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# Development of a Short Version of the Modified Yale Preoperative Anxiety Scale

Brooke N. Jenkins, MS,\*† Michelle A. Fortier, PhD,\*† Sherrie H. Kaplan, PhD,\*‡§ Linda C. Mayes, MD,|| and Zeev N. Kain, MD, MBA\*||

**BACKGROUND:** The modified Yale Preoperative Anxiety Scale (mYPAS) is the current “criterion standard” for assessing child anxiety during induction of anesthesia and has been used in >100 studies. This observational instrument covers 5 items and is typically administered at 4 perioperative time points. Application of this complex instrument in busy operating room (OR) settings, however, presents a challenge. In this investigation, we examined whether the instrument could be modified and made easier to use in OR settings.

**METHODS:** This study used qualitative methods, principal component analyses, Cronbach  $\alpha$ s, and effect sizes to create the mYPAS-Short Form (mYPAS-SF) and reduce time points of assessment. Data were obtained from multiple patients ( $N = 3798$ ;  $M_{\text{age}} = 5.63$ ) who were recruited in previous investigations using the mYPAS over the past 15 years.

**RESULTS:** After qualitative analysis, the “use of parent” item was eliminated due to content overlap with other items. The reduced item set accounted for 82% or more of the variance in child anxiety and produced the Cronbach  $\alpha$  of at least 0.92. To reduce the number of time points of assessment, a minimum Cohen  $d$  effect size criterion of 0.48 change in mYPAS score across time points was used. This led to eliminating the walk to the OR and entrance to the OR time points.

**CONCLUSIONS:** Reducing the mYPAS to 4 items, creating the mYPAS-SF that can be administered at 2 time points, retained the accuracy of the measure while allowing the instrument to be more easily used in clinical research settings. (Anesth Analg 2014;119:643–50)

Preoperative anxiety is frequently experienced by children undergoing anesthesia and surgery<sup>1</sup> and is associated with a significant number of adverse outcomes such as maladaptive behavioral changes and increased postoperative analgesic requirements.<sup>1</sup> It is important, therefore, to be able to accurately assess preoperative anxiety levels in children undergoing surgery. Measuring anxiety in the preoperative settings, however, is challenging in young children. First, there is limited time in which children can be observed during the preoperative phase. Second, the operating room (OR) and holding areas are often hectic settings, which can make administration of an observational anxiety measure a burden for health care providers. Third, young children may not be capable of expressing their levels of anxiety verbally either because they are not yet developmentally capable of such communication or are hindered

in doing so because of their anxious state. These dilemmas increase the difficulty in accurately observing and assessing child preoperative distress.

To aid in measuring child anxiety before surgery, the modified Yale Preoperative Anxiety Scale (mYPAS) was developed in 1995<sup>2</sup> and modified in 1997<sup>3</sup> (Appendix 1). The mYPAS has been used in >100 studies spanning diverse health fields, such as anesthesia, surgery, pediatrics, and dentistry.<sup>4–9</sup> This measure uses 5 items, each representing a different domain of child anxiety, and is used at 4 points in time during the preoperative phase.

Because of the wide use of the measure, shortening the mYPAS may increase its efficiency in clinical studies and eliminate redundancy within the measure. Several previous studies have used this measure at <4 time points and with <5 items, but these studies did not validate the psychometric properties of their methodology.<sup>5,9–12</sup> The goals of this study were to assess the validity and reliability of a short version of the mYPAS and to determine whether the measure can be used at fewer preoperative time points.

## METHODS

Over the past 15 years, our research group has conducted multiple studies using the mYPAS.<sup>1,8,9,13–27</sup> Participants in these studies ( $N = 3798$ ,  $M_{\text{age}} = 5.63$ ,  $SD_{\text{age}} = 2.63$ ) were recruited from 2 major children’s hospitals in the northeastern and southwestern United States and were undergoing outpatient surgery with general anesthesia. Many participants in the sample studied were men (58%) and non-Hispanic Caucasians (78%).

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## Modified Yale Preoperative Anxiety Scale

### Content

The mYPAS consists of 5 items (activity, vocalizations, emotional expressivity, state of apparent arousal, and use of parent). Each item has Likert-type response options reflecting behaviors. Children's behavior is rated from 1 to 4 or 1 to 6 (depending on the item), with higher numbers indicating the highest severity within that item (Appendix 1).

### Timing of Administration

The mYPAS is typically administered at 4 different time points, which include preoperative holding, walk to the OR, entrance to the OR (child enters the OR but has not yet seen the anesthesia mask), and introduction to the anesthesia mask.

### Training

The 5 items of the mYPAS are rated at each of the 4 time points by trained raters. During training, raters first read the mYPAS manual describing the purpose, administration, and scoring of the measure. Second, raters in training and previously trained raters score videos as a group and discuss their scoring decisions. Finally, raters in training score videos alone and have their scores compared with previously trained raters' scores. Any discrepancies between scores are discussed. This procedure is continued until raters in training have  $\kappa$  scores of at least 0.80 for intra- and interrater reliability.

### Scoring

Ratings produce 4 mYPAS scores (1 for each time point). Each score is calculated by dividing each item rating by the highest possible rating (i.e., 6 for the "vocalizations" item and 4 for all other items), adding all the produced values, dividing by 5, and multiplying by 100. This calculation produces a score ranging from 23.33 to 100, with higher values indicating higher anxiety. The item "use of parent" may not always be rated because it requires the presence of the parent. A large majority of participants in this sample

(Table 1) were not rated on the use of parent item during various time points due to lack of parental presence. When this item is not rated, the score is calculated by dividing each item rating by the highest possible rating, adding all the produced values, dividing by 4, and multiplying by 100. This calculation produces a score ranging from 22.92 to 100, with higher values indicating greater anxiety. The mYPAS measure has strong internal reliability, interrater reliability, and convergent validity.<sup>3</sup>

## Statistical Analytic Approach

### Eliminating Items

Content analysis of the items was used to determine whether any item's content overlapped with content in the other items. This was accomplished by comparing each response option within an item with all other scale points of the other items. If all the response options in one item were represented in response options of other items, the item was eliminated.

After eliminating item(s), the reduced item set was then compared with the original full set within each time point. First, confirmatory principal component analyses (using SPSS version 21; IBM Corp, Armonk, NY) were done to ensure that the integrity of the scale was preserved. These analyses examined the variance accounted for in the original item set compared with the reduced item set. If the variance accounted for was within 5%, the reduced item set was considered to be comparable.

Second, the changes in the Cronbach  $\alpha$ s from the original item set to the reduced set, within each of the time points, were examined. The Cronbach  $\alpha$  can range from 0 to 1, with higher values indicating greater internal consistency. If the Cronbach  $\alpha$  for the reduced item set was  $>0.90$  (based on previous literature)<sup>28</sup> or higher than the Cronbach  $\alpha$  of the original item set, it was considered acceptable.

### Eliminating Time Points

The mYPAS produces 4 scores, 1 score for each of the 4 time points. It is possible that these scores are redundant and therefore do not add unique information for research or clinical purposes when assessing child preoperative anxiety. Therefore, it was determined whether the mean mYPAS scores at each of the time points had minimally clinically important (as opposed to statistically significant) differences from one another.<sup>29</sup> To establish a minimally clinically important difference (MCID), we used a distribution-based approach in which we examined the effect sizes of mYPAS score differences within the literature. Studies were identified through the search terms "mYPAS" and "intervention" in PubMed and Google Scholar and a recent review of articles on the topic.<sup>30</sup> Studies that were selected for use in the table met the following conditions: had a control group receiving no treatment for preoperative anxiety and an intervention group receiving treatment for preoperative anxiety; used the mYPAS as a measure of preoperative anxiety; presented the sample sizes, means, and standard deviations of the groups; provided data on intervention effects; were written in English; and included samples generalizable to our study population (Table 2). Effect sizes of Cohen  $d$  among studies comparing children in control conditions with children receiving an intervention were examined to establish an MCID. Cohen  $d$ <sup>31</sup> measure of effect size is the

**Table 1. Means, Number of Participants, and Percentage of Missing Data for the Modified Yale Preoperative Anxiety Scale over the Assessment Points With and Without the Use of Parent Item**

Assessment point	mYPAS <sup>a</sup>		
	Means <sup>b</sup> (SD)	N	% Missing
With the use of parent item			
Preoperative holding	36.76 (17.02)	2874	24
Walk to operating room	38.89 (19.97)	2419	36
Entrance to operating room	45.55 (22.78)	1340	65
Introduction of anesthesia mask	52.53 (27.18)	1315	65
Without the use of parent item			
Preoperative holding	35.90 (17.11)	2899	24
Walk to operating room	38.26 (19.94)	2634	31
Entrance to operating room	42.48 (21.97)	3259	14
Introduction of anesthesia mask	49.06 (26.18)	3178	16

<sup>a</sup>Modified Yale Preoperative Anxiety Scale.

<sup>b</sup>Repeated measures analyses of variance revealed that mYPAS scores at each of the time points were significantly different from one another with the use of parent item  $F(2.142, 1917.517) = 155.368, P < 0.001$ , and without the use of parent item  $F(2.247, 5137.156) = 304.574, P < 0.001$ .

**Table 2. Effect Sizes Between Control and Intervention Groups<sup>a</sup>**

Group compared with control	Research design		Effect size
	(Total sample size of 2 groups)	Time point of assessment	
Children receiving midazolam <sup>b</sup>	Randomized controlled study (197)	Introduction of the anesthesia mask	0.48
Children playing with a toy <sup>c</sup>	Randomized controlled study (88)	Holding room/operating room	0.70/0.81
Children watching a cartoon <sup>c</sup>	Randomized controlled study (86)	Operating room	1.79
Parental presence (versus parental absence) <sup>d</sup>	Randomized controlled study (61)	Walk to the operating room	0.78
Children accompanied by a clown <sup>e</sup>	Randomized controlled study (50)	Induction of anesthesia	1.46
Children receiving midazolam <sup>e</sup>	Randomized controlled study (50)	Induction of anesthesia	0.65

<sup>a</sup>Studies were identified through the search terms “mYPAS” and “intervention” in PubMed and Google Scholar and a recent review of articles on the topic.<sup>30</sup> Studies that were selected for use in the table met the following conditions: had a control group receiving no treatment for preoperative anxiety and an intervention group receiving treatment for preoperative anxiety; used the mYPAS as a measure of preoperative anxiety; presented the sample sizes, means, and standard deviations of the groups; provided data on intervention effects; were written in English; and included samples generalizable to our study population.

<sup>b</sup>mYPAS measures taken in holding area and during introduction of anesthesia mask.<sup>24</sup>

<sup>c</sup>mYPAS measure taken during preanesthetic visit and in the holding area and operating room.<sup>32</sup>

<sup>d</sup>mYPAS measure taken 90 minutes before surgery, 5 minutes before surgery, walk to the operating room (when children in the parental absence group were separated from their parents), and induction of anesthesia.<sup>33</sup>

<sup>e</sup>mYPAS measure taken in the holding area and at induction of anesthesia.<sup>34</sup>

difference between the 2 means divided by the pooled standard deviation of both means. Effect sizes of 0.20, 0.50, and 0.80 represent small, medium, and large effects, respectively. We determined that the smallest effect size representing the reduction in mYPAS score due to the treatment would represent an MCID. Subsequent time points that did not produce this effect, starting from baseline, were eliminated.

## RESULTS

### Eliminating Items

#### Selecting Items to Eliminate

Content analysis was used to eliminate items that were a duplication of other items. The items of “activity,” “vocalizations,” “emotional expressivity,” and “state of apparent arousal” did not have all their behaviors present in other scale points and as such were not eliminated (Appendix 2). The use of parent item, however, was excluded because all the content within this item was also present in the “activity” item. For example, “may sit close to parent while waiting” and “may push mask away or cling to parent” are behaviors that can be selected within the activity item. The item use of parent was also eliminated for practical purposes because it is not always possible to rate this item since it requires that the parent be present during induction of anesthesia. Because parents are not always present, this item is often not scored (Table 1).

#### Assessing Reduced Item Set

Confirmatory principal component analyses of all 5 items (full item set) during each of the 4 time points (Appendix 3) were conducted to obtain the percentage of variance accounted for in mYPAS scores. Each analysis produced 1 factor that accounted for at least 80% of the variance (Table 3). Confirmatory principal component analyses of the reduced item set for each of the time points (Appendix 3) produced 1 factor that accounted for at least 82% of the variance in mYPAS score (Table 3). Each difference between the variances accounted for in the mYPAS score during each time point was not >5%. Therefore, the variance accounted for was considered comparable, indicating that the negative impact of eliminating the item was negligible.

The Cronbach  $\alpha$ s of the full item set (all 5 items) during each time point were at least 0.93 (see Table 3). The Cronbach  $\alpha$ s for the reduced item set (4 items) during each time point were at least 0.92. All  $\alpha$  values were above 0.90. Therefore, the  $\alpha$  values of the reduced item set (now referred to as the

mYPAS-Short Form [SF]) were considered to be sufficient, indicating that the internal reliability of the measure was not compromised when removing 1 item.

### Eliminating Time Points

#### Establishing a Minimally Clinically Important Difference

Table 2 presents the effect sizes of Cohen  $d$  among studies comparing children in control conditions with children receiving an intervention. We determined that the smallest effect size of 0.48, representing the reduction in mYPAS score due to midazolam, is an MCID. This effect size served as our criterion for the elimination of time points.

#### Comparing Time Points

The mean differences between time points of assessment and the pooled standard deviations of mYPAS scores presented in Tables 4 and 5 were used to calculate effect sizes between time points. Although all differences in mYPAS scores among time points were statistically significantly different from one another, effect size measures were used to examine the MCIDs between the mYPAS scores.

Tables 4 and 5 present the effect sizes between each of the time points for the original mYPAS and the mYPAS-SF, respectively. Because changes in mYPAS score from preoperative holding to walk to the OR and from holding to entrance to the OR produced effect sizes below the set criterion of 0.48, these 2 time points were eliminated. The change in mYPAS score from preoperative holding to introduction of the anesthesia mask produced effect sizes of 0.53 and 0.48 for the original mYPAS and the mYPAS-SF, respectively. Because these changes were at or more than the set criterion, this time point was retained. Although the change from walk to the OR to introduction of the anesthesia mask was above the set criteria of 0.48 in Table 4, the prior elimination of the time point walk to the OR renders that change not useful.

## DISCUSSION

The purpose of this investigation was to revise the mYPAS, which was developed and validated as an observational measure of children’s preoperative anxiety. Because this measure, originally published in *Anesthesia & Analgesia*,<sup>3</sup> has been in use for >15 years, it was the goal of this study to revisit the mYPAS, given the abundance of data that have been collected over the past decade and a half. Accordingly,

**Table 3. Variance Accounted for by Full Item Set Compared with Reduced Item Set and the Cronbach  $\alpha$  of Full Item Set and Reduced Item Set at Each Assessment Point**

Assessment point	Variance accounted for		Cronbach $\alpha$	
	Full item set	Reduced item set	Full item set	Reduced item set
Preoperative holding	80%	82%	0.93	0.92
Walk to operating room	85%	86%	0.95	0.94
Entrance to operating room	86%	87%	0.95	0.94
Introduction of the anesthesia mask	90%	91%	0.96	0.95

**Table 4. Effect Sizes Between Assessment Points of Administration of the Modified Yale Preoperative Anxiety Scale (5 Items)**

Assessment points compared <sup>a</sup>	Mean difference <sup>b</sup>	Pooled standard deviation	P value <sup>c</sup>	Effect size	95% CI on effect size
Holding versus walk to OR	2.52	20.29	<0.001	0.12	0.08–0.15
Holding versus entrance to OR	7.72	22.84	<0.001	0.34	0.29–0.40
Holding versus introduction to anesthesia mask	14.83	28.18	<0.001	0.53	0.47–0.63
Walk to OR versus entrance to OR	5.56	15.15	<0.001	0.37	0.31–0.43
Walk to OR versus introduction of anesthesia mask	12.96	23.04	<0.001	0.56	0.49–0.63
Entrance to OR versus introduction of anesthesia mask	7.43	16.86	<0.001	0.44	0.38–0.50

CI = confidence interval; OR = operating room.

<sup>a</sup>Although some studies within this data set do not independently produce the same significant results, almost all the studies produce the same pattern of results.

<sup>b</sup>Mean differences represent the increase in mYPAS score from the first time point to the second.

<sup>c</sup>P values remain significant when Bonferroni correction for familywise error is used.

**Table 5. Effect Sizes Between Assessment Points of Administration of the Modified Yale Preoperative Anxiety Scale-Short Form (mYPAS-SF; 4 Items)**

Assessment points compared <sup>a</sup>	Mean difference <sup>b</sup>	Pooled standard deviation	P value <sup>c</sup>	Effect size	95% CI on effect size
Holding versus walk to OR	2.50	20.56	<0.001	0.12	0.08–0.14
Holding versus entrance to OR	6.89	23.50	<0.001	0.29	0.26–0.33
Holding versus introduction to anesthesia mask	13.41	27.97	<0.001	0.48	0.44–0.52
Walk to OR versus entrance to OR	4.37	16.39	<0.001	0.27	0.23–0.31
Walk to OR versus introduction of anesthesia mask	10.83	23.31	<0.001	0.46	0.42–0.51
Entrance to OR versus introduction of anesthesia mask	6.71	16.56	<0.001	0.41	0.37–0.44

CI = confidence interval; OR = operating room.

<sup>a</sup>Although some studies within this data set do not independently produce the same significant results, almost all the studies produce the same pattern of results.

<sup>b</sup>Mean differences represent the increase in mYPAS score from the first time point to the second.

<sup>c</sup>P values remain significant when Bonferroni correction for familywise error is used.

we have used validated statistical methods to develop the mYPAS-SF (Appendix 4) in an attempt to increase ease of use by removing redundant items. We have also improved the measure by eliminating time points of administration.

Preoperative anxiety is frequently experienced by children undergoing surgery<sup>1</sup> and is associated with a significant number of adverse outcomes such as maladaptive behavioral changes, increased postoperative analgesic requirements, and increased incidence of emergence delirium.<sup>2</sup> It is important, therefore, to accurately assess child distress before surgery. However, measuring anxiety in the preoperative setting becomes difficult due to the limited time children can be observed, the hectic settings of the OR and holding areas, and the inability of young children to communicate their anxious state. Because of these challenges, the present study was an opportunity to revise the mYPAS to increase efficiency of its clinical use by addressing barriers to administration.

This investigation resulted in 2 findings. First, the use of parent item was eliminated while retaining the psychometric integrity of the scale. Elimination of this item will shorten the process of training raters to use the mYPAS-SF. Second, using a minimum effect size criterion of change in anxiety

across time points of administration resulted in eliminating 2 of the 4 time points. This effectively reduces the time and effort in administration of the mYPAS (or mYPAS-SF) in half without any loss of significant clinical information regarding children’s preoperative anxiety. Specifically, health care providers or researchers were previously present for the entire preoperative process to administer the mYPAS at each of the 4 time points. Eliminating these time points will allow for administration once at the beginning of the preoperative process in the holding area and one final time in the OR when the anesthesia mask is introduced to the child.

In conclusion, we were able to modify the mYPAS to create the mYPAS-SF. This decreased redundancy among items and reduced the time it takes to administer the measure. These revisions increase the clinical applicability of the scale by expanding the use of the measure to health care providers in busy perioperative clinical settings. ■■

**DISCLOSURES**

**Name:** Brooke N. Jenkins, MS.

**Contribution:** This author helped analyze the data and write the manuscript.



**Attestation:** Brooke N. Jenkins has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

**Name:** Michelle A. Fortier, PhD.

**Contribution:** This author helped design the study, conduct the study, and write the manuscript.

**Attestation:** Michelle A. Fortier has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

**Name:** Sherrie H. Kaplan, PhD.

**Contribution:** This author helped analyze the data and write the manuscript.

**Attestation:** Sherrie H. Kaplan has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

**Name:** Linda C. Mayes, MD.

**Contribution:** This author helped design the study, conduct the study, and write the manuscript.

**Attestation:** Linda C. Mayes has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

**Name:** Zeev N. Kain, MD, MBA.

**Contribution:** This author helped design the study, conduct the study, and write the manuscript.

**Attestation:** Zeev N. Kain has seen the original study data, reviewed the analysis of the data, approved the final manuscript, and is the author responsible for archiving the study files.

**This manuscript was handled by:** Peter J. Davis, MD.

## APPENDIX 1. The mYPAS

### A. Activity

1 = Looking around, curious, playing with toys, reading (or other age-appropriate behavior); moves around holding area/treatment room to get toys or go to parent; may move toward OR equipment.

2 = Not exploring or playing, may look down, may fidget with hands or suck thumb (blanket); may sit close to parent while waiting, or play has a definite manic quality.

3 = Moving from toy to parent in unfocused manner, nonactivity-derived movements; frenetic/frenzied movement or play; squirming, moving on table, may push mask away, or clinging to parent.

4 = Actively trying to get away, pushes with feet and arms, may move whole body; in waiting room, running around unfocused, not looking at toys or will not separate from parent, desperate clinging.

### B. Vocalizations

1 = Reading (nonvocalizing appropriate to activity), asking questions, making comments, babbling, laughing, readily answers questions but may be generally quiet; child too young to talk in social situations or too engrossed in play to respond.

2 = Responding to adults but whispers, "baby talk," only head nodding.

3 = Quiet, no sounds or responses to adults.

4 = Whimpering, moaning, groaning, silently crying.

5 = Crying or may be screaming "no."

6 = Crying, screaming loudly, sustained (audible through mask).

### C. Emotional expressivity

1 = Manifestly happy, smiling, or concentrating on play.

2 = Neutral, no visible expression on face.

3 = Worried (sad) to frightened, sad, worried, or tearful eyes.

4 = Distressed, crying, extremely upset, may have wide eyes.

### D. State of apparent arousal

1 = Alert, looks around occasionally, notices or watches what anesthesiologist does with him/her (could be relaxed).

2 = Withdrawn, child sitting still and quiet, may be sucking on thumb or face turned into adult.

3 = Vigilant, looking quickly all around, may startle to sounds, eyes wide, body tensed.

4 = Panicked whimpering, may be crying or pushing others away, turns away.

### E. Use of parents

1 = Busy playing, sitting idle, or engaged in age-appropriate behavior and does not need parent; may interact with parent if parent initiates the interaction.

2 = Reaches out to parent (approaches parent and speaks to otherwise silent parent), seeks and accepts comfort, may lean against parent.

3 = Looks to parents quietly, apparently watches actions, does not seek contact or comfort, accepts it if offered or clings to parent.

4 = Keeps parent at distance or may actively withdraw from parent, may push parent away or desperately clinging to parent and will not let parent go.

Appendix 2. List of Item Scale Point Behaviors and Overlapping Content Among Other Items		
Item	Scale point behaviors	Overlapping content from other items
Activity	1. Looking around, curious, playing with toys, reading (or other age-appropriate behavior); moves around holding area/treatment room to get toys or go to parent; may move toward OR equipment	"Looks around occasionally"—state of arousal "Looking quickly all around"—state of arousal "Too engrossed in play to respond"—vocalizations "Reading"—vocalizations "Engaged in age-appropriate behavior"—use of parent
	2. Not exploring or playing, may look down, may fidget with hands or suck thumb (blanket); may sit close to parent while waiting	"May be sucking on thumb"—state of arousal "Reaches out to parent (approaches parent and speaks to otherwise silent parent), may lean against parent"—use of parent
	3. Moving from toy to parent in unfocused manner, nonactivity-derived movements; frenetic/frenzied movement or play; squirming, moving on table, may push mask away or clinging to parent	"Clings to parent"—use of parent
	4. Actively trying to get away, pushes with feet and arms, may move whole body; in waiting room, running around unfocused, not looking at toys or will not separate from parent, desperate clinging	"Pushing others away"—state of arousal "Keeps parent at distance or may actively withdraw from parent, may push parent away or desperately clinging to parent and will not let parent go"—use of parent
Vocalizations	1. Reading (nonvocalizing appropriate to activity), asking questions, making comments, babbling, laughing, readily answers questions but may be generally quiet; child too young to talk in social situations or too engrossed in play to respond	"Reading"—activity "Speaks to otherwise silent parent"—use of parent "Concentrating on play"—emotional expressivity "Playing with toys"—activity
	2. Responding to adults but whispers, "baby talk," only head nodding	
	3. Quiet, no sounds or responses to adults	
	4. Whimpering, moaning, groaning, silently crying	"Panicked whimpering"—state of arousal
	5. Crying or may be screaming "no"	"Crying"—emotional expressivity "Crying"—state of arousal
	6. Crying, screaming loudly, sustained (audible through mask)	"Crying"—emotional expressivity "Crying"—state of arousal
Emotional expressivity	1. Manifestly happy, smiling, or concentrating on play	"Playing with toys"—activity "Too engrossed in play"—vocalizations "Busy playing"—use of parent
	2. Neutral, no visible expression on face	
	3. Worried (sad) to frightened, sad, worried, or tearful eyes	
	4. Distressed, crying, extreme upset, may have wide eyes	"Crying"—vocalizations "Crying"—state of arousal "Eyes wide"—state of arousal
State of arousal	1. Alert, looks around occasionally, notices/watches what anesthesiologist does with him/her	"Looking around"—activity
	2. Withdrawn, child sitting still and quiet, may be sucking on thumb, or face turned to adult	"Sitting idle"—use of parent "Generally quiet"—vocalizations "May fidget with hands or such thumb (blanket)"—activity "Looks to parent quietly"—use of parent
	3. Vigilant, looking quickly all around, may startle to sounds, eyes wide, body tense	"Looking around"—activity "Wide eyes"—emotional expressivity
	4. Panicked whimpering, may be crying or pushing others away, turns away	"Whimpering"—vocalizations "Crying"—vocalizations "Crying"—emotional expressivity "Pushes with feet and arms"—activity "May push parent away"—use of parent
Use of parent	1. Busy playing, sitting idle, or engaged in age-appropriate behavior and does not need parent; may interact with parent if parent initiates the interaction	"Concentrating on play"—emotional expressivity "Too engrossed in play"—vocalizations "Sitting still"—state of arousal "Playing with toys, reading (or other age-appropriate behavior)"—activity
	2. Reaches out to parent (approaches parent and speaks to otherwise silent parent), seeks and accepts comfort, may lean against parent	"Moves around holding area/treatment room to get toys or go to parent"—activity "Making comments"—vocalizations "May sit close to parent while waiting"—activity
	3. Looks to parents quietly, apparently watches actions, does not seek contact or comfort, accepts it if offered or clings to parent	"Face turned to adult"—state of arousal "Clings to parent"—activity
	4. Keeps parent at distance or may actively withdraw from parent, may push parent away or desperately clinging to parent and will not let parent go	"Pushing others away"—state of arousal "Will not separate from parent, desperate clinging"—activity

### Appendix 3. Results of the Principal Component Analyses of the mYPAS at the Preoperative Holding Time Point for Full Item Set and Reduced Item Set

Item	Full item set factor loading	Reduced item set factor loading
Activity	0.91	0.90
Vocalizations	0.86	0.88
Emotional expressivity	0.90	0.91
State of apparent arousal	0.93	0.93
Use of parent	0.88	—
Eigenvalue	4.00	3.28
% of variance explained	80.0	82.0

Note: Use of parents is only scored when parent is present. Scoring: Divide each item rating by the highest possible rating (i.e., 6 for the “vocalizations” item and 4 for all other items), add all the produced values, divide by 5 (or 4 if E is not rated), and multiply by 100.

### Appendix 4. The mYPAS-SF

#### A. Activity

- 1 = Looking around, curious, playing with toys, reading (or other age-appropriate behavior); moves around holding area/treatment room to get toys or go to parent; may move toward OR equipment
- 2 = Not exploring or playing, may look down, may fidget with hands or suck thumb (blanket); may sit close to parent while waiting, or play has a definite manic quality
- 3 = Moving from toy to parent in unfocused manner, nonactivity-derived movements; frenetic/frenzied movement or play; squirming, moving on table, may push mask away or clinging to parent
- 4 = Actively trying to get away, pushes with feet and arms, may move whole body; in waiting room, running around unfocused, not looking at toys or will not separate from parent, desperate clinging

#### B. Vocalizations

- 1 = Reading (nonvocalizing appropriate to activity), asking questions, making comments, babbling, laughing, readily answers questions but may be generally quiet; child too young to talk in social situations or too engrossed in play to respond
- 2 = Responding to adults but whispers, “baby talk,” only head nodding
- 3 = Quiet, no sounds or responses to adults
- 4 = Whimpering, moaning, groaning, silently crying
- 5 = Crying or may be screaming “no”
- 6 = Crying, screaming loudly, sustained (audible through mask)

#### C. Emotional expressivity

- 1 = Manifestly happy, smiling, or concentrating on play
- 2 = Neutral, no visible expression on face
- 3 = Worried (sad) to frightened, sad, worried, or tearful eyes
- 4 = Distressed, crying, extreme upset, may have wide eyes

#### D. State of apparent arousal

- 1 = Alert, looks around occasionally, notices/watches what anesthesiologist does with him/her (could be relaxed)
- 2 = Withdrawn, child sitting still and quiet, may be sucking on thumb or face turned into adult

3 = Vigilant, looking quickly all around, may startle to sounds, eyes wide, body tense

4 = Panicked whimpering, may be crying or pushing others away, turns away

Scoring: Divide each item rating by the highest possible rating (i.e., 6 for the “vocalizations” item and 4 for all other items), add all of the produced values, divide by 4, and multiply by 100.

### REFERENCES

1. Kain ZN, Mayes LC, Caldwell-Andrews AA, Karas DE, McClain BC. Preoperative anxiety, postoperative pain, and behavioral recovery in young children undergoing surgery. *Pediatrics* 2006;118:651–8
2. Kain ZN, Mayes LC, Cicchetti DV, Caramico LA, Spieker M, Nygren MM, Rimar S. Measurement tool for preoperative anxiety in young children: the Yale Preoperative Anxiety Scale. *Child Neuropsychol* 1995;1:203–10
3. Kain ZN, Mayes LC, Cicchetti DV, Bagnall AL, Finley JD, Hofstadter MB. The Yale Preoperative Anxiety Scale: how does it compare with a “gold standard”? *Anesth Analg* 1997;85:783–8
4. Cuzzocrea F, Gugliandolo MC, Larcari R, Romeo C, Turiano N, Dominici T. A psychological preoperative program: effects on anxiety and cooperative behaviors. *Paediatr Anaesth* 2013;23:139–43
5. Davidson AJ, Shrivastava PP, Jansen K, Huang GH, Czarnicki C, Gibson MA, Stewart SA, Stargatt R. Risk factors for anxiety at induction of anesthesia in children: a prospective cohort study. *Paediatr Anaesth* 2006;16:919–27
6. Huet A, Lucas-Polomeni MM, Robert JC, Sixou JL, Wodey E. Hypnosis and dental anesthesia in children: a prospective controlled study. *Int J Clin Exp Hypn* 2011;59:424–40
7. Weldon BC, Bell M, Craddock T. The effect of caudal analgesia on emergence agitation in children after sevoflurane versus halothane anesthesia. *Anesth Analg* 2004;98:321–6
8. Fortier MA, MacLaren JE, Martin SR, Perret-Karimi D, Kain ZN. Pediatric pain after ambulatory surgery: where’s the medication? *Pediatrics* 2009;124:e588–95
9. Fortier MA, Del Rosario AM, Martin SR, Kain ZN. Perioperative anxiety in children. *Paediatr Anaesth* 2010;20:318–22
10. Rice M, Gasper A, Keeton D, Spargo P. The effect of a preoperative education programme on perioperative anxiety in children: an observational study. *Paediatr Anaesth* 2008;18:426–30
11. Ferguson GG, Chen C, Yan Y, Royer ME, Campigotto M, Traxel EJ, Copley DE, Austin PF. The efficacy of oral midazolam for decreasing anxiety in children undergoing voiding cystourethrogram: a randomized, double-blind, placebo controlled study. *J Urol* 2011;185:2542–6
12. Kil HK, Kim WO, Han SW, Kwon Y, Lee A, Hong JY. Psychological and behavioral effects of chloral hydrate in day-case pediatric surgery: a randomized, observer-blinded study. *J Pediatr Surg* 2012;47:1592–9
13. Fortier MA, Blount RL, Wang SM, Mayes LC, Kain ZN. Analysing a family-centred preoperative intervention programme: a dismantling approach. *Br J Anaesth* 2011;106:713–8
14. Chorney JM, Garcia AM, Berlin KS, Bakeman R, Kain ZN. Time-window sequential analysis: an introduction for pediatric psychologists. *J Pediatr Psychol* 2010;35:1061–70
15. Fortier MA, Del Rosario AM, Rosenbaum A, Kain ZN. Beyond pain: predictors of postoperative maladaptive behavior change in children. *Paediatr Anaesth* 2010;20:445–53
16. Chorney JM, Kain ZN. Behavioral analysis of children’s response to induction of anesthesia. *Anesth Analg* 2009;109:1434–40
17. Chorney JM, Torrey C, Blount R, McLaren CE, Chen WP, Kain ZN. Healthcare provider and parent behavior and children’s coping and distress at anesthesia induction. *Anesthesiology* 2009;111:1290–6
18. Kain ZN, McLaren J, Weinberg M, Huszti H, Anderson C, Mayes L. How many parents should we let into the operating room? *Paediatr Anaesth* 2009;19:244–9
19. Kain ZN, McLaren JE, Hammell C, Novoa C, Fortier MA, Huszti H, Mayes L. Healthcare provider-child-parent communication in the preoperative surgical setting. *Paediatr Anaesth* 2009;19:376–84



20. Kain ZN, MacLaren JE, Herrmann L, Mayes L, Rosenbaum A, Hata J, Lerman J. Preoperative melatonin and its effects on induction and emergence in children undergoing anesthesia and surgery. *Anesthesiology* 2009;111:44–9
21. MacLaren JE, Thompson C, Weinberg M, Fortier MA, Morrison DE, Perret D, Kain ZN. Prediction of preoperative anxiety in children: who is most accurate? *Anesth Analg* 2009;108:1777–82
22. Thompson C, MacLaren JE, Harris A, Kain Z. Brief report: prediction of children's preoperative anxiety by mothers and fathers. *J Pediatr Psychol* 2009;34:716–21
23. MacLaren JE, Kain ZN. Prevalence and predictors of significant sleep disturbances in children undergoing ambulatory tonsillectomy and adenoidectomy. *J Pediatr Psychol* 2008;33:248–57
24. Kain ZN, Caldwell-Andrews AA, Mayes LC, Weinberg ME, Wang SM, MacLaren JE, Blount RL. Family-centered preparation for surgery improves perioperative outcomes in children: a randomized controlled trial. *Anesthesiology* 2007;106:65–74
25. Kain ZN, MacLaren J, McClain BC, Saadat H, Wang SM, Mayes LC, Anderson GM. Effects of age and emotionality on the effectiveness of midazolam administered preoperatively to children. *Anesthesiology* 2007;107:545–52
26. Caldwell-Andrews AA, Kain ZN. Psychological predictors of postoperative sleep in children undergoing outpatient surgery. *Paediatr Anaesth* 2006;16:144–51
27. Kain ZN, Caldwell-Andrews AA, Mayes LC, Wang SM, Krivutza DM, LoDolce ME. Parental presence during induction of anesthesia: physiological effects on parents. *Anesthesiology* 2003;98:58–64
28. Nunnally JC. *Psychometric Theory*. 2nd ed. New York: McGraw-Hill, 1978
29. Crosby RD, Kolotkin RL, Williams GR. Defining clinically meaningful change in health-related quality of life. *J Clin Epidemiol* 2003;56:395–407
30. Scully SM. Parental presence during pediatric anesthesia induction. *AORN J* 2012;96:26–33
31. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates, 1988
32. Lee J, Lee J, Lim H, Son JS, Lee JR, Kim DC, Ko S. Cartoon distraction alleviates anxiety in children during induction of anesthesia. *Anesth Analg* 2012;115:1168–73
33. Wright KD, Stewart SH, Finley GA. When are parents helpful? A randomized clinical trial of the efficacy of parental presence for pediatric anesthesia. *Can J Anaesth* 2010;57:751–8
34. Vagnoli L, Caprilli S, Messeri A. Parental presence, clowns or sedative premedication to treat preoperative anxiety in children: what could be the most promising option? *Paediatr Anaesth* 2010;20:937–43