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PICU Nurses' Pain Assessments And Intervention Choices for Virtual Human And Written Vignettes

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Abstract

The purpose of this concurrent mixed-methods study was to 1) examine the factors pediatric intensive care unit nurses consider when assessing and intervening for children who report severe pain and to 2) determine the effect of child behavior and diagnosis on the nurses' pain ratings and intervention choices for written and virtual human vignettes. Quantitative and qualitative results substantiated that despite recommendations to use self-report, many PICU nurses use behavior as the primary indicator to assess and treat pain, even when a child is old enough to articulate pain intensity and there is sufficient cause for pain to be present.

Keywords

acute pain; hospitalized child; pediatric nurse; pediatric intensive care; patient simulation; knowledge use in pain care

Children in pediatric intensive care units (PICUs) continue to experience pain that is moderate to severe in intensity (Agarwal et al., 2010; Grant, Scoppettuolo, Wypij, Curley, & Team, 2012; Groenewald, Rabbitts, Schroeder, & Harrison, 2012; Larsen, Donaldson, Parker, & Grant, 2007), even though many (82.2%) pain events of this severity have been

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deemed preventable (Agarwal et al., 2010). Nurses play an important role in identifying and treating pain in children who are critically ill. Yet, PICU nurses are challenged to manage pain in a complex population of children with varying ages, cognitive abilities, levels of acuity, and diagnoses (Riley, Poss, & Wheeler, 2013; Turner, 2005). For this reason, interventions to improve the management of children's pain likely cannot be a “one-size fits all”. An understanding of nurses’ assessment and treatment considerations for different PICU populations is needed to guide interventions that will improve the management of pain in children who are critically ill.

PICU Nurses’ Pain Management

Though over a decade of research indicates that PICU nurses rely heavily on behavioral and physiological factors to assess and manage pain (Coffman et al., 1997; Curley et al., 1992; Mattsson, Forsner, & Arman, 2011; Pederson & Bjerke, 1999; Ramelet, 1999; Staveski et al., 2014), little research specifically addresses nurses’ considerations for children able to self-report pain or how nurses’ choices may vary for children with differing diagnoses. Pederson and Bjerke (1999) identified a need for PICU nurses to focus more on patients’ self-report when assessing and treating pain and noted high variability in the use of self-report to guide analgesic administration. Nurses in one study used medical diagnosis as a cue for pain in critically-ill children (Ramelet, 1999) and in another, identified more pain indicators for children admitted for trauma or surgery than children of other diagnoses (Coffman et al., 1997). Whether diagnosis influences PICU nurses’ choices for pain interventions has not been previously studied.

PICU nurses’ have most frequently reported using vital signs to assess and choose interventions for pain (Coffman et al., 1997; Curley et al., 1992; Ramelet, 1999). However, recommendations for the assessment of pain give little weight to the use of physiologic measures (American Academy of Pediatrics. Committee on Psychosocial Aspects of, Family, Task Force on Pain in Infants, & Adolescents, 2001; Herr, Coyne, McCaffery, Manworren, & Merkel, 2011). Vital sign changes are not specific to pain in critically ill children (may result from medications or other sources of physiologic or psychological distress) (Carnevale & Razack, 2002; Curley et al., 1992) and have demonstrated weak and highly variable associations with other measures of pain in children including behavior and self-report. It is speculated that PICU nurses rely on vital signs due to their care of children who are continuously monitored, mechanically ventilated, and sedated (Pederson & Bjerke, 1999; Pederson, Matthies, & McDonald, 1997). However, as few as 30% of PICU patients are reported to be intubated and mechanically ventilated (Khemani, Markovitz, & Curley, 2009); only 3 of the 25 children in Coffman et al.'s (1997) study were intubated and 68% were preschool age or older; yet nurses identified the child's verbalization of pain as an indicator to administer analgesics in just one third of observations. Because a number of children in PICUs may be able to verbalize pain, further evaluation of nurses’ pain assessment and intervention choices for this population is warranted. Additionally, to improve unrelieved pain, understanding nurses’ choices to withhold analgesics may be equally as important as understanding indicators to intervene.

Purpose/Aims

The purpose of this concurrent mixed-methods study was to examine PICU nurses' assessment and intervention choices for children who report severe pain. Of specific interest was the effect of behavior and diagnosis on the nurses' choices. A surgical diagnosis and a diagnosis of sickle-cell vaso-occlusive crisis were chosen for use in this study because both of these pediatric populations are noted to experience moderate to severe pain in the hospital (Beyer, 2000; Groenewald et al., 2012; Jacob et al., 2007; Jacob & Mueller, 2008; Kozlowski et al., 2014; Zempsky et al., 2008). This study was innovative in the use of both written and virtual human (VH) vignettes (computer-generated patient scenarios) to elicit nurses' responses. Therefore a secondary purpose was to determine the effect of vignette type (VH and written) on the nurses' choices.

The aims of this study were to:

1. Identify the factors PICU nurses consider when they assess and choose interventions for children reporting severe pain.
2. Determine the effect of child behavior (smiling, grimacing) and diagnosis (post-operative, sickle cell vaso-occlusive crisis) on PICU nurses' pain ratings and pain intervention choices for written and VH vignettes.
3. Compare the factors considered by nurses with opposing choices (those who agreed with the child's pain rating/chose an increased analgesic dose versus those who disagreed with the child's pain rating/chose no analgesic dose).

Theoretical Framework

The theoretical framework used for this study is the Knowledge Use in Pain Care (KUPC) conceptual model (Latimer, Ritchie, & Johnston, 2010). The KUPC addresses nurses' delayed use of pediatric pain management research results in clinical practice. The KUPC authors describe the main theoretical concepts as *child*, *nurse*, *organizational*, and *sociopolitical* factors (see Table 1). These factors are proposed to influence nurses' knowledge use and ultimately the *pain care outcomes* of pain assessment, management, and documentation (Latimer et al., 2010). Because the KUPC incorporates individual nurse characteristics within the context of the environment in which the nurse practices, it allows for a more comprehensive understanding of pain assessment and intervention choices. Components of the KUPC model specifically addressed in this study include: nurse (education, experience, and critical thinking), child (age and acuity/diagnosis), and pain care outcomes (nurses' pain ratings and intervention choices for children in vignettes).

Methods

Design

A concurrent mixed-methods design was used to capture the complexities of nurses' pain beliefs and their pain assessment and intervention choices. Qualitative content analysis of interviews allowed for contextualization of quantitative findings (Ostlund, Kidd, Wengstrom, & Rowa-Dewar, 2011).

Sample

PICU nurses were recruited from two urban Midwest hospitals. Inclusion criteria consisted of registered nurses working at least 20 hours a week for the past year in the PICU. A sample size of 34 was determined by an a priori power analysis to achieve sufficient power for the originally planned statistical analysis, paired samples t-test (alpha 0.05, two-tailed) to detect the calculated effect of 0.5 to 0.87 of behavior (smile and grimace) for nurses' pain ratings and morphine dose administration (Vincent, Wilkie, & Wang, 2010) and a medium (0.5) effect of diagnosis and vignette type. Additionally, the sample size was sufficient to obtain information-rich data from the interviews for qualitative content analysis (Patton, 2002) and to allow for maximal variation in nurse attributes such as years of experience or nursing degree (Neergaard, Olesen, Andersen, & Sondergaard, 2009; Sandelowski, 2000).

Instruments

PICU nurses responded to 3 instruments: a demographic form, the PBPQ, and 4 VH vignettes. The instruments are described below.

Nurse demographics—All participating nurses completed a demographic form that included age, sex, race, ethnicity, highest nursing degree obtained, years of pediatric nursing experience, years of PICU nursing experience, and frequency caring for children in pain for the preceding 3 months.

Pain Beliefs and Practices Questionnaire (PBPQ).—The PBPQ is an instrument with three separate sections: total beliefs, opioid kinetics, and simulated pain management practices (Vincent, Wilkie, & Wang, 2010). PBPQ content validity was confirmed through use of previously validated items and review by nursing experts in pain research (Vincent, Wilkie, & Wang, 2010). Internal consistency of the PBPQ has been reported for the three sections (Cronbach's alpha of 0.83 to 0.85, agreement in repeated items 71to 88.5%) (Vincent, Wilkie, & Wang, 2010). Results from the simulated pain management practices section of the instrument are presented here. For this section nurses read vignettes about children reporting pain, rate each child's pain on a numeric rating scale from 0 to 10, and indicate the analgesic dose they would provide, if any (Vincent, Wilkie, & Wang, 2010).

The PBPQ simulated pain management practice section was adapted for this study with co-authors CV and DW who were developers of the instrument. The adapted vignettes describe 10-year-old boys who report the same pain levels (8 out of 10), and have the same analgesic orders (intravenous morphine 1 to 3 mg as needed every 2 hours). The only variance among the vignettes is the child's facial expression and diagnosis. Two vignettes are of boys in the first day after abdominal surgery; one boy smiles and the other grimaces. The other two vignettes are of boys with sickle cell vaso-occlusive crisis. Similarly, one boy smiles and the other grimaces. Four advanced practice nurses with expertise in care of critically ill children reviewed the adapted PBPQ for accuracy of content and applicability to the PICU. Details regarding this process have been previously reported (LaFond et al., in press).

Virtual human (VH) vignettes.—The four VH vignettes were based on the four adapted PBPQ vignettes. A description of the development and validation of the VH vignettes can be

read elsewhere (LaFond et al., in press). Each VH vignette depicts a boy in the PICU; nurses visualize his current behavior, vital signs, and reported level of pain. An electronic medical record provides information about the child (sex, age, admitting diagnosis, vital signs and pain ratings for the past 2 hours) and the morphine ordered for his pain (dose, route, frequency, and time last dose provided). The patients in the VH vignettes are the same race (African American), sex (male), age (10 years), report the same pain levels (8 out of 10), and have the same morphine order. Like the written vignettes, the only variance among the VH vignettes is the child's facial expression (smiling or grimacing) and diagnosis (abdominal surgery or vaso-occlusive crisis).

Nurses were asked to respond to each VH vignette as if assigned to the care of the child in their PICU. They documented: (a) their rating of the child's level of pain on a numeric pain scale from 0 to 10, (b) if they would intervene for the child's pain, and (c) if so, what intervention(s) they would provide. The nurses' intervention choices were not limited to a dose of morphine; they were encouraged to describe how they would intervene in actual practice. During the interview, nurses were asked what they were thinking about as they chose a rating for each child's pain. Next, they were asked what they were thinking about when making a pain intervention choice. The nurses were encouraged to discuss anything else they felt was important regarding the assessment and management of children's pain.

Data Collection Procedures

Upon approval from the appropriate Institutional Review Boards, nurses were recruited to participate in the study. At an appointment with the principal investigator (first author), consent was obtained and a demographic survey was completed. The nurses were instructed on navigation of the VH vignettes with a practice vignette and then viewed the four study VH vignettes. For each VH vignette, the nurses recorded their rating of the child's pain and any interventions they would provide (open-ended item). Additional details regarding the viewing of the VH vignettes can be found elsewhere (LaFond et al., in press). After viewing all of the VH vignettes, open-ended semi-structured interviews approximately 10 to 20 minutes in length were conducted and audio-recorded. The VH vignettes were available to the nurses for reference during the interview. Lastly, the nurses completed the Pain Beliefs and Practices Questionnaire (PBPQ). Field notes were taken during the appointments.

Analysis

Qualitative content analysis of the interviews was conducted using a directed content analysis approach (Hsieh, 2005). Operational definitions were derived from Latimer, Ritchie, and Johnston's (2010) descriptions of the KUPC (shown in Table 1). Prior to analysis, the clarity of the operational definitions was confirmed with a second pediatric pain researcher. Once accuracy of the interview transcripts was determined, text was analyzed for the presence of the KUPC factors and sub-concepts. Text that did not fit the KUPC model was given a new code and was evaluated for relevance to the KUPC. The principal investigator and another nurse researcher independently coded a subset of interview transcripts to resolve discrepancies in coding and to ensure consistent application of the codes. NVivo software was used to assist with data analysis. Once coding was complete, sub-concepts were analyzed by number of nurses' endorsements. SPSS statistical

software was used to analyze quantitative data. Descriptive statistics were employed to analyze nurses' demographic information, VH vignette responses, and PBPQ results. Bivariate relationships were examined using correlations and paired t-tests. Multifactorial analysis was conducted using multivariate analysis of variance (MANOVA).

Results

Demographic Information

A total of 40 PICU nurses participated in the study. The nurses ranged in age from 22 to 56 years old with a mean age of 34.9 (*SD* = 10.15). Nurses were majority female (92.5%) and identified their ethnicity and race as non-Hispanic and white (77.5%). Ninety-five percent of the nurses reported their highest nursing degree to be at a baccalaureate level (n = 32) or higher (n = 6). The nurses' years of PICU experience ranged from 1 to 29 years (*M* = 9.19, *SD* = 8.7) and all reported caring for children experiencing pain weekly for the past three months.

Factors PICU Nurses Consider When Assessing Pain and Choosing Interventions

Qualitative description of nurses' thinking.—The qualitative codes most frequently identified (present in the transcripts of 50% of nurses or greater in response to the VH vignettes) are described as they relate to the KUPC factors of child, nurse, and organization. No sociopolitical content was identified.

Child: All child codes fell into four categories: diagnosis (sickle cell disease, abdominal surgery), child's pain rating (self-report), behavior (smile, grimace), and vital signs. The most frequently identified child factors described by the nurses for their pain assessment included: smile (82.5%), grimace (75%), self-report (75%), vital signs (72.5%), sickle cell disease (65%), and abdominal surgery (57.5%). The most frequently identified child factors for intervention choices included: sickle cell disease (87.5%), abdominal surgery (87.5%), self-report (67.5%), vital signs (60%), smile (60%), and grimace (56%).

Behavior (smile and grimace): Though the nurses addressed the facial expressions of the smiling and grimacing patients at a similar frequency, their thinking related to the expressions when rating pain contrasted. The grimacing expression was most often discussed as verifying the presence of pain. One nurse comment included, "He does grimace in the observation which leads me to believe that he is in pain". In contrast, the smiling expression was usually a reason for rating the child lower than his reported pain. "Well, he was awake and smiling, so I assess his pain to not be very severe." The nurses similarly differentiated the two expressions when explaining their pain interventions: "I would've still medicated him with something, but I would probably give him a little less because he was smiling" and "...but he grimaced. So because of his facial reaction I gave him a little bit more morphine."

Child's Pain Rating (Self-report): Second to facial expressions, nurses described thinking about the child's current pain rating while assessing pain. Comments were generally brief, such as "if he says 8, I'm putting 8". When making intervention choices, nurses often

described the child's rating as substantiating intervention. One nurse stated, “Obviously an 8 when he's saying his acceptable level is a 2, he needs treatment for his pain. So I would give him morphine”.

Diagnosis: When rating the child's pain the nurses referred to both diagnoses as cause for pain. One nurse stated, “I didn't think his pain was truly an 8 but I figured he did have abdominal surgery, I'm going to give him the benefit of the doubt.” The most prevalent code for intervention choices, diagnosis, was described as a legitimate reason for pain and therefore treatment. For example, a nurse stated “He just had surgery so he's more than likely in some discomfort. So I would've given him morphine.”

Vital Signs: Nurses regularly pointed out the child's normal vital signs as a part of their assessment, making statements such as “vitals were fine”. Often, nurses would add that changes in vital signs were anticipated with pain. One nurse said, “Well, I was just looking at first his vital signs which they were just stable, 80, no increase in heart rate or blood pressure.” In relation to pain management, stable vital signs were most often denoted as reason to discount the severity of pain and to provide lesser treatment. One nurse commented, “... but I wouldn't give him morphine because his vitals are stable.”

Nurse: The most frequent nurse-related codes were consistent with the tasks of critical thinking (an interchange between active thought process and beliefs) and experience. The most common nurse codes regarding factors considered during assessment included beliefs the diagnosis is painful, a noted incongruity of the child's pain rating with other assessment components, beliefs about behaviors as indicators of pain, and the experience of behavioral inconsistencies in children's pain expression. Critical thinking codes were not as prevalent for intervention choices (< 50% of nurses).

Beliefs the diagnosis is painful and beliefs about behavior: Most nurses (70%) expressed beliefs that the diagnoses were painful. Belief statements often precluded with the words “I know” or “I think”. An example includes: “...but I know abdominal surgery is very painful”. More nurses described beliefs for the children with sickle cell disease (50%) than with surgery (35%). Beliefs regarding behavior were also common (62.5%) with pain assessment. These beliefs included the use of behavior to validate pain ratings, the expected behaviors for a child rating a pain of 8, and the belief that children's behavior with pain varies. Quotes include: “...if I'm seeing a child at an 8 or a 9 I guess I would expect him to be squirming, yeah grimacing, maybe even tearing up” and “See, expressions to me, they mean nothing.”

Incongruous pain assessment findings: Inconsistencies were often (65%) noted between a child's pain rating and other assessment indicators, most often the child's pain rating and behavior. When this occurred, nurses weighed the assessment findings with their beliefs to arrive at a pain rating. In example:

> I think even though his vital signs were still – I mean, for a 10-year-old those are probably pretty good vital signs without the elevated heart rate or elevated blood pressure. I guess in my head I'm still thinking sickle cell and a vaso-occlusive crisis and then just thinking chronic pain and that these kids always have it anyway, so

even though they're smiling they may still be in pain. They just may not be physically showing it.

Experience of behavioral inconsistencies: Nurses most often (72.5%) discussed their experiences of children's inconsistent behavior when in pain. The inconsistencies included when two children rate the same number but have differing behaviors and when children rate a higher pain score, but display behavior the nurse believes is incompatible with pain. One nurse stated regarding her experience of patients with sickle cell disease, “they can either show that they're in a lot of pain or they're very stoic in their facial expressions”, And “we definitely do get kids who rate their pain higher than what they actually look like”.

Organization: The organizational subcategories most frequently coded among the nurses were information (access to data and providers) and support (autonomy to act on clinical judgment).

Data: The nurses often (70%) described referring to the child's last documented morphine dose to choose a pain intervention. Sometimes the last dose was given as reason to increase the next dose “...it looked like he had only gotten 2 milligrams at five, so see what 3 milligrams does” or as reason to follow suit “I know that he got 2 milligrams, so I think off the bat I could try to give the exact same thing”. Other nurses described interest in evaluating the patient's pattern of doses over time “...I would look back and see how often he's been getting it. Have we been giving it every two hours on the hour?”

Exchange between nurse and provider: Nurses (52.5%) described contacting a physician or advanced practice nurse to request a different medication for the patient or different mode of delivery (such as patient controlled analgesia). They also described contacting the provider if interventions did not relieve the child's pain. One nurse said: “I would let the doc's know and maybe they want to add something else to it like Toradol.”

Autonomy to act on clinical judgment: The organizational code of autonomy to act on clinical judgment was most often identified (55%) in regards to the “as needed” order for pain medication. Nurses described the ability to provide analgesics and/or increase the dose for the patient because of the order, such as “he has it written so if he needs it then I'll give it to him”.

Nurses’ Choices and the Effect of Behavior, Diagnosis, and Vignette Type

For both the VH vignettes and the PBPQ written vignettes, the nurses’ mean pain ratings and morphine dose choices were higher for the children who were grimacing than for the children who were smiling (see Table 2). Sixteen times (5% of vignettes) a smiling child's pain was rated as zero. None of the grimacing children were rated as zero. For the VH vignettes, nurses chose pharmacologic interventions more often for the grimacing children than the smiling children (see Table 3). Seven times a child was denied treatment of any type (4.4% of vignettes); six times this was for a smiling child. Most (88%) instances in which a nurse chose to only provide a non-pharmacologic intervention were for the smiling

children. For the PBPQ written vignettes, a dose of morphine was chosen for all of the grimacing children; 21 times a nurse chose no morphine for a smiling child.

Because nurses' pain ratings and morphine doses for the VH and PBPQ vignettes were conceptually related and upon preliminary analysis significantly correlated, r (310) = 0.592, p < 0.001, MANOVA was conducted. Nurses' pain ratings and morphine doses were the dependent variables (pain care outcomes) and behavior, diagnosis, and vignette type served as the independent variables in the analysis. Because the Box M test was significant (p < 0.001), Pillai's trace is reported.

Significant multivariate effects were identified for behavior [Pillai's trace 0.18, F (2, 303) = 33.91; $p < 0.001$, $\eta p^2 = 0.18$] and vignette type [Pillai's trace 0.10, F (2, 303) = 15.90; p < 0.001, $\eta p^2 = 0.10$], indicating a statistically significant difference in pain care outcomes between smiling and grimacing children and between children in the VH vignettes and the PBPQ written vignettes. There were no significant multivariate effects for diagnosis. Significant univariate Fs were identified such that grimacing children were rated higher for pain and received more morphine (see Table 4) than the smiling children. And, children in the written PBPQ vignettes were rated higher for pain and received more morphine (see Table 5) than children in the VH vignettes. No interactions between variables were found. Because data screening revealed multivariate normality to be violated, bootstrapped confidence intervals (95%) were computed. No differences in the results were identified, confirming our original MANOVA findings.

Factors Considered by Nurses with Opposing Pain Ratings and Intervention Choices

A matrix was developed, grouping nurses by their VH vignette pain rating and intervention choices. Factors considered by nurses with the most divergent responses were compared. Four nurses rated all children 8/10 for pain and chose an increased dose of morphine (3 mg). Their PICU experience ranged from 4.5 to 29 years and they all reported a baccalaureate degree in nursing. These nurses' qualitative codes were compared to four nurses with the lowest pain ratings, ranging from 0 to 4 ($M = 2.0$, SD 1.83) and the least amount in milligrams of morphine chosen ($M = 0.19$, SD 0.75). The lower-rating nurses' PICU experience ranged from 2.5 to 25 years and nursing degrees included diploma (1), baccalaureate (2), and masters (1). These nurses chose an analgesic for 7 of 16 vignettes. Ibuprofen or acetaminophen was chosen most often (6 of 7 vignettes); morphine was chosen once.

"...pain is what they say it is and not what we think it is"—Nurses with the highest pain ratings all considered the child's self-report when rating his pain. When choosing the morphine dose of 3mg, these nurses all noted the lack of adequate relief the patient had from the previous 2mg dose. They mentioned the child's pain intensity ranging from 6 to 8 for two hours and his pain goal score of 2. More often, when vital signs were described they were discussed in the context of safe medication administration—that the morphine could be provided because the blood pressure and respiratory rate were stable. These nurses rarely discussed child behavior.

"...they said 8, I picked zero, they didn't look like it"—Nurses with the lowest pain ratings all described behavior and vital signs as factors they considered when rating pain. Smiling, "only one grimace", and "looking around" were behaviors that the nurses identified as cause to discount the child's pain rating. All of the nurses described the child's stable vital signs as inconsistent with pain. This same rationale was provided for their intervention choices. These nurses anticipated more extreme pain behaviors such as "constant screaming and crying," "hunched over," and "clenched fists" for a child rating pain 8 out of 10. Three of the four nurses described both diagnoses as painful conditions.

Discussion

The purpose of this study was to examine the factors PICU nurses consider when assessing and intervening for children who report severe pain and to determine the effect of child behavior (smiling, grimacing), and diagnosis (post-operative, sickle cell) on the nurses' pain ratings and morphine dose choices among vignettes (written and VH). Our findings present the complexity of the PICU nurses' considerations and the variability of their choices when managing pain. Quantitative and qualitative results substantiated that despite recommendations to use self-report (American Academy of Pediatrics. Committee on Psychosocial Aspects of et al., 2001; Herr et al., 2011), many PICU nurses use behavior as the primary indicator to assess and treat pain, even when a child is old enough to articulate pain intensity and there is sufficient cause for pain to be present. The nurses' use of physical findings (behavior and vital signs) to verify pain is consistent with reports over the past twenty years for PICU nurses (Coffman et al., 1997; Curley et al., 1992; Mattsson et al., 2011; Pederson & Bjerke, 1999) and pediatric nurses in other acute-care settings (Staveski et al., 2014; Vincent & Gaddy, 2009; Vincent, Wilkie, & Szalacha, 2010)

During the interviews, one quarter of nurses did not mention the child's self-report as a consideration when rating his pain and over one-third did not consider self-report when choosing a pain intervention. If behavior and/or vital signs seemed incongruous with the child's pain rating, many nurses described thinking about the assessment findings, the child's pain rating, and their beliefs to make a choice. These results support the KUPC proposition of the influence of nurses' critical thinking on pain care outcomes (Latimer et al., 2010). This proposition is further supported in the comparison of extremes: nurses who rated children the lowest for pain and provided the least amount of analgesia considered different factors (vital signs and behavior) than nurses who agreed with the child's pain rating and chose to increase the morphine dose (self-report and goal scores for pain). Our findings are similar to Mattsson, Forsner, and Arman's (2011) results regarding PICU nurses' perspectives on the expression of pain in children who are non-verbal, where nurses were either measure-oriented (measurable parameters most reliable indicator of pain) or patient-oriented (focus on child's communication of pain, child as a whole).

The impact of the nurses' use of vital signs and behavior over self-report was evident in their pain ratings and intervention choices. More often the nurses rated the children lower for pain than the child's self-report of 8 and chose a lesser intervention than provided previously, even though the child reported pain for two hours since the last morphine dose and additional morphine was available by order. Children who were smiling children were

rated significantly lower for pain and received less morphine than children who were grimacing. Only smiling children had their pain rated zero and in most cases when a nurse chose no treatment or a non-pharmacologic treatment only, the child was smiling. The nurses' sole choice of non-pharmacologic interventions for one fifth of VH vignette patients is contrary to prior research in which pediatric and PICU nurses most often answered questions correctly regarding non-pharmacologic interventions—agreeing that children can be distracted and still feel pain and that non-drug techniques should be used in combination with pain medications (Habich et al., 2012). These findings are concerning as they suggest that children reporting pain may be under-treated if they do not exhibit the physical indicators a nurse anticipates. Of particular concern is the choice to discount pain entirely and deny a child pain treatment of any type, as nurses have an ethical obligation to ensure humane and appropriate care (American Nurses Association, 2001) and patients have the right to access to pain management (Cousins & Lynch, 2011).

PICU nurses in this study did consider diagnosis when rating pain and choosing interventions. However, diagnosis did not have a significant effect on the nurses' choices. Limited statistical power may have played a role in our ability to detect a small effect of diagnosis or an interaction between diagnosis and another variable. It is also possible that there was not a difference between patients of the two different diagnoses because both were perceived as likely to cause pain.

Differences in nurses' choices between the VH and written vignettes are likely related to the methods to deliver information to the nurses (visual or written) and to collect data (open-ended interview or multiple choice items). Because the PICU nurses did not have a visual referent for the written vignettes, they may have rated the children more generously for pain (closer to 8). However it should be noted that though statistically significant, the differences in pain ratings between vignette types was not necessarily clinically meaningful, as the pain ratings were less than one point apart on a 0 to 10 scale. In choosing a pain intervention, when the nurses were responding to the written vignettes, they were limited to an intravenous morphine dose. Nurses who would have otherwise provided oral analgesics or non-pharmacological measures may have been inclined to choose morphine over choosing no intervention. Race may have also influenced the nurses' choices, as the written vignettes did not address race of the child and our VH vignettes presented children who were African-American. However, because of the differences in methods, inferences regarding nurses' responses between these two forms of vignette are inconclusive.

Limitations and Strengths

Limitations of this study include a modest convenience sample of PICU nurses within an urban setting; findings may not be generalizable. Also, a limitation of all vignette studies is the inability to conclude that simulated responses are consistent with real life responses (Hughes, 1998). Furthermore, these vignettes represent only a small subset of patients within a PICU; results cannot be generalized to patients of differing characteristics. However, the findings are consistent with literature in which PICU nurses relied upon physical factors for pain assessment (Coffman et al., 1997) and medication administration (Curley et al., 1992) with actual patients. Our use of open-ended interviews, in which nurses could choose any

pain intervention and share past experiences, likely enhanced the consistency of the nurses' responses with their practice.

Implications for Research and Practice

Though no significant multivariate effects for diagnosis were identified, many nurses did consider diagnosis when assessing and treating pain. Future research evaluating the relationship between diagnosis and nurses' pain management practices is needed. Because sub-concepts of the nurse factor were more often considered when rating the child's pain and sub-concepts of the organizational factor were more often considered when choosing an intervention, future interventions to improve pain management in the PICU should target both of these KUPC factors for greatest efficacy. Additional research is needed to identify aspects of organizations that best support nurses to appropriately manage pain. It is not surprising that the KUPC sociopolitical factor was not identified in the nurses' transcripts, as most nurses obtain information from individuals or systems within their organization over external sources of information (Marshall, West, & Aitken, 2011; McKnight, 2006; O'Leary & Mhaolrúnaigh, 2012; Pederson & Bjerke, 1999). However, the relationship of the sociopolitical and organizational factors should be further explored. The sociopolitical factor may indirectly influence nurses' practice as sociopolitical factors filter into organizational guidelines and systems.

Though PICU nurses only have physical indicators to assess and treat pain in patients who are very young, cognitively impaired, or severely ill, this same pain assessment strategy is inappropriate for patients able to report pain (American Academy of Pediatrics. Committee on Psychosocial Aspects of et al., 2001; Herr et al., 2011). Interventions to help PICU nurses adapt their pain assessments for children capable of self-report are needed. Nurses should be informed of the multitude of intrinsic, contextual, psychological, and social factors that can influence a child's expression of pain (American Academy of Pediatrics. Committee on Psychosocial Aspects of et al., 2001; Voepel-Lewis, Piscotty, Annis, & Kalisch, 2012), the shortcomings of differing pain assessment methods, and be provided with strategies to assess pain when observable findings are incongruous with self-report (e.g. ways to help the child further articulate discomfort or evaluate the child's ability to use the pain scale). Without guidance in the best ways to handle these clinical conflicts, nurses may inappropriately deem the child's self-report unreliable and manage pain solely from physical findings or accept and intervene for an inaccurate pain report. In this study PICU nurses considered many of the same factors when managing pain, but their choices for interventions varied widely. Methods to support nurses in the clinical setting to choose the most appropriate pain interventions for patients are needed. Furthermore, sampling bias has occurred in past research, in which only situations when nurses chose to provide analgesics were assessed. Future research should evaluate PICU nurses' actual pain management choices for children able to self-report, including the choice not to treat.

Overall, this study contributes a current description of PICU nurses' considerations and choices for children reporting severe pain. Results substantiate prior findings regarding the effect of behavior on nurses' choices and begin to address the gap in understanding the effect of a child's diagnosis on nurses' choices for pain. By using VH vignettes, we were

able to provide nurses with a standardized visual experience from which to respond and were able to eliminate many ambiguities that exist when text alone is used for a vignette. Additionally, in using a mixed-methods design, we were better able to capture the intricacies of the nurses' considerations and provide context to their resulting choices.

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HIGHLIGHTS

- Child factors considered were diagnosis, behavior, self-report, and vital signs
- Nurses considered similar factors but their intervention choices varied widely
- Many children were rated under their self-report and given a lesser intervention
- Significant effects were identified for behavior and vignette type, not diagnosis
- Nurses rated pain lower and chose less morphine when children smiled

Table 1

KUPC Concepts (Factors), Sub-concepts (Key tasks and Associated Activities), and Study Operational Definitions

KUPC Concept and related proposition	Sub-concepts		Study Operationalization
Factors	**Key Tasks**	**Associated Activities**	
Child:			Nurse describes thinking about factors that relate to the *VH vignette child* when rating the child's pain or selecting a pain intervention.
	Age	Developmental and verbal expression	Nurse describes child's communication of pain, can be in relation to developmental level, cognitive ability, or vocal expression of pain.
	Acuity	High versus Low Acuity	Nurse discusses the level of severity of the child's illness
	Behavior*		Nurse describes behavior of child including: movements, facial expressions, or posture
	Vital Signs*		Nurse describes vital signs (blood pressure, heart rate, respiratory rate, or pulse oximetry) in context of pain assessment or management
Individual Nurse			Nurse describes thinking about factors that relate to *self* when rating the child's pain or selecting a pain intervention.
	Education	Nurses with accurate pain knowledge	Nurse describes past formal training related to pain care
	Experience		Nurse describes past professional experiences caring for children in pain
	Critical thinking	Nurse with critical thinking skills	Nurse describes an active thought process, comparing/contrasting observed data and personal beliefs
	Empathy and Wellness	Nurse physically and mentally well and able to experience empathy for pain	Nurse describes current or past personal health or personal empathy for VH vignette child in pain
Organizational			Nurse describes factors related to the *hospital or unit of employment* when rating the child's pain or selecting a pain intervention.
	Opportunity	Knowledge enhancing opportunities	Nurse describes increasing knowledge or skills for practice through ability to attend training offered by organization
	Information	Data** and available expertise	Nurse describes accessing data or collaborating with another knowledgeable hospital employee for pain care
	Support	Autonomy to act on clinical judgment	Nurse describes factors that allow the nurse to initiate pain care
	Resources	Sufficient staff with expertise, materials or equipment	Nurse describes factors that allow pain care to be provided (personnel or equipment)
Sociopolitical		Policy statements, accreditation guidelines, professional associations	Nurse describes factors related to *external organizations/influences* when rating the child's pain or selecting a pain intervention.

* Not specifically described in KUPC but interpreted to coincide with the related KUPC factor

** Described in text of KUPC publication but not listed as an associated activity

Table 2

Nurses' Pain Ratings and Morphine Doses for Vignettes (Virtual Human and Written)

Pain Care Outcome	Vignettes			N	Range	Mean	*SD*
	Vignette Type	Behavior	Diagnosis				
Pain Rating (0 - 10)	Virtual	Smiling	Sickle Cell	40	0 - 8	4.94	*2.89*
			Surgery	40	0 - 8	4.49	*2.94*
		Grimacing	Sickle Cell	40	2 - 9	6.24	*2.01*
			Surgery	40	2 - 9	6.45	*1.88*
	Written	Smiling	Sickle Cell	39	0 - 8	5.05	*2.81*
			Surgery	39	0 - 8	4.82	*2.78*
		Grimacing	Sickle Cell	38	4 - 9	7.16	*1.39*
			Surgery	38	4 - 9	7.16	*1.46*
Morphine Dose (0 - 3 milligrams)	Virtual	Smiling	Sickle Cell	40	0 - 3	1.11	*1.29*
			Surgery	40	0 - 3	0.73	*1.06*
		Grimacing	Sickle Cell	40	0 - 3	1.81	*1.20*
			Surgery	38	0 - 3	1.70	*1.16*
	Written	Smiling	Sickle Cell	39	0 - 3	1.51	*1.19*
			Surgery	39	0 - 3	1.59	*1.16*
		Grimacing	Sickle Cell	39	1 - 3	2.49	*0.72*
			Surgery	39	1 - 3	2.46	*0.72*

Table 3

Pain Interventions Chosen by Nurses for Virtual Human Vignette Patients

	VH Vignette			
	Sickle Cell Smile (n = 40)	**Sickle Cell Grimace (n = 40)**	**Post-operative Smile (n = 40)**	**Post-operative Grimace (n = 38 [*])**
Pain Intervention	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Pharmacologic				
Morphine (intravenous)	19 (47.5)	31 (77.5)	15 (38.5)	29 (76.3)
Morphine 1 mg	3 (7.5)	5 (12.5)	5 (12.5)	5 (13.2)
Morphine 2 mg	6 (15)	10 (25)	6 (15)	12 (31.6)
Morphine 3 mg	10 (25)	16 (40)	4 (10)	12 (31.6)
Non-opioid	4 (10)	10 (25)	7 (17.5)	5 (12.5)
Oral opioid/non-opioid	1 (2.5)	1 (2.5)	2 (5)	4 (10.5)
Morphine/non-opioid	1 (2.5)	4 (10)	2 (5)	2 (5)
Non-pharmacologic [**]				
Distraction	18 (45)	12 (30)	19 (47.5)	13 (33.3) [***]
Heat/Cold	12 (30)	12 (30)	7 (17.5)	8 (10.3) [***]
Reposition	2 (5)	4 (10)	7 (17.5)	4 (20.5) [***]
Other	2 (5)	1 (2.5)	2 (5)	3 (7.7) [***]

[*] unable to determine answer for two nurses

[**] some nurses chose multiple non-pharmacologic interventions

[***] n = 39, unable to determine answer for one nurse

Table 4

Univariate Differences in Pain Ratings and Morphine Doses Between Behaviors

Dependent Variable	*df*	*df* error	*F*	*Partial*	Behavior	Means	95% Confidence Interval	
							Lower bound	Upper bound
Pain rating	1	304	51.05*	0.14	Smile	4.82	4.45	5.19
					Grimace	6.74	6.36	7.11
Morphine dose	1	304	52.37*	0.15	Smile	1.24	1.07	1.41
					Grimace	2.12	1.95	2.29

* $p < 0.001$

Table 5

Univariate Differences in Pain Ratings and Morphine Doses between Vignette Types

Dependent Variable	*df*	*df* error	*F*	*Partial* η^2	Behavior	Means	95% Confidence Interval	
							Lower bound	Upper bound
Pain rating	1	304	3.96*	0.01	Virtual	5.51	5.14	5.88
					Written	6.05	5.67	6.42
Morphine dose	1	304	30.80**	0.09	Virtual	1.34	1.17	1.51
					Written	2.02	1.85	2.19

* $p < 0.05$

** $p < 0.001$