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Behavioral Interactions in the Perioperative Environment

A New Conceptual Framework and the Development of the Perioperative Child–Adult Medical Procedure Interaction Scale

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Background: **The authors suggest that research in the area of parental presence during induction of anesthesia should shift to emphasize what parents actually do during induction, rather than focusing simply on their presence. As a first step, the authors aimed to develop a behavioral coding system that would measure child and adult interactions in the perioperative environment.**

Methods: **The authors enrolled 45 parents and children (aged 2–12 yr) undergoing elective surgery and general anesthesia. A multidisciplinary team examined videotapes and transcriptions of interactions between children, parents, and medical personnel in the holding room and operating room. The team used an existing scale, the Child-Adult Medical Procedure Interaction Scale, as the prototype for the development of a new perioperative behavioral coding system. The research team conducted extensive revisions to the original scale and added multiple codes to the original scale, including nonverbal codes. Interrater reliability was assessed using weighted κ statistics. Construct validity was also examined.**

Results: **The final Perioperative Child-Adult Medical Procedure Interaction Scale contains 40 codes in four domains. Analyses showed excellent reliability overall for verbal and nonverbal codes. Kappa values averaged 0.87 for verbal codes characterizing adult vocalizations, 0.92 for verbal codes characterizing child vocalizations, and 0.88 for nonverbal codes. Construct validity was demonstrated by finding the hypothesized associations between certain scale codes and children's anxiety (*P* = 0.0001).**

Conclusion: **Showing excellent reliability, the Perioperative Child-Adult Medical Procedure Interaction Scale is an appropriate tool for assessing child–adult behavioral interaction during the perioperative period. When sequential analyses are conducted and target behaviors are identified, empirically based parent preparation programs can be developed.**

PARENTAL presence during induction of anesthesia continues to be a controversial issue. Although early studies suggested that children experience reduced anxiety and increased cooperation when their parents are present during induction,[1,2] later investigations indicated that routine parental presence during induction of anesthesia is not beneficial in terms of reducing children's anxiety or increasing children's compliance.[3–7] These reports, however, should be interpreted cautiously because they do not take into account what parents actually do during induction of anesthesia. In fact, we have been told on numerous occasions by experienced anesthesiologists that "in their hands," parental presence during induction of anesthesia is an effective practice, suggesting that variables beyond the mere presence or absence of the parent are at the forefront of effective anxiety reduction. Therefore, we strongly believe that research interests in this area should shift toward an emphasis on what parents actually do during induction of anesthesia, rather than simply on their presence. Furthermore, the perioperative behaviors of participating healthcare providers should be evaluated as well, because these individuals also have a large potential to impact children's anxiety levels. Simply ignoring the impact of the behavior of healthcare providers and treating them as a "black box" is not a viable solution.

Blount *et al.*[8] investigated the influence of parents' and healthcare providers' behaviors on the coping and distress of children with cancer who underwent painful bone marrow aspiration and lumbar puncture procedures. As a first step, Blount *et al.*[9] developed the Child-Adult Medical Procedure Interaction Scale (CAMPIS), a system of behavioral codes that categorize child and adult verbal interactions during painful medical procedures. Using the statistical technique of sequential analysis, which allows for the determination of temporal antecedents and consequences of particular child and adult behaviors, they mapped and coded the flow of the interactions occurring during invasive, painful medical procedures.[8] Results from assessment studies with the CAMPIS identified specific parental and healthcare provider behaviors that preceded children's distress and coping. These adult antecedent behaviors were subsequently modified in experimental treatment studies, with concomitant reductions in children's distress during painful immunizations, voiding cystourethrography, and lumbar puncture procedures.[10–15]

We propose that similar, highly technical investigations take place to examine behavioral interactions during induction of anesthesia. The CAMPIS, however, needs significant modification to be appropriate for the use in the perioperative environment. That is, the CAMPIS was created within the context of pediatric pain, and therefore, multiple codes in the original CAMPIS are unique to the pain inherent in bone marrow aspiration and lumbar puncture procedures.

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Also, the CAMPIS is based on audio data only, therefore, nonverbal aspects of behavioral interactions are not included. Specific codes unique to the perioperative environment must also be added.

The creation of the Perioperative Child-Adult Medical Procedure Interaction Scale (P-CAMPIS) is important for the development of research involving parental presence during induction of anesthesia. That is, a sequential view of behavioral interactions between parent, health-care provider, and child in the perioperative settings can be obtained by assessing behaviors that immediately precede or follow children's anxious behaviors. When these adult "trigger" behaviors have been identified, they could be modified by the development of empirically based parental training programs. Therefore, the purpose of this investigation was to develop a reliable and valid behavioral coding system that is aimed to assess child and adult interactions in the perioperative environment.

Materials and Methods

As a first step for this investigation, we assembled a multidisciplinary team including experts in anesthesiology, pediatrics, child psychiatry, child psychology, and child development. Subjects recruited for this study were children (aged 2–12 yr) who were undergoing elective surgery and general anesthesia and whose parents were present during the induction of anesthesia. No child in this study received sedative premedication. Exclusion criteria included children with chronic illness, children with developmental delay, children taking psychiatric medication, and children with parents who did not speak English. The Yale Human Investigation Committee (New Haven, Connecticut) approved this study, and parents and children provided written informed consent and assent as appropriate.

Study Protocol

After informed consent was obtained, parents who were enrolled in the study completed a demographic questionnaire, and an observer measured the child's preoperative anxiety using the modified Yale Preoperative Anxiety Scale, an observation measure of anxiety previously developed by our laboratory.[16,17] This measure has good reliability and validity when compared with both the State Trait Anxiety Inventory–Child's version and with cortisol levels obtained during induction of anesthesia;[16,17] scores range from 22 to 100, and higher scores indicate higher levels of anxiety. Next, parents and children were videotaped for a period of 5 min as they waited in the preoperative holding area. Parents and children were then brought into the operating room. The entire process of induction of anesthesia was videotaped. Children were placed on the table, a pulse oximetry probe was placed on the child's hand, and a scented anesthesia mask was introduced. Anesthesia was induced using an oxygen–nitrous oxide–sevoflurane technique. The child's state anxiety was evaluated by trained observers upon entering the operating room and again upon introduction of the anesthesia mask. After anesthesia was induced, researchers escorted parents to a waiting area.

We performed a total of 45 video recordings of children and their parents and various medical staff, including the anesthesiologist and nurses. All verbal interactions and nonverbal interactions in these videotaped recordings were then transcribed and typed by members of the research staff. Transcription (that is, writing down everything that was said, as well as writing down descriptions of all body movements and distinct facial expressions) of each videotaped patient took approximately 3–4 h.

Based on our experience with previous development of behavioral instruments[16] as well as clinical experience and on repeated observations of 15 of these particular videos, we noted recurring behaviors that occurred during the children's and adults' interactions. We determined which of the existing CAMPIS codes should be modified, deleted, or retained. The original 35 CAMPIS behavioral codes include 19 codes for adults' behaviors and 16 for children's behaviors.[9] Code types on the CAMPIS include adult–to-adult, adult-to-child, and child-to-adult vocalizations.

We then began an iterative process of testing and refining the coding system. A number of codes representing behaviors unique to the perioperative environment were added, and developmental aspects of the behaviors captured in each new and original CAMPIS code were discussed and considered by the task force. A number of differences (primarily that children undergoing induction of anesthesia do not undergo procedural pain) indicated the deletion of several pain-related codes in the CAMPIS. In addition, several adult behaviors observed during painful medical procedures were not likewise observed in the perioperative environment; these behavior codes were also deleted. We developed appropriate labels for codes that were added to the original CAMPIS and modified multiple definitions and behavioral examples to fit the perioperative environment. Upon careful examination of videotaped interactions, our multidisciplinary team also identified appropriate nonverbal codes to capture relevant nonverbal behavior of children, parents, and medical personnel.

A preliminary list of P-CAMPIS codes was developed, and appropriate examples and explanations were written. After the development of the preliminary version of the P-CAMPIS, we used an additional set of 10 transcriptions to explore the fit of the preliminary codes. The original task force met weekly and discussed coding disagreements, modifying and clarifying codes where needed. After the task force was satisfied with these refinements, raters then coded 5 new transcripts (total

Table 1. Demographic Characteristics

Demographic Characteristic	Study Subjects (n = 45)
Child's age, mean ± SD (range), y	5.34 ± 2.5 (2–12)
Ethnicity, %	
White	73.20
African American	9.80
Hispanic	7.30
Other	9.80
Parent's years of education, mean ± SD (range)	15.45 ± 3.3 (2–20)
% Married	80.50
Child's state anxiety (mYPAS)	
Holding area, mean ± SD (range)	40 ± 16.2 (22–73.3)
Induction of anesthesia, mean ± SD (range)	51.96 ± 5.1 (22–100)

mYPAS = modified Yale Preoperative Anxiety Scale.

transcriptions used at this point = 20) to calculate preliminary reliability of the P-CAMPIS codes.

Reliability and Validity Analysis

As a first step to examine the P-CAMPIS, we determined interrater reliability estimates for each of the verbal and nonverbal codes, using κ statistics provided by the computer program ComKappa (version 1.0, 1997; © Roger Bakeman & Byron Robinson, Atlanta, GA). Kappa statistics provide a measure of concordance between raters that is more stringent than correlation because it requires exact agreement to increase the κ value, rather than close agreement. Kappa statistics are becoming the standard for measurement of interrater reliability. In addition to computing κ, we also examined the frequency at which various behaviors occurred in the preoperative holding area and during induction of anesthesia.

Next, we examined construct validity of the P-CAMPIS by determining the relation of some of the codes to the child's anxiety. Specifically, we hypothesized that increased verbalized fear, resistance, and crying from the child as assessed on the P-CAMPIS should be associated with increased preoperative anxiety as assessed by the modified Yale Preoperative Anxiety Scale. We used independent *t* tests to analyze the relation between P-CAMPIS subscale scores on children's anxiety. Data are reported as mean ± SD. Significance was accepted at $P < 0.05$. Data were analyzed using SPSS 13.0 (SPSS Inc., Chicago, IL).

Results

Children recruited for this study were aged 2–12 yr, and the ratio of males to females was 66% to 34%. The attendant parent during induction of anesthesia was the mother in 74% of the cases. Demographic characteristics are presented in table 1.

Table 2. Reliability of P-CAMPIS Codes for Adult Vocalizations

Adult to Child	κ
Active distraction (ActD)	0.87
Bargaining (BARG)	0.83
Behavioral command (BCC)	0.80
Cajole (CAJ)	0.85
Check child's status (CST)	0.93
Child-friendly talk (CFT)	0.86
Coping strategy (CCSC)	0.94
Criticism (CRIT)	1.00
Emotional support (ESC)	0.81
Empathy (EMP)	0.80
Give child control (GCC)	0.72
Use of humor (HMC)	0.91
Nonprocedural talk (NPTC)	0.91
Praise (PRAS)	0.98
Procedural command (CPAC)	0.94
Procedural talk (PTC)	0.83
Reassurance (REASU)	0.94
Other (OT)	NA

General agreement exists that the following interpretations of clinical significance apply to individual weighted κ values as follows: κ (*W*) < 0.40 = poor, 0.40–0.59 = fair, 0.60–0.74 = good, and 0.75–1.00 = excellent.

NA = not applicable; P-CAMPIS = Perioperative Child-Adult Medical Procedure Interaction Scale.

Initial results showed that κ reliability for all codes averaged 0.62 for verbal codes and 0.64 for nonverbal codes. Based on these initial results and on further discussion of coding disagreements, the P-CAMPIS was refined again, and a set of 5 more transcriptions were tested by an independent members task force for coding reliability. Kappa values for this last set of transcriptions averaged 0.803 for verbal codes and 0.787 for nonverbal codes. As a reference point, verbal codes of the original CAMPIS showed a κ of 0.79 (range, 0.53–0.94), and codes added to the P-CAMPIS showed an average κ reliability of 0.84 (range, 0.78–0.89).

To ensure that P-CAMPIS codes were transportable to researchers who were not part of the original P-CAMPIS task force, a second set of independent naive coders were then trained to use the P-CAMPIS. A last set of 20 new transcripts (total transcriptions used at this point = 45) was then coded. Kappa values for the final version of the P-CAMPIS averaged 0.87 for verbal codes characterizing adult vocalizations, 0.92 for verbal codes characterizing child vocalizations, and 0.88 for nonverbal codes (tables 2 and 3). The following interpretations of clinical significance apply to individual weighted κ values: $\kappa_{(W)} < 0.40$ = poor, 0.40–0.59 = fair, 0.60–0.74 = good, and 0.75–1.00 = excellent.[18]

The final version of the P-CAMPIS‖ contains 40 codes that characterize verbal and nonverbal interactions between children, parents, and medical personnel in the perioperative setting. Coders can apply the most appropriate codes to either written transcriptions of interactions (verbal codes) or videotaped interactions (verbal

‖ The P-CAMPIS as well as the 23-page manual are available from the authors.

Table 3. Reliability of P-CAMPIS Codes for Adult/Child Vocalizations and Nonverbal Behaviors

	κ
Adult to adult or child	
Humor to adults (HMA)	0.91
Nonprocedural talk (NPTA)	0.91
Procedure talk (PTA)	0.84
Check parent status (CAST)	0.80
Future status (FGSC)	0.81
Nonverbal codes	
Eye contact (EYE)	0.76
Empathic touch (EMPT)	0.90
Medically related touch (MRT)	0.97
Nonverbal resistance (NVRES)	0.88
Nonverbal request for touch (NVRT)	0.85
Mask introduction type (MASK)	0.94
Child to adult	
Cry (CRY)	1.00
Child informs (CIA)	0.82
Child states fear (VFEAR)	1.00
Child states pain (VPAIN)	0.80
Verbal resistance (VRES)	0.92
Request for support (EMSUP)	1.00
Request information (INSEK)	0.89
Nonprocedural talk (NPTC)	0.91
Humor (HUM)	0.89

General agreement exists that the following interpretations of clinical significance apply to individual weighted κ values as follows: κ (*W*) < 0.40 = poor, 0.40–0.59 = fair, 0.60–0.74 = good, and 0.75–1.00 = excellent.
P-CAMPIS = Perioperative Child-Adult Medical Procedure Interaction Scale.

and nonverbal codes) using specific criteria as described in the 23-page P-CAMPIS manual. Five of these codes describe adult-to-adult communication, including behaviors such as use of humor and commands for managing their child's behavior. Eighteen codes describe communications between and adult and child and include behaviors such as commands to engage in procedural activities, reassurance, empathy, and giving control to the child. One code, vocalizations that refer to the child's future health status, can be applied to either adult–adult interactions or adult–child interactions. Nine codes describe child vocalizations, including distress behaviors such as crying, and coping behaviors such as nonprocedural talk and request for support. Finally, 7 codes describe nonverbal behavior such as empathic touch and nonverbal resistance. A partial list of codes is found in tables 2 and 3, and an example of 2 code descriptors from the P-CAMPIS manual are found in the appendix.

We also report how frequently behaviors assessed by the P-CAMPIS occurred across all 45 subjects in the holding area and in the operating room (table 4). It is important to note that some subjects may have experienced any one behavior more frequently than other subjects, and some subjects may not have experienced any particular behavior. Therefore, these data should not be interpreted as an indication of the relative impact or importance of any particular behavior.

To assess partial construct validity, codes representing anxiety-related constructs (tables 2 and 3) from all 45 subjects were then compared with the child's anxiety during induction of anesthesia to determine support for the validity of selected P-CAMPIS codes. We identified all children who exhibited at least one of the following: fear (as indicated by the code VFEAR), resistance (indicated by the code VRES), and crying (indicated by the code CRY). Then, we compared this group of children to children who did not exhibit any of these three behaviors. An independent *t* test examining state anxiety differences between these two groups of children found that indeed, children who verbalized resistance, fear, or crying as coded on the P-CAMPIS were scored by observers on the modified Yale Preoperative Anxiety Scale as significantly more anxious during induction of anesthesia (75.5 ± 18.2 *vs.* 44.2 ± 22.4; $P = 0.001$).

Table 4. Frequency of Top 10 Verbal Code Occurrences (n = 45) in the Preoperative Holding Area and in the Operating Rooms

Code	%
Holding area	
Nonprocedural talk	72.2
Procedural talk	14.4
Use of humor	2.7
Verbal resistance	1.9
Future status	1.9
Behavioral command	1.8
Check child's status	1.1
Request information	1.0
Cajole	0.9
Operating room	
Praise	14.5
Procedural command	13.8
Procedural talk	13.5
Nonprocedural talk	9.8
Child-friendly talk	8.4
Coping strategy	5.8
Check child's status	5.5
Emotional support	5.1
Active distraction	4.9

Definitions and examples for each code are specified in the 23-page manual for the Perioperative Child-Adult Medical Interaction Scale.

Discussion

This investigation supports the reliability and initial validity of the newly developed P-CAMPIS. Kappa statistics showed excellent reliability and confirmed expected associations between P-CAMPIS codes and children's perioperative anxiety, indicating construct validity. The creation of this scale is the first necessary step in the development of parental preparation programs for both parents and healthcare providers. Indeed, as we stated at the onset of this article, we propose the need to move from the question of whether we should let parents into the operating room to the question of what parents actually should do while they are present in the operating room.

Previously, Blount *et al.*[19,20] developed a working model to conceptualize how various factors impact anxiety and distress behavior in children undergoing painful invasive medical procedures. We suggest that this model is valid for parental presence during induction of anesthesia. This model suggests that there are primarily two types of factors that predict the reaction of children in acute painful medical situation. Proximal factors are the parental and healthcare staff behaviors that occur immediately before or during the medical procedure, and distal factors are baseline variables such as temperament, child's age, and level of distress during past medical procedures.[21–24] Although distal factors may strongly impact child's anxiety and distress, these factors are difficult or impossible to change. In contrast, proximal factors, such as parental behaviors and healthcare provider behaviors, can be modified, thus resulting in decreased child's distress. In a study of children receiving immunizations, Frank *et al.*[25] found that proximal factors accounted for 38% of the variance in child distress and 55% of the variance in child coping. Given the strong contribution of proximal factors to children's reactions during painful medical procedures, it is not surprising that a number of recent experimental studies involving children undergoing immunizations, voiding cystourethrogram, and lumbar puncture have demonstrated that parental behavior training programs effectively reduce children's distress.[11,14,15,26] Despite methodologic difficulties in some of these preliminary interventional studies, it is clear that when the appropriate parent–child interaction patterns are identified, training parents and healthcare providers to change their state-like behaviors during invasive medical procedures is a valid and effective approach to reducing children's distress. We suggest that children's anxiety and distress during induction of anesthesia also can be reduced in large part by modifying proximal factors such as parental and healthcare provider behaviors.

It is important to note that only statistical tools that examine sequences or chains of behavior can determine which specific adult behaviors are likely to actually prompt particular child behaviors. That is, simply looking at correlations or frequencies between parental behaviors and anxiety in children will only indicate an association, not a cause-and-effect relation. In contrast, sequential analysis can identify specific child behaviors that most often immediately precede and follow parent and healthcare provider behaviors. Briefly, to address such questions, the investigator defines windows of time around the first (given) behavior and then asks whether onsets of the second (target) behavior are more likely within such windows than not. An odds ratio is used to describe such relations for individual dyads, and a log odds ratio is used for subsequent analyses.[27,28] Separate sequential analyses are conducted for different adults (*e.g.*, parents *vs.* healthcare providers) and for different

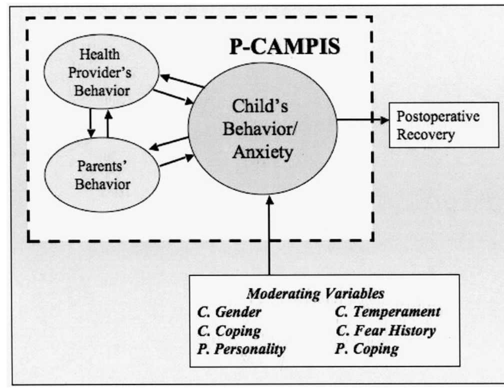

Fig. 1. The conceptual framework that underlies the relation between a child's preoperative anxiety, parental behaviors, healthcare provider behaviors, moderating variables, and postoperative recovery. C = child; P = parent; P-CAMPIS = Perioperative Child-Adult Medical Procedure Interaction Scale.

phases (preoperative, induction) of the procedure. Given bidirectional effects between individuals during interactions, identifying the immediate behavioral precedents and antecedents of specific adult behaviors provides a more complete understanding of when and why an adult may engage in a potentially negative behavior and allows for more targeted intervention efforts with children, parents, and healthcare providers. The sample size of such a future study must be sufficiently high, because moderating variables such as age of the child are likely to affect the response of a child to any particular adult behavior (fig. 1).

Finally, some methodologic limitations of the P-CAMPIS and the approach described in this article should be discussed. We recognize that some parent–child interactions cannot be fully captured by the P-CAMPIS. However, based on the body of work that was done over the past decade by Blount and others, as well the successful intervention programs developed for procedures such as voiding cystourethrogram, we are confident that the parent–child interactions that are captured by the newly developed P-CAMPIS coding system are powerful enough to enable us to effectively modify children's distress during induction of anesthesia. In addition, we recognize that future investigations should validate the P-CAMPIS in the context of other cultures and social backgrounds.

In conclusion, we have provided initial validation for a new scale that is directed at measuring behavioral interactions that occur during the perioperative period between children, their parents, and healthcare providers. We suggest that this scale should be used to identify specific parental and healthcare behaviors that lead to increased or decreased children's anxiety. When such causal sequential analyses are conducted and these behaviors are identified, empirically based, cost-effective parental preparation programs can be developed.

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Appendix: A Sample Page from the P-CAMPIS Manual

REASU: Invalidating Reassurance REASU includes comments that are directed toward the child with the intent of reassuring the child about his or her condition or the course of the procedure but with the function of also invalidating the child's feelings. These may be volunteered by staff or parents and may be in response to questions by the child or may reflect the child's comments. Reassurance as defined by this code is specifically invalidating communications to the child and should not be understood as conventional reassurance in the lay use of this term. Communications that reflect the code of invalidating reassurance are those that send a message that the child's emotions are inappropriate or should be dismissed. For example, if the child begins to cry and the parent responds with "It's okay, you are fine," this is coded as REASU. Generally, if you can add the fragment ". . . so stop feeling X" to the end of the sentence, it is probably coded as REASU. If, in the context, the fragment "so stop feeling X" does not fit, the comment is probably ESC. If procedure related information is repeated in response to the child's request for reassurance or emotional support, code these procedural notifications as PTC. If given after (in response to) VFEAR, CRY, VRES, NVRES, or any other statement indicating distress by the child, the following are then coded as REASU: "I'm right here, it's okay," "It's all right, its okay, I love you." Note that these statements are not coded as reassurance when they are not in response to VFEAR, CRY, VRES, NVRES, or any other statement indicating distress by the child. Also coded as REASU are repeated "I love you" statements where the parent says "I love you" over and over. Any statement of "I love you" that occurs more than twice in the same instance is REASU. For example, the following entire verbalization would be coded as REASU: "I love you, I love you tiger, it's okay, it's okay, I love you Johnny, it's okay, I love you pumpkin, I love you." This comment is invalidating reassurance because it functions more to provide resolution for the parent's feelings rather than to validate the child's current experience. Most parents and medical personnel mean well when they reassure children and do not intend to invalidate the child's feelings; however, the functional impact of these statements is nonetheless invalidating because the overall message to the child is that he or she should stop having the current feeling of (usually) distress.

1. "You're O.K."
2. "It's almost over."
3. "Those pajamas aren't scratchy, they are cute, put them on, you'll be fine."
4. "Honey, it's not going to hurt you, it's just medicine."
5. "I'm not doing anything."
6. "Just touching honey."
7. "Okay, okay, you're going to be happy, it's okay."
8. Child: "I don't want it." Adult: "Oh, you're all right."

ESC: Emotional Support to Child/Comfort ESC includes soothing, noninvalidating statements. See REASU for discriminators. These can be in response to requests for support from the child (EMSUP) but not in response to child's fear, cry, or verbal resistance. ESC also should not be coded when parent is calming his or her own fears (see REASU). ESC can be coded for any reminder that others are there to help the child.

1. "I love you."
2. "I'm with you honey."
3. "You're going to be fine sweetie, your dad is right here."
4. "Look at all these nice people who are here to help you!"