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Parent responses to pediatric pain: The differential effects of ethnicity on opioid consumption

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Abstract

Objective: Within the context of the United States opioid epidemic, some parents often fear the use of opioids to help manage their children's postoperative pain. As a possible consequence, parents often do not dispense optimal analgesic medications to their children after surgery, putting their children at risk of suffering from postsurgical pain. The objective of this research was to assess ethnicity as a predictor of both pain and opioid consumption, and to examine how Hispanic/Latinx and Non-Hispanic White parents alter their child's opioid consumption in response to significant postsurgical pain.

Methods: Participants were 254 children undergoing outpatient tonsillectomy and/or adenoidectomy surgery and their parents. Longitudinal multilevel modeling examined changes in both parent-reported pain and hydrocodone/APAP consumption (mg/kg) on days 1 to 7 after surgery.

Results: Parent reports of postoperative pain were higher in Hispanic/Latinx patients compared to their Non-Hispanic White counterparts ($\beta = -0.15$; 95% CI: −0.28, −0.01). There was also a significant interaction of ethnicity and pain on opioid consumption ($\beta = 0.07$; 95% CI: 0.01, 0.13).

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Declaration of Competing Interest

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The relationship between parent perceived pain and opioid use was stronger for Non-Hispanic White children, suggesting that this group was more likely to consume opioids to help manage clinically significant postsurgical pain.

Conclusions: Hispanic/Latinx children might be at risk for undertreatment of surgical pain. Findings highlight the importance of assessing parent background and cultural beliefs as predictors of at home pain management and the potential effectiveness of tailored interventions that educate parents about monitoring and treating child postoperative pain.

Keywords

Opioids; Postoperative pain; Pediatric pain; Analgesia; Pain management

1. Introduction

The opioid epidemic remains a public health crisis impacting the United States (U.S.). The economic cost of the opioid crisis is estimated to be $504 billion, with over 33,000 Americans dying of an opioid-related overdose annually [1]. Opioids are prescribed for pain relief from surgery; however, they are highly addictive and have a range of side effects. The opioid crisis is not limited to the adult population [2]. Millions of children undergo ambulatory surgery in the U.S. each year [3] and many are prescribed opioids for their postoperative pain. Recent trends have started to raise questions about the use of opioids for pediatric patients [4-6]. Children and adolescents are vulnerable to brain changes in the habit formation and reward centers of the brain [7], and patients prescribed opioids at a young age are at risk for later problems with misuse and dependence [8,9]. Nevertheless, surgery and postoperative pain in children are very common, making adequate pain control also a significant concern [10,11]. Despite the adverse effects of opioids, they do have significant therapeutic advantages for managing moderate to severe acute pain [12].

Recent trends dictate that many surgeries in children are now performed on an outpatient (as opposed to inpatient) basis, making parents accountable for their child's pain management and recovery [11]. Current outpatient guidelines for managing and preventing post-surgical pain recommend the use of oral opioid and non-opioid analgesics to be administered “as needed” or on a pain contingent basis [13]. Unfortunately, there is a gap in interpretation of these guidelines to manage pain at home, as many parents struggle with optimal analgesic administration [14,15]. This is problematic, as the undertreatment of pediatric postsurgical pain can result in delayed recovery [16], unexpected hospitalization [17], and chronic or persistent pain [18].

One determinant of pain and its management is ethnic identification [19-21], which represents a person's self-classification into an ethnic group. While ethnicity is used to distinguish groups of people based on their shared culture, history, social background, and beliefs, race differentiates people based on physical characteristics [19,22]. Furthermore, pain is argued to be shaped by the interactive effects of biological (e.g., genetics), psychological (e.g., coping strategies), and social (e.g., family history and culture) factors [23,24], which are all highly influential in a person's cultural identification [25].

In the U.S., the Hispanic/Latinx population is the largest minority group constituting approximately 18.1% of the total population [26]. Research examining the impact of ethnicity on the pain experience suggests that Hispanic/Latinx adults report higher levels of postsurgical pain [27] and exhibit a greater number of physical pain symptoms [20,28], but receive fewer opioids [29-31] compared to Non-Hispanic Whites (NHW). Similar racial/ethnic differences in pain [32] and its management for children have been shown in the emergency department [33-35], post-anesthesia care unit [36], and in an outpatient setting [37,38]. These observed differences might be explained by several factors such as patient communication style [39], language preference [40], socioeconomic status [34], financial constraints to pay for care [41], and physician implicit bias [42], and indicate that minority pediatric patients might be at risk for suffering from postsurgical pain disproportionally compared to their NHW counterparts [32,43].

For pediatric patients, home-based recovery and pain management is dependent on parental pain assessment and the decision to respond by administering analgesic medication. Specifically, research suggests that parent responses to their children's emotional and behavioral expressions of pain are often mediated by cultural beliefs, expectations, and past experiences, which all differ based on cultural/ethnic identity [44]. Due to the growing Hispanic/Latinx population in the U.S., it is crucial to understand the pain management attitudes and behaviors of Hispanic/Latinx parents in order to help improve pediatric recovery. For example, cultural barriers might impact the analgesic usage behaviors of Hispanic/Latinx Americans. This population is shown to cope with pain by remaining stoic by suffering through pain without complaining, and bearing pain with courage and dignity [45]. Stoicism is often learned from the family [45], and is utilized to avoid appearing weak, and to suppress behaviors that might burden others [41,46]. This cultural emphasis on stoicism might impact child pain expression [15,47], and parent responses to child pain.

Parental beliefs might also represent a pain management barrier. Previous research by our group shows that compared to NHW parents, Hispanic/Latinx parents report greater misconceptions regarding pain expression (e.g., the belief that children always express pain by crying and always tell their parents when they are in pain) and analgesic administration (e.g., fear of side-effects and addiction) [15,48], and that Hispanic/Latinx parents often do not administer adequate doses of analgesic medications to their children despite reports that they experienced clinically significant postsurgical pain [14]. Medication-related fears and misunderstandings are often rooted in cultural context [49]. Research suggests that Hispanic/Latinx Americans possess concerns about taking strong pain medications and believe opioid medications to be dangerous [46,50]. As a result, Hispanic/Latinx patients might alter prescribed doses [49] or exhibit a preference for traditional treatment methods (e.g., herbs, ointments) that are perceived as safer and more effective than opioid medications.

The cited studies suggest that parent pain interpretations and attitudes about analgesic medication might represent a barrier to medication adherence. The current study aims to expand this previous body of research [14,15,48] by assessing how Hispanic/Latinx and NHW parents alter their child's opioid consumption in response to significant postsurgical pain. Parents of Hispanic/Latinx children were hypothesized to report their child experienced greater pain (Hypothesis 1) [38], but received fewer opioids (Hypothesis

2) during recovery compared to NHW children [33,36]. Also, an interaction of ethnic identification and parent-reported pain on opioid consumption was posited (Hypothesis 3), such that Hispanic/Latinx parents were expected to be less likely to adjust their child's opioid dose based on pain level compared to NHW parents [14,35].

2. Method

2.1. Patients and procedure

The current study involves a secondary data analysis of baseline longitudinal data collected with children and parents for an NIH funded larger randomized clinical trial centered on examining the effectiveness of a provider tailored intervention for perioperative stress (R01HD048935). The larger clinical trial was conducted from 2012 to 2017 and was funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development [51]. Participants were pediatric patients between the ages of 2 and 15 and their parents. Patients underwent outpatient T&A surgery at the Children's Hospital of Los Angeles (CHLA), Children's Hospital of Orange County (CHOC), Children's Hospital, Colorado (CHC), and Lucile Packard Children's Hospital at Stanford (LPC). The larger clinical trial consisted of observational baseline and intervention phases. For the purpose of the present report, we used data only from the observational baseline data (before any intervention) and control group data.

Patients were required to have an American Society of Anesthesiologists physical health status of I-III and be English- and/or Spanish-speaking. Exclusion criteria included children with chronic illness that puts them in ASA IV (extreme systemic disorders which have already become an eminent threat to life regardless of the type of treatment), having a developmental delay or special need, and being born prematurely (< 32 weeks gestational age).

On the day of surgery, research assistants obtained written parent consent and patient assent after fully explaining the nature of the study procedures. While waiting in the holding area, parents completed a paper and pencil preoperative survey in their preferred language that included demographic measures. Parents were given standardized prescription medication discharge information and instructions in their primary language. After returning home from the hospital, parents completed a paper and pencil daily diary entry as part of the study, recording their child's level of pain and the medications taken. Pain was recorded once per day; medication use was recorded up to seven times per day. Parents continued to record their child's medication use and pain level on the first 3 days and the 7th day following surgery. Protocols were approved by an institutional review board at each of the four sites.

2.2. Within-patient measures

2.2.1. Parent-reported pain—Parent perceptions of child pain was operationalized using parent report on the Numeric Rating Scale (NRS) with responses ranging from 0 (*No Pain*) to 10 (*Severe Pain*). This rating scale has been shown to be reliable and valid indicator of pain in pediatric patients [52], and has been used to assess parent global ratings of their child's pain using a daily diary format [10].

2.2.2. Hydrocodone/APAP consumption—

Hydrocodone/acetaminophen (APAP) liquid consumption (mg/kg) was measured by having parents record the medication type and dose administered to their child throughout the week after returning home from the hospital. A sum of the amount of hydrocodone/APAP consumed in mg/kg was computed for each of the postoperative days. Current guidelines [53] suggest administering 0.1–0.2 mg/kg of hydrocodone/APAP every 4 to 6 h (i.e., 0.4–1.2 mg/kg per day). Patients who did not take hydrocodone/APAP, but took acetaminophen only received a value of 0 for hydrocodone/APAP consumption.

2.2.3. Additional acetaminophen use—

Additional acetaminophen use (mg/kg; e.g., children's acetaminophen liquid, junior acetaminophen liquid) was computed for each day. Hydrocodone/APAP contains both hydrocodone and acetaminophen. Thus, this measure controls for acetaminophen use, in addition to the dose of hydrocodone taken. Parents recorded the type and dose of acetaminophen administered. Children who took only Hydrocodone/APAP only were given a value of 0 for additional acetaminophen.

2.3. Between-patient measures

The year of data collection, hospital site, and procedure type were included as control variables. Parents reported their household income range and education level, and their child's age, sex, and ethnic identification. For children with one parent, education level reflects the value of that parent only.

2.4. Data preparation

One hospital, LPC, did not prescribe opioids to any patients, and was therefore removed from the analysis. Participants were children who underwent T&A surgery at CHLA, CHOC, or CHC, that took either hydrocodone/APAP liquid or acetaminophen-only, and reported at least one pain response ($N = 305$). Given the low sample size of African American and Asian participants meaningful differences could not be examined. In total, 34 participants were removed from the sample because they did not fall into either ethnicity category.

Three participants were identified as having univariate outliers (> 3 standard deviations from the mean) and 14 were found to be multivariate outliers using the Mahalanobis distance test [54]. All 17 outliers were removed before conducting statistical tests ($N = 254$). Missing data was also assessed (Table 1). Binary logistic regression modeling was used to compare rates of missing data for Hispanic/Latinx and NHW patients, while controlling for hospital site. Findings showed no significant ethnicity-based differences for income, education, hydrocodone/APAP, acetaminophen, or pain (see Table 1). Across all variables, rates of missingness were similar Hispanic/Latinx and NHW patients (OR = 0.60, $p = 0.28$). The data was also examined for systematic patterns of missingness. No patterns emerged; thus, the data was considered to be missing at random. In line with current recommendations [55], analyses employed maximum likelihood procedures. Further, stochastic regression imputation was used under the conditions of missing at random to address any potential biasing effect of missing data at Level 2 (between-patient) [56].

2.5. Statistical analysis

Longitudinal multilevel modeling (MLM), using the SPSS mixed procedure [57,58] was performed using robust maximum likelihood estimation to assess the changes in both pain and hydrocodone/APAP consumption 1 to 7 days post-surgery. The repeated measures of pain, hydrocodone/APAP consumption, and additional acetaminophen use were conceptualized nested within each patient, and changes in both pain and hydrocodone/APAP were examined at two levels—within patient (Level 1; intra-individual) and between patient (Level 2; interindividual) [57,59]. A major advantage of using MLM is that missing data at Level 1 can be handled flexibly. All available data can be included, meaning that individuals with data missing on one or two time points can still be used in the analyses [60]. All variables were standardized (*Z*-scored) prior to conducting analyses [57,61]. This approach is suitable for fixed-effect models and enables the interpretation of standardized regression coefficients.

Separate MLM analyses were conducted to evaluate changes in both pain and hydrocodone/APAP consumption overtime. Models were successively specified to produce models that could be statistically compared using the −2LL and AIC [57]. Model 1 estimated baseline model to compute the intraclass correlation (ICC), an assessment of whether the outcome variable changes between patients overtime [57,62]. Model 2a estimated a linear growth model with time as the only predictor to examine overall and individual differences in pain and hydrocodone/APAP use overtime. Model 2b scrutinized a quadratic growth curve model, examining whether pain level and hydrocodone/APAP use accelerated or decelerated overtime. In both Model 2a and 2b time was specified as a random parameter to examine between-subject variations in the relationship between the outcome variables and time.

Model 3 incorporated all fixed-effect predictors to identify which variables explained differences in the growth curve trajectory of pain level and hydrocodone/APAP use. When assessing hydrocodone/APAP use as the outcome variable, a cross-level interaction of pain level and ethnic identification was also incorporated into Model 3. Significant interaction effects were decomposed using a test of simple slopes [63]. An online calculator [64] was used to probe the cross-level interaction, with pain level assessed at 1 standard deviation below the mean, at the mean, and 1 standard deviation above the mean for Hispanic/Latinx and NHW patients.

An important consideration of longitudinal MLM is whether residual error varies overtime [65]. When estimating hierarchical linear models, it is appropriate to assess whether the specification of different covariance structures impact model fit. Covariance structures typically implemented when multiple waves of measurement are obtained include diagonal (DIAG), first-order auto-regressive (AR1), compound symmetry (CS), heterogeneous autoregressive (ARH1), and unstructured (UN). To assess whether residual error variances were heteroscedastic versus homoscedastic across measurement periods, a likelihood ratio test was used to compare random intercepts models for pain and hydrocodone/APAP consumption. The heteroscedastic error variance model estimated the variance components at Level 1 by specifying the DIAG covariance structure for the repeated covariance type. The UN matrix was used for the homoscedastic model estimation [57]. In both the pain and hydrocodone/APAP random intercepts models, the likelihood ratio test showed that

the models with an UN matrix exhibited a better model fit (both $p = 0.001$), suggesting heteroskedasticity of error terms overtime. To account for this, an UN covariance matrix was used in all analyses to estimate random intercepts (UN 1,1), random slopes (UN 2,2) and the covariance between intercept slopes (UN 2,1) [57].

3. Results

The final sample (Table 1) consisted of 254 pediatric patients ranging from ages 2 to 15. In total, 146 patients were Hispanic/Latinx and 108 were NHW. Average pain scores and hydrocodone/APAP consumption for both Hispanic/Latinx and NHW patients are depicted in Table 2.

3.1. Parent-reported pain

Results of Model 1 revealed that 44% of the variance in pain severity could be explained by between-patient variations (Table 3). Results of Model 2a showed that on average, pain decreased overtime ($p < 0.001$), that each patient's initial pain score was different, UN (1,1) = 0.51, and that the linear decrease in pain was different for each patient, UN (2,2) = 0.05. The quadratic trend (Model 2b) was non-significant ($p = 0.07$), and was not retained. All fixed effect predictors were included in Model 3, which was the best fitting model. At the within-patient level, parents that reported higher levels of postoperative pain were more likely to administer both acetaminophen and hydrocodone/APAP to the pediatric patient. At the between-patient level, ethnicity was significantly associated with pain. In support of Hypothesis 1, parents of Hispanic/Latinx patients indicated that their children experienced greater pain severity, even when controlling for differences in medication use.

3.2. Hydrocodone/APAP consumption

Model 1 revealed that that 67% of the variance in in hydrocodone/ APAP consumption could be explained by between-patient variations (Table 4). Hydrocodone/APAP use decreased significantly throughout the post-surgical week ($p < 0.001$; Model 2a). This trend was qualified by significant random effects of time. Each patients' initial hydrocodone/APAP use was different, UN (1,1) = 0.60, and patient changes in hydrocodone/APAP consumption overtime covaried with initial use, UN (2,1)= −0.06. As initial dose increased, the slope of the relationship between time and use decreased. The quadratic effect (Model 2b) was also was significant ($p < 0.001$). Hydrocodone/APAP consumption did not change from day 1 to day 2, and then slightly decreased on day 3, with the largest decrease from day 3 to day 4 (Table 1). Model 2b was a better fitting model ($p < 0.001$); thus, both the linear and quadratic components were retained in the subsequent analyses.

Model 3 was the best fitting model. At the within-patient level, patients who took additional acetaminophen were less likely to consume hydrocodone/APAP, and those who experienced greater pain were more likely to consume hydrocodone. At the between-patient level, findings disclosed no significant main effect of ethnicity (Hypothesis 2); however, an examination of average hydrocodone/APAP usage (Table 2) did show that Hispanic/Latinx patients consumed less hydrocodone on each postoperative day. Hypothesis 3 was supported by the significant interaction of ethnic identification and pain see (Fig. 1). A test of simple

slopes indicated that the relationship between parent-reported pain and hydrocodone/APAP consumption was stronger for NHW patients, $b = 0.26$, $SE = 0.05$, $p < 0.001$, than for Hispanic/Latinx patients, $b = 0.12$, $SE = 0.04$, $p = 0.01$, suggesting findings that NHW patients were more likely to consume higher doses of hydrocodone/APAP when parents perceived them as experiencing clinically significant pain. The region of significance for pain level ranged from −2.75 to 3.12, with values outside this region statistically significant.

3.3. Auxiliary sensitivity analysis: additional acetaminophen consumption

A post-hoc sensitivity analysis was conducted to assess whether ethnic identification and pain severity interacted to also predict acetaminophen use. The relationship between ethnicity and acetaminophen use was not significant, $\beta = 0.07$, (95% CI: −0.05, 0.18, $p = 0.27$), and the interaction of ethnicity and pain was also not statistically significant, $\beta = -0.06$, (95% CI: −0.13, 0.01), $p = 0.07$. Simple slopes analyses showed that the relationship between pain and acetaminophen use was not significant for NHW, $b = 0.01$, $SE = 0.08$, $p = 0.90$, or Hispanic/Latinx, $b = 0.07$, $SE = 0.06$, $p = 0.27$, patients.

4. Discussion

Under the conditions of this study, Hispanic/Latinx parents were shown to perceive their children as experiencing higher levels of postoperative pain compared to parents of NHW patients. Despite these higher levels of pain, no differences in at home opioid consumption were found based on ethnic identification alone. Instead, an interaction was found between ethnicity and pain, such that Hispanic/Latinx parents were less likely to administer opioids based on children's pain severity. In contrast, NHW parents were more likely to administer opioids in reaction to their children's pain, dispensing more opioids as children's pain severity increased.

Explanations for the cultural differences observed in this research are complex; thus, a biopsychosocial model [66] of pain that considers the interaction of biological, psychological, and sociocultural processes might be useful for understanding ethnic differences in pain management observed in this study. At a psychological and sociocultural level, findings should be interpreted in context of the opioid epidemic. Parent fears about prescription opioids are likely to act as a barrier to effective pain management [10,48], making postsurgical pain management in children a significant concern [10,11,67]. In other words, parents' worries about the negative consequences of opioids may lead them to undertreat their child's pain. Although about 80% of children report significant postoperative pain [10,68,69], less than 50% of these patients receive adequate pain relief [14]. This is troubling, as inadequately controlled postoperative pain can negatively impact quality of life, increase risk of complications, and interfere with overall surgical recovery [16,17]. Despite their side effects, opioids are the mainstay of treatment for acute postoperative pain and are shown to effectively help with acute pain management [12]. Thus, understanding the misconceptions and barriers linked with opioid pain management among Hispanic/Latinx patients is important for ensuring optimal pain management at home.

Past research by our group supports that psychological and social factors can impact suboptimal pain management at home, including pain assessment, attitudes about analgesic

medications, and cultural bias [10,15,48,70]. In prior studies, Hispanic/Latinx parents have reported greater misconceptions about analgesic use for children including a greater fear of side effects and addiction [48], and parents with greater misconceptions have been previously shown to under medicate their children after surgery [69]. Parents also tend to endorse inaccurate beliefs about pain expression. Specifically, a previous study showed that many Hispanic/Latinx parents believed children always express pain by crying or whining [15], despite research suggesting that children do not always communicate to their parents when they are in pain [71]. In the current study, Hispanic/Latinx parents realized their child was in pain, but did not adjust opioid or non-opioid acetaminophen dosing accordingly. Thus, in combination with previous research by our group, findings of the current investigation suggest that Hispanic/Latinx children are at risk for undertreatment of surgical pain, and highlight the importance of assessing parent background and cultural beliefs as predictors of at home pain management.

Racial/ethnic inequalities in acute pain management have been documented in other settings [32-34,36]. Therefore, characteristics of the health delivery system could also act as a barrier to optimal pain management, since Hispanic/Latinx Americans face disparities in both access to care and the quality of care received [41]. These barriers to care and resulting disparities are likely to lead to an overall mistrust of healthcare providers recommendations [19]. Parents with fears about opioids and financial limitations on their ability to pay for prescribed medications might decide to exhaust other options and seek alternative treatments before subjecting their child to the perceived dangerous effects of opioid medications. Also, identification with an underrepresented group can be associated with stressful experiences (e.g., discrimination, acculturation, difficulties obtaining health insurance) [41,72]. Stress shown to be related with cortisol production and continual activation of the hypothalamus-pituitary adrenal axis, which can impact pain perception and processing [73]. In turn, prolonged cortisol production from psychological distress might contribute to the higher levels of pain perceived by Hispanic/Latinx parents [74].

Results should be interpreted in light of several limitations. The average age of patients included in this study was 6 years old (with age ranging from 2 to 15 years old), implying that findings might not be generalizable to older adolescent samples. Though physicians within the same hospital prescribe patients of similar age and procedure the same medications post-surgery, information on each individual prescription was not recorded. Thus, we could not determine whether Hispanic/Latinx children were prescribed opioids at different rates compared to their NHW counterparts. The information provided to patients and caregivers are intended to be the same for all, but this was not dictated or evaluated as part of this study. Future investigations might examine the relationship between each physician-prescribing pattern, discharge education, and at home use of pain medication. While some studies suggest that pain scores reported by parents are highly correlated with child-reported pain levels [75,76], other investigations have found that parents overestimate their children's pain severity [70]. Therefore, the use of parent-reported pain also represents a limitation.

Although parents were instructed to provide real-time assessments of their child's pain management by indicating the time each dose was administered [14], the parent-reported

nature of opioid use also presents a potential limitation due to the possibility of response bias and underreporting. In the future, researchers might consider using alternative medication use measures, such as electronic medication packaging devices [77]. Further, an alternative explanation to the observed findings could be that NHW parents overmedicated their children, while Hispanic/Latinx parents administered the correct amount of opioid medications. As such, additional research is needed to assess the relationship between postoperative opioid consumption and later misuse.

5. Conclusion

Findings suggest that parents of Hispanic/Latinx children perceived their children as experiencing greater pain severity following T&A surgery. Although Hispanic/Latinx patients did consume less hydrocodone than NHW children on each postoperative day, statistically significant differences in hydrocodone consumption were not found. Instead, Hispanic/Latinx children reporting high levels of postsurgical pain were less likely to receive increased doses of opioids compared with NHW children experiencing similar pain levels. Findings support a growing body of research that suggests Hispanic/Latinx patients are at risk for experiencing inadequate pain management at home following ambulatory surgery [14,15,48]. Accordingly, future investigations might focus on developing culturally sensitive interventions tailored to parental demographic characteristics that focus on parental monitoring and management of children's pain at home (for a review of parent-targeted interventions see 78). Such an intervention could be tailored based on the user's cultural background and language preference [79], and might be delivered using online or smartphone modalities [80-82]. Efforts could be tailored to parent literacy and matched based on reported barriers (e.g., fear of overdose or addiction) and cultural values (e.g., the role of religion and familism).

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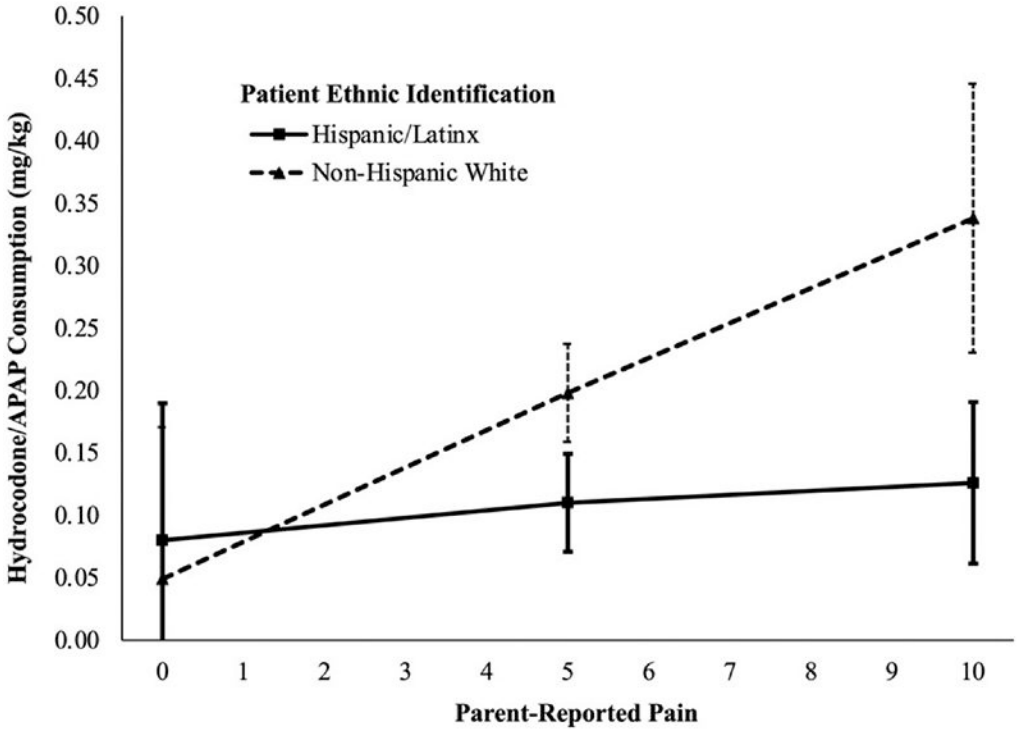

Fig. 1.

Interaction of parent-reported pain level and ethnic identification on hydrocodone/APAP consumption (mg/kg) from the multilevel model analysis shown in Table 4. Hispanic/Latinx patients are represented by the solid line; Non-Hispanic White (NHW) patients are represented by the dashed line. Hydrocodone/APAP consumption ranged from 0.00 to 0.82. However, the scale of hydrocodone/APAP consumption (y-axis) displayed in this figure was truncated to maintain conceptual clarity. Error bars represent 95% confidence intervals.

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Table 1

Descriptive statistics and rates of missing data.

	Descriptive Statistics				Missing Data	
			Total Patient Sample	**Hispanic/Latinx Patients**	**NHW Patients**	**OR, *p*-value*b***
			***N* = 254**	***n* = 146**	***n* = 108**	
Level 1 (within-patient)		*M (SD)*	(% missing)	(*n* missing)	(*n* missing)	
Hydrocodone/APAP Consumption (mg/kg)	Day 1	0.20 (0.18)	31.1%	58	21	OR =0.77, *p* =0.44
	Day 2	0.20 (0.20)	37.8%	66	30	OR =0.90, *p* = 0.74
	Day 3	0.19 (0.19)	50.0%	87	40	OR =0.99, *p* = 0.97
	Day 7	0.06 (0.12)	57.1%	82	63	OR = 0.88, *p* = 0.69
	Total[a]	0.17 (0.19)				
Acetaminophen Consumption (mg/kg)	Day 1	12.36 (18.08)	31.1%	58	21	OR = 0.77, *p* = 0.44
	Day 2	14.40 (18.98)	37.8%	66	30	OR =0.90, *p* = 0.74
	Day 3	13.97 (18.10)	50.0%	87	40	OR = 0.99, *p* =0.97
	Day 7	11.96 (12.47)	57.1%	82	63	OR =0.88, *p* = 0.69
	Total[a]	13.21 (17.41)				
Parent-Reported Pain	Day 1	5.61 (2.51)	22.8%	44	14	OR = 0.68, *p* =0.33
	Day 2	5.21 (2.67)	26.8%	50	18	OR =0.79, *p* = 0.52
	Day 3	4.20 (2.66)	37.0%	66	28	OR = 0.93, *p* =0.82
	Day 7	3.62 (2.65)	33.5%	51	34	OR =0.90, *p* =0.74
	Total[a]	4.71 (2.73)				
Level 2 (between-patient)						
	2012	13.4%	–	–	–	–
	2013	63.0%				
Year	2014	14.2%				
	2015	8.7%				
	2016	0.8%				
	CHLA/	34.6%/	–	–	–	–
Hospital Site	CHOC/	26.8%/				
	CHC	38.6%				

	Descriptive Statistics				Missing Data	
			Total Patient Sample	Hispanic/Latinx Patients	NHW Patients	OR, *p*-value*b*
			N = 254	*n* = 146	*n* = 108	
Procedure	Tonsillectomy & Adenoidectomy	90.6%	–	–	–	–
	Adenoidectomy only	7.5%				
	Tonsillectomy only	2.0%				
Family Income	Less than $10,000	12.8%	16.9%	30	13	OR =0.72, *p* =0.42
	$11,000 to $20,000	12.3%				
	$21,000 to $30,000	13.3%				
	$31,000 to $50,000	10.4%				
	$51,000 to $80,000	13.7%				
	$81,000 to $100,000	10.0%				
	$100,000 to $200,000	16.1%				
	More than $200,000	11.4%				
Parent Education	*M (SD)*	3.80 (1.51)	6.7%	14	3	OR = 0.51, *p* =0.35
Age	Range	2–15				
	M (SD)	6.00 (2.71)				
Sex	Male	52.6%	0.4%	0	1	–
	Female	47.4%				
Ethnic Identification	Hispanic/Latinx	57.5%	–	–	–	
	Non-Hispanic White	42.5%				

Note. Analyses were performed on 254 pediatric patients across 4 time points.

[a]Total values represent the mean (*SD*) score/value across all days.

[b]Odds ratios (OR) are from the binary logistic regression models comparing rates of missing data for Hispanic/Latinx and NHW patients, while controlling for hospital site.

Table 2

Average parent-reported pain and hydrocodone/APAP consumption for Hispanic/Latinx and Non-Hispanic White patients throughout the postoperative week.

	Parent-Reported Pain		Hydrocodone/APAP Consumption (mg/kg)	
	n	***M* (95% CI)**	***n***	***M* (95% CI)**
Day 1				
Hispanic/Latinx	102	5.75 (5.22, 6.29)	88	0.15 (0.11, 0.19)
Non-Hispanic White	94	5.45 (4.98, 5.91)	87	0.25 (0.21, 0.28)
Day 2				
Hispanic/Latinx	96	5.29 (4.74, 5.84)	80	0.17 (0.13, 0.22)
Non-Hispanic White	90	5.12 (4.56, 5.68)	78	0.22 (0.18, 0.26)
Day 3				
Hispanic/Latinx	80	4.61 (3.97, 5.25)	59	0.19 (0.13, 0.24)
Non-Hispanic White	80	3.78 (3.26, 4.30)	68	0.21 (0.17, 0.25)
Day 7				
Hispanic/Latinx	95	3.97 (3.41, 4.53)	64	0.06 (0.02, 0.09)
Non-Hispanic White	74	3.16 (2.59, 3.74)	45	0.08 (0.03, 0.08)

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Table 3

Standardized estimates from the longitudinal multilevel model predicting parent-reported pain.

	Model 1		**Model 2a**		**Model 2b**		**Model 3**	
	β	***p*-value**	**β**	***p*-value**	**β**	***p*-value**	**β**	***p*-value**
Fixed-Effect Predictors								
Intercept	0.00 (−0.10, 0.10)	0.96	0.01 (−0.09, 0.11)	0.88	0.07 (−0.14, 0.12)	0.28	0.12 (0.02, 0.22)	0.02
Time			−0.31 (−0.37, −0.25)	< 0.001	−0.32 (−0.37, −0.26)	< 0.001	−0.16 (−0.22, −0.09)	< 0.001
Time x Time					−0.06 (−0.12, 0.00)	0.07		0.002
Level 1 (within-patient predictors)								
Acetaminophen							0.14 (0.05, 0.23)	< 0.001
Hydrocodone/APAP							0.23 (0.13, 0.33)	0.53
Level 2 (between-patient predictors)								
Year							−0.04 (−0.15, 0.07)	0.84
Site: Children's Hospital of Orange County							−0.02 (−0.17, 0.14)	0.06
Site: Children's Hospital of Los Angeles							−0.13 (−0.26, 0.01)	0.21
Procedure: Adenoidectomy							−0.07 (−0.18, 0.04)	0.20
Procedure: Tonsillectomy							−0.07 (−0.17, 0.04)	0.60
Family Income							0.04 (−0.11, 0.19)	0.44
Parent Education							−0.06 (−0.21, 0.09)	0.18
Age							−0.07 (−0.17, 0.03)	0.90
Sex							−0.01 (−0.09, 0.11)	0.30
Ethnic Identification							−0.15 (−0.28, −0.01)	0.02
Random Effects (Covariance Parameters)								
	β	***p*-value**	**β**	***p*-value**	**β**	***p*-value**	**β**	***p*-value**
UN (1,1)	0.44	0.06	0.51	< 0.001	0.52	< 0.001	0.42	< 0.001
UN (2,1)	–	–	0.01	0.74	0.01	0.66	0.01	0.79
UN (2,2)	–	–	0.05	0.01	0.05	0.01	0.03	0.16

Note. Model 1 intraclass correlation = 0.44. The site reference group was the Children's Hospital, Colorado. The reference group for sex was male; the reference group for ethnic identification was Hispanic/Latinx; the reference group for procedure was tonsillectomy & adenoidectomy surgery. Estimates represent standardized coefficients and (95% CI).

Table 4

Standardized estimates from the longitudinal multilevel model predicting hydrocodone/APAP consumption.

	Model 1		Model 2a		Model 2b		Model 3	
	β	***p*-value**	**β**	***p*-value**	**β**	***p*-value**	**β**	***p*-value**
Fixed-Effect Predictors								
Intercept	−0.13 (−0.24, −0.01)	0.03	−0.14 (−0.25, −0.03)	0.01	0.06 (−0.07, 0.18)	0.36	0.09 (0.00, 0.18)	0.06
Time			−0.19 (−0.25, −0.13)	< 0.001	−0.25 (−0.30, −0.19)	< 0.001	−0.21 (−0.26, −0.16)	< 0.001
Time x Time					−0.18 (−0.24, −0.12)	< 0.001	−0.22 (−0.27, −0.16)	< 0.001
Level 1 (within-patient predictors)								
Acetaminophen							−0.42 (−0.48, −0.35)	< 0.001
Hydrocodone/APAP							0.18 (0.12, 0.24)	< 0.001
Level 2 (between-patient predictors)								
Year							0.02 (−0.06, 0.10)	0.66
Site: Children's Hospital of Orange County							−0.36 (−0.47, −0.25)	< 0.001
Site: Children's Hospital of Los Angeles							−0.17 (−0.27, −0.07)	0.001
Procedure: Adenoidectomy							−0.05 (−0.14, 0.03)	0.24
Procedure: Tonsillectomy							0.06 (−0.02, 0.14)	0.15
Family Income							−0.08 (−0.19, 0.03)	0.17
Parent Education							−0.02 (−0.13, 0.09)	0.77
Age							0.05 (−0.03, 0.12)	0.24
Sex							0.01 (−0.06, 0.09)	0.71
Ethnic Identification							−0.01 (−0.11, 0.09)	0.91
Cross-level interaction								
Ethnic Identification x Pain							0.07 (0.01, 0.13)	0.02
Random Effects (Covariance Parameters)								
	β	***p*-value**	**β**	***p*-value**	**β**	***p*-value**	**β**	***p*-value**
UN (1,1)	0.65	< 0.001	0.60	< 0.001	0.59	< 0.001	0.22	< 0.001
UN (2,1)	–	–	−0.06	0.02	−0.06	0.01	−0.01	0.49
UN (2,2)	–	–	0.02	0.26	0.03	0.15	0.01	0.45

Note. Model 1 intraclass correlation = 0.67. The site reference group was the Children's Hospital, Colorado. The reference group for sex was male; the reference group for ethnic identification was Hispanic/Latinx; the reference group for procedure was tonsillectomy and adenoidectomy surgery. Estimates represent standardized coefficients and (95% CI).