Children’s Behavior in the Postanesthesia Care Unit: The Development of the Child Behavior Coding System-PACU (CBCS-P)

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Objective To develop and validate a behavioral coding measure, the Children’s Behavior Coding System-PACU (CBCS-P), for children’s distress and nondistress behaviors while in the postanesthesia recovery unit. Methods A multidisciplinary team examined videotapes of children in the PACU and developed a coding scheme that subsequently underwent a refinement process (CBCS-P). To examine the reliability and validity of the coding system, 121 children and their parents were videotaped during their stay in the PACU. Participants were healthy children undergoing elective, outpatient surgery and general anesthesia. The CBCS-P was utilized and objective data from medical charts (analgesic consumption and pain scores) were extracted to establish validity. Results Kappa values indicated good-to-excellent (κ’s > .65) interrater reliability of the individual codes. The CBCS-P had good criterion validity when compared to children’s analgesic consumption and pain scores. Conclusions The CBCS-P is a reliable, observational coding method that captures children’s distress and nondistress postoperative behaviors. These findings highlight the importance of considering context in both the development and application of observational coding schemes.

Key words children; health behavior; pain.

Introduction

Over five million children undergo surgery in the United States each year and, despite recent advances, up to 86% of children suffer significant postoperative pain (Fortier, MacLaren, Martin, Perret, & Kain, 2009). Children first experience postoperative pain in the postanesthesia care unit (PACU), otherwise known as the recovery room. Given that children undergoing ambulatory surgery spend most of their time (54% of their total visit time) in hospital in the PACU (Cullen, Hall, & Golosinskiy, 2009), addressing pain in this setting is important. The statistics on undertreatment of pain are alarming given the growing body of recent evidence suggesting long-term impacts of early childhood exposure to pain. Specifically, research has indicated that earlier pain experiences can sensitize children to be hypersensitive to pain in subsequent procedural situations (Taddio, Goldbach, Ipp, Stevens, & Koren, 1995; Taddio, Katz, Ilersich, & Koren, 1997; Woolf & Salter, 2000). Optimal pain management relies on understanding the way children express pain and distress and the way they cope with distress in the postoperative setting. Unfortunately, despite work in other medical procedures and previous work in pain, there is currently no validated measure of the range of children’s pain and distress behavior in the PACU. Such a tool is imperative to serve as a foundation for further research in this setting.
with the aim of improving postoperative pain management in children.

Children display a range of behaviors when undergoing medical procedures; some of these behaviors may be adaptive whereas others may be maladaptive. Early attempts at measuring children’s distress reactions were in the form of observational behavioral scales such as the Procedural Behavior Rating Scale (Katz, Kellerman, & Siegel, 1980) and the Observational Scale of Behavioral Distress (OSBD) (Elliott, Jay, & Woody, 1987). The OSBD is widely used and considered to be a reliable and valid measure of child procedural distress. Building on previous work and expanding interests from child behavior only to both child and adult behavior, the Child–Adult Medical Procedures Interaction Scale (CAMPIS) was developed and has since facilitated the most notable of research on children’s procedural distress.

The CAMPIS is an observational tool to categorize and quantify children’s behavior in the medical setting and was originally developed for use with bone marrow aspirations and lumbar punctures (Blount et al., 1997). Recently, the CAMPIS has been modified for immunizations (Blount, Bunke, Cohen, & Forbes, 2001), new populations [e.g., infants (Blount, Devine, Cheng, Simons, & Hayutin, 2008)], and anesthesia induction (Caldwell-Andrews, Blount, Mayes, & Kain, 2005). The strength of this behavior coding approach has been its ability to identify groups of child behaviors that tend to co-occur and may serve similar functions. In this way, previous studies have grouped behaviors into “distress,” “coping,” and “neutral” (Blount, Sturges, & Powers, 1990). Behaviors, such as nonprocedural talk, distraction, and using humor have been termed “coping behaviors” and seem to function by helping to shift children’s attention away from the distressing event (Blount et al., 1989, 1990; MacLaren & Cohen, 2005). Alternatively, behaviors such as crying, requests for support, and resistance can be indicative of children’s distress, and can also serve to perpetuate distress by focusing children’s attention on their immediate negative emotional state (Jay, Ozolins, Elliot, & Caldwell, 1983). Behaviors typically associated with the procedure, such as medically oriented talk, have generally been categorized as neutral behaviors.

The relevance of these previous studies to the postoperative settings is not clear, as the PACU represents a qualitatively unique setting that has not been captured by previous measures. Although there may be some parallels between what children do in the PACU and what they do during procedures (either painful or not), direct translation is premature for several reasons. First, acute painful procedures (e.g., immunizations and venipunctures) tend to be relatively short and have clear anticipatory and procedural phases (and a recovery phase in the case of painful procedures). In comparison, in the PACU, children continue to be exposed to noxious stimuli, may experience persistent symptoms (e.g., nausea), and undergo distressing procedures (e.g., IV removal). Second, children are also in the postoperative recovery area for substantially longer than they are in procedure rooms and children also tend to be less familiar with the perioperative setting than they are with the settings of other medical procedures (e.g., pediatrician’s office). Taken together, these differences suggest the need for a PACU-specific measure and for the examinations of the functions of children’s behavior in this new setting. For example, children’s lack of familiarity with the PACU may lead to different functions of previously termed “neutral” behaviors, particularly behaviors that refer to the medical procedure (e.g., medical talk).

The development of behavioral coding tools has greatly facilitated the research in medical procedures and perioperative care. Identification of these behavioral categories has provided opportunities for further work in assessment and intervention (Chambers, Craig, & Bennett, 2002; Chorney & Kain, 2009, 2010; Chorney et al., 2009; Cohen, Blount, & Panopoulos, 1997; Cohen, 2002). Research into children’s postoperative recovery would similarly benefit from characterization of the behaviors occurring in the PACU. Although there has been some work on global assessment of pain in the PACU (Gilbert et al., 1999; Merkel, Voeple-Lewis, Shayevitz, & Malviya, 1997; Perrott DA, Goodenough B, & GD, 2004; Suraseranivongse et al., 2001; von Baeyer & Spagrud, 2007), no research has examined the moment-to-moment changes in operationally defined child behavior as has been done previously in medical settings. Further, no study in the PACU has examined nonpain behaviors. Most importantly, no study has identified those behaviors that may be indicative of coping in the PACU and therefore might be targets of intervention in future studies. As vital as it is to be able to identify children’s pain, it is equally important to know which behaviors are beneficial for children’s postoperative recovery.

The purpose of the current report is to describe the development and refinement of the Child Behavior Coding System-PACU (CBCS-P) and to examine interrelations among children’s behaviors and relevant postoperative outcomes, namely pain and analgesic use. The CBCS-P differs from existing behavioral measures by including new, novel behaviors that also include nonverbal behaviors. It is hypothesized that operational definitions will be able to be applied to children’s behavior in a reliable way...
(i.e., high inter-rater reliability). It is also hypothesized that a group of behaviors with face validity as indicators of distress will be correlated and will be positively related to ratings of children’s pain and morphine use in the PACU (termed “Distress Compatible” behaviors). Finally, it is hypothesized that a second group of behaviors will be identified that will be negatively correlated with distress behaviors (termed “Distress Incompatible” behaviors).

Methods
Participants
Participants in this study were generally healthy children with American Society of Anesthesiologists physical status classification of I or II (i.e., healthy, no major systemic disease). A total of 121 children, age 2–11 years, who were undergoing outpatient surgery with general anesthesia were included in the study. Children were excluded from participation in the study if they were reported by their parents to be developmentally delayed, had a documented chronic illness, or if their parents did not speak English, because these characteristics may have affected the ability to categorize children’s interactions in the PACU.

Measures
Demographics
Parents completed a demographic sheet indicating children’s age, gender, ethnicity, and previous hospitalization history.

Analgesics
Children’s use of opioid analgesia was collected from medical charts, and all opioid medications (e.g., fentanyl, morphine) were converted into morphine (IV/IM) units for comparison purposes. Children’s total usage of opioid analgesia was then summed together and divided by children’s weight (kg).

Pain Assessment
The Face, Legs, Activity, Cry, Consolability [FLACC; (Merkel et al., 1997)] scale is an observational scale used by nursing staff to indicate children’s pain. Children’s behaviors and expressions are rated for each of the five categories on a 0–2 scale, with higher scores indicating a greater degree of pain. Scores are summed across categories and can range from 0 to 10, with 0 indicating no pain and 10 indicating intense pain. Nursing staff rated children’s pain every 15 min and scores were retrieved from children’s medical charts.

CBCS-P
The CBCS-P was used to quantify operationally defined behaviors of children in their PACU stay. Further information on the development and implementation of the CBCS-P is provided below.

Procedure
All procedures were approved by the Institutional Human Investigation Committee, parents provided written informed consent and children 5 years of age and older gave assent. Children were recruited several days prior to surgery by trained research assistants via telephone and demographic data were obtained at the preoperative holding area. Sedative premedication was not used and all parents were present in the operating rooms during induction of anesthesia. Children received standard care based on anesthesiologist judgment. The induction process was not standardized among anesthesiologists. Children were admitted into the PACU following surgery and their entire stay was digitally recorded by a set of video cameras. The footage was converted into computer files and imported to Observer XT software (Noldus) for coding. Observer XT was used to code for verbal events and code for the duration (onset and offset of behaviors) of nonverbal behaviors. Moreover, Observer XT allows for researchers to capture not only the frequency of events, but the sequence of events as well, which will allow for future time-sequential analyses. Coded text files from the Observer XT were converted for analysis in General Sequential Querier Software [GSEQ, Version 5.1 (Bakeman & Quera, 1995)].

CBCS-P Development and Implementation
CBCS-P Development
A multidisciplinary team representing anesthesiology, pediatrics, child psychology, and child development was assembled to review existing measures of children’s behavior [including the original and preoperative versions of the CAMPIS, FLACC, Procedure Behavior Rating Scale (PBRS), OSBD, and other behavioral coding measures]. The team further reviewed study independent observations of children in the PACU. Relevant behaviors and operational definitions from existing measures were generally retained with modifications of examples to be relevant to the PACU. New PACU-specific behaviors and corresponding operational definitions and examples were added. Of particular note, nonverbal behaviors were relevant in the PACU and have been captured here in a way not previously described in most behavioral measures (e.g., nonverbal resistance). Eating/drinking and talk about food and drink were prevalent in the recovery room and codes were also developed.
to capture these interactions. An iterative process was followed to develop operational definitions for new codes and to modify existing codes for the PACU. In sum, half of the codes were adapted from previous measures, and the other half was developed for the PACU context. A team of two research assistants and the first author each independently applied the codes and compared ratings. Disagreements were discussed and definitions were modified based on these discussions. An extensive log of prototypical examples of code applied to PACU behaviors was assembled. The final CBCS-P included 23 verbal and nonverbal behaviors of children, which are detailed in a comprehensive manual (see Supplementary Appendix A1).

Coding Process

The Observer XT (Noldus Inc, The Netherlands) was used to facilitate the administration of the coding scheme on video data. Timed-event data coding was used to capture data on frequency, duration, and timing of codes (Bakeman & Gottman, 1997). Utterance coding was used for verbal behaviors such that each utterance by the child that could be assigned meaning was assigned a code. Consecutive codes were allowed to repeat (i.e., two verbal resistances in a row if the child said “No...No”). Verbal behaviors were mutually exclusive and exhaustive (i.e., each utterance by the child was assigned a code and only one code was assigned to each utterance). Given that verbal codes represented utterances of which duration was not meaningful, onset times were recorded in The Observer XT (referred to as “Event” codes), therefore providing frequency data for all verbal (event) codes. Nonverbal behaviors were organized into mutually exclusive and exhaustive groups with behaviors that could co-occur being included in separate groups. For example, the “Cry” group included the codes of scream, full cry, soft cry, and no cry, and the “Resistance” group included the codes of nonverbal resistance and no nonverbal resistance. Children were assigned one code from each group at every time. Given that nonverbal codes had meaningful durations, onset and offset times were recorded (referred to as “State” codes). Thus, data on frequency and duration of occurrence of state behaviors were available. For simplicity, only presence of state codes are reported in this manuscript (e.g., duration of “resistance” is reported but duration of “no resistance” is not). Data were coded by research assistants using several passes. All the verbal codes were captured by watching the video once. To properly capture the state behaviors (duration scores), the research assistant viewed the entire segment one time through for every state behavior. Thus, multiple passes were required to code all state behaviors.

Due to the length of these recordings (some of which lasted 4 hr), three 5-min segments were selected for coding. Segments were selected to capture a range of children’s behavior throughout their PACU stay. The three, 5-min segments were: (a) the first 5 min children were awake, coherent, and exhibiting purposeful behavior (no emergence delirium); (b) a 5-min segment around the time the IV was removed (2 min before, 3 min after); and (c) a random 5-min segment. The first 5-min segment was ensured not to include emergence delirium through the judgment of a trained research assistant and an experienced PACU nurse. Emergence delirium represents a unique clinical phenomenon that is different from normative recovery behaviors in the PACU, characterized by a state of hyperexcitation that can include such behaviors, such as: kicking, thrashing, inconsolable crying; and, thus we excluded emergence delirium episodes from coding (Vlajkovic & Sindjelic, 2007). To identify the third segment, a random number generator would identify a time segment. From that random time, the research assistant would identify the first distress episode and code for 5 min surrounding the distress (2 min before, 3 min after); if no distress episode was identified, the first 5 min that the random number generator identified would be coded. This randomly selected period did not overlap with the previous two segments. Given that child behavior was of interest in this study; times in which the child was asleep were excluded from coding.

Training of Raters

Two independent post-baccalaureate research assistants coded all data in this study. Coders underwent a rigorous training protocol with the first author, in which they were familiarized with the technological coding interface, Observer XT and the behavioral codes. After the raters were familiarized with the coding interface, they applied the CBCS-P to study-independent video observations. Raters met to discuss coding and disagreements daily during the training period and weekly when coding study data. Coders were considered “trained” after they met a κ-criterion of .80 with the lead trainer’s codes.

Plan of Analysis

Sample Size

A power analysis was conducted using GPower Version 3.1 (Erdfelder, Faul, & Buchner, 1996; Erdfelder, Faul, Lang, & Buchner, 2007). Assuming a α-set at .05, a sample size of 115 participants would provide 95% power to detect a correlation of .30 between coded behaviors and postoperative outcomes.
Reliability Analysis

Reliability analyses were conducted using GSEQ 5.1 (Bakeman & Quera, 1995). Kappa statistics relevant to timed-event data were used to examine inter-rater reliability. Two types of $\kappa$-statistics are reported here: time-unit and event alignment. Time-unit $\kappa$ examines interrater agreement in time. A time tolerance of 2 s ($\pm$) was used. In this procedure, the program looks 2 s forward and backward from a code assigned by one rater and counts an agreement if the same code was counted by the second rater within this time frame. Event alignment $\kappa$ examines the interrater reliability of the order of codes. In this procedure, GSEQ aligns codes using a predefined algorithm (Bakeman, Quera, & Gnisci, 2009) and examines agreements, omission, and commission errors. An event tolerance of 2 s and overlap percentage of 80% was set for these analyses. Since there are often differences in values of time-unit and event alignment $\kappa$s, Bakeman recommends reporting both analyses, suggesting that the true value of $\kappa$ likely falls between these two values. Since coders can assign a different number of codes in timed-event data, $\kappa$-statistics may not always have a maximum value of 1. Potential maximum values of $\kappa$ are reported to provide a context for interpretation. Codes that were unable to be applied with adequate interrater reliability were considered for combination or exclusion from data analysis and the CBCS-P.

Relational Analysis

Since observation sessions may vary slightly in length, codes were transformed into rates (for event behaviors) and proportions (for state behaviors). Rates were calculated by taking the sum of each event behavior across the three time segments, dividing it by the total time children were present in the segments. Thus, rates represent the frequency of a particular behavior per minute. Proportions were calculated by taking the total time the child spent engaged in each behavior (e.g., crying) across all three time segments and dividing it by the total time the children were present so that proportions represent the proportion of their total time they spent in a particular state event. Codes that did not occur in study data or occurred on rare occasions were considered for exclusion from analysis and the coding measure, unless they were theoretically similar to another code and could be combined.

Given nonnormal distributions, Spearman rank-order correlations were used to examine interrelations among behaviors that were hypothesized to be indicative of children’s distress. On the basis of these results, two composite distress scores (i.e., verbal and nonverbal) were calculated for each participant by summing the rates and proportions of relevant behaviors (Supplementary Appendix A1). Spearman correlations were then conducted between the behaviors and objective measures of children’s pain (i.e., analgesic consumption and FLACC scores).

Results

Children were on average 4.72 years of age ($SD = 2.24$ years) and were primarily White (87%). Nearly equal numbers of boys and girls were enrolled in the study (50.5% boys). Thirty-eight percent of children had previously undergone surgery. The most common procedures that children were undergoing were tonsillectomy and/or adenoidectomy ($n = 42$), endoscopy ($n = 21$), hernia repairs ($n = 14$), ear–nose–throat ($n = 12$), urological procedures ($n = 9$), and dermatological procedures ($n = 4$).

Reliability

Nineteen participants (15% of sample) were randomly selected and coded by two independent raters for reliability analysis. Kappa statistics are shown in Table I. Kappa values were generally in the moderate to high range (0.57–1.0) with the exception of four behaviors: positive home talk, coping statement, positive affect, and screaming. Notably, all of these behaviors were also low frequency, a factor known to deflate $\kappa$-statistics. Positive home talk, coping statement, and positive affect were excluded from further analyses. Kappa values for full cry (Time-unit $\kappa = .81$, Event alignment $\kappa = .55$) and soft cry/moan/grimace (Time-unit $\kappa = .60$, Event alignment $\kappa = .46$) were lower than most other codes. Discussions of disagreements between the coders and the primary investigator indicated that distinctions between full cry, soft cry, and scream were difficult and may not have been reliably made. Thus, full cry, soft cry, and scream were combined into one code. The $\kappa$-statistics for this combined code were higher than for the original codes (Time-unit $\kappa = .90$, Event alignment $\kappa = .61$).

Prevalence of Behaviors

Descriptive statistics for each behavioral code are presented in Table I, including the number of children displaying the behavior and corresponding rates or proportions. The five behaviors shown by the most children were (in descending order) were eating/drinking (67.7%), crying (62.9%), engaging in nonverbal distraction (64.3%), talking about food/drink (61.3%), and informing positive physical status (58.9%). The five behaviors shown by the least number of children (in ascending order) were coping statements...
(no children), screaming (5%), positive affect about the procedure (9.1%), talk about going home (10.7%), and negative verbal emotion (12.1%). Given that coping statements were not displayed, they were not included in further analyses.

**Distress-Compatible Behaviors**

Nine behaviors were judged to have face validity for distress on the basis of previous literature and clinical observations. The interrelations among these behaviors are displayed in Table II. All but one behavior showed significant positive correlations with at least three other distress behavior; informing negative status demonstrated a mix of positive and negative correlations with other behaviors. As a result of the high intercorrelations, two composite variables were created: one that combined the nonverbal behaviors (i.e., crying, guarding, nonverbal resistance, screaming, and nonverbal request for support), and one that combined the verbal behaviors with the exception of inform negative status (i.e., verbal pain, verbal resistance, verbal request for support, and negative verbal emotion). Given that nonverbal and verbal behaviors were not mutually exclusive, the sum or rates and proportions of these behaviors could be higher than 1.

**Concurrent Validity of Distress Composites**

Concurrent validity of Distress Composites was examined via correlations with FLACC scores and analgesic use in the PACU. All three composites showed some evidence for concurrent validity. Verbal Distress Composite score was significantly positively correlated with FLACC ($r = .24$, $p < .05$), and analgesic use ($r = .028$, $p < .01$), as was Nonverbal Distress Composite score (FLACC, $r = .40$, $p < .001$, analgesic, $r = .30$, $p < .001$).

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**Table I. Descriptive Data on Children’s Display of Behaviors Across All Time Periods Coded**

<table>
<thead>
<tr>
<th>Behavior</th>
<th>n (%) of Children Displaying Behavior</th>
<th>Median Rate or Proportion</th>
<th>Range Rate or Proportion</th>
<th>Time Unit Kappa (max)</th>
<th>Event Alignment Kappa (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal pain</td>
<td>69 (57.0)</td>
<td>0.18</td>
<td>0.06–2.71</td>
<td>1.00 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
<tr>
<td>Informs negative physical status</td>
<td>67 (54.0)</td>
<td>0.13</td>
<td>0.05–1.01</td>
<td>0.88 (0.88)</td>
<td>0.69 (0.87)</td>
</tr>
<tr>
<td>Informs positive physical status</td>
<td>73 (58.9)</td>
<td>0.19</td>
<td>0.05–0.67</td>
<td>0.90 (0.90)</td>
<td>0.71 (0.84)</td>
</tr>
<tr>
<td>Negative verbal emotion</td>
<td>15 (12.1)</td>
<td>0.11</td>
<td>0.06–0.37</td>
<td>0.57 (0.57)</td>
<td>0.57 (0.89)</td>
</tr>
<tr>
<td>Home talka</td>
<td>15 (12.1)</td>
<td>0.07</td>
<td>0.06–0.20</td>
<td>0.00 (0.00)</td>
<td>0.30 (0.50)</td>
</tr>
<tr>
<td>Coping statementa</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Food/Drink talk</td>
<td>76 (61.3)</td>
<td>0.17</td>
<td>0.02–1.40</td>
<td>0.94 (0.94)</td>
<td>0.73 (0.85)</td>
</tr>
<tr>
<td>Verbal resistance</td>
<td>58 (47.9)</td>
<td>0.21</td>
<td>0.05–4.77</td>
<td>0.93 (0.93)</td>
<td>0.78 (0.89)</td>
</tr>
<tr>
<td>Verbal request for support</td>
<td>21 (17.4)</td>
<td>0.07</td>
<td>0.06–0.74</td>
<td>0.91 (0.91)</td>
<td>0.81 (0.97)</td>
</tr>
<tr>
<td>Humor</td>
<td>13 (10.7)</td>
<td>0.07</td>
<td>0.06–0.33</td>
<td>1.00 (1.00)</td>
<td>0.66 (0.66)</td>
</tr>
<tr>
<td>Verbal engage in distraction</td>
<td>46 (38.0)</td>
<td>0.16</td>
<td>0.06–0.75</td>
<td>0.94 (0.94)</td>
<td>0.78 (0.88)</td>
</tr>
<tr>
<td>Information seeking</td>
<td>57 (47.1)</td>
<td>0.20</td>
<td>0.07–1.41</td>
<td>1.00 (1.00)</td>
<td>0.97 (0.97)</td>
</tr>
<tr>
<td>Nonprocedural talk</td>
<td>34 (28.1)</td>
<td>0.17</td>
<td>0.06–1.05</td>
<td>0.73 (0.73)</td>
<td>0.77 (0.77)</td>
</tr>
<tr>
<td>Medical talk</td>
<td>72 (59.5)</td>
<td>0.20</td>
<td>0.06–1.67</td>
<td>0.80 (0.80)</td>
<td>0.67 (0.99)</td>
</tr>
<tr>
<td>Positive affecta</td>
<td>11 (9.1)</td>
<td>0.07</td>
<td>0.06–0.20</td>
<td>0.00 (0.00)</td>
<td>0.49 (1.00)</td>
</tr>
<tr>
<td>Nonverbal behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full cry</td>
<td>60 (48.4)</td>
<td>0.14</td>
<td>0.00–0.79</td>
<td>0.81 (0.99)</td>
<td>0.55 (0.90)</td>
</tr>
<tr>
<td>Soft Cry/Moan/Grimace</td>
<td>70 (56.5)</td>
<td>0.07</td>
<td>0.00–0.99</td>
<td>0.60 (0.93)</td>
<td>0.46 (0.93)</td>
</tr>
<tr>
<td>Screamingb</td>
<td>6 (5.0)</td>
<td>0.02</td>
<td>0.00–0.13</td>
<td>0.09 (0.36)</td>
<td>0.58 (0.79)</td>
</tr>
<tr>
<td>Combined cry (full, soft, and scream)</td>
<td>78 (62.9)</td>
<td>0.20</td>
<td>0.00–0.99</td>
<td>0.90 (0.99)</td>
<td>0.61 (0.91)</td>
</tr>
<tr>
<td>Guarding</td>
<td>19 (15.7)</td>
<td>0.02</td>
<td>0.00–0.27</td>
<td>0.64 (0.81)</td>
<td>0.62 (0.84)</td>
</tr>
<tr>
<td>Nonverbal resistance</td>
<td>29 (24.0)</td>
<td>0.02</td>
<td>0.00–0.17</td>
<td>0.86 (0.91)</td>
<td>0.79 (0.94)</td>
</tr>
<tr>
<td>Nonverbal request for support</td>
<td>19 (15.7)</td>
<td>0.12</td>
<td>0.06–0.69</td>
<td>1.00 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
<tr>
<td>Nonverbal distraction</td>
<td>78 (64.5)</td>
<td>0.23</td>
<td>0.00–0.77</td>
<td>0.73 (0.75)</td>
<td>0.65 (0.84)</td>
</tr>
<tr>
<td>Holding secure object</td>
<td>42 (34.7)</td>
<td>0.26</td>
<td>0.00–1.05</td>
<td>0.51 (0.84)</td>
<td>0.71 (0.84)</td>
</tr>
<tr>
<td>Eating/Drinking</td>
<td>84 (67.7)</td>
<td>0.04</td>
<td>0.00–0.58</td>
<td>0.72 (0.94)</td>
<td>0.79 (0.95)</td>
</tr>
</tbody>
</table>

*Note. Medians represent either proportions (nonverbal behaviors) or rates (verbal behaviors). "Max" is the maximum value of κ possible given the potential for raters to have provided a different number of codes. Actual κ-values should be evaluated in relation to maximum κ rather than 1.*

*aExcluded from further analysis due to low frequency or reliability.*

*bScreaming was later included into the cry code in subsequent analyses.*
Identification of Distress-Incompatible Behaviors

Table III shows relations between Distress Composites, FLACC score, analgesic use and other codes. Eight child behaviors were significantly negatively correlated with the Nonverbal Distress Composite: humor, information seeking, medical talk, food/drink talk, informing positive physical status, nonprocedural talk, positive affect, and eating and drinking. The potential distress-incompatible function of these behaviors was further evidenced by their negative correlations with FLACC scores and analgesic use. Six of these behaviors—humor, information seeking, positive affect, food/drink talk, informing positive status, and eating and drinking—were significantly negatively correlated with either or both FLACC and analgesic use. Medical talk and nonprocedural talk, although not significantly correlated to pain and morphine scores, were negatively correlated with the nonverbal distress composite. One behavior (holding security object) was significantly positively correlated with the Nonverbal Distress Composite and morphine use. Of note, no behaviors were significantly correlated with the Verbal Distress Composite.

Discussion

The purpose of this article is to describe the development of a new observational coding system to capture and classify children’s behavior in the PACU following surgery. Results reported here show that codes included in this measure can be applied in a consistent manner across raters (i.e., have high inter-rater reliability). Results also show that a set of codes with face validity for distress were interrelated and showed preliminary concurrent validity with other measures of children’s distress (observed pain rated by nurses and analgesic use). The rates of the distress behaviors observed support previous assertions that a sizable portion of children display behaviors indicative of distress during their recovery room stay (Cummings, Reid, Finley, McGrath, & Ritchie, 1996). Identification of behaviors that are indicative of pain and distress are important in continued efforts to manage pain and discomfort in the PACU. In this study, a composite of expected distress behaviors made up of crying, verbal pain, verbal resistance, and nonverbal requests for support was positively related with analgesia use and pain scores. While these findings parallel previous procedural pain studies, they highlight the importance of attending to a range of behaviors when assessing children in the recovery room. Children, who display behaviors such as reaching out to be hugged, leaning on their parent’s shoulder, or seeking proximity to their parents, may be in pain and should be further evaluated.
This study also identified child behaviors that were related to less distress in children, or what we term here, distress-incompatible behaviors. Results indicate that there are a set of behaviors that are consistently related to lower nonverbal distress behavior, less analgesic use, and lower distress observed by nurses. Notably, these behaviors are different than those typically referred to as coping behaviors in other studies. Whereas nonprocedural talk, engaging in distraction and humor have previously been termed “coping” behaviors in procedural pain contexts (Blount et al., 1989, 1990; Chorney et al., 2009), in this context, medical talk and asking questions about medically related issues appear to be particularly relevant to lower distress in the recovery room. In previous measures, talk about the procedure has been categorized as a neutral behavior and information seeking has been included in a group of distress behaviors. The explanation for the different functions of behaviors between procedures and the PACU is unclear at this point, but could be due to the nature of the environment. The PACU is a unique, new environment in which they wake-up to and try to seek information in order to orient and familiarize themselves to their new surroundings. Children’s eating and drinking activity was associated with lower distress, pain, and analgesia consumption. This finding corroborates traditional clinical indicators that when children are able to eat and keep down their food they are well enough to go home. It is also interesting to note that being engaged in distraction (e.g., watching TV, reading), does not seem to be as strongly related to lower distress as it is in procedural contexts. This may be because the stay in the PACU is significantly longer than typical procedures and sustaining attention on distracting tasks to the degree that is necessary for reduced distress is more difficult. As a group, these findings highlight the importance of considering context in both the development and application of observational coding schemes. Existing tools or groupings of behaviors on the basis of previous research (e.g., “distress” or “coping”) may not be appropriate in a new setting.

The finding that there were no behaviors that were negatively related to children’s verbal distress is worth noting, especially given the focus on verbal behaviors in previous procedural pain studies. The explanation for this finding is unclear, but it may be that children’s verbal behaviors are more difficult to modulate in the PACU, relative to nonverbal behaviors. Most of the previous work demonstrating impacts on children’s verbal behaviors involves relations between children and adults; this study examines child behavior only. Results may be more consistent with previous work when adult behavior is considered.

This study has several methodological and conceptual strengths and limitations. As previously discussed, codes included in this new measure demonstrate strong internal reliabilities and capture a wide breadth of children’s verbal and nonverbal behaviors. Collection of timed-event data provides a representation of behavior that is more ecologically valid than other coding methods (e.g., interval, event coding) and presents unique opportunities for further analysis of behavior sequences over time. Despite these strengths, several weaknesses of the current study should be mentioned. First, although an effort was made to select intervals for coding that were representative of the range of children’s experiences in this environment, selection of intervals was based on investigator judgment. There are currently no empirical or theoretical guidelines on sampling children’s behavior during prolonged painful procedures, as most of these procedures are generally short and time sampling is not necessary. It is possible that we may have found different results if we sampled different time points during the PACU stay. It should be noted that the influence of the presence and behaviors of parents in the PACU on children’s distress is unknown at this time. Future studies should address the role of parental anxiety and behaviors on children’s recovery in the PACU. It is also notable that our validation measures of pain were limited to nurse observation and analgesic use. It would have been beneficial to have additional measures of pain and distress including children’s self-report of pain and anxiety. Additionally, although these new codes demonstrate good initial construct validity, they have yet to be validated in other populations, beyond the relatively homogenous population used in this initial validation. Nevertheless, a reliable and preliminarily valid measure of children’s behaviors has been established, that identifies behaviors that are indicative of and incompatible with children’s distress. Future directions will include adapting this measure for more clinical use; which should include a proper validation of the clinical use of this measure (i.e. assessment of specificity and sensitivity of the tool).

Identifying the range of potential behaviors that are indicative of children’s distress and those incompatible with distress is an important first step to developing evidence-based assessment and interventions to better address children’s pain and distress following surgery. Results reported here identify child behaviors that may not typically be part of standard pain assessment in the recovery room (e.g., requests for support), but may be indicative of children being in need of additional intervention. Further, these results draw attention to the importance of considering context in behavioral assessment in children. Behaviors that have previously been categorized
as “neutral” or “distress” in procedural pain contexts were related to less distress in the recovery room. The CBCS-P expands preexisting measures by adding additional context-relevant codes, and includes both distress and nondistress behaviors. Having established a reliable measure of children’s behaviors in the PACU opens opportunities to conduct further examinations of the influence of adult behavior on children’s distress and the eventual development of intervention programs.

**Supplementary Data**

Supplementary data can be found at: http://www.jpepsy.oxfordjournals.org/.

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