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Pediatric Nurses' Cognitive Representations of Children's Pain

Catherine Van Hulle Vincent, RN, PhD [Assistant Professor, Department of Women, Children, and Family Health Science]¹, Diana J. Wilkie, PhD, RN, FAAN [Professor, Harriet H. Werley Endowed Chair for Nursing Research, Director, Center for End-of-Life Transition Research Department of Biobehavioral Health Science]¹, and Laura Szalacha, Ed.D [Associate Research Professor]²

¹College of Nursing, University of Illinois at Chicago, Chicago, IL 60612

²College of Nursing and Health Innovation, Arizona State University, Tempe, AZ 85287

Abstract

The aim of this mixed methods exploratory study was to describe pediatric nurses' cognitive representations (CRs) of the assessment and management of children's pain and to determine the relationships between their CRs and their choices about pain assessment and morphine administration. We recruited a convenience sample of 87 nurses caring for hospitalized children at four institutions. We measured the CRs with the Conceptual Content Cognitive Map (3CM) technique and pain assessment and morphine administration with smiling and grimacing child vignettes. We used content analyses for the 3CM data and fit logistic regression models to predict participants' analgesic choice for each vignette. Nearly all (91%) participants identified the child's behavior as an assessment approach; 48% indicated it as most important. Participants (92%) identified pharmacologic as a management approach; 47% indicated it as most important. Participants' CRs did not predict assessment or morphine administration choices. Significantly more participants choose the appropriate analgesic response for the grimacing child than did for the smiling child. Nurses with more years of pediatric experience were less likely to select administration of the appropriate morphine dose. The 3CM method provided insights into nurses' thinking about pain that are indicative of gaps, which may be amenable to interventions.

Keywords

Children; pain; nursing; assessment; management; cognitive representations

In spite of the importance, we do not know how nurses assess children's pain and make choices about analgesic administration. We do know from research that substantial numbers of hospitalized children report moderate to high levels of pain^{3, 13, 18, 20, 23, 31, 32, 36, 40} and that nurses consistently administer analgesics to children in amounts that were less than those available by physician order^{8, 12, 14, 19, 32, 37, 40} and recommended by national standards.^{12, 13, 37, 40} To identify and better understand influences on pain-related practices, the purpose of

Corresponding author: Catherine Vincent, Phone 312 355 3283, FAX 312 996 8871, vincentc@uic.edu.

Perspective: Findings are from an innovative, unique measure of nurses' knowledge and beliefs about the complex phenomenon of children's pain management. Extensive details about the thought processes of pediatric nurses regarding pain assessment and management surfaced through this analysis, which provide excellent information for direction of future research and practice innovations.

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this study was to examine pediatric nurses' cognitive representations of the assessment and management of children's pain.

In studies of pediatric nurses' knowledge and attitudes regarding pain, one striking finding was that 55% to 90% of nurses believed that children over-reported their pain.^{26, 38} The single most reliable indicator of the existence and intensity of acute pain in individuals able to verbally communicate is the patient's self-report.⁵ If nurses fail to believe children's self-reports of pain, it is unlikely that they will take appropriate action to relieve children's pain. Unrelieved pain can have profound deleterious effects on the cardiovascular, pulmonary, immunological, and nervous systems and can alter children's responses to pain later in life.^{6, 28, 34, 35} The American Academy of Pediatrics (AAP) and American Pain Society (APS)¹ attribute the lack of effective pain management to myths and insufficient knowledge of caregivers, and inadequate application of knowledge.

Cognitive representations (CRs) are the orderly cognitive structures resulting from experiences, that embody an individual's beliefs and misconceptions, guide the interpretation of incoming information, and influence behavior.^{21, 22} In a pilot study with 20 pediatric nurses, Van Hulle Vincent³⁹ found that when nurses were thinking about assessing children's pain, 35% did not include self-report in their cognitive representations and 20% did not consider the child's behavior. Regarding pain management, 25% of nurses did not report thinking about pharmacologic approaches to relieve children's pain and 40% did not include nonpharmacologic approaches. Based on a comparison of nurses' choices of morphine doses in vignettes, results were suggestive that there may be a relationship between nurses' CRs and their choice of a morphine dose for a smiling child reporting pain.³⁹

If nurses' pain management behaviors can be predicted from their CRs, then interventions (e.g., educational, unit culture changes, policy changes) can be tailored to correct misconceptions which could lead to a change in practice. This study builds on the extant literature on nurses' knowledge and attitudes about pain management for children and extends study of nurses' knowledge and attitudes with an innovative and unique strategy to better understand nurses' thinking about this complex phenomenon.

The specific aim for this study was to describe pediatric nurses' cognitive representations of assessment and management of children's pain and determine the relationship between their cognitive representations and their choices about pain assessment and morphine administration. We predicted that measurement of nurses' CRs could explicate information about nurse's individual knowledge structures, gaps in knowledge, and misconceptions about assessing and managing children's pain likely to influence their pain management behaviors. Specifically, we predicted that information about nurses' CRs could elucidate why some nurses do not believe children's self-report of pain intensity and reasons why they do not administer adequate analgesics to relieve children's pain. [Preliminary findings from this study were presented (abstract) at the 2007 APS meeting.⁴²]

Materials and Methods

Because so little is known about nurses' cognitive representations of assessment and management of children's pain, a descriptive and exploratory design was most appropriate to address the study aim. The Institutional Review Boards at the University of Illinois at Chicago and all referral institutions approved the study.

Participants

Recruitment—The first author recruited pediatric nurses via individual/group meetings on hospital units and email contact. A one-hour appointment was scheduled at each nurse's

convenience during which the first author informed participants of the study purpose, requirements, potential risks and benefits, and rights as a volunteer, obtained written informed consent and conducted an interview to measure participants' CRs of assessment and management of children's pain. Participants then responded to two case study vignettes and provided demographic information. The appointments were held outside of working hours in a space in the hospital away from the unit, or in a more convenient mutually agreed upon location. Nurses were compensated for their participation with a \$20.00 gift card to a local store.

Sample Characteristics—Nurses were invited to participate if they were registered nurses (RNs) working at least 20 hours per week on any shift on an inpatient general care unit and had at least one year of current experience as a pediatric nurse. Nurses working exclusively with infants or in critical care units were excluded because the nature of pain management for infants and critically ill children is different from that of the general hospitalized pediatric population and beyond the scope of this study.

We recruited a convenience sample of 87 RNs caring for hospitalized children in the Midwest at the following locations: four units at one large urban children's hospital (68%), two pediatric units in two suburban hospitals (18%), one pediatric unit in an urban university-based hospital (9%), and graduate student-nurses (5%). Neither the investigators nor the research assistant had any established relationships with the nurses from the hospital units; three of the four graduate student-nurses were known by the investigator. These nurses cared for at least 1 to 5 children in pain per week with most (69%) caring for six or more children per week. Participants reported caring for children with pain from surgery/trauma (90.8%), sickle cell disease/cancer (49%), and procedures (66.7%). Participants' mean age was 31.9 ($SD = 8.9$) years and their mean years of pediatric experience was 6.9 ($SD = 7.5$). Most were female (95%) and prepared with a Bachelor of Science in Nursing degree (83.9%), Associate Degree (9.2%), Diploma (3.4%), or Masters in Nursing/Science (3.4%). They identified their race/ethnicity as White/Caucasian (71.3%), Asian (11.5%), Black/African American (8%), other (6.9%), or not reported (2.3%). The participants did not significantly differ in any of these characteristics by recruitment site. A sample of 87 provided .95 power to detect medium sized effects ($\lambda = 20$) for contingency table analysis; .83 power to detect medium sized effects ($\rho = .3$) for correlations at $\alpha = .05$; and .74 power to detect a large effect (Odds ratio 1.8) for one-tailed z-test in logistic regression.⁷

Instruments

Cognitive Representations—We measured the nurses' CRs of children's pain with the Conceptual Content Cognitive Map (3CM) open-ended technique.²² This mapping method permits identification of the most salient features of the participant's knowledge, beliefs, and assumptions and provides a visual display of how this knowledge is organized and conceptualized.²² Researchers demonstrated content validity by the technique's ability to differentiate levels of knowledge based on different levels of expertise.²² Scientists successfully utilized the 3CM method to measure patients' perceptions of breast cancer²⁴ and worry about lung cancer.²⁵ For the current study, content validity of the instrument was supported by review of the 3CM script and process by three expert nurses and previous pilot testing.³⁹

Following Kearney and Kaplan's²² method, we instructed participants to "Think for a moment about the assessment of children's pain. Let's say that you are going to explain your thoughts about assessment of children's pain to a nurse who is unfamiliar with it. What are the things you would tell that nurse about?" We then asked participants to:

1. Please write down a phrase or sentence (each on a separate piece of paper) expressing each thing that you think is important about assessing children's pain.
2. Group/organize your items into categories that make sense to you and provide a short label (word or phrase) for each group that explains why you put those particular items together.
3. Rate the importance of each of your categories (Start with #1 for the most important category, #2 for the next important, etc.). Please assign a different number to each category.
4. Provide a rating of importance for each of your items in the same manner. These instructions were presented sequentially as tasks were completed.

After participants completed their cognitive map of assessment of children's pain, the entire process, step-by-step, was repeated with the prompt, "Think for a moment about the management of children's pain (interventions to relieve pain). Let's say that you are going to explain your thoughts about the management of children's pain to a nurse who is unfamiliar with it..."

We encouraged the participants to add more content items at any time and did not place any constraints on the number of items or organization of items. The first author (principal investigator, PI) or research assistant (RA) assured participants that this was not a test; there were no right or wrong answers.

Case Study Vignettes—Following participants completion of their CRs, we then determined the relationship between pediatric nurses' CRs and their choices about pain assessment and analgesic administration by adapting case study vignettes about children in pain from the Pediatric Nurses' Knowledge and Attitude Survey Regarding Pain.²⁷ We adapted the original case study vignettes by changing the age of the child from a 15-year-old adolescent to a 10-year-old, thus measuring a child's pain rather than an adolescent's pain. We chose a 10-year-old rather than a younger child to represent a child old enough to reliably provide a self-report of pain. We asked participants to respond to two written vignette items concerning assessment and management of pain. In the vignettes, two 10-year-old boys are presented with identical surgical procedures and vital signs; both provide the same self-report of pain rated as 8 on a scale of 0 to 10. One boy exhibits behavioral manifestations of pain (i.e., grimaces); the other boy smiles and is talking and joking with visitors. The vignettes indicated the following information: (a) two hours earlier both children received 2 milligrams (mg) of morphine; (b) since then they both have reported pain levels ranging from 6 to 8; (c) the children identified 2 as an acceptable pain level; (d) neither child experienced any respiratory depression, sedation, or other adverse effects related to the morphine; and (e) the physician's order was for intravenous (IV) morphine, 1 to 3 mg every hour as needed for pain.

For each vignette, we asked participants to respond to two multiple-choice items: (1) rate the child's pain level on a scale of 0 to 10 and (2) indicate how much morphine she/he would administer from options of 0, 1, 2, and 3 mg. Rating of the children's pain level as an 8 was considered the appropriate response because it was in agreement with the child's pain rating. Because both children identified an acceptable pain level of 2 and their pain levels had not reached this goal even after an earlier dose of 2 mg of morphine, the appropriate response for the morphine dose was to administer 3 mg.

Data Analysis

We used both qualitative and quantitative analytic strategies. We used content and descriptive analyses to analyze the written data obtained from the Conceptual Content Cognitive Maps.

³⁰ We examined bivariate relationships with contingency tables, independent t-tests, and correlation analyses. Then, we then fit a series of logistic regression models to the data, predicting participants' analgesic choice for each vignette.

Qualitative data analysis—The data from participants' cognitive maps (categories and content items) were transcribed verbatim onto Excel spread sheets. Using a directed content analysis approach¹⁶ and prior research,³⁹ the first author and her RA independently reviewed nurse-identified categories (Figures 1 & 2, ovals) and content items (Figures 1 & 2, rectangles) and clustered content items into subgroups within pain assessment and pain management domains. We modified or added subgroups as new ideas emerged from the data. Both raters compared findings to identify any overlap, ambiguity, or lack of clarity in domains and subgroups. When data included content items that could be coded in more than one subgroup, we counted the appropriate components of items in all appropriate subgroups. The raters discussed findings until they reached consensus. Figure 1 depicts one participant's cognitive map of pain assessment and Figure 2 depicts another participant's cognitive map of pain management. Once we coded data into subgroups, we analyzed subgroups both by number of content items per subgroup and by number of participants' endorsements.

We also used content analysis to determine the presence or absence of content items reflective of standards of practice for assessing children's pain. Because pain is a subjective experience, the AAP and APS¹ recommend assessment of self-report as the primary measure of pain intensity and using behavior to complement self-report or when self-report is not possible. The AAP and APS further recommend that because physical measures usually reflect stress reactions during acute pain and are only tenuously correlated with self-report, they should not be relied on to judge pain levels. Based on these recommendations, we specifically examined participants' pain assessment CRs for self-report, behavior, and physical signs items. Likewise, based on the AAP's and APS's recommendations for the combined use of pharmacologic and nonpharmacologic approaches and family involvement to manage pain, we examined participants' pain management CRs for these items.

Quantitative data analysis—We first examined bivariate relationships with contingency tables, independent t-tests, and correlations. Guided by these findings, we then fit a series of logistic regression models to the data, predicting participants' analgesic choice for each vignette. We began with control variables (e.g., unit, race/ethnicity, age) and then added the two predominant subgroups of assessment and management: self-report versus behavior, and the use of pharmacologic approaches versus nonpharmacologic approaches. We fit exploratory factor analysis models to determine if there were subgroups within the pain assessment and pain management approaches. In addition, we examined groups of participants (i.e., those who chose to administer 3 mg of morphine in both the grimacing and smiling child vignettes versus those who chose to administer less or no morphine at all; older versus younger cohort, etc.) to see if they differed systematically from each other. We conducted all quantitative analyses with SPSS 16.0 (SPSS Inc., Chicago, IL).

Results

Assessment Content Items: Type, Frequency, and Importance

In their cognitive representations (cognitive maps) of assessment of children's pain, the 87 participants conveyed a total of 993 content items coded into 15 subgroups. Participants identified 4 to 25 items ($M = 10.59$, $SD = 4.88$) in 2 to 12 subgroups ($M = 6.0$, $SD = 2.07$). Table 1 shows examples of assessment subgroups, determined by the number of content items per subgroup, by number of endorsements per subgroup, and examples of participants' content items. *Number of items per subgroup* indicates the number of times participants' content items

were coded into a specific subgroup; for example in the case of behavior, 214 of nurses' total 993 map items were coded as behavior. *Number of endorsements* indicates the number of participants who included content items in a specific subgroup in their maps. Items in seven subgroups (behavior, self-report, age/developmental level, scale, physical signs, type/source of pain, parent involvement) accounted for 76.2% of the total 993 assessment content items; the other eight subgroups accounted for the remaining 23.8% of items with each subgroup contributing $\leq 5\%$. Nearly 50% of participants endorsed items in the seven major subgroups.

Analysis of importance scores revealed 47.7% of 86 participants' ranked behavior as the most important assessment approach. Behavior was followed in importance by self-report (29.1%), self-report plus behavior (with or without physical signs) (12.7%), physical signs only (5.8%), behavior plus physical signs (3.5%), and none of the above (1.2%).

Management Content Items: Type, Frequency, and Importance

As with assessment, participants conveyed plentiful and varied data in their CRs of management of children's pain. Participants conveyed a total of 649 management content items coded into 13 subgroups. Participants identified 1 to 22 items ($M = 7.44$, $SD = 4.2$) in 1 to 7 subgroups ($M = 3.84$, $SD = 1.4$). Table 2 shows the management subgroups, determined by the number of content items per subgroup, by number of endorsements per subgroup, and examples of participants' content items. Four subgroups (nonpharmacologic-cognitive behavior, pharmacologic, nonpharmacologic -physiologic, health care provider/pain team) accounted for 79% of the total 649 management content items; the other nine subgroups accounted for the remaining 21% with each contributing $< 5\%$. The four major subgroups, except for health care provider/pain team, were endorsed by more than 70% of participants.

Analysis of importance scores revealed 46.5% of 86 participants ranked pharmacologic as the most important pain management approach. Pharmacologic approaches were followed in importance by nonpharmacologic (41.9%), both pharmacologic and nonpharmacologic (8.1%), and neither pharmacologic nor nonpharmacologic (3.5%) approaches.

Congruence of Assessment/Management Items and Standards

When participants' CRs were compared with the AAP and APS recommendations¹ that self-report is the primary measure of pain intensity for children who are able to provide a self-report (cognitively intact and verbally communicative), behavior should be used to complement self-report or when self-report is not possible, and physical measures should not be relied on to judge pain levels, we found that for the assessment of children's pain, 71 participants (81.6%) included self-report items in their CRs whereas 90.8% included behavior. Sixty-three participants (72.4%) included both self-report and behavior items in their maps. Physical signs were included by 58.6% of participants.

Similarly, when participants' CRs were compared to the AAP and APS recommendations¹ for the combined use of pharmacologic and nonpharmacologic approaches with family involvement to manage pain, only 11 (12.6%) of the participants' maps included all three recommended approaches-. However, 76 participants (87.4%) did include both pharmacologic and nonpharmacologic approaches.

Relationship between CRs and Assessment/Morphine Choices

In response to pain assessment in the vignettes, most participants agreed with both the smiling and grimacing children's self-report of pain (8 on a scale of 0 to 10); 88.5% agreed with the grimacing child and 72.4% agreed with the smiling child. Regarding morphine administration, a statistically significant larger proportion of the participants chose to administer the appropriate 3 mg of morphine to the grimacing child (64 participants, 73.6%) than chose to

administer the appropriate 3 mg of morphine to the smiling child (36 participants, 41.4%) ($\chi^2_{(df=2)} = 42.7, p < .001$). Table 3 shows participants' assessment and management choices for the children.

In bivariate analyses, there were no significant differences in the participants' pain assessment for the smiling child or for the grimacing child based on their (1) hospital, (2) unit, education level, (3) race/ethnicity, (4) religion, (5) whether they had children, or (6) whether they had ever experienced severe or chronic pain themselves or had children, other family members, or close friends with severe or chronic pain. There were two significant predictors of participants' analgesic administration: (1) agreement with the patients' own pain assessment; and (2) experience in pediatric nursing.

When the participants' own pain assessment agreed with the child's self-report in each vignette, the correct analgesic dose was often chosen. For the smiling child, of the 36 participants who chose to administer 3 mg of morphine, 91.7% agreed with the child's self-report of pain ($\chi^2_{(df=1)} = 11.4, p < .001$). For the grimacing child, of the 64 participants who chose to administer 3 mg of morphine, 95.3% agreed with the child's self-report of pain ($\chi^2_{(df=1)} = 11.0, p < .001$). On the other hand, of the 63 participants who agreed with the smiling child's self-report of pain, 30 participants (47.6%) still did not choose to administer the full dose of analgesic. And, of the 77 participants who agreed with the grimacing child's self-report of pain, 16 participants (20.8%) still did not choose to administer the full dose of analgesic.

Participants who correctly chose to administer 3 mg of morphine in both vignettes had significantly fewer years experience in pediatric nursing ($M = 5.0, SD = 4.4$) than did those who indicated under-medicating ($M = 8.2, SD = 8.9, t = 1.95, p = .054$). There were no other significant differences in medication administration.

In bivariate analyses focused on the participants' pain assessment and management cognitive representations, neither self-report of pain nor behavior (assessment items) nor pharmacologic or nonpharmacologic approaches (management items) were significant predictors of pain assessment for the smiling child or for the grimacing child or participants' analgesic administration for either vignette. These bivariate findings were reified in logistic regression analyses of participants' analgesic choices with congruent (i.e., grimaces) and discordant (i.e., smiles) behavioral manifestations of pain. The only significant predictor of the administration of 3 mg of morphine (appropriate response) for both the smiling and grimacing vignettes in the regression models was the participants' own pain rating for each child (congruent OR: 3.47, 95% CI = 1.32 – 9.16; discordant OR: 1.69, 95% CI = 1.19 – 2.40).

During the conduct of this study, we also learned that one of the institutions at which most of the participants worked had a pain management policy that may affect pain management decisions. The policy directs nurses to record vital signs, oxygen saturation, and level of consciousness (LOC) at baseline and every 15 minutes for one hour after administering an opioid IV bolus dose. The other three institutions did not have such a policy.

Discussion

Our innovative mixed methods approach provided rich data to describe nurses' thinking about pain and their simulated pain assessment and management practices, but disappointingly we were unable to find a relationship between the nurses' thinking and their practices. In fact, the only predictor of their practices was the length of time they had worked as pediatric nurses. Our findings, however, show complexity in nurses' assessment and management of children's pain and provide insights to guide intervention development.

Our finding that behavior was a frequent and important assessment item in the nurses' CRs indicates a major knowledge gap. In an earlier pilot study of CRs,³⁹ nurses also endorsed behavior more frequently than self-report for assessment of children's pain. In an additional study in which nurses were asked to talk about a smiling and joking child with a pain level of 8 in a vignette,⁴¹ nurses reported that when the child's pain rating did not agree with the child's other signs such as behavior (smiling/laughing/joking), they often relied on the child's behavior to judge pain intensity and to administer morphine. Taken together, these findings indicate that in contrast to the AAP and APS¹ recommendations, nurses did not identify self-report as the primary measure of pain intensity for children who were able to provide a self-report but rather relied on behavior to validate pain. It is known that children's self-report is not always in agreement with children's manifested behavior and in fact some children experiencing moderate to severe pain do not demonstrate any behavioral manifestations.^{4, 9, 36} If nurses believe that behavior or change in vital signs are the primary measures of pain intensity rather than self-report, it is unlikely that they will administer analgesics based on the child's self-report and the child is then at risk to experience unrelieved pain.

Our finding that 4 out of 10 participants rated nonpharmacologic pain management approaches alone as most important indicates an additional knowledge gap and may indicate that the nurses were not comfortable administering analgesics, particularly opioid analgesics.

Pharmacotherapy is the mainstay of management of acute and cancer pain^{1, 2} and nonpharmacologic approaches are intended to supplement, not substitute for, pharmacologic techniques.⁵ In prior research of nurses' knowledge and attitudes about children's pain, nurses frequently scored incorrectly on items regarding recommended analgesic types and administration routes, incidence of adverse effects (e.g., respiratory depression), and titration.^{26, 33, 38} In the previous study of nurses' thinking in response to vignettes on administering analgesics, the investigators⁴¹ found that nurses demonstrated misconceptions about opioid pharmacokinetics and unwarranted concerns about the adverse effects of morphine. Taken together, these findings suggest that nurses may not choose to administer an analgesic as the primary treatment for a child in pain.

The institutional policy directing frequent monitoring of vital signs and oxygenation for an hour after an opioid IV bolus may have influenced whether or not participants from this institution chose to administer morphine in the vignette and may in part explain why some nurses identified more nonpharmacologic than pharmacologic approaches. This focus on vital signs after administration of an opioid may also have provided an unintended focus on vital signs overall in the management of pain.

It was evident from participants' responses to our questions about developing one cognitive map for pain assessment and one cognitive map for pain management that these concepts are not two distinct entities in nurses' minds. The boundary between assessment and management was not always clear. A number of participants included assessment items in their management maps and vice versa. This finding suggests that pain assessment and management are not necessarily linear steps in a process but more cyclic in nature.

It is encouraging that the majority of nurses in this study rated both the smiling and grimacing child's pain intensity consistent with the child's ratings of pain. Nurses did, however, agree more often with the grimacing child than the smiling child; these results support the findings of earlier research.³⁸ However, not all participants who agreed with the child's self-report administered 3 mg of morphine. The finding that only 4 out of 10 nurses chose the appropriate analgesic response for the smiling child, to administer 3 mg of morphine, is less appropriate than those of a previous study in which 7 out of 10 nurses said they would administer 3 mg.³⁸ This finding further supports the possibility that the nurses were not acting on the child's self-report and suggests that nurses lacked knowledge about optimal administration of

analgesics. Taken together, these findings indicate that although pain assessment of children's self-report is necessary, assessment alone is not sufficient to improve nurses' pain management practices. Assessment must be followed by the administration of a sufficient amount of analgesics to relieve children's pain which requires nurses to be knowledgeable about the validity of self-report, effects of unrelieved pain, use of opioids, and opioid kinetics.

Our finding that nurses with fewer years of experience were more likely to administer the appropriate dose of morphine (3 mg) to both children may be an indication that they have learned and are demonstrating more current and appropriate pain management practices than their older counterparts. This finding contradicts those reported in a similar study by Pederson and Bjerke;²⁹ nurses with more years of experience were more likely to medicate children with lower pain intensities than nurses who had recently graduated. Where as, Van Hulle Vincent and Denyes⁴⁰ found no significant relationship between nurses' years of practice and analgesics administered in actual practice. As can be seen in these studies with pediatric nurses, results are inconsistent. More investigation of this relationship is needed.

Using Kaplan and Kaplan's theory of cognitive representations,^{21, 22} we predicted that measurement of nurses' CRs could explicate information about nurse's individual knowledge structures, gaps in knowledge, and misconceptions about assessing and managing children's pain. This theory was supported in this study for its ability to explicate nurses' knowledge and misconceptions about assessing children's pain (e.g., validity of self-report for measurement of pain) and managing pain (e.g., use of pharmacologic versus nonpharmacologic approaches). We were able to elucidate some reasons why nurses do not believe children's self-report of pain intensity (e.g., behavior, such as grimacing, was an important indicator of pain intensity).

Limitations of this study included the relatively small sample and measurement issues related to the vignettes and cognitive mapping. Although our sample was large for most qualitative research, low power may have prevented us from identifying relationships between nurses' CRs and their morphine administration choices. Although utilizing vignettes is an economical and useful way to collect valuable data about attitudes and beliefs, they cannot completely capture reality.¹⁷ A limited view of children's pain was depicted in the vignette; use of newer technologies such as a colored photograph of children in pain¹¹ or virtual human technology¹⁵ may have provided a more complete view of a child in pain and netted different results. The child's age in the vignette was ten years. If an older child was represented, nurses may have been more likely to agree with the child's self-report of pain and if the child was younger, less likely to agree. Caution must be exercised in the interpretation and generalization of the findings as CRs captured nurses' thinking at one point in time while the assessment and management of pain is a dynamic process. Furthermore, one contributor to our inability to find significant relationships between nurses' CRs and their morphine administration choices may have been due to the fact that our questions of nurses about their CRs were general in nature, that is, we asked nurses to tell us about their thoughts about children's pain, not any particular type of pain. In contrast, the vignettes depicted a boy with postoperative pain. If we had matched the type of pain in the CRs questions and vignettes, we may have found different results.

The strengths of this study include the use of a mixed methods approach and a new and innovative measure of nurses' beliefs and misconceptions about assessing and managing children's pain. Extensive details about the thought processes of pediatric nurses regarding pain assessment and management surfaced through the qualitative aspect of this mixed methods approach; we were then able to code and categorize these cognitions and compare them with vignette-based pain management choices in the quantitative aspect of our research.

Although the findings from this study do not provide sufficient evidence for extensive recommendations for pain management practice, education, and research, when combined with

prior research, suggestions can be made. Nurses should become more aware of their biases to rely on behavior rather than self-report when judging children's pain intensity. Nurses need to improve their knowledge of current recommended analgesic administration practices. Educational interventions need to be developed to provide nurses with the necessary information to fill their knowledge gaps particularly about use of self-report as a valid measure of children's pain intensity as well as the appropriate use of pharmacologic approaches to relieve children's pain. The culture of patient-care units where nurses work must be changed so that children able to self-report pain are provided with analgesics sufficient to relieve their pain and with outcomes measured by self-report. Also, following recommendations by the American Pain Society,¹⁰ approaches addressing all health care providers as well as health care organizations and patients (children and families) must be developed to improve the quality of pain management. Researchers must test the effectiveness of interventions on changes in nursing pain management practices and children's pain outcomes.

In summary, our innovative mixed methods approach using the 3CM measure provided insights into nurses' thinking about children's pain indicative of gaps in their knowledge, particularly about the validity of self-report as a measure of pain intensity and the appropriate use of analgesics to relieve children's pain. These insights provide the foundation for further interventions to improve children's pain relief.

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Figure 1. Example of One Nurse's Cognitive Representation (Cognitive Map) of Pain Assessment
Ovals indicate participant-defined categories. Rectangles indicate content items in participant's own words. Numbers indicate participant-defined importance ratings.

Figure 2. Example of One Nurse's Cognitive Representation (Cognitive Map) of Pain Management
Ovals indicate participant-defined categories. Rectangles indicate content items in participant's own words. Numbers indicate participant-defined importance ratings.

Table 1

Participants' Content Items Coded into ASSESSMENT Subgroups by Number of Items and Number of Endorsements per Subgroup

ASSESSMENT SUBGROUPS* CODED BY INVESTIGATOR	# (%) ITEMS N = 993	# (%) NURSES N = 87	EXAMPLE CONTENT ITEMS IN NURSES' OWN WORDS
Behavior	214 (21.6%)	79 (90.8%)	Posture; guarding Facial expression General appearance
Self-report	128 (12.9%)	71 (81.6%)	Kids that can speak...it is what they say it is Believing patient's pain Ask if they are in pain
Age/developmental level	123 (12.4%)	59 (67.8%)	Consider the child's age We need to assess developmental stage Use age-appropriate scale
Scale	92 (9.3%)	57 (65.5%)	Ask on a scale or 1–10 FLACC scale Use age-appropriate scale
Physical signs	74 (7.5%)	51 (58.6%)	Any change in vital signs Color Look at physical...cues
Type/Source of pain	73 (7.4%)	43 (49.4%)	Type of pain: Incisional, location, length of time Acute vs chronic Consider diagnosis
Parent involvement	53 (5.3%)	46 (52.9%)	Parent perception and input on pain Ask parents what they think Parent assessment

* Other subgroups included: child's acceptable level of pain, behavior/physical signs do not match self-report, general assessment, individual characteristics, psychological factors, nursing judgment, reassessment, what has helped in the past.

Table 2

Participants' Content Items Coded into MANAGEMENT Subgroups by Number of Items and Number of Endorsements per Subgroup

MANAGEMENT SUBGROUPS* CODED BY INVESTIGATOR	# (%) ITEMS N = 649	# (%) NURSES N = 87	EXAMPLE CONTENT ITEMS IN NURSES' OWN WORDS
Nonpharmacologic -cognitive behavior	183 (28.2%)	72 (82.8%)	Distract with toys, games, activities Gentle touch Guided imagery
Pharmacologic	168 (25.9%)	80 (92.0%)	Don't be afraid to use narcotics Give pain medication Relieve side effects of pain meds
Nonpharmacologic -physiologic	122 (18.8%)	62 (71.3%)	Heat or cold packs Reposition Massage
Health care provider/pain team	40 (6.2%)	26 (29.9%)	Discuss options with MD Consult pain team Don't be afraid to call doc/service

* *Other subgroups* included: advocate for child, child's age/developmental level, documentation, education (parent and child), general management approach, goal of intervention, nonspecific nonpharmacologic, parent involvement, timing of intervention.

Table 3Participants' Assessment and Morphine Administration for Children in Vignettes ($N = 87$)

	PARTICIPANT RESPONSE	
	FOR SMILING CHILD	FOR GRIMACING CHILD
ASSESSMENT	# (%)	# (%)
9–10	0	0
8 ^a	63 (72.4%)	77 (88.5%)
7	1 (1.1%)	4 (4.6%)
6	5 (5.7%)	2 (2.3%)
5	1 (1.1%)	2 (2.3%)
4	5 (5.7%)	2 (2.3%)
3	6 (6.9%)	0
2	6 (6.9%)	0
0–1	0	0
MORPHINE ADMINISTRATION		
3 mg ^b	36 (41.4%)	64 (73.6%)
2 mg	12 (13.8%)	14 (16.1%)
1 mg	23 (26.4%)	8 (9.2%)
None	16 (18.4%)	1 (1.1%)

^aChild's reported pain intensity^bAppropriate response