Title
The impact of parental health mindset on postoperative recovery in children

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Complete Title: The Impact of Parental Health Mindset on Postoperative Recovery in Children
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Short title: Mindset and Children's Surgical Recovery

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Abbreviations: RCT = randomized controlled trial, HBS = Health Beliefs Scale, T&A = tonsillectomy & adenoidectomy, CHOC = Children's Hospital of Orange County, CHLA = Children's Hospital Los Angeles, CHC = Children's Hospital Colorado, PACU = post anesthesia care unit, MBSS = Miller Behavioral Style Scale, MAQ = Medication Attitudes Questionnaire, EAS-TS = Emotionality Activity Sociality Temperament Survey, STAI = State Trait Anxiety Inventory,

PPPM = Parents' Postoperative Pain Measure, FPS-R = Faces Pain Scale-Revised, VRS = verbal rating scale, RI = Recovery Inventory, PSS = Perceived Stress Scale, SES = socioeconomic status.

Key Words: Child; Parents; Surgery; Recovery; Pain; Internal-External Control

Clinical Implications:

a. What is already known about the topic
There is a need to optimize children's surgical recovery. The concept of mindset, or one's beliefs about the ability to change consquences and outcomes, has been studied extensively in the educational space but not in the pediatric surgical space.

b. What new information this study adds
We found that parent mindset affects their assessment and management of child's pain. The next step will be to to develop a clinical intervention that will be directed at changing parental mindset and thus enhancing children's surgical recovery.

Abstract

Background: Mindset, or one's beliefs about the ability to change one's outcomes, has been studied in the educational domain but not in surgical settings. The purpose of this study was to examine the role of parental health mindset on children's recovery.

Methods: Participants were part of a larger National Institutes of Health-funded trial that included 1470 children undergoing outpatient tonsillectomy and adenoidectomy. We used measures of parental coping style (Monitor Blunter Style Scale; MBSS) and medication attitudes (Medication Attitudes Questionnaire; MAQ) to validate the Health Beliefs Scale (HBS; Criterion validity, Cohen's kappa). HBS categorizes parents as having a *growth* mindset, or the belief that health can be changed, or a *fixed* mindset, which reflects the belief that individuals cannot change their health. Next, we identified demographic and personality variables (e.g., temperament, anxiety) as predictors for the HBS. Finally, we examined the relationship between the HBS with postoperative outcomes.

Results: Findings supported criterion validity of the HBS; Parents with a growth mindset reported seeking out more medical information (MBSS, 7.15 ± 3.32 vs. 6.22 ± 3.38, $p < 0.001$, CI = -1.387 to -0.471) and reported fewer misconceptions regarding analgesic use (MAQ, 22.11 ± 4.09 vs. 21.41 ± 4.25, $p = 0.035$, CI = 0.046 to 1.229). In assessing outcomes we found that fixed-mindset parents rated their children's postoperative pain as more severe on days 1 (9.22 ± 3.82 vs. 8.37 ± 3.71, $p = 0.007$, CI = 0.234 to 1.459) and 3 (8.13

± 4.28 vs. 7.27 ± 4.28, p = 0.007, CI = 0.094 to 1.638) and reported that their children received more doses of ibuprofen on postoperative day 1 (2.91 ± 1.24 vs. 2.44 ± 1.44, p = 0.041, CI = 0.089 to 0.848) .There was no difference in children's self-reported pain scores between groups (p = 0.585).

Conclusions: These findings, coupled with recent mindset intervention studies in the educational space, suggest that parent mindset is an important target for clinical intervention in the context of children's surgical recovery.

Introduction

Tonsillectomy and adenoidectomy (T&A) is one of the most common pediatric surgeries, with over half a million performed yearly[1]. Although determinants of recovery following T&A including anxiety and temperament have been extensively studied, there is a lack of understanding as to what mediates these and other recovery factors[2–4]. Determinants of children's recovery from T&A include both non-modifiable factors (e.g, temperament or medical history), and a number of modifiable factors such as (e.g. anxiety and coping skills) that are important targets of intervention that can improve surgical outcomes[5]. Thus, in order to optimize children's surgical recovery, focusing on identification and impact of new modifiable factors is necessary.

The concept of mindset, or one's beliefs about the ability to change consquences and outcomes, has been studied extensively in the educational space[6]. Two core mindsets have been identified: fixed, or the belief that one's skills and consquences are unchangeable, and growth, the belief that one's skills are malleable and that outcomes can be changed[7]. This concept has been largely studied in the educational domain where Carol Dweck's Implicit Theory of Intelligence Scale has been used to predict academic outcomes in students[8]. Accordingly, Dweck and colleagues have introduced a cost-effective intervention that successfully taught children how to change their mindset, which resulted in improvements in academic performance[9,10]. In fact, mindset has been proposed as an important concept in the context the health and well-being of children and adolescents[11].

More recently, mindset has been explored in the context of healthcare using the Health Beliefs Scale (HBS) developed by Mueller and Dweck. The HBS is an adaptation of the Implicit Theory of Intelligence Scale[12] and similarly categorizes parents as having either a fixed or growth mindset. The majority of the application of mindset in the domain of healthcare has focused on chronic conditions. However, a recent study examined how mindset may impact pain experience in adolescents following pectus excavatum repair, with results showing that adolescents who endorsed a growth mindset reported significantly less pain after surgery compared to those who endorsed a fixed mindset[13]. To date, the concept of mindset as assessed by the HBS has not been examined in parents of young children undergoing surgery. This is important given that for young children, parents are responsible for pain management following ambulatory surgery and because research by our group and others has demonstrated that parents provide suboptimal pain management in the home setting post-operatively[14–16].

Because Dweck and colleagues have shown that mindset is malleable, this concept can introduce a new type of behavioral intervention for parents of young children undergoing surgery. Thus, the overall goal of this paper is to examine the impact of parental health mindset on the posoperative recovery of children undergoing T&A. Although the HBS has been used in numerous studies in the domain of health where findings have consistently demonstrated that individuals who endorse a growth mindset also show more adaptive and

positive health behaviors and health outcomes, formal validation of the scale has not yet been conducted. Consequently, although the goal of the present study was not to conduct formal validation, our first aim was to provide some initial support for the use of the HBS in the context of acute post-operative pain in children. Thus, we present data to support preliminary reliability and validity of the measure within the context of the overall study from which these data were drawn. Secondly, we aimed to examine pain and post-operative recovery in children as a function of parent health mindset. The primary outcome of this second aim was postoperative pain severity; secondary outcomes included physical recovery and analgesic administration by parents. We hypothesized that children of growth mindset parents would experience less pain and have better postoperative recovery as compared to children of fixed mindset parents.

Patients and Methods

Participants

Participants were part of a larger study funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development (R01HD048935) that included 1470 child-parent dyads undergoing outpatient T&A between the years of 2012-2017. Four hospitals participated: Children's Hospital Orange County, (CHOC) Children's Hospital Los Angeles (CHLA), Lucile Packard Children's Hospital (Stanford), and Children's Hospital Colorado (CHC). The sites were randomized to either be control (CHOC and CHLA) or intervention (Stanford and CHC) sites. The larger study was an effectiveness trial of a behavioral intervention to minimize children's preoperative anxiety. The study was conducted in two phases. The first phase (baseline) involved collecting all study measures from children and parents at all four sites prior to implementing the behavioral intervention. Then the two intervention sites received the behavioral program. The second phase involved collecting the same study measures from all four sites to examine how the intervention impacted the outcomes. Two intervention sites received the behavioral program. Thus, in order to ensure that the intervention was not a confounding variable in the present analysis, only data from the baseline phase (from all four sites) and the control sites (2-sites, baseline plus phase two data) were included in the analyses of this current manuscript (N = 1005). Data analysis of the full baseline and post-intertention phases in all 4-sites to examine the impact of the intervention on the primary outcome of the larger study (children's

perioperative anxiety) is in progress and will be presented in a separate manuscript.

Data from this study were drawn from a larger National Institutes of Health-funded study designed to examine the impact of a healthcare provider behavioral training on children's post-operative anxiety following T&A. Several publications have resulted from the larger study, including an examination of acculturation on children's pre-operative anxiety[17], parent/child agreement in ratings of children's post-operative pain severity at home following T&A [18], factors associated with patient experience following T&A[19], and a descriptive report on clinical and behavioral recovery in children after T&A[20]. The data presented here have not previously been reported.

Children in the present study were between the ages of 2-15 years and American Society of Anesthesiologists Physical Status Classification I-III. Exclusion criteria included developmental delay, severe obstructive sleep apnea, or premature birth. The study was approved by the Institutional Review Board at each site and all dyads provided informed consent/assent. Children ages 4-15 years provided self-report of postoperative pain severity using both the Faces Pain Scale-Revised and a verbal rating scale of pain severity each day of the study (see Measures section); all other measures included in the present study were parent-report.

Data Collection

In this cross sectional approach, eligible participants were consented on the day of surgery by a research associate fluent in both Spanish and English

and parents completed demographic and behavioral baseline data in the preoperative holding area. All measures and study materials were available in both Spanish and English and parents completed forms in the language of their choice. Children's intraoperative and postoperative pain was treated according to hospital protocol and parents were provided with questionnaires to assess pain and recovery at home prior to undergoing surgery. Postoperative data were collected on days 1-3, 7, and 14 after surgery; only data from days 1-3 are presented in the current manuscript. Data were collected by parents via telephone on each of the postoperative days and parents were also provided prepaid envelopes to return study measures by mail. Parents and children completed measures once per day at the end of the day.

Measures

Demographics. Demographic information included age, ethnicity, household income, education, marital status, primary language spoken, and the Hollingshead Index of Social Position.[21]

Construct of Mindset

Health Beliefs Scale (HBS).[22] The HBS contains three items utilizing a Likert-type scale ranging from 1 (strongly agree) to 6 (strongly disagree). Parents are classified as fixed or growth mindset based the following statements: "Your body has a certain amount of health, and you really can't do much to change it", "Your health is something about you that you can't change very much", and "You can try to make yourself feel better, but you can't really change your basic health". The average of all items is taken, and scores below

four represent a fixed mindset, whereas scores of four and above represent a growth mindset. The HBS and scoring protocol were adapted from the Implicit Theory of Intelligence Scale[22].

Validation Measures

Miller Behavioral Style Scale (MBSS).[23] The MBSS asks participants to respond to four stress inducing scenarios and provides two coping scores: monitor and blunter. High monitoring scores reflect information seeking behavior and high blunter scores reflect avoidance of medical information. The MBSS has strong internal consistency and validity[23].

Medication Attitudes Questionnaire (MAQ).[24] The 27-item MAQ assesses parental attitudes towards administering analgesic medication to children on a 1-7 Likert-type scale ranging from strongly disagree to strongly agree[25]. The MAQ is comprised of three subscales: appropriate use (e.g., knowledge of appropriate use of analgesics), fear of side effects (e.g., misconceptions regarding analgesic side effects), and avoidance (e.g., beliefs that analgesics should be avoided) and has strong validity and reliability[24].

Predictor Measures of Health Mindset

Emotionality Activity Sociality Temperament Survey (EAS-TS).[26] The EAS-TS, which has strong psychometric properties, was used to measure parental report of child temperament[27]. Parents answer 20 statements on a 1-5 Likert-type scale in the following categories: emotionality, activity, sociality, and shyness[26].

State-Trait Anxiety Inventory (STAI).[28] The STAI was used to measure a

parent-report of state (situational) and trait (baseline) anxiety, with higher scores indicating increased anxiety. Previous findings have found the STAI to have high internal consistency and validity[28].

Parental satisfaction.[29] Parental satisfaction with children's surgical experience was measured using a 21-item survey which has been shown to be valid and reliable in previous studies[30]. Responses were provided using a 5-point Likert-type scale ranging from "strongly disagree" to "strongly agree," with total scores ranging from 0-100.[29]

Perceived Stress Scale (PSS).[31] The PSS was used to determine parent-report of perceived stress. The 14-item measure has good psychometric properties and utilizes a 0-4 Likert-type scale ranging from "never" to "very often"[31]. Higher scores reflect higher perceived stress.

Outcome Measures of Postoperative Recovery

Parents' Postoperative Pain Measure (PPPM).[32,33] The PPPM was used to assess parent-report of child pain following surgery. The PPPM is a series of 15 yes or no questions to assess a child's behavior changes after being discharged from the hospital (e.g. "Does your child whine or complain more than usual?"). The PPPM has demonstrated good psychometric properties[32,33]. Parents completed the PPPM for all children in this study.

Faces Pain Scale-Revised (FPS-R).[34,35] The FPS-R has been shown to be a good indicator of child pain severity in previous studies.[34,35] This measure uses six unique facial expressions to assess the intensity of pain that a child between the ages of 4-18 is experiencing. The facial expressions range from "no pain" to

"the most pain possible." Children ages 4-15 in the present study completed the FPS-R.

Verbal Rating Scale (VRS).[36] The VRS asks a child to define the intensity of their pain as one of four categories: None, mild, moderate, or severe pain. Previous manuscripts have supported the validity and reliability of the VRS.[36] Children ages 4-15 in the present study completed the FPS-R.

Recovery Inventory (RI).[37] The RI is a 5-item, Likert-type scale that asks parents to rate their child's sleep, appetite, strength and energy, self-assistance, and movement after surgery with higher scores reflective of better recovery. The RI has previously proven to be an excellent self-report measure of recovery[2].

Statistical Analysis

HBS Reliability & Validity Analysis

Reliability. Cohen's kappa was used to examine test-retest reliability of the HBS by examining agreement between parental scores at two time points – on the day of surgery in the preoperative room and on first postoperative day at home. Cohen's kappa values range from -1 to +1 where values greater than 0.70 are generally considered to reflect substantial to excellent agreement.[38]

Criterion Validity. Criterion validity reflects the extent to which a measure is associated with a particular outcome. We examined the concurrent validity (a subtype of criterion validity) of the HBS with two theoretically associated outcomes: coping style (MBSS) and attitudes regarding medication use in children (MAQ). Because evidence from the academic achievement literature

suggests that growth mindset individuals tend to seek out challenging tasks whereas fixed mindset individuals avoid difficult experiences, we hypothesized that parents with a growth mindset would score higher on the monitor scale (i.e., seek out health-related information) of the MBSS compared to parents with fixed mindsets. In addition, we predicted that parents with a fixed mindset would have higher blunter scores (avoid medical information) compared to growth mindset parents. In terms of medication attitudes, we hypothesized that fixed mindset parents would report higher misconceptions regarding analgesic use for children (consistent with avoidance of medical information - fear of side effects, avoidance) compared to growth mindset parents and that growth mindset parents would report higher scores on the appropriate use of analgesics subscale (consistent with information seeking) compared to fixed mindset parents.

Predictors of Mindset Score

Next, we aimed to examine factors that may be associated with mindset by examining associations with participant demographic and baseline characteristics. Specifically, we examined child temperament (EAS-TS); parent anxiety (STAI), stress (PSS), ethnicity, education, socioeconomic status (SES; Hollingshead Index of Social Position), and parent-reported satisfaction as predictors of mindset. Categorical variables (ethnicity) were examined using chi-square analyses and continuous variables (EAS-TS, STAI, education, Hollingshead, and satisfaction) were examined using independent samples t-tests. Because Dweck originally proposed that the concept of mindset should

cut across SES and related demographic variables[39], our analysis of potential predictors of mindset was exploratory in nature. Nonetheless, because of the dramatic expansion in the concept of mindset in the academic setting the past decade and the evidence that mindset is malleable[40], our goal was to determine whether factors such as educational background might be associated with mindset.

Mindset as a Predictor of Postoperative Recovery in Children

Finally, we aimed to examine children's postoperative pain and recovery as a function of parental mindset. Specifically, conducted independent samples t-tests to examine group differences (growth vs. fixed mindset) in parent- and child-report of children's postoperative pain severity (PPPM, FPS-R, VRS), children's physical recovery (RI), and doses of analgesics (ibuprofen and acetaminophen) administered at home on postoperative days 1, 3, and 7. In addition to t-tests to examine mean PPPM scores, we also categorized scores on the PPPM as clinically significant (>5) or not clinically significant (<6) and chi-square analyses were conducted to examine whether the proportion of parents who rated pain as clinically significant varied as a function of fixed versus growth mindset. We predicted that parents with a growth mindset would be more proactive regarding management of postoperative pain and therefore would administer greater number of doses of analgesics and that such children would experience lower pain severity and better recovery.

Results

Participants

Of the 1146 participants who participated at the two control sites (CHOC and CHLA) and the baseline phase of the two intervention sites (Stanford and CHC), 1005 completed the HBS. Across the four study sites, there was an average lost-to-follow up of 9.5% of participants for postoperative data. Demographic data for the 1005 parent-child dyads can be found in Table 1. Children were on average 6.37 ± 2.97 years of age and slightly over half (515, 51.2%) were male. Most children (560, 56.2%) were Hispanic/Latino. The primary parent language was English (912, 69.2%), followed by Spanish (363, 27.5%). Additional demographic characteristics are reported in Table 1.

Reliability and Validity of the Health Beliefs Scale

Test Re-Test Reliability. Cohen's kappa derived from examination of agreement at the two HBS assessment points was 0.726, above the agreement threshold of 0.70 [41].

Validity. Criterion validity was assessed by comparing the HBS to the MBSS and MAQ, with both demonstrating significant results using independent samples t-test (Table 2). As predicted, individuals classified as having a growth mindset reported significantly higher monitor scores compared to individuals classified as having a fixed mindset (7.15 ± 3.32 vs. 6.22 ± 3.38, $p < 0.001$). No differences were found in blunter scores between groups (3.29 ± 2.34 vs. 3.20 ± 1.96, $p = 0.596$. For the subscales of the MAQ, parents with a fixed mindset reported higher scores on the avoidance (28.36 ± 7.90 vs. 24.49 ±

8.25, $p < 0.001$) and fear of side effects (22.11 ± 4.09 vs. 21.41 ± 4.25, $p = 0.035$) subscales compared to parents with growth mindsets. No significant differences were found on the appropriate use subscale (18.50 ± 4.65 vs. 18.97 ± 4.26, $p = 0.127$).

Parent and Child Predictors of Mindset

Table 3 illustrates results of analyses of predictors of parent mindset. Children of growth mindset parents were rated as less emotional (2.61 ± 0.89 vs. 2.84 ± 0.86, $p = <0.001$less shy (2.38 ± 0.80 vs. 2.66 ± 0.76, $p = <0.001$), more active (4.19 ± 0.66 vs. 4.01 ± 0.75, $p = <0.001$), and more social (3.697 ± 0.62 vs. 3.54 ± 0.71, $p = <0.001$)compared to children of fixed mindset parents. In terms of parental predictors, parents who were Hispanic/Latino were more likely to report a fixed mindset compared to parents who were non-Hispanic/Latino (3.9% vs. 16.5%, $p < 0.001$). Growth mindset parents reported greater years of education (14.48 ± 3.27 vs. 12.18 ± 3.49, $p < 0.001$), lower Hollingshead Index scores (43.74 ± 19.29 vs. 54.7 ± 17.44, $p < 0.001$), lower stress (19.28 ± 7.52 vs. 22.20 ± 7.46, $p < 0.001$), and lower trait (34.80 ± 7.89 vs. 37.43 ± 8.62, $p < 0.001$) and state (39.57 ± 10.49 vs. 41.48 ± 9.98, $p = 0.010$) anxiety compared with fixed mindset parents. In addition, growth mindset parents were more satisfied with their children's surgical care compared with fixed mindset parents (92.33 ± 8.45 vs. 90.21 ± 9.92, $p = 0.027$).

Outcomes of Mindset: Children's Surgical Pain and Recovery

Children's postoperative pain and recovery outcomes are presented in Table 4. Growth mindset parents rated their children as experiencing significantly less pain on days 1 (8.37 ± 3.71 vs. 9.22 ± 3.82, $p = 0.007$) and 3 (7.27 ± 4.28 vs. 8.13 ± 4.28, $p = 0.007$) compared to fixed mindset parents but no differences were found in the child self-reported pain variables ($p = 0.585$). Chi-square analyses of the clinically significant vs. not clinically significant PPPM scores were not significant for each of the postoperative days ($p = 0.695$, $p = 0.101$, and $p = 0.592$ for days 1, 3, and 7, respectively, Table 4). Children of parents with growth mind set were given higher postoperative RI scores on postoperative days 1 (16.42 ± 5.03 vs. 15.54 ± 4.87, $p = 0.035$) and 7 (20.81 ± 5.26 vs. 19.77 ± 5.12, $p = 0.017$) compared to children of fixed mindset parents. The trend in recovery scores was similar on day 3, but not statistically significant ($p = 0.087$). Finally, children of fixed mindset parents received more doses of ibuprofen on postoperative day 1 (2.91 ± 1.24 vs. 2.44 ± 1.44, $p = 0.041$) compared to children of growth mindset parents. No significant differences were found in analgesic administration on any other day for ibuprofen or acetaminophen (p-values for acetaminophen on postoperative days 1-3 = 0.066, 0.803, and 0.917, respectively; p-values for ibuprofen on days 2-3 = 0.343 and 0.391, respectively).

Discussion

Under the conditions of study, we found that parental health mindset had a statistically significant impact on the recovery of children undergoing T&A. This impact, however, was of limited clinical significance. Parents who reported a fixed mindset of health, or the belief that health cannot be changed, reported their children as suffering from more pain and their children recived higher dosages of analgesics compared to parents who reported a growth mindset. Interestingly, children did not report differences in pain; instead, it was the parents' perceptions of children's pain that were influenced by their views of health and its malleability. In addition, we found that children of parents with growth mindsets had improved recovery scores within the first week after surgery compared to children of fixed mindset parents. Finally, we found that parents classified as having a growth mindset reported significantly higher monitor scores in our coping tool compared to individuals classified as having a fixed mindset. This validation of a new way of assessing tendencies in parents of surgical patients is novel and worthwhile.

The U.S. healthcare system is the most expensive in the world, yet our surgical and perioperative process and outcomes could be significantly improved[42]. Whereas system issues such as failures of care coordination and administrative complexity have been cited as major issues, other constructs such as involvement of patients and their families in their own care have been developed more recently.[43] Within the domain of increasing patient involvement in their care, a new construct has been proposed more recently: health mindset.

Here, mindset is defined "a set of beliefs or assumptions held by individuals that contribute to their world view and can lead to different perceptions and actions."[11] Mueller revised the original mindset scale developed by Dweck to be appropriate for use in the healthcare settings.[12]

In addition to the academic realm, mindset has been explored across a number of domains including stress[44] and personal relationships[45,46]. This body of work has consistently demonstrated an association between a growth mindset and more positive and adaptive outcomes[47,48,49]. Application of the HBS in the domain of health and health outcomes has also increased in recent literature. This body of literature as shown positive associations between a growth mindset and health perceptions and behavior outcomes for healthy adolescents as well as for those with Type I diabetes,[50] and those undergoing thoracic surgery.[51] In a sample of college students, a growth mindset was also shown to be associated with lower BMI as a function of increased physical activity [52].

Our findings that fixed mindset parents rated their children as suffering from higher levels of pain *and* that such parents provided their children with more analgesics even though there were no differences in children's self-reported pain between the two groups is of clinical interest. Because previous research in the educational space has shown that mindset can be altered, this finding could have a significant impact on managing postoperative pain in children at home.

Growth mindset parents reported more years of education, higher SES, and greater satisfaction with their children's surgical experience compared to fixed mindset parents. Fixed mindset parents were more likely to be Hispanic/Latino, reported higher levels of anxiety and stress, and had children who were more shy and emotional and less active and social compared to growth mindset parents. The ethnic differences in mindset should be interpreted cautiously given that education and SES are also associated with a fixed mindset. There may also be other potential cultural factors not addressed by this questionnaire, such as implicit trust in the medical system. A limitation of this study is the inability to examine specific cultural variables (e.g., acculturation) in mindset. The findings that anxiety and stress are associated with a fixed mindset of health make intuitive sense given that parents who believe that health cannot be improved through effort might be less optimistic about their children's ability to recover after surgery.

Our preliminary validation efforts showed that growth mindset was associated with a monitoring coping style, which is characterized by seeking out information related to a perceived threat. Monitoring has previously been shown to be associated with higher levels of anxiety compared to a blunting style of coping (i.e., individuals who engage in distraction),[23] but neither coping style has been found to be associated with postoperative pain severity or analgesic administration by parents in children undergoing outpatient surgery [53]. Thus, it may be that although assessment of coping style does not directly inform parental management of children's postoperative pain, assessment of

the broader context of mindset provides clinically relevant data. In addition, monitoring/blunting as assessed by the MBSS is time consuming; whereas the HBS is a simple and efficient four-item survey of health beliefs that may be more feasible in a busy clinical environment. The tendency to engage in distraction (i.e., blunting) may be less relevant to health mindset; however, further research into the intersection of health beliefs and coping style is needed.

Although we were unable to conduct thorough construct validity testing of HBS, our findings are consistent with converging evidence that growth mindset is associated with more adaptive health and psychosocial outcomes. Growth mindset parents reported lower anxiety and stress on the day of surgery, suggesting a more adapative ability to manage the emotional impact of having a child undergo surgery compared to fixed mindset parents. In addition, growth mindset parents described less “difficult” temperaments in their children. Children with more “difficult” temperaments have been shown to have greater behavioral difficulties as they age, which is also impacted by parenting behavior [54]. Thus, parent mindset may be an important variable to consider in this relationship and in how children manage health-related stressors and challenges. Nonetheless, these findings are all preliminary and would require replication once a full validation of the HBS has been conducted.

Findings from the present investigation are also consistent with extant literature using the HBS in the domain of healthcare in that growth mindset was related to better pain and recovery postoperatively in children. Following

pectus excavatum repair in adolescents, growth mindset was associated with lower postoperative pain, although no differences in analgesic consumption compared to a fixed mindset [51]. Although the differences in pain found in the present investigation cannot be considered clinically significant, taken together with previous publications these results suggest mindset may be relevant to recovery from surgery and impact pain perception. Nonetheless, even though the findings in the study by Sujka and colleagues were clinically meaningful, in both studies, the difference in pain scores between fixed and growth mindset groups was approximately one point. Therefore, an important question is what do these small findings in pain suggest? We propose that because of the complexity of management of pain given the myriad psychosocial factors that contribute to the experience and perception of pain, mindset may be one such factor that has a small impact on pain experience. It is possible that parental perception of children's recovery is impacted by mindset such that fixed mindset parents characterize children's pain slightly more poorly but it is also possible that a fixed mindset in parents has negative impacts on children's postoperative recovery. Because of the simplicity of interventions that can change mindset, it also represents a clinically viable factor that could be targeted in multimodal interventions for postoperative pain that will allow for incremental impact on pain severity.

Although this study provides novel information to the field of postoperative pain management in children and has the potential to inform new approaches to intervention in this domain, it is not without its limitations.

Specifically, because data presented here were part of a larger study whose aim was not a formal validation of the HBS, we were limited in the psychometric data we would present. Thus, future steps include a thorough validation of the measure in order to support its continued use in the context of acute pain and healthcare. In particular, it would be important to provide support for inter-rater reliability as well as more in depth evaluation of both criterion and construct validity. A second limitation of this study is that although we found statistically significant differences in parent-reported pain and recovery between growth and fixed mindset parents, these differences were small and not clinically significantly, which limits the clinical significant of the findings. Further research is needed in order to determine whether mindset indeed is a clinically relevant construct in the context of interventions directed at management of postoperative pain in children at home. A third limitation is that potential confounding variables that could have impacted pain and surgical recovery were not included and thus could not be accounted for, such as anesthetic, analgesic, and surgical technique across sites and providers. Thus, future research should control for variables that impact these outcomes when examining the impact of health mindset in the perioperative domain. Finally, our analyses could be considered subject to the problem of multiple testing that were not corrected (e.g., Bonferroni method). However, given criticisms of the Bonferroni method[55] including its potential negative impact on Type II error, we chose not to correct our p-value. Nonetheless, it should be noted that the

majority of our findings were significant at the $p < 0.001$ level, which would have satisfied the Bonferroni method regardless.

In conclusion, findings from the present study suggest that parental mindset may be relevant to the recovery of children following outpatient T&A and may represent a novel target of perioperative interventions for children and families. The most fundamental question raised by this study is whether we can alter parental mindset and subsequently impact recovery. In the educational setting, simple one-hour interventions can improve growth mindset and grades.[11] More recently, online interventions have successfully impacted mindset and achievement,[56] and these types of interventions can impact physiological response to stress by lowering cortisol.[57] Our group and others have adopted mobile health (mHealth) interventions targeting perioperative anxiety, pain, and recovery in children undergoing outpatient surgery[58,59]. The benefit of mHealth is the ability to deliver interventions prior to surgery to allow children and families appropriate time to receive psychoeducation and practice and develop coping skills that will benefit children's surgical recovery, including pain management. Education regarding mindset could be incorporated into these types of interventions. However, more simply, the time that parents are waiting for their children's surgery to be completed could be a time to deliver a simple, short, educational intervention targeting mindset using a computer tablet that could target the development of a growth health mindset. We propose that a health mindset intervention in the perioperative environment should be developed for parents of children undergoing surgery and that this

kind of a scalable, cost-effective intervention could be widely adopted in the clinical settings. Nonetheless, given the limitations of this preliminary study in terms of lack of complete validation and limited clinical significant, further research evaluating the role and impact of parental health mindset on children's surgical recovery is important to pursue in terms of evaluating the usefulness of this construct in perioperative interventions.

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Table 1 Baseline Characteristics

Variable	**Study Population**
	(*n* = 1005)
Child Gender (*n*(%))	
Male	515 (51.2%)
Female	483 (48.1%)
Other/Missing	7 (0.7%)
Age (Years) (*M* ± SD)	
Child	6.24 ± 2.93
Mother	35.27 ± 6.83
Father	37.74 ± 7.43
Child Ethnicity (*n*(%))	
Hispanic or Latino	560 (56.2%)
Not Hispanic/Latino	413 (41.4%)
Unknown/Prefer not to answer	24 (2.4%)
Parent Primary Language (*M* ± SD)	
English	912 (69.2%)
Spanish	363 (27.5%)
Other/Prefer not to answer	47 (3.3%)
Parent Marital Status (*n*(%))	
Single	157 (15.9%)
Married	656 (66.5%)
Other/Missing	192 (17.6%)
Mother Education (*n(%)*)	
Professional Degree	144 (13.7%)
Four-year Degree	177 (18.5%)
1-3 years College	153 (16.0%)
High School Graduate	228 (23.8%)
Less than High School	177 (17.2%)
Prefer not to answer	30 (2.9%)
Father Education (*n*(%))	
Professional Degree	131 (14.0%)
Four-year Degree	220 (21.4%)
1-3 years College	227 (22.1%)
High School Graduate	230 (22.4%)
Less than High School	221 (23.1%)
Prefer not to answer	47 (4.9%)
Income Bracket (Dollars)	

(*n*(%))	
20,000 and under	223 (23.3%)
21,000-50,000	250 (24.8%)
51,000-100,000	139 (13.9%)
100,000 and above	222 (22.0%)
Missing/Prefer not to answer	151 (17.0%)

Table 2 Health Belief Scale Validity Measures

Variable	**Fixed Mindset** M ± SD (*n* = 291)	**Growth Mindset** M ± SD (*n* = 687)	***p*-value**	**95% CI**
MBSS				
Blunter Score	3.29 ± 2.34	3.20 ± 1.96	0.596	-0.241 to 0.379
Monitor Score	6.22 ± 3.38	7.15 ± 3.32	<0.001	-1.387 to -0.471
MAQ				
Avoidance Scale	28.36 ± 7.90	24.49 ± 8.25	<0.001	2.759 to 4.988
Fear of Side Effects Scale	22.11 ± 4.09	21.41 ± 4.25	0.035	0.046 to 1.229
Appropriate Use Attitude	18.50 ± 4.65	18.97 ± 4.26	0.127	-1.067 to 0.132

Note. MBSS = Monitor Blunter Style Scale. MAQ = Medication Attitudes Questionnaire.

Table 3 Parent/Child Baseline and Demographic Predictors of Mindset

Variable	**Fixed Mindset** (*n* = 295)	**Growth Mindset** (*n* = 680)	***p* value**	**95% CI**
Child Temperament- EAS-TS (*M* ± *SD*)				
Emotionality	2.84 ± 0.86	2.61 ± 0.89	<0.001	0.117 to 0.358
Shyness	2.66 ± 0.76	2.38 ± 0.80	<0.001	0.172 to 0.388
Activity	4.01 ± 0.75	4.19 ± 0.66	<0.001	-0.273 to -0.080
Sociability	3.54 ± 0.71	3.697 ± 0.62	<0.001	-0.250 to -0.073
Parent Ethnicity (*n*(%))				
Latino	175 (39.9%)	252 (57.9%)	<0.001	n/a
Non-Latino White	78 (16.5%)	395 (83.5%)	<0.001	n/a
Parent Years of Education (*M* ± *SD*)	12.18 ± 3.49	14.48 ± 3.27	<0.001	-2.760 to -1.845
Hollingshead Index (*M* ± *SD*)	54.7 ± 17.44	43.74 ± 19.29	<0.001	8.210 to 13.714
Parent Anxiety (*M* ± *SD*)				
STAIT	37.43 ± 8.62	34.80 ± 7.89	<0.001	1.499 to 3.763
STAIS	41.48 ± 9.98	39.57 ± 10.49	0.010	0.465 to 3.345
Parent Stress – PSS (*M* ± *SD*)	22.20 ± 7.46	19.28 ± 7.52	<0.001	1.904 to 3.951
Total Satisfaction Score (*M* ± *SD*)	90.21 ± 9.92	92.33 ± 8.45	0.027	-4.007 to -0.238

Note. EAS-TS = Emotionality, Activity, Sociability Temperament Survey. STAIT = State Trait Anxiety Inventory – Trait form. STAIS = State Trait Anxiety Inventory – State form. PSS = Perceived Stress Scale.

Table 4. Associations Between Parental Mindset and Children's Surgical Pain and Recovery

Variable	**Fixed Mindset M ± SD** (*n* = 266)	**Growth Mindset M ± SD** (*n* = 682)	***p*-value**	**95% CI**
Parent-reported pain – PPPM				
Day 1	9.22 ± 3.82	8.37 ± 3.71	**0.007**	0.234 to 1.459
Day 3	8.13 ± 4.28	7.27 ± 4.28	**0.007**	0.094 to 1.638
Day 7	6.02 ± 4.29	5.71 ± 4.44	0.409	-0.418 to 1.026
Child-reported pain – FPS-R				
Day 1	4.89 ± 3.01	4.82 ± 2.98	0.848	-0.624 to -0.759
Day 3	3.43 ± 2.81	3.65 ± 2.88	0.585	-1.002 to 0.567
Day 7	2.04 ± 2.45	2.04 ± 2.36	0.999	-0.780 to 0.779
Child-reported pain – VRS				
Day 1	1.99 ± 0.93	1.89 ± 0.96	0.296	-0.091 to 0.295
Day 3	1.43 ± 0.94	1.56 ± 0.93	0.227	-0.352 to 0.084
Day 7	0.96 ± 0.96	0.95 ± 0.97	0.884	-0.204 to 0.236
Recovery Inventory				
Day 1	15.54 ± 4.87	16.42 ± 5.03	**0.035**	-1.701 to -0.064
Day 3	16.80 ± 5.05	17.64 ± 5.31	0.087	-1.796 to 0.121
Day 7	19.77 ± 5.12	20.81 ± 5.26	**0.017**	-1.891 to -0.183
Ibuprofen Doses Given				
Day 1	2.91 ± 1.24	2.44 ± 1.44	**0.041**	0.089 to 0.848
Day 3	1.30 ± 1.20	1.37 ± 1.29	0.723	-0.460 to 0.320
Day 7	0.52 ± 0.97	0.35 ± 0.79	0.084	-0.023 to 0.361
Acetaminophen Doses Given				
Day 1	2.89 ± 1.28	2.82 ± 1.41	0.598	-0.197 to 0.342
Day 3	2.27 ± 1.63	2.26 ± 1.61	0.945	-0.358 to 0.384
Day 7	0.72 ± 1.02	0.70 ± 1.03	0.888	-0.188 to 0.217

Note. PPPM = Parents Postoperative Pain Measure. FPS-R = Faces Pain Scale-Revised. VRS = Verbal Rating Scale.