during the time the child stayed in the PACU, and in four of the six hospitals, both parents were permitted to be present. Emotional support (comforting) and a physical method (positioning) were the nonpharmacological methods most commonly used by nurses according to a study conducted at hospitals in Fujian Province, China (He, Vehvilainen-Julkunen, Polkki, & Pietila, 2007). Children considered that the most important strategy used by parents was for them to be present (He et al., 2007; Idvall, Holm, & Runeson, 2005; Sng et al., 2013), and they needed parents as their advocates (Sng et al., 2017).

Despite nurses' frequent use of nonpharmacological methods, strategies such as singing, music, skin-to-skin contact, nonnutritive sucking, sweet-tasting solutions, and facilitated tucking and swaddling were seldom used in the PACU. Similarly, nurses seldom used phones,

tablets, toys, books or magazines, or television as distraction techniques. These techniques have all been shown to be effective in relieving pain (Harrison, Elia, Royle, & Manias, 2013; Hauer et al., 2017; Pillai Riddell et al., 2015; van der Heijden, Araghi, van Dijk, Jeekel, & Hunink, 2015; Wente, 2013).

Nurses may not know which nonpharmacological pain-relieving methods are most effective. This was not specifically explored in the present study, but we found that a lack of available play equipment in the hospital environments, such as books, tablets, DVDs, and toys, limited the use of these nonpharmacological strategies. Many children now have their own mobile phone, but in the present study very few used them during their stay in the PACU. When parents or children asked if they could use their phone or tablet, the nurses allowed them to do so, but not many children asked. Perhaps the children and their parents did not know whether they were allowed to bring their phone or tablet into the PACU or to use them in this setting.

Pharmacological Pain Management

In the present study, nurses least often correctly answered items concerning the risk of respiratory depression, useful drugs for treatment of pain, and the risk of opioid addiction. These findings are consistent with those of other studies (Ekim & Ocakcı, 2013; Manworren, 2000; Rieman & Gordon, 2007; Vincent, 2005). Most nurses (94%) knew that young infants, less than six months of age, can tolerate opioids. For this question, only one other study had similar findings (Hovde et al., 2012). In more recent studies by Omari (2016) and Ekim and Ocakcı (2013), only 29% and 24%, respectively, of nurses correctly answered this question. The PNKAS-N responses in this aspect of the study were consistent with the observational data, which were that 85% of children under six months of age received morphine in the

PACU. However, the observed clinical practices did not always follow current international guidelines for pediatric pain management. For example, the choices of drugs, dosages, and how they were administered or the use of multimodal pain management, were not consistently compliant with the guidelines. The PNKAS-N findings identified a lack of knowledge about different types of pain medication and drug doses, corresponding to the findings of the observational study.

Multimodal pain management strategies should be used to treat postoperative pain in children (Conway, Rolley, & Sutherland, 2016), and although 85% of the nurses correctly answered the PNKAS-N question about combining different drugs, only 24% of the children were observed receiving acetaminophen combined with NSAIDs. More than half of the children (64%) were not prescribed NSAIDs. One reason for this may be the reluctance of surgeons in Norway to prescribe NSAIDs.

One hospital used pethidine postoperatively, even though the use of pethidine is not recommended for postoperative pain management in children (Howard et al., 2012). More than half of the children in the present study received suboptimal doses of morphine and required repeated doses, sometimes administered three to six times, before the pain was relieved, either because of suboptimal doses being prescribed, or because nurses gave the lowest doses or even less than prescribed.

Fear of respiratory depression and opioid addiction may contribute to undertreated postoperative pain in children and adolescents (Seisser & Ward, 2002). In addition, lack of knowledge about recommended drug doses or the attitudes of nurses to pain, or both, may explain suboptimal administration practices (Hovde et al., 2012; Jacob & Puntillo, 1999; Vincent, 2005; Vincent & Denyes, 2004). Some nurses expect that children will have some

pain after surgery (Twycross, Williams, & Finley, 2015). This may mean they wait to give pain relief or give a lower dose of an opioid than is prescribed.

Limitations

There are some limitations to the present study. While pain management is multidisciplinary, we only focused on the nurses. It is important that both nurses and physicians have updated knowledge about pain management because they should be working together to relieve children's pain experience after surgery. However, this study does provide, for the first time, insight into how nurses manage children's pain in Norway as well as their knowledge deficits.

The PNKAS was developed in 1998, and the question about opioid addiction may no longer be valid (Manworren, 2014). The original answer stated that there is less than 1% risk of opioid addiction for patients treated for pain, which may be too low. Therefore, Manworren recommend that responses less than 1% and 5% should be both categorized as correct (Manworren, 2014). Adjusting for this recommendation in the present study, this question would no longer be among the bottom 10 correctly answered questions, but the total mean score would remain the same. Furthermore, nurses were asked to report what they would do in clinical practice in hypothetical case-related questions that do not necessary reflect on actual practices. Another challenge in the present study is social desirability in the way that in self-reports, people (nurses) will often report inaccurately on sensitive topics in order to present themselves in the best possible light (Fisher, 1993). This phenomenon could be true as they might know what is most correct even if they don't perform it in their clinical practice.

Observation of nurses' clinical practice was only for a limited period, sometimes in very busy units, and it is possible not all details were recorded. Furthermore, it is difficult to know the justifications of nurses for their actions in pain management, because the present study

used a non-participant approach to observation. However, some nurses discussed pain management issues with other colleagues and some of these discussions were heard by the researcher. However, as noted before, this study provides an insight into Norwegian nurses' pediatric postoperative pain management practices for the first time.

Lastly, the present study has not covered the children's experiences of pain and pain management, and has not fully explored their use of nonpharmacological pain relief methods, and these items warrant investigation.

Implications for Nursing Practice

Nurses' lack of knowledge about pain assessment, not having pain assessment tools available in the units, and a belief that pain assessment tools are not useful, along with a tendency to concentrate on physical indicators of pain, may be barriers to optimal pain assessment.

Barriers such as a lack of knowledge about useful nonpharmacological pain-relieving strategies or a lack of resources limit the nurses' use of these methods. Nurses should be encouraged to increase the use of nonpharmacological pain-relieving strategies, including providing preparatory information and education for children and their parents about postoperative pain management.

There are currently no national guidelines in Norway for pediatric postoperative pain management. Although each unit had pain treatment guidelines, staff were not always aware of them, and the guidelines were not evidence based. This may contribute to the suboptimal pain management observed. Given this, units should develop evidence based guidelines in relation to pediatric postoperative pain management. The findings of this study also emphasize the need for continuing education in pain management for nurses. This education

should use methods that facilitate the application of knowledge in practice.

Future Research Priorities

More studies in pediatric pain management should be conducted to determine why nurses do not use pain assessment tools in practice. Children's pain and pain management experience after surgery should be investigated, and which nonpharmacological strategies the children experience as helpful. We recommend that intervention studies should be conducted to identify strategies for improving pediatric pain management and to improve the application of nursing knowledge in practice.

CONCLUSIONS

Based on the findings of the present study, we suggest that pediatric pain management practices in Norway require improvement. Nurses appear to lack knowledge in pediatric pain management, especially about pharmacological matters. This concurs with observed clinical practice in this study where over half of the children received inadequate doses of morphine. Furthermore, we found a discrepancy between nurses' PNKAS-N responses and their actual assessment of pediatric pain. Almost all the nurses answered correctly the items relating to pain assessment, but based on the observational data, 81% of the children did not have their pain assessed using a pain assessment tool. Clinical practices were not always consistent with international best practice guidelines, and there are no national guidelines for pediatric pain management in Norway. Only a few hospitals have their own guidelines, but they were not always well known or evidence based. There is a need to develop guidelines and to implement them in all hospitals.

The present study identifies a lack of knowledge concerning key topics in pediatric pain

management, and there appears to be a need to emphasize these topics in nursing curricula to improve performance in pediatric nursing, communication with children, and pain management, and to strengthen the management of pediatric pain.

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Declaration of interest

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Figure legends

Figure 1: Observed use of pain assessment tools by nurses per patient age group

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