J Clin Psychol Med Settings (2014) 21:374–385
DOI 10.1007/s10880-014-9413-4

A Sequential Examination of Parent–Child Interactions at Anesthetic Induction

Kristi D. Wright · Sherry H. Stewart · G. Allen Finley · Mateen Raazi

Published online: 29 October 2014

Abstract Parental presence is often employed to alleviate distress in children within the context of surgery under general anesthesia. The critical component of this intervention may not be the presence of the parent per se, but more importantly the behaviors in which the parent and child engage when the parent is present. The purpose of the current study was to examine the sequential and reciprocal relationships between parental behaviors and child distress during induction of general anesthesia. Participants were 32 children (3–6 years) receiving dental surgery as a day surgery procedure, and their parents. A modified Child Adult Medical Procedures Interaction Scale-Revised was used to code parent and child behaviors. Initial child distress led to increased parental provision of reassurance and decreased provision of physical comfort. Our findings may inform the development of preoperative preparation programs whereby parents can be appropriately educated about what behaviors will be helpful/unhelpful for their child during induction of general anesthesia.

Keywords Anesthesia · Preoperative anxiety · Children · Parental behaviors · Measurement

K. D. Wright (✉)
Department of Psychology, University of Regina, Regina, SK S4S 0A2, Canada
e-mail: kristi.wright@uregina.ca

S. H. Stewart · G. A. Finley
Department of Psychology, Dalhousie University, Halifax, NS, Canada

S. H. Stewart
Department of Psychiatry, Dalhousie University, Halifax, NS, Canada

G. A. Finley
Department of Anesthesia, IWK Health Centre, Dalhousie University, Halifax, NS, Canada

M. Raazi
Department of Anesthesiology, Perioperative Medicine and Pain Management, University of Saskatchewan, Saskatoon, SK, Canada

Introduction

Allowing parents to be present at the induction of general anesthesia just prior to surgery ("parental presence") is one type of intervention employed to alleviate anxiety and distress in children undergoing a surgical procedure. The efficacy of this intervention has received considerable attention throughout the years (see reviews by Chundamala et al. 2009; Piira et al. 2005; Strom, 2012; Wright et al. 2007; Yip et al. 2009). An overwhelming amount of evidence seems to suggest that child anxiety during anesthetic induction is not impacted by the mere presence/absence of a parent. That is, in controlled investigations where parents are randomly assigned to parental presence/absence groups, child anxiety frequently does not differ across groups (e.g., Wright et al. 2010). In spite of this evidence, the use of parental presence continues to be regarded as a viable intervention method in clinical practice. In fact, the most recent survey examining the trends in the practice of anesthesiologists in employing parental presence across the U.S. indicated that parents are increasingly allowed to be present during induction (Kain et al. 2004). More recently, we completed a survey of 200 Canadian anesthesiologists' practices for alleviating anxiety in children and adolescents (Wright et al. 2013). Overall, our findings suggested that parental presence is encouraged very frequently in Canada today. Specifically, 71 % of our respondents indicated that the hospitals where they are employed allowed or encouraged parental presence. Employing parental presence may be seen as preferable since other intervention methods (e.g., sedative premedication) have associated time restrictions, negative side-effects, and/or increased health care costs.

Review of the existing findings in the literature leads one to consider that there may be moderators of the relationship between parental presence and child anxiety and distress. It may be the case that in some situations parental presence is helpful, in others harmful, and yet in others neutral. One possible moderator may be the actual behaviors that parents engage in during the anesthetic induction experience. Chambers (2003) was one of the first to note that there has been a surprising lack of coordination between investigations that examine parental presence during medical procedures (e.g., those requiring general anesthesia) and investigations that describe and quantify what parents actually do during these procedures. It has been speculated that what a parent says and does while being present during medical procedures may be the critical component, not necessarily whether the parent was physically present or absent per se (Piira & von Baeyer 2001). According to Piira et al. (2005), it appears that parents are not routinely informed about what they could do to improve their child's experience when parents are present during a medical procedure (e.g., those requiring general anesthesia) and that parents desire information regarding how they could best help their child in such a situation. The combination of parental presence, coupled with information provision, may improve parent and child outcomes when parents are present during medical procedures such as anesthetic induction. Nevertheless, the current literature lacks evidence to suggest which types of behaviors would be most useful for parents to employ in the surgery context; there is limited knowledge of which particular parental behaviors are associated with decreased child anxiety and distress in this context. Similarly, there is limited evidence on which behaviors parents should avoid in this context, i.e., which particular parental behaviors are associated with increased child anxiety and distress in this context. Albeit outside the surgery context, during painful medical procedures such as immunizations, bone marrow aspirations, and lumbar punctures, and during experimental pain tasks, certain parental behaviors have been demonstrated to be associated with child distress (e.g., Blount et al. 1989, 1990, 1991; Bush & Cockrell, 1987; Noel et al. 2010; Walker et al. 2006; Williams et al. 2011). These behaviors include reassuring comments, apologies to the child, indicating empathy, giving control to the child, and criticism of the child by the parent.

Employing a revised perioperative version of the Child Adult Medical Procedures Interaction Scale (P-CAMPIS; Caldwell-Andrews et al. 2005), Chorney et al. (2009) examined associations between observed adult (i.e., anesthesiologist, nurse, and parent) behaviors and children's distress and coping in a sample of 293 two- to ten-year-old children undergoing anesthetic induction with a parent present; they made several important observations. First, positive associations were observed between behaviors termed "adult emotion-focused behaviors" (i.e., empathy and reassurance), and child distress and negative associations were observed between these adult behaviors and child coping behaviors. Second, humor and distracting talk (termed Adult distracting behavior) showed the opposite patterns. Third, Chorney et al. (2009, p. 1,295) examined the behavior of medical re-interpretation, i.e., "attempts to provide information on the induction procedure while re-framing the procedure as less threatening (perhaps even fun)". When this behavior was observed in anesthesiologists, a positive association was seen in terms of child coping behaviors; however, when the same behavior was observed in parents, a positive association was observed with child distress. This study has contributed key findings to the literature, but the study examined the associations between adult and child behaviors at the same time point. In order to determine causality, i.e., which adult behaviors cause child behaviors during the induction of general anesthesia, we need to know that the adult behavior precedes the child behavior. It may also be the case that child distress "pulls for" certain behaviors on the part of the parent (e.g., Horstmann 2003; Hudson et al. 2008; Huebner & Izard 1988; Shipman et al. 2003). For example, a distressed child may elicit more provision of reassurance or of physical comfort from a parent, which may in turn negatively (or positively) impact child distress. The use of sequential modeling allows for the examination of such reciprocal relationships by allowing for testing of the possibility that child behaviors precede and significantly contribute to later parental behaviors in the context of the induction of general anesthesia.

Given the status of the current literature, it appears that exploration of sequential relationships between parent and child behaviors during anesthetic induction is warranted. It is anticipated that examination of the sequential relationships between parent and child behaviors at the induction of general anesthesia may shed some light on why empirical investigations into the effectiveness of parental presence to reduce child preoperative anxiety has produced inconsistent results. The primary purpose of the present study was to examine the sequential association between Child Distress behaviors and Adult (i.e., parent) Distress-Promoting behaviors during anesthetic induction. Specifically, we hypothesized that Adult Distress-Promoting behaviors (e.g., reassuring comments, apologies to the child, indicating empathy, giving control to the child, and criticism of the child by the parent) would be associated with later child distress behaviors. As noted previously, an association has been demonstrated between such parent behaviors and child distress in the anesthesia context (e.g., Chorney et al. 2009), post-anesthesia care (Chorney et al. 2013), and other painful medical procedures such as immunizations and bone marrow aspirations and lumbar punctures (e.g., Blount et al. 1990, 1989; Blount et al. 1991; Bush & Cockrell 1987; Noel et al. 2010; Walker et al. 2006; Williams et al. 2011).

Method

Participants

The participants were 32 children, ages three through 6 years (mean age 4.56 years; $SD = 1.06$ years), scheduled to receive dental surgery as a day surgery procedure at the Department of Dentistry and Oral Maxillofacial Surgery, Royal University Hospital (RUH) in Saskatoon, Saskatchewan, Canada. Our age range (i.e., 3–6 years) represents the age range of the majority of patients who are provided dental intervention under anesthesia at RUH. In turn, this age range represents a group that is more likely to have a parent present during the induction of anesthesia. More importantly, a methodological concern with many of the studies in this research area is the wide age range of the participants, (i.e., ages 1–12 years). We improved on this limitation by employing a more narrow age range (i.e., 3–6 years). This improvement allows us to examine the relationship between child and parent behaviors in a sample with less variability in cognitive capacity. Two participants' data were not used in analyses. One participant's parent was not present during anesthetic induction. Therefore, we were unable to examine the relationship between parent and child behaviors during anesthetic induction and had to exclude the data as a result. The second child whose data were not used had a significant visual impairment. The child was unable to participate fully, so we excluded this participant's data as well. The analyzed sample consisted of 16 males (mean age = 4.52 years; $SD = 1.04$ years) and 14 females (mean age = 4.65 years; $SD = 1.14$ years). Ethnicity in the sample was primarily Aboriginal (53.3 %) and Caucasian (43.3 %). Mothers participated primarily ($n = 25$ of the 30 parents) and the average age of all parents was 30.27 years ($SD = 5.65$ years). All participants received a dental check-up, cleaning, two X-rays, and fluoride. Of the participants: 93.0 % ($n = 28$) had stainless steel crowns placed (number of crowns ranged from 1 to 8); 80.0 % ($n = 24$) had amalgams completed (number of amalgams ranged from 1 to 7); 80.0 % ($n = 24$) had pulpotomies completed, i.e., removal of the soft tissue in the pulp chamber to address infection or inflammation (number of pulpotomies ranged from 1 to 8); 43.3 % ($n = 13$) had tooth extractions (number of extractions ranged from 1 to 7); and 6.7 % ($n = 2$) had sealants placed for preventative reasons. All children required general anesthesia to complete their procedures. Any child aged 3–6 years who was scheduled for dental surgery as a day surgery procedure at the RUH Department of Dentistry and Oral Maxillofacial Surgery was considered for inclusion, unless he or she met any of several exclusionary criteria. Aside from dental health problems as noted above, it was our goal to have an otherwise healthy sample of children. Thus, a child was excluded if he or she had been diagnosed with central nervous system disease, psychiatric disease, liver disease, renal disease, or cancer. If a child was cognitively impaired, he or she was excluded as the researchers needed to be able to communicate with him or her. Also, if the child had been diagnosed with having gastroesophageal reflux disease they were excluded, since someone with this condition may be anesthetized with an IV induction as opposed to a mask (Cheong et al. 1999), and it was necessary to standardize the method of induction. The information relating to these criteria was obtained either from the child's parent and/or from their case file (with the parent's consent). The study was approved by the University of Saskatchewan Behavioral Research Ethics Board. Finally, this study had an 83 % participation rate from all of the potential participants contacted. The primary reason for a parent declining to participate in the present study was lack of interest.

Measures

Modified Child–Adult Medical Procedure Interaction Scale-Revised (Modified CAMPIS-R).

The CAMPIS-R (Blount et al. 1997) is an observational behavior rating scale for assessing: (1) Child procedural distress and coping; and (2) Adult coping-promoting behaviors and distress-promoting behaviors as displayed by the children's parents and the medical personnel who are present during medical procedures. Typically, the behaviors of parent, medical staff, and child are videotaped and later coded in accordance with a dichotomous rating (present/absent) on six dimensions: Child Coping, Child Distress, Child Neutral, Adult Coping-Promoting, Adult Distress-Promoting, and Adult Neutral. (An updated version of the P-CAMPIS was not available to us during the planning stages of the present research because the P-CAMPIS developers were examining the psychometric properties of the instrument).

Our modified CAMPIS-R consisted of four dimensions: Child Coping, Child Distress, Adult Coping-Promoting, and Adult Distress-Promoting. In the present study we examined only child distress and adult distress-promoting (exhibited by parents or guardians only) behaviors. Behaviors previously coded in the original CAMPIS-R as "Child Distress behaviors" include crying, screaming, verbal resistance, request of emotional support, verbal fear, verbal pain, verbal emotion, and information seeking. Finally, behaviors previously coded in the original CAMPIS-R as "Adult Distress-Promoting behaviors" include reassuring comments, apologies, empathic statements to child, giving control to child, criticism, and provision of physical comfort. In the present study, the coding system was expanded by including additional potential child distress behaviors, i.e., physical request of support, observed restraint of child, flailing, and physical resistance. These behaviors were included as they are behaviors specific to this particular context, i.e., anesthetic induction. Anecdotal reports from health professionals who work in this context indicate they observe these behaviors when children are distressed in these situations. We believed the existing CAMPIS-R codes did not adequately capture these behaviors. Further, previous research has demonstrated associations between elevated preoperative anxiety and such behaviors (e.g., Lumley et al. 1993). They were classified based on face validity for inclusion in the category of interest, i.e., child distress.

Child and parent behaviors were videotaped during the induction of general anesthesia. Two coders, blind to the study hypotheses, coded the tapes at a later date. Raters coded the videotapes in two passes: child codes were rated first and then parent codes. Behaviors were coded as being present or absent during 5 s increments for 1.5 min during anesthetic induction. This 1.5 min period began as the child entered the operating room (OR) until anesthetic induction was complete. Inter-rater reliabilities were calculated on 20 % of the participant tapes at anesthetic induction. Most codes had highly skewed distributions. Kappa measurements are extremely sensitive and do not accurately reflect inter-rater agreement (Bakeman & Gottman 1997; Conger 1980; Light 1971; Zwick 1988) and are overly punishing for low base rate behavior (Feinstein & Cicchetti 1990). Thus, percent agreement was used. For anesthetic induction, the inter-rater reliabilities were as follows: child distress behaviors = 97 % and adult distress-promoting behaviors = 95 %.

Procedure

When a child had been scheduled for a dental day surgery procedure at the RUH Department of Dentistry and Oral Maxillofacial Surgery and met all of the inclusion criteria, an information package (i.e., information letter and consent form) was sent to the child's parent(s)/guardian(s). A researcher followed up the information package by contacting a parent/guardian by telephone to inquire about participation. If a parent/guardian was willing to allow his or her child to participate, the researcher arranged to meet with the parent(s)/guardian(s) and child on the day of surgery.

Prior to the child's surgery, parental consent and child verbal assent were obtained. Parental consent and child verbal assent was obtained for all components of the study (including having the anesthetic induction videotaped) after the nature of the study was fully explained to them. Parents provided consent to having the anesthetic induction videotaped. The video camera was held by a researcher at the base of bed where the surgical procedure was taking place. The anesthetic induction procedure was impacted as little as possible by the presence of the researchers. The anesthesiologist performed a pre-anesthetic assessment to determine the child's medical eligibility for the study. All children received acetaminophen suspension 10 mg·kg^{-1} (Children's TylenolTM, grape-flavoured, McNeil Consumer Products, Guelph, ON, Canada) prior to surgery. The child's behavior was videotaped as he/she walked into the OR and until anesthetic induction was complete. The child was brought (either walked or was carried) into the operating room and placed on the bed. The parent sat beside the bed. A finger pulse oximeter was placed on the child's finger. The child was shown the anesthetic mask and the mask was placed over the nose and mouth by the anesthesiologist and the child was asked to breathe into the mask. The nurse helped to facilitate a smooth induction (i.e., help position child on bed, help position child to receive anesthesia, reduce movement of child by applying subtle pressure on/around child's body, and aid in restraining child if necessary). Once the induction was complete, the parent was escorted to the waiting area. The child awoke in the recovery room. The parent was called to the recovery room once the child was awake. Once the child returned to the day surgery area from the recovery room, the researcher met with the child and parent(s) and the child was given a sheet of stickers as a token of thanks for his/her participation.

Data Analysis

Descriptive statistics were computed for demographic data and frequency of child and adult behaviors (see Table 1 for frequency of child and adult behaviors). Bivariate correlations were computed to examine the relationship between child distress behaviors and adult distress-promoting behaviors at anesthetic induction. Structural equation models were constructed and analyzed using the maximum likelihood variance–covariance estimation method in AMOS 22.0. Structural equation modeling (SEM) was utilized in order to test the potential sequential

Table 1 Modified CAMPIS-R Child Distress and Adult Distress-promoting behavior descriptions

Behaviors	Example	% Observed[a]
Child Distress Behaviors		
Cry	1. "Sobbing"	13.6
	2. Crying sounds	
Scream	1. Sharp, shrill, harsh, high tones	2.2
	2. Shrieks	
Verbal resistance	1. "Stop!"	4.2
	2. "Don't!"	
Verbal request of support	1. "Hold me"	0
	2. "Help me"	
Physical request of support[b]	1. Grabbing or holding parent's hand	58.9
	2. Reaching for parent	
Verbal fear	1. "I am afraid"	4.5
	2. "I am scared"	
Verbal pain	1. "That hurts"	0.6
	2. "It stings"	
Negative emotion	1. "I hate doctors"	2.5
	2. "I don't like doing this"	
Information seeking	1. "Will you let me know when you're ready to start?"	0
	2. "What does that balloon do?"	
Restraint of child	NA	1.7
Flail[b]	NA	0.2
Physical resistance[b]	NA	13.8
Adult Distress-Promoting Behaviors		
Reassure	1. "You're Ok"	5.9
	2. "You'll be awake before you know it"	
Empathy	1. "I know this is hard"	0
	2. "I know it hurts"	
Physical comfort	1. The parent holds the child's hand	89.8
	2. The parent hugs the child	
Giving control	1. "Which way do you want to lay?"	4.3
	2. "Where do you want your toy?"	
Apology	1. "I am sorry you have to go through this"	0
	2. "Jaime, we don't like doing this either"	
Criticism	1. "Timmy, you are not being a big boy"	0
	2. "You didn't use your breathing that time like I told you to"	

[a] % observed = % of behaviors observed in a specific category out of the total number of behaviors observed

[b] These are behaviors that were new to the modified CAMPIS-R

relationships between child distress behaviors and adult distress-promoting behaviors (and vice versa) from the point at which the child entered the operating room until anesthetic induction was complete.

Results

Relationship Between Child and Adult Behaviors

Relationship Between Child Distress and Adult Distress-Promoting Behavior

A modified CAMPIS-R was employed to examine the specific behaviors that children and their parents engaged in as well as their interactions during anesthetic induction, i.e., Child Distress behaviors and Adult Distress-Promoting behaviors. Bivariate correlations were computed separately for the observed Child Distress and Adult Distress-Promoting behaviors. All observed Child Distress behaviors with the exception of two, Physical Request of Support and Negative Emotion, demonstrated significant positive associations with one another. The significant correlations ranged from .51 ($p < .01$), between Cry and Verbal Resistance, to 1.00 ($p < .001$), between Verbal Pain and child Restraint). One Child Distress behavior, Verbal Fear, showed some association with other behaviors, but this was not consistent. With respect to adult behaviors, only one set of behaviors were significantly associated, Physical Comfort and Giving Control ($r = -.41$, $p < .05$); these have been classified as distress-promoting behaviors in previous research. This association was in the negative direction, which suggests that it is not tapping the same construct.

Given these findings, the individual behaviors that comprise the overall child and adult behavior categories were modified. It appears that only one overall behavior category deserves composite scoring: Child Distress. For the most part, all behaviors in this category were significantly positively intercorrelated. The one behavior that was not intercorrelated with other Child Distress behaviors was Verbal Fear. However, the Verbal Fear code has high face validity for inclusion in a Child Distress composite score, and so we decided to include Verbal Fear in the overall Child Distress behavior category. However, physical request of support and negative emotion were excluded from the overall Child Distress behavior category as they had no significant associations with other Child Distress behaviors. The Child Distress behavior composite score was coded by re-examining the data coding sheets and providing only 1 point for 1 or more Child Distress behavior(s) observed during each 5-second interval indicating the presence of child distress in that interval.

Table 2 Correlations between Child and Adult behaviors observed during the 1.5 min period from which the child entered the OR until anesthetic induction was complete

	Reassurance by adult	Physical Comfort by adult	Giving Control by adult	Child Distress total
Reassurance by adult	–			
Physical Comfort by adult	−.181	–		
Giving Control by adult	.015	−.408*	–	
Child Distress total	.495**	−.235	.413*	–

* $p < .05$

** $p < .01$

Relationship Between Child Distress Composite Score and Adult Distress-Promoting Behaviors

Bivariate correlations were computed between the Child Distress composite score and the three separate Adult Distress-Promoting Behaviors: (1) Adult provision of Physical Comfort, (2) Adult provision of Reassurance, and (3) Adult Giving Control at anesthetic induction (see Table 2). The association between parental provision of Reassurance and Child Distress was significant ($r = .50$ $p < .01$); the positive direction of the association suggests that child distress may "pull for" parents to provide reassurance to the child, and/or that parents who provide reassurance to their children cause increased distress in the child. This correlation is consistent with the notion of parental provision of Reassurance to the child as a parental Distress-Promoting behavior as suggested by previous work with the CAMPIS in other contexts (e.g., Blount et al., 1989).

The association between parental provision of Giving Control to the child and Child Distress behaviors was also significant ($r = .41$ $p < .05$); the positive direction of the association similarly suggests that child distress may "pull for" parents to give control to the child, or that parents who give control to their distressed child may further increase the child's distress. As above, this finding is consistent with previous work with the CAMPIS (e.g., Blount et al. 1989), which suggests that parent Giving Control to the child in such situations can increase Child Distress. Adult provision of Physical Comfort was not significantly related to Child Distress.

Sequential Relationship Between Parent and Child Behaviors

Potential sequential and reciprocal associations were explored between Child Distress and parental provision of Reassurance, and parental Giving Control. Additionally, we examined the potential sequential association between Child Distress and the remaining potential Adult Distress-Promoting Behavior, i.e., parental provision of Physical Comfort. Although a significant relationship was not observed between the Physical Comfort and Child Distress total scores (collapsed across observation intervals), this does not negate a potential sequential relationship(s) at certain observation intervals. To examine the sequential relationship between Child Distress behaviors and these three potential Adult Distress-Promoting behaviors, structural equation models were constructed and analyzed using the maximum likelihood variance–covariance estimation method AMOS 22.0. Structural equation modeling (SEM) was utilized in order to test the potential sequential relationships between observable child and parent behaviors during induction of general anesthesia.

For the purpose of sequential analyses, parent and child behaviors were recorded in 5-second intervals for a total of 90 s during induction of general anesthesia, which included the time of child entry to the operating room until completion of anesthetic induction. To accommodate the small sample size ($n = 30$), the 18 5-second intervals were collapsed into three 30-second segments, with each segment composed of six 5-second intervals. Having three segments allows for one replication of any observed sequential effect.

Using AMOS, six models were built to examine the sequential relationships between child and parent behaviors during anesthetic induction. Specifically, two models were built for each Child Distress and Adult Distress-Promoting Behavior pair. The sequential association between parental Giving Control could not be examined due to the low base rate observed for the parent behavior of Giving Control across the three intervals. Thus, there remained two models to examine sequential relationships when parental behavior preceded the child behavior, and two additional models to examine sequential relationships when child behavior preceded parental behavior. These models are discussed below.

Figures 1, 2 and 3 show results for the three models that were examined and statistically fit the data. At the top of each figure is the 1.5-minute observational timeline, which is divided into three 30-second blocks, Time 1, Time 2, and Time 3, that depict the progression of time moving from left to right across the figure. Figures 2 and 3 display results for two models in which Child Distress at Time 1 is an initiator of parent behavior at Time 2, either parental effort to provide Reassurance (Fig. 2, Model 3), or parental effort to provide Physical Comfort (Fig. 3, Model 4). Thus, Fig. 2 shows Child Distress at Time 1 as an initiator and predictor of Parent Reassurance at Time 2, with the downward pointing arrow linking the child's behavior as

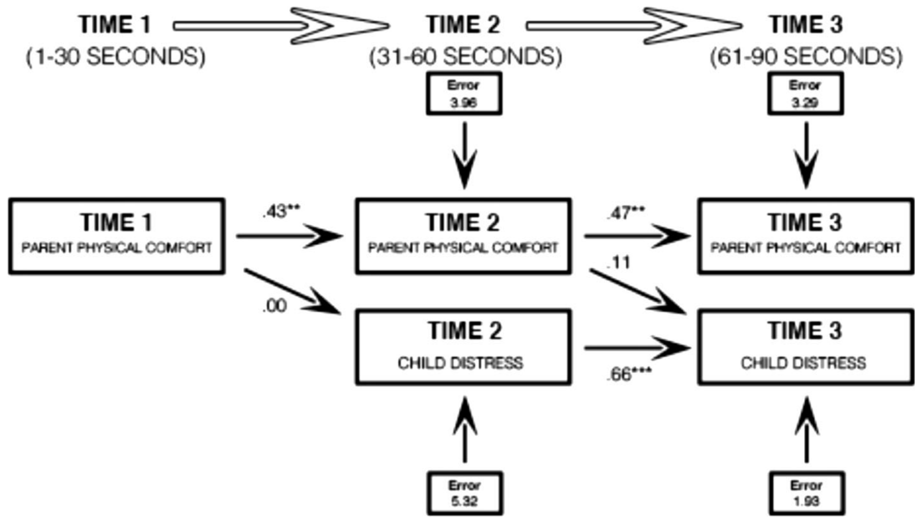

Fig. 1 Model 2: Parent provision of physical comfort as initiator of child distress. $^{**}p < .01$; $^{***}p < .001$

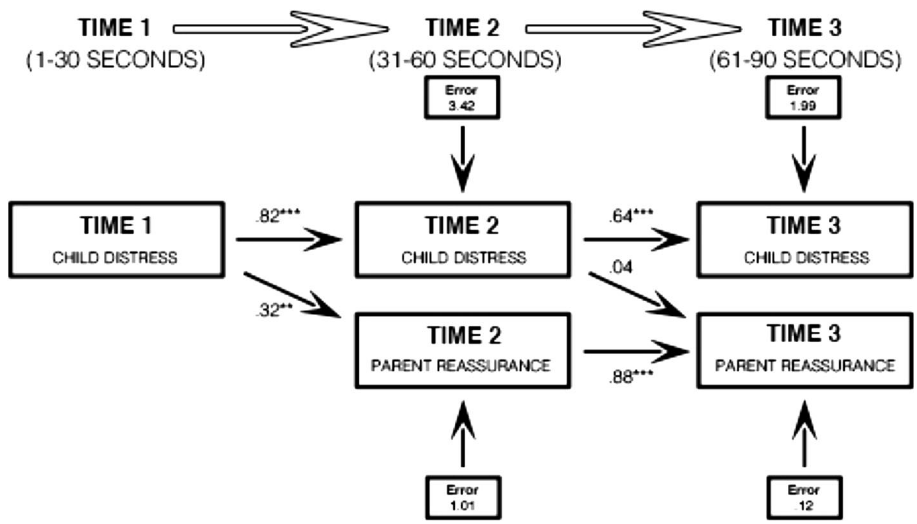

Fig. 2 Model 3: Child distress as initiator of parent reassurance. $^{**}p < .01$; $^{***}p < .001$

predictor to the parent's response. Figure 3 depicts Child Distress at Time 1 as an initiator and predictor of Parent Provision of Physical Comfort at Time 2, with the downward pointing arrow illustrating a possible causal linkage. Figure 1, Model 2, portrays a reverse temporal sequence of behaviors in which Parent Provision of Physical Comfort at Time 1 is positioned as a potential initiator and predictor of Child Distress at Time 2, with the downward pointing arrow linking the parent's behavior as a potential predictor of the child's response. It is noteworthy that no Figure is presented for Model 1, the fourth model examined, and which focused on the possible sequential relationship of parent's Reassurance at Time 1 as a potential predictor of Child Distress at Time 2. No Figure is presented because, as noted below, that model did not statistically fit the data.

In each figure, the values next to each vector arrow that connects behavior at a prior Time point to a behavior at the following Time point, are the unstandardized regression weights that demonstrate the degree of association between the two observed behaviors. The values that appear in smaller rectangles attached to each observed variable are error terms and speak to the amount of variance in each observed variable.

Following the recommendations of Hu and Bentler (1998), multiple indices of model fit were used in evaluating the goodness of fit of the four models calculated: χ^2/df (values should be < 2.0), Comparative Fit Index (CFI; values should be close to .95), Root Mean Square Error of Approximation (RMSEA; values should be around .05), and Standardized Root Mean Square Residual (SRMR; values should be around .08). In addition to the aforementioned fit indices, the individual models were examined for theoretical fit. Models examining the influence of parent behavior on child behavior will be examined first, followed by models examining the influence of child behavior on parent behavior.

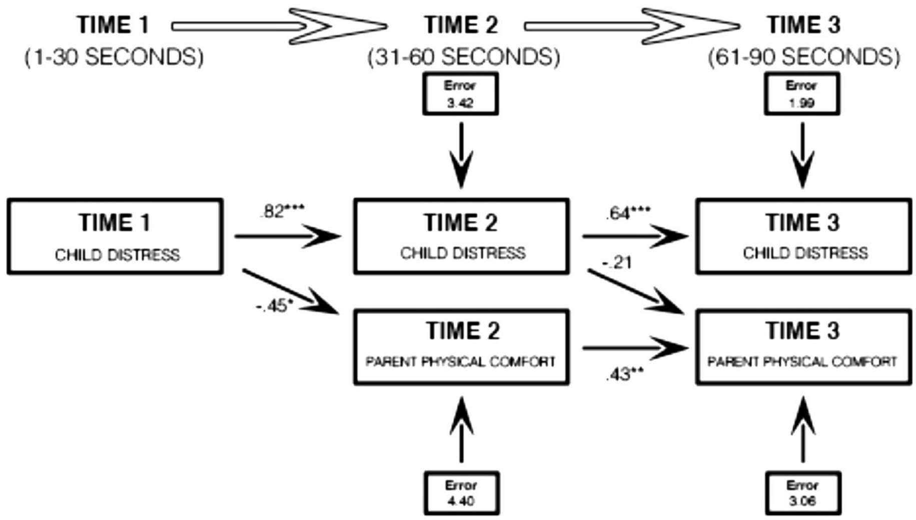

Fig. 3 Model 4: Child distress as initiator of parent provision of physical comfort. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

Results for model for which no Figure is shown, Model 1, examined the sequential association between Parent Reassurance and Child Distress, with parental provision of reassurance preceding child distress, suggested that the model did not fit the data. The model Chi square was significant, suggesting a poor fit, $\chi^2(5) = 61.28$, $p = .000$. Similarly, all individual fit statistics were poor ($\chi^2/df = 12.26$; CFI = .71; RMSEA = .62) with the exception of SRMR = .04. The fact that Model 1 did not fit the data suggests that parental provision of reassurance is neither helpful nor harmful in this context.

As shown in Fig. 1, Model 2 examined the sequential relationship between Parent Physical Comfort and Child Distress, with parent provision of physical comfort preceding child distress. The findings suggest that the model fit the data. The model Chi square was not significant, suggesting good fit, χ^2 (5) = 4.44, $p = .488$. Similarly, the individual fit statistics were all excellent ($\chi^2/df = 0.88$; CFI = 1.00; RMSEA = .00) with the exception of SRMR = .13. In Model 2, there was no relation between initial parental provision of physical comfort (Time 1) and child distress (Time 2; i.e., $r = .00$). Later parental provision of physical comfort to the child at Time 2 showed a mildly positive association with increased child distress at Time 3 (r =.11), but the effect was not significant. Therefore, while the direction of the association suggests that parental provision of physical comfort to the child just prior to mask placement may be a distress-promoting behavior, that trend was weak and not confirmed.

As shown in Fig. 2, Model 3 examined the sequential relationship between Child Distress and Parent Reassurance, with child distress preceding parental reassurance. The findings suggest that the model fit the data. The model Chi square was not significant, suggesting good fit, $\chi^2(5) = 7.00$, $p = .221$. Similarly, the individual fit statistics were good ($\chi^2/df = 1.40$; CFI = .98; SRMR = .05), with the exception of RMSEA = .12. Consistent with theoretical prediction, Model 3 demonstrated a moderate positive association between initial child distress at Time 1 and increased parental reassurance at Time 2 ($r = .32$, $p = .004$). However, later child distress at Time 2 showed a poor association with subsequent increased parental reassurance at Time 3 ($r = .04$, $p = .176$).

As shown in Fig. 3, Model 4 examined the sequential relationship between Child Distress and Parent Physical Comfort, with child distress preceding parental provision of physical comfort to the child. The findings suggest that the model fit the data, $\chi^2(5) = 1.44$, $p = .920$. The individual fit statistics were all excellent ($\chi^2/df = 0.29$; CFI = 1.00; RMSEA = .00; SRMR = .04). The direction of the relations between initial child distress and provision of later physical comfort by the parent in Model 4 suggests that, in contrast to theoretical prediction, increased child distress is associated with *less* parental provision of physical comfort (r's = −.45 and −.21, respectively). In this model the association between initial child distress and parental provision of physical comfort at Time 1 neared significance (i.e., $p = .05$), while the association between child distress and provision of later physical comfort at Time 2 was not significant (i.e., $p = .14$). This variability may help to explain why there was no overall significant association observed between child distress and parental provision of physical comfort in the initial bivariate correlations.

In summary, results suggest that three of the four sequential models tested fit the data. Initial parental provision of reassurance appeared to neither positively nor negatively impact sequential child distress. However, initial child distress may lead to increased parental provision of reassurance and decreased provision of physical comfort.

Discussion

Using a modified version of the CAMPIS-R (Blount et al., 1997), we examined potential sequential associations between specific parental behaviors, i.e., parental provision of Reassurance, and parental provision of Physical Comfort, and Child Distress to determine whether these parental behaviors preceded and possibly contributed to child distress and/or whether they were parental responses to child distress during anesthetic induction. Our findings are novel in that the examination of sequential associations extends the current understanding of the relationship between adult and child behaviors in this context (e.g., Chorney et al. 2009) and assists in examining potential reciprocal relationships between child and parent behaviors. Our primary findings are discussed below.

First, provision of reassurance by parents was overall related to greater child distress in bivariate correlations. However, the examination of sequential relations revealed that parental reassurance did not lead to increased child distress. Rather, child distress preceded increased parental provision of reassurance. Findings regarding the positive relationship between parental provision of reassurance and child distress have been fairly consistent (e.g., Blount et al. 1989; Manimala et al. 2000), with one exception (i.e., Gonzalez et al. 1993). McMurtry et al. (2006) speculated that although the exact mechanism by which reassurance contributes to child distress is unknown, reassurance may be transmitted via words, facial expressions, and intonation of voice. McMurtry et al. (2010) designed an experimental study to examine this possibility in children 5-10 years of age undergoing a painful medical procedure (i.e., venipuncture). They found that the children provided higher ratings of fear during reassurance than during distraction while performing experimental tasks. Our findings, that child distress is more likely a cause than a consequence of reassurance, appear inconsistent with McMurtry's et al. (2010) findings. However, McMurtry et al. (2010) did not employ a sequential approach to collection or interpretation of their data and therefore the reciprocal nature of this relationship cannot be judged. Specifically, we do not know if children in the McMurtry et al. (2010) study in fact experienced distress prior to the provision of reassurance by parents, we only know that they endorsed increased fear during provision of reassurance by parents and that this was greater than the fear endorsed during provision of distraction by parents. McMurtry's et al. (2010) findings, coupled with our findings, highlight the complexity of the relationship between parental provision of reassurance and child distress. Future research is necessary to clarify this relationship further.

Second, even though there was no overall significant association between parental provision of physical comfort and child distress in bivariate correlations, this did not negate a potential sequential relationship(s) at certain observation intervals. Therefore, we chose to examine the potential sequential relationship between these variables. In fact, Models 2 and 4 demonstrated a good fit to the data suggesting a sequential relationship between parental provision of physical comfort and child distress. Yet, the relationship was not straightforward. The sequential relations were opposite in direction depending on the actor (i.e., parent behavior preceding child behavior and vice versa). Specifically, parental provision of physical comfort appeared to lead to greater distress in the child but this association was not significant. Greater distress in the child, on the other hand, was associated with less provision of physical comfort by the parent. With respect to the latter, it could be the case that children who exhibit extreme distress may require more physical assistance from medical staff (e.g., restraint) and therefore parents may not be in a position to provide physical comfort. With respect to the former, parental provision of physical comfort appeared to have little to no impact on child distress. Our findings suggest that the relationship between parental provision of physical comfort and child distress is not straightforward and that there may be a time factor at play, i.e., provision of physical comfort closer to time of induction may facilitate child distress, which warrants subsequent examination.

Limitations

Although the present investigation's findings are noteworthy, there were a number of possible limitations that deserve mention. First, our sample size was small (i.e., 30) for SEM. As such, our results should be interpreted with caution. Further research is required to replicate our findings in a larger sample. Second, related to the first limitation, given our small sample size, we were unable to examine potential cultural differences. It is certainly possible that some parental behaviors are more helpful or harmful in certain cultural groups due to different cultural practices in parenting. Third, all medical personnel involved with this investigation were very cooperative. Nevertheless, at times there were some instructions made to the parents that may have impacted the results reported herein, i.e., parents were often instructed to sit on a chair beside their child and told that they could hold their child's hand. Our intent was to observe natural behaviors between parent and child during anesthetic induction; however it appears that behaviors that take place within the operating room, as commonly directed by medical staff, may at times have been observed instead. Parents may have behaved quite differently without the direction of medical personnel. These instructions may have increased parental provision of physical comfort, for example, when parents may have normally engaged in a different behavior. It is also not known what variables influenced medical staff to instruct some parents to engage in provision of physical comfort (e.g., Did the parent appear particularly distressed? Or did the child? Or was this instruction simply more likely to occur when there was more time for the medical staff to focus on assisting the parent such as in the case of a cooperative child?). In turn, we did not focus on the behaviors of the medical personnel and, as such, did not from the outset of this study plan on systematically observing and coding their behaviors. Our findings may have been strengthened if we had included the medical personnel's behavior as a focus of investigation as we would have been able to examine the impact of their behavior on child distress.

In line with the above, it is important to note that there are some limitations to inferring causation from the sequential analysis employed. Specifically, the sequential analyses demonstrated that there is a confirmed directionality within the relationship between distress and parental provision of reassurance. However, these analyses do not prove causality (i.e., that parental provision of reassurance caused increased child distress). Our findings are a step in the right direction in determining what causes increased child distress as causality requires directionality (i.e., A cannot cause B unless A precedes B, but A preceding B is not enough to determine that A caused B). Rather than demonstrating a causal relationship, the fact that parental provision of reassurance preceded increased child distress at induction could also be explained if both variables were caused by a third variable such as child anxious/shy temperament (which could both cause increased reassurance to the child prior to mask placement and increased child distress at mask placement).

Fourth, the physical set up of the RUH Department of Dentistry and Oral Maxillofacial Surgery may have impacted anxiety ratings and/or behavior. The OR is down the hall from the waiting room and recovery room is beside the OR. Often one could hear children in distress (i.e., crying or screaming). Hearing other children's distress may have elevated individual children's ratings of anxiety or possibly reduced levels of participation. In order to examine the impact of this variable it may be necessary for future investigations in this type of setting to inquire if the participants are bothered by hearing other children in distress and if so whether this experience impacted their anxiety ratings or behavior. Future studies might also artificially control for this factor (i.e., put up sound barriers) or investigate its impact through experimental manipulation. While it is important to acknowledge the possible impact of this variable, it should also be recognized that this is simply an aspect of conducting research in the real world. Fifth, it is also important to note that our sample was comprised of healthy participants undergoing dental day surgery procedures. Our findings may not generalize to children undergoing more complex day surgery procedures and/or procedures that require inpatient stay following surgery.

Future Directions

There are a number of interesting directions for future research on this topic. First, the interaction between parent and child behaviors and their impact on reduction of anxiety and distress need to be examined using the newly designed P-CAMPIS (Caldwell-Andrews et al. 2005). Second, employing a more sophisticated, fine-grained statistical approach (i.e., time-window sequential analysis) will allow us to understand the temporal contingency between behaviors observed during anesthetic induction (Chorney et al. 2010). This type of analysis would allow us to determine sequential relationships in both forward and backward directions within a specific time-window. Third, the behavior of the medical personnel during anesthetic induction should be included in future research designs as a means to fully understand the complexity of interactions between medical staff, parents, and children. Fourth, evaluating the impact of variables inherent in certain settings, i.e., patients being able to hear other patient's distress, on participant distress would better inform us of whether and how these types of "real world" issues impact child anxiety and distress in the pediatric surgery context. Fifth, it would be advantageous to examine potential similarities or differences in parent–child interactions across more simple versus complex medical procedures including those that require inpatient hospital stay following surgery. Sixth, experimental studies designed to examine the complex associations between parental provision of physical comfort and child distress and between parental provision of reassurance and child distress are required. For example, a subsequent investigation could experimentally manipulate the provision of physical comfort (e.g., parents would be randomly assigned to either provide physical comfort such as instructions to hold a child's hand, or to not provide physical comfort but still be present within the operating room during anesthetic induction). Experimental investigations would provide us with a better understanding of the potential causal impact that provision of physical comfort has on child distress at anesthetic induction. Improved understanding of the subtleties of these parent behaviors will aid in designing appropriate prevention and intervention strategies for child distress associated with anesthetic induction. Such information will be useful for professionals working with children and their parents and or guardians who are awaiting surgical procedures to take place (i.e., anesthesiologists, child life specialists, nurses, and psychologists).

The knowledge that parents are engaging in behaviors that may increase child anxiety and distress and possibly make the child's anesthetic induction experience unpleasant may decrease the likelihood that anesthesiologists would allow parents to be present during the anesthetic induction. This decision may be premature, as these findings provide a basis for subsequent research designed to identify or clarify the particular behaviors that parents should engage in while being present during anesthetic induction in an effort to promote less child anxiety and distress behaviors or, at the very least, to have information to provide to parents that they should not engage in particular behaviors if they are to be present in the OR with their child.

Acknowledgement Dr. Wright was supported by a Fellowship from Canadian Institutes of Health Research at the time the research was conducted. Dr. Stewart was supported by a Killam Research Professorship from the Dalhousie Faculty of Science. Dr. Finley was supported by a Dalhousie University Clinical Research Scholar Award at the time the research was conducted.

Conflict of interest Dr. Wright, Dr. Stewart, Dr. Finley, and Dr. Raazi declare that they have no conflict of interest.

Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

References

Bakeman, R., & Gottman, J. M. (1997). Assessing observer agreement (2nd ed.). Cambridge: Cambridge University Press.

Blount, R. L., Cohen, L. L., Frank, N. C., Bachanas, P. J., Smith, A. J., Manimala, M. R., et al. (1997). The Child-Adult Medical Procedure Interaction Scale-Revised: An assessment of validity. *Journal of Pediatric Psychology, 22*, 73–88. doi:10.1093/jpepsy/22.1.73.

Blount, R.L., Corbin, S.M., Sturges, J.W., Wolfe, V.V., Prater, J.M., & James, L.D. (1989). The relationship between adults' behavior and child coping and distress during BMA/LP procedures: A sequential analysis. *Behavior Therapy, 20,* 585–601. doi:10.1016/s0005-7894(89)80136-4.

Blount, R. L., Landolf-Fritsche, B., Powers, S. W., & Sturges, J. W. (1991). Differences between high and low coping children and between parent and staff behaviors during painful medical procedures. *Journal of Pediatric Psychology, 16*, 795–809. doi:10.1093/jpepsy/16.6.795.

Blount, R.L., Sturges, J.W., & Powers, S.W. (1990). Analysis of child and adult behavioral variations by phase of medical procedure. *Behavior Therapy, 21*, 33–48. doi:10.1016/S0005-7894(05)80187-X.

Bush, J. P., & Cockrell, C. S. (1987). Maternal factors predicting behaviors in the pediatric clinic. *Journal of Pediatric Psychology, 12*, 505–518. doi:10.1093/jpepsy/12.4.505.

Caldwell-Andrews, A.A., Blount, R.L., Mayes, L.C., & Kain, Z.N. (2005). Behavioral interactions in the perioperative environment: A new conceptual framework and the development of the Perioperative Child-Adult Medical procedure Interaction Scale. *Anesthesiology, 103,* 1130–1135. doi:10.1097/00000542-200512000-00005.

Chambers, C. T. (2003). The role of family factors in pediatric pain. In P. J. McGrath & G. A. Finley (Eds.), *Context of Pediatric Pain: Biology, Family, Culture* (pp. 99–130). Seattle: IASP Press.

Cheong, Y.P., Park, S.K., Son, Y., Lee, K.C., Song, Y.K., Yoon, J.S., & Kim, T.Y. (1999). Comparison of incidence of gastroesophageal reflux and regurgitation associated with timing of removal of the laryngeal mask airway: on appearance of signs of rejection versus after recovery of consciousness. *Journal of Clinical Anesthesia, 11,* 657–662. doi:10.1016/s0952-8180(99)00117-8.

Chorney, J. M., Garcia, A., Berlin, K. S., Bakeman, R., & Kain, Z. N. (2010). Time-window sequential analysis: An introduction for pediatric psychologists. *Journal of Pediatric Psychology, 35*, 1061–1070. doi:10.1093/jpepsy/jsq022.

Chorney, J. M., Tan, E. T., & Kain, Z. N. (2013). Adult–child interactions in the postanesthesia care unit: behavior matters. *Anesthesiology, 118*, 834–841. doi:10.1097/ALN.0b013e31827e501b.

Chorney, J. M., Torrey, C., Blount, R., McLaren, C. E., Chen, W.-P., & Kain, Z. N. (2009). Healthcare provider and parent behavior and children's coping and distress at anesthesia induction. *Anesthesiology, 111*, 1290–1296. doi:10.1093/jpepsy/jsq022.

Chundamala, J., Wright, J. G., & Kemp, S. M. (2009). An evidence-based review of parental presence during anesthesia induction and parent/child anxiety. *Canadian Journal of Anesthesia, 56*, 57–70. doi:10.1007/s12630-008-9008-3.

Conger, A.J. (1980). Integration and generalization of kappas for multiple raters. *Psychological Bulletin, 88,* 322–328. doi:10.1037//0033-2909.88.2.322.

Feinstein, S.R., & Cicchetti, D.V. (1990). High agreement but low kappa: I. The problem of two paradoxes. *Journal of Clinical Epidemiology, 43,* 543–549. doi:10.1016/0895-4356(90)90158-l.

Gonzalez, J. C., Routh, D. K., & Armstrong, F. D. (1993). Effects of maternal distraction versus reassurance on children's reactions to injections. *Journal of Pediatric Psychology, 18*, 593–604. doi:10.1093/jpepsy/18.5.593.

Horstmann, G. (2003). What do facial expressions convey: Feeling states, behavioral intentions, or action requests? *Emotion, 3*, 150–166. doi:10.1037/1528-3542.3.2.150.

Hu, L., & Bentler, P.M. (1998). Fit indices in covariance structure modelling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3,* 424–453. doi:10.1037//1082-989x.3.4.424.

Hudson, J. L., Comer, J. S., & Kendall, P. C. (2008). Parental responses to positive and negative emotions in anxious and nonanxious children. *Journal of Clinical Child and Adolescent Psychology, 37*, 303–313. doi:10.1080/15374410801955839.

Huebner, R.R., & Izard, C.E. (1988). Mothers' responses to infants' facial expressions of sadness, anger, and physical distress. *Motivation and Emotion, 12,* 185–196. doi:10.1007/bf00992173.

Kain, Z. N., Caldwell-Andrews, A. A., Krivutza, D. M., Weinberg, M. E., Wang, S.-M., & Gaal, D. (2004). Trends in the practice of parental presence during induction of anesthesia and the use of preoperative sedation premedication in the United States, 1995–2000: Results of a follow-up national survey. *Anesthesia and Analgesia, 98*, 1252–1259. doi:10.1213/01.ane.0000111183.38618.d8.

Light, R.J. (1971). Measures of response agreement for qualitative data: some generalizations and alternatives. *Psychological Bulletin, 76*, 365–377. doi:10.1037/h0031643.

Lumley, M. A., Melamed, B. G., & Abeles, L. A. (1993). Predicting children's presurgical anxiety and subsequent behavior changes. *Journal of Pediatric Psychology, 18*, 481–497. doi:10.1093/jpepsy/18.4.481.

Manimala, M. R., Blount, R. L., & Cohen, L. L. (2000). The effects of parental reassurance versus distraction on child distress and coping during immunizations. *Children's Health Care, 29*, 161–177. doi:10.1207/s15326888chc2903_2.

McMurtry, C. M., Chambers, C. T., McGrath, P. J., & Asp, E. (2010). When "don't worry" communicates fear: Children's perceptions of parental reassurance and distraction during a painful pediatric medical procedure. *Pain, 150*, 52–58. doi:10.1016/j.pain.2010.02.021.

McMurtry, C. M., McGrath, P. J., & Chambers, C. T. (2006). Reassurance can hurt: Parental behavior and painful medical procedures. *Journal of Pediatrics, 148*, 560–561. doi:10.1016/j.jpeds.2005.10.040.

Noel, M., McMurtry, C. M., Chambers, C. T., & McGrath, P. J. (2010). Children's memory for painful procedures: The relationship of pain intensity, anxiety, and adult behaviors to subsequent recall. *Journal of Pediatric Psychology, 35*, 626–636. doi:10.1093/jpepsy/jsp096.

Piira, T., Sugiura, T., Champion, G. D., Donnelly, N., & Cole, A. S. J. (2005). The role of parental presence in the context of children's medical procedures: A systemic review. *Child Care Health, and Development, 31*, 233–243. doi:10.1111/j.1365-2214.2004.00466.x.

Piira, T., & von Baeyer, C. (2001). Parents' behavior in helping children to cope with painful procedures. *Pediatric Pain Letter, 5*, 13–15.

Shipman, K.L., Zeman, J., Nesin, A.E., & Fitzgerald, M. (2003). Children's strategies for displaying anger and sadness: What works with whom? *Merrill-Palmer Quarterly, 49,* 100–123. doi:10.1353/mpq.2003.0006.

Strom, S. (2012). Preoperative evaluation, premedication, and induction in infants and children. *Current Opinion in Anesthesiology, 25*, 321–325. doi:10.1097/ACO.0b013e3283530e0d.

Walker, L. S., Williams, S. E., Smith, C. A., Garber, J., Van Slyke, D. A., & Lipani, T. A. (2006). Parent attention versus distraction: Impact on symptom complaints by children with and without chronic functional abdominal pain. *Pain, 122*, 43–52. doi:10.1016/j.paoin.2005.12020.

Williams, S. E., Blount, R. L., & Walker, L. S. (2011). Children's pain threat appraisal and catastrophizing moderate the impact of parent verbal behavior on children's symptom complaints. *Journal of Pediatric Psychology, 36*, 55–63. doi:10.1093/jpepsy/jsq043.

Wright, K. D., Finley, G. A., Lee, D., Raazi, M., & Sharpe, D. (2013). A snapshot: Practices of Canadian anesthesiologists in alleviating preoperative anxiety in children and adolescents. *Canadian Journal of Anesthesia*, *60*, 1161–1162. doi:10.1007/s12630-013-0018-4.

Wright, K. D., Stewart, S. H., & Finley, G. A. (2010). Preoperative anxiety in children: When is parental presence helpful? *Canadian Journal of Anesthesia, 57*, 751–758. doi:10.1007/s12630-010-9333-1.

Wright, K. D., Stewart, S. H., Finley, G. A., & Buffett-Jerrott, S. E. (2007). Prevention and intervention strategies to alleviate preoperative anxiety in childhood: A review. *Behavior Modification, 31*, 52–79. doi:10.1177/0145445506295055.

Yip, P., Middleton, P., Cyna, A.M., & Carlyle, A.V. (2009). Non-pharmacological interventions for assisting the induction of anaesthesia in children. *Cochrane Database Systematic Review, 3,* CD006447.

Zwick, R. (1988). Another look at interrater agreement. *Psychological Bulletin, 103,* 374–378. doi:10.1037//0033-2909.103.3.374.