Is Postoperative Pain a Self-Fulfilling Prophecy? Expectancy Effects on Postoperative Pain and Patient-Controlled Analgesia Use Among Adolescent Surgical Patients

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Objective To explore relationships among anxiety, anticipated pain, coping styles, postoperative pain, and patient-controlled analgesia (PCA) use among adolescent surgical patients and their parents. Methods Sixty-five 12- to 18-year-old surgical patients undergoing surgery with postoperative PCA pain management were included. Before surgery, adolescents and parents reported anxiety and expected levels of postoperative pain. Pain catastrophizing and coping style were assessed within 48 hr after surgery, with pain scores and PCA use recorded through the end of the second postoperative day. Results Adolescents’ preoperative psychological characteristics (anxiety and anticipated pain) predicted postoperative pain scores, number of PCA injections and demands, and the PCA injections:demands ratio, with reports of anticipated pain associating most closely with these postoperative pain outcomes. Parental anxiety and anticipated pain did not predict teens’ postoperative pain. Coping style did not moderate the relationship between anticipated pain and pain outcomes. Conclusions Findings are interpreted as suggesting a self-fulfilling prophecy in adolescents’ postoperative pain experience wherein teens who expect to have high levels of postoperative pain ultimately report more pain and use more opioid PCA medication than those who report lower levels of pain.

Key words adolescents; anxiety; pain; postoperative pain; patient-controlled analgesia.

Managing children’s pain is a growing priority in the hospital setting (Finley & McGrath, 2001), with increasing attention given to minimizing the painful aspects of their hospital experiences. Despite this clinical mandate, studies show that moderate-to-severe pain remains a common outcome of pediatric surgical procedures (Brennan-Hunter, 2001; Gauthier, Finley & McGrath, 1998; Simons & Roberson, 2002). In recent years, pharmacologic approaches to pediatric postoperative pain management have advanced considerably (Morton, 2001), but our understanding of the psychological influences on postoperative pain in children and adolescents remains less developed. Identifying modifiable psychological characteristics associated with postoperative pain intensity and analgesia use has important implications for developing nonpharmacologic interventions to improve postoperative pain management.

The biobehavioral model of pediatric pain purports that in the face of a stressful event such as surgery, factors such as cognitive appraisal, coping strategies, and parental/familial influences can attenuate outcomes related to pain perception, pain behavior, and functional status (e.g., Varni, Blount, Waldron, & Smith, 1995). To date, most empirical studies of psychological risk and protective factors for postsurgical outcomes have examined behavioral adjustment rather than pain (e.g., Kain, Mayes, Wang, & Hofstadter, 1999). The biobehavioral model provides the theoretical framework for the current study, which focused directly on the outcomes of pain perception (indicated by reports of pain intensity)
and pain behavior (indicated by patterns of analgesia use). Palermo and Drotar (1996) developed and tested a model of children’s presurgical expectations, anticipatory emotions, and postoperative pain consistent with this framework. In their model, the child’s postoperative pain report is a product of background variables (age, surgery severity, medication received), anticipatory emotions (anxiety), and expectations about pain and analgesia. The current study expands this model and tests it further by conceptualizing analgesia use as a second outcome of interest, rather than as a background variable, and by examining adolescent and parent coping processes as potential moderators of these relationships.

Patient-controlled analgesia (PCA) is now a routine part of inpatient pain management for older children and adolescents (Berde, Lehn, Yee, Sethna, & Russo, 1991; Hendrickson et al., 1990). Through a button that the patient pushes, PCA allows the patient to self-administer intravenous pain medication when needed, with minimal risk of sedation or other adverse effects (Gil, Ginsberg, Muir, Sullivan, & Williams, 1992). A programmable lockout function sets the time that must elapse between injections so that patients cannot receive too much medication, regardless of how many “demands” they make—that is, how often they push the button. Use of PCA for postoperative pain management may also help to reduce anxiety by increasing patients’ sense of control in a stressful situation (Rodgers, Webb, Stergios, & Newman, 1988). Increased control over analgesia has been associated with more positive emotional states, greater patient satisfaction with the postoperative experience, and decreased conflict between patients and hospital staff (Shapiro, Cohen, & Howe, 1993; Taylor, Hall, & Salmon, 1996).

In several respects, PCA is well suited to adolescents. First, it eliminates the need for repeated injections, a process that pediatric patients often find objectionable. Second, given the salience of autonomy in adolescence, increased control over pain management may be especially beneficial (Tyler, 1990). PCA eliminates the conflict that arises for some teenagers who experience pain but worry that hospital staff might judge them negatively if they disclose their pain (Taylor et al., 1996). Although the safety and efficacy of adolescent PCA use is well established (Berde et al., 1991; Kotzer & Foster, 2000; Peters et al., 1999), we know less about the behavioral aspects of PCA for this age group. Some studies (e.g., Gil et al., 1992) have shown that adolescents do not always follow the expected paradigm of increasing PCA demands when experiencing more pain, owing at least in part to environmental influences such as parental distress and family characteristics. No empirical studies of adolescent PCA use have focused on the role of preoperative psychological distress. Further research appears warranted to advance our understanding of factors that may influence adolescents’ PCA-related behaviors.

Palermo and colleagues (Palermo & Drotar, 1996; Palermo, Drotar, & Lambert, 1998) demonstrated links between patients’ presurgical anticipatory distress and reported pain after surgery but did not incorporate outcomes related to analgesia use. Palermo and Drotar (1996) found that adolescents’ general preoperative anxiety predicted postoperative pain, though expectations about pain intensity or helpfulness of medication did not. However, the sample was small (n = 25), and anxiety was assessed with a single item, so the findings call for replication in a larger sample with more thorough measurement techniques. The current study advances our knowledge of these relationships by merging existing lines of inquiry. We examine anticipatory emotions and expectations of adolescent surgical patients and their parents on postoperative pain reports and on patterns of PCA use.

Laboratory research on pain expectancies has indicated that expectations of acute pain are closely linked to the degree of control individuals anticipate having over the pain and their sense of self-efficacy, or confidence in their ability to exert that control effectively (Bandura, 1977; Litt, 1988; Williams & Kinney, 1991). Research with adults suggests that before initial exposure to a painful stimulus, people tend to overpredict how much pain they will have but adjust their subsequent expectations to match experience (Crombez, Vervaet, Baeyens, Lysens, & Eelen, 1996; Rachman & Arntz, 1991). Whether similar effects occur in adolescents or their parents remains unknown. The established importance of self-efficacy in the pain experience suggests that coping skills may help shape an individuals’ expectations of pain and their subsequent pain experiences (e.g., Reid, Gilbert, & McGrath, 1998; Varni et al., 1995). Coping strategies, construed broadly as active or passive coping style, are examined as potential moderators of the relationships between anticipatory emotions and postoperative pain perceptions and behaviors in the current study.

The primary aim of this study was to examine relationships among psychological distress, anticipated pain, coping styles, postoperative pain, and PCA use among adolescent surgical patients and their parents. Related to this aim were the following specific hypotheses:

Adolescents’ preoperative anxiety and their expectations of postoperative pain intensity—that is, their...
anticipated pain—will predict perceived postoperative pain and, in turn, PCA use.

Parents’ preoperative anxiety and their expectations of their adolescents’ postoperative pain intensity will also predict adolescents’ reports of pain and their PCA use.

Adolescent and parent coping styles will moderate associations between psychological factors and pain outcomes.

**Methods**

**Participants**

Eligible participants were 12- to 18-year-old patients from a large pediatric hospital who were scheduled for elective surgeries requiring overnight admission and whose postoperative pain was managed by opioid PCA. Exclusion criteria included inability to complete questionnaires in English, significant cognitive delays, or history of a chronic pain disorder (per parent report). Written informed consent was obtained from parents of all participating adolescents and from adolescents aged 14 and older; verbal assent was obtained from adolescents aged 12 to 13. Of families contacted to participate in the study, nine refused, citing lack of time or concerns that participation would place additional stress on the child undergoing surgery. An additional six families enrolled but failed to complete all postoperative measures and were therefore excluded from analyses (they were discharged before postoperative assessment and were not reachable by telephone for follow-up in a suitable time span). The final sample included 65 adolescents with a mean age of 15.0 years (SD = 1.8). Further sample characteristics and surgical information are reported in Table I. The gender disparity in the sample reflects the fact that the most common surgery in our sample was spinal fusion, which is more frequently performed on girls than it is on boys.

**Procedure**

The study protocol was approved by the hospital’s institutional review board before data collection. The operating room roster was used to identify eligible participants 1 to 2 weeks before surgery. Families were contacted by telephone, when verbal consent was obtained, with written consent gathered before the collection of postoperative data. Parents were asked to identify who planned to be with the child in the hospital after surgery; this parent was included in the study. Within 48 hr after surgery, a research team member completed postoperative questionnaires with the family. Questionnaires were administered at bedside, with the researcher assisting adolescents with the self-report measures and ensuring as much privacy as possible, such as by drawing the curtain around the bed. Parents completed the measures on their own unless they opted to have the questions read aloud to them. Reports of postoperative pain and PCA use were recorded from the patients’ medical charts.

**Measures**

**Preoperative Assessment**

*State–Trait Anxiety Inventory (STAI)*. The STAI (Spielberger, 1983) is a brief self-report measure of anxiety that assesses general trait anxiety and state anxiety
specific to the upcoming surgical experience. Adolescents and parents report on their own anxiety symptoms. The STAI possesses strong reliability and validity (e.g., Tenenbaum, Furst, & Weingarten, 1985).

**Anticipated pain.** Using a 0 to 10 numeric rating scale, adolescents were asked, “Rate the worst level of pain you expect to feel after your surgery,” and parents were asked, “Rate the worst level of pain you expect your child to feel after surgery.” Past research has shown that adolescents are capable of using numeric rating scales validly, although scores on such intensity rating scales do not necessarily possess ratio qualities (McGrath & Gillespie, 2001).

**Postoperative Assessment**

**Pain Catastrophizing Scale (PCS).** The PCS (Sullivan, Bishop, & Pivik, 1995) is a 13-item scale that assesses three types of negative thinking styles related to pain: rumination, magnification, and helplessness. The PCS adds a pain-specific measure of emotional distress to our assessment. Content, construct, and divergent validity, as well as test–retest reliability, have been documented for the PCS (Sullivan et al., 1995). In the current study, only adolescents completed the PCS.

**Brief COPE.** To assess the moderating effects of coping styles, we used this the Brief COPE (Carver, Scheier, & Weintraub, 1989), a 28-item self-report inventory that yields 14 subscale scores describing a range of coping responses. Respondents were prompted to think about “stressful events such as this surgery” when answering the items. In addition to providing a broader view of preferred coping styles compared to that derived from a pain-specific coping inventory, use of this tool enabled us to obtain parallel measures of adolescents’ and parents’ coping with the adolescent’s surgical experience. The Brief COPE correlates strongly with the full-length COPE (Carver, 1997). Both versions are widely used, with demonstrated reliability and validity, including for adolescent populations e.g., (Bailey & Dua, 1999; Phelps & Jarvis, 1994). Parents and adolescents reported on their own coping styles using the Brief COPE.

**Medical Record Data**

**Pain scores.** Adolescents rated their pain intensity every 4 hr using a 0–10 numeric rating scale with the prompt “How much pain are you having right now if 0 is no pain and if 10 is the worst pain ever?” Participants’ nurses obtained ratings and vital signs around the clock, using the prompt question and recording adolescents’ numeric responses verbatim. Similar methods for assessing acute pain in adolescents have been used previously (e.g., Ellis, Blouin & Lockett, 1999; Palermo & Drotar, 1996). Highest pain ratings for Postoperative Days (PODs) 0, 1, and 2 were averaged to form a summary score of high pain across this period. A summary of average pain ratings across this period also was calculated. The highest pain variable was our primary outcome variable of interest, given that participants were asked preoperatively to rate the worst pain they expected after surgery.

**PCA use.** Following standard hospital anesthetic procedures, participants received initial opioid medication doses in the surgical recovery room, administered in increments of 0.25 to 0.50 mg per kg (morphine or morphine equivalent) every 5 to 10 min until the patient was comfortable. At that time, the PCA machine was initiated. For all participants, the starting PCA regimen was 20 mcg per kg in morphine equivalents, with an 8-min lockout, a basal rate between 0 and 20 mcg per kg per hour, and an hourly maximum dosage of 100 mcg per kg. Of the 65 participants, 64 received morphine PCA; data from the one participant prescribed another opioid (Dilaudid) were converted to morphine equivalents. Study participants received standard care in terms of subsequent PCA dose adjustments or additional pain medications (“rescue doses”) if deemed necessary. Rescue medications were delivered intravenously or orally and are not included in the results pertaining to PCA use.

Study data recorded from the PCA pump included daily total demands—that is, the number of button pushes, regardless of whether medication was delivered or withheld because of the lockout function; injections—that is, the successful deliveries of a physician-set amount of medication; and a ratio of successful injections to total demands per day. The injections:demands ratio is a rough indicator of whether the adolescent used the PCA effectively or asked for medication that could not be delivered. PCA use was recorded for each day (see Table II). However, because no notable differences emerged in patterns of use across days and because 60.7% of our sample discontinued PCA use on or before POD 2, subsequent statistical analyses are based on averages of PCA use through the end of POD 1.

**Surgery severity.** Type and duration of surgery and any complications were recorded from the patients’ charts. Two experts—a pediatric anesthesiologist and a pediatric nurse with extensive operating room experience—then rated severity on a 3-point scale (minor, moderate, severe) based on pain associated with the surgery and on invasiveness of the procedures (see Bush, Holmbeck, & Cockrell, 1989; Palermo et al., 1998). An intraclass correlation coefficient of .75 indicated acceptable interrater reliability.
### Descriptive Statistics

The mean pain rating across PODs 0, 1, and 2 was 4.6 (SD = 1.4), with the highest pain ratings across this period being 6.3 (SD = 2.2). The modal surgery severity rating was severe, indicating that most study participants underwent major surgeries generally associated with significant postoperative pain. See Table II for descriptive data related to psychological factors and PCA analgesia use.

### Accuracy of Preoperative Pain Predictions

Comparisons between participants’ reports of anticipated worst pain and their actual highest postoperative pain ratings indicated that 42.9% of participants under-estimated postoperative pain—that is, they expected less pain than they later reported; that 46.4% overestimated their postoperative pain; and that 10.7% were accurate predictors of pain. An examination of the magnitude of “errors” reveals that the mean difference score for the underestimators was 1.4 (SD = 1.1) and that the mean difference score for overestimators was 2.4 (SD = 1.6). T tests indicated that overestimators had a larger discrepancy between their preoperative and their postoperative pain ratings than did underestimators, t (48) = −2.6, p < .05.

### Bivariate Correlations

Table III shows Pearson correlation coefficients for bivariate relationships between the demographic/psychological measures and the postoperative pain outcomes. Additionally, strong associations emerged between postoperative pain reports and PCA behaviors: pain scores correlated with PCA demands, r = .45, p < .01; PCA injections, r = .37, p < .05; and ratio of injections to demands, r = −.38, p < .05. Adolescent and parent state anxiety were significantly interrelated, r = .26, p < .05, as were adolescent and parent trait anxiety, r = .42, p < .001. Parents and teens also corresponded in their expectations of teens’ postoperative pain, r = .34, p < .01.

We examined correlations between psychological variables and postoperative pain separately for pain underestimators and overestimators. Although highly correlated in both groups, anticipated pain and postoperative pain had a larger correlation coefficient for underestimators, r = .87, p < .001, than it did for

### Table II. Descriptive Statistics on Psychological Variables and Patient-Controlled Analgesia Use

<table>
<thead>
<tr>
<th>Psychological measures</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescent STAI-state</td>
<td>40.0 (11.4)</td>
</tr>
<tr>
<td>Parent STAI–state</td>
<td>41.8 (10.7)</td>
</tr>
<tr>
<td>Adolescent STAI–trait</td>
<td>36.8 (8.1)</td>
</tr>
<tr>
<td>Parent STAI–trait</td>
<td>36.7 (8.1)</td>
</tr>
<tr>
<td>Adolescent anticipated pain (0–10)</td>
<td>6.9 (2.0)</td>
</tr>
<tr>
<td>Parent anticipated pain (0–10)</td>
<td>7.6 (2.1)</td>
</tr>
<tr>
<td>PCS total (adolescent; range = 0–52)</td>
<td>23.7 (12.9)</td>
</tr>
<tr>
<td>Adolescent Active Coping style score</td>
<td>25.9 (9.6)</td>
</tr>
<tr>
<td>Parent Active Coping style score</td>
<td>25.5 (5.6)</td>
</tr>
</tbody>
</table>

Table III. Pearson Correlation Coefficients Between Demographic/Psychological Measures and Postoperative Pain Outcomes

<table>
<thead>
<tr>
<th></th>
<th>STAI-T</th>
<th>STAI-S</th>
<th>Antic. pain</th>
<th>PCS</th>
<th>STAI-T</th>
<th>STAI-S</th>
<th>Antic. pain</th>
<th>Adol. age</th>
<th>Surgery severity</th>
<th>No. of past surg</th>
<th>Active coping</th>
</tr>
</thead>
<tbody>
<tr>
<td>High pain&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.05</td>
<td>−.03</td>
<td>.42***</td>
<td>.33*</td>
<td>.01</td>
<td>.25†</td>
<td>.19</td>
<td>.30*</td>
<td>.36*</td>
<td>−.11</td>
<td>−.29*</td>
</tr>
<tr>
<td>Avg. pain&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−.02</td>
<td>.11</td>
<td>.29†</td>
<td>.30*</td>
<td>.18</td>
<td>.32*</td>
<td>.01</td>
<td>.31*</td>
<td>.09</td>
<td>−.09</td>
<td>−.32*</td>
</tr>
<tr>
<td>Inject&lt;sup&gt;c&lt;/sup&gt;</td>
<td>−.01</td>
<td>−.21</td>
<td>.39**</td>
<td>−.05</td>
<td>−.01</td>
<td>.08</td>
<td>.30*</td>
<td>−.01</td>
<td>.59***</td>
<td>−.04</td>
<td>−.17</td>
</tr>
<tr>
<td>Demands&lt;sup&gt;c&lt;/sup&gt;</td>
<td>−.14</td>
<td>−.32*</td>
<td>.30*</td>
<td>−.06</td>
<td>−.21</td>
<td>.06</td>
<td>.27*</td>
<td>−.01</td>
<td>.40**</td>
<td>−.11</td>
<td>−.19</td>
</tr>
<tr>
<td>Ratio&lt;sup&gt;c&lt;/sup&gt;</td>
<td>−.08</td>
<td>.24†</td>
<td>−.31*</td>
<td>−.01</td>
<td>.24†</td>
<td>−.10</td>
<td>−.24†</td>
<td>−.02</td>
<td>−.10</td>
<td>.21</td>
<td>.27†</td>
</tr>
</tbody>
</table>

STAI = State-Trait Anxiety Inventory (T = trait, S = state); PCS = Pain Catastrophizing Scale.
<sup>a</sup>High pain = averages of high pain scores Postoperative Days 0, 1, and 2.
<sup>b</sup>Avg. pain = mean pain scores Postoperative Days 0, 1, and 2.
<sup>c</sup>Injects = total daily patient-controlled analgesia injections averaged across Postoperative Days 0 and 1.
<sup>d</sup>Demands = total daily patient-controlled analgesia demands averaged across Postoperative Days 0 and 1.
<sup>e</sup>Ratio = injections:demands ratio for Postoperative Days 0 and 1.

†p < .10; *p < .05; **p < .01; ***p < .001.
Predictors of Postoperative Pain

Linear regression techniques were used to analyze the effects of the psychological variables on reports of postoperative pain. To control for effects of adolescent age and surgery severity, these variables were entered on the first step of the regression model. Based on results of the bivariate correlation analyses, only the pain-specific psychological variables were included in the multivariate analyses; that is, state and trait anxiety scores did not correlate with ratings of postoperative pain. These variables included adolescents’ anticipated pain and pain-catastrophizing scores. When added to the equation containing age and surgery severity, the psychological variables accounted for an $r^2$ change of .28, $p < .001$. Adolescent anticipated pain scores emerged as the strongest unique predictor of postoperative pain. See Table IV for the complete multivariate regression results. Parent psychological characteristics only correlated with postoperative pain at a trend level and did not predict postoperative pain once the effects of surgery severity were controlled.

Predictors of PCA Use

Multivariate linear regression techniques were used to examine the demographic and psychological influences on patterns of PCA use. Examining the appropriateness of the data for multiple regression analyses, we identified and removed one outlier data point. Age did not correlate with any PCA outcomes. Surgery severity correlated strongly with PCA use and was entered into the first step of the equation. The psychological variables correlating at the trend level or higher with each PCA outcome were entered into the second step. For PCA injections, only adolescent anticipated pain was included. Surgery severity accounted for a substantial portion of variance in total successful PCA injections, but adding adolescents’ anticipated pain to the model explained a statistically significant portion of additional variance in PCA injections, $r^2$ change = .09, $p < .01$, indicating that teens who expected more postoperative pain received more PCA injections. For PCA demands and ratio, adolescent state anxiety and anticipated pain were included in the regression equations. Jointly, the psychological variables explained a significant amount of variance in total number of PCA demands and in the injections: demands ratio. Higher anticipated pain was associated with more PCA demands and a lower injections: demands ratio, whereas higher preoperative state anxiety associated with fewer demands and a higher ratio (see Table V).

Parents’ ratings of anticipated pain correlated with PCA behaviors but were also closely linked to surgery severity, $r = .44$, $p < .001$. Controlling for surgery severity,

**Table V. Multivariate Linear Regression Results Predicting PCA Usage Behaviors**

<table>
<thead>
<tr>
<th>Model</th>
<th>Dependent variable</th>
<th>$\beta$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Adjusted $r^2 = .33^{***}$</td>
<td>PCA injections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity</td>
<td>0.59</td>
<td>5.2***</td>
<td></td>
</tr>
<tr>
<td>Step 2: Adjusted $r^2 = .41^{**}$</td>
<td>PCA demands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity</td>
<td>0.52</td>
<td>4.7***</td>
<td></td>
</tr>
<tr>
<td>Adolescent anticipated pain</td>
<td>0.31</td>
<td>2.8*</td>
<td></td>
</tr>
<tr>
<td>Step 1: Adjusted $r^2 = .13^{**}$</td>
<td>Injections:demands ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity</td>
<td>0.39</td>
<td>3.0**</td>
<td></td>
</tr>
<tr>
<td>Step 2: Adjusted $r^2 = .30^{**}$</td>
<td>Adolescent anticipated pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity</td>
<td>0.28</td>
<td>2.3*</td>
<td></td>
</tr>
<tr>
<td>Adolescent state anxiety</td>
<td>−0.30</td>
<td>2.3*</td>
<td></td>
</tr>
<tr>
<td>Step 1: Adjusted $r^2 = .02$</td>
<td>Adolescent anticipated pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity</td>
<td>−0.07</td>
<td>−0.5</td>
<td></td>
</tr>
<tr>
<td>Step 2: Adjusted $r^2 = .14^*$</td>
<td>Adolescent state anxiety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity</td>
<td>−0.05</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Adolescent anticipated pain</td>
<td>−0.40</td>
<td>−2.7**</td>
<td></td>
</tr>
<tr>
<td>Adolescent state anxiety</td>
<td>0.35</td>
<td>2.4*</td>
<td></td>
</tr>
</tbody>
</table>

Standardized $\beta$; $r^2$ change = .09, $p < .001$. Controlling for surgery severity, $r = .44$, $p < .001$.
neither parents’ anticipated pain nor anxiety predicted adolescent PCA usage behaviors on PODs 0 and 1.

**Moderating Effects of Coping on Relationship Between Anticipated Pain and Pain Outcomes**

Subscale scores were computed from the Brief COPE to indicate active and passive coping styles. Results for parental coping style indicated that neither active nor passive coping associated significantly with adolescents’ postoperative pain, \( r = -0.25 \) and \( r = -0.20, \) ns. Among adolescents, participants reporting more active coping styles had lower postoperative pain scores, \( r = -0.37, \) \( p < .05. \) No statistically significant relationships emerged between coping and PCA use. We next examined adolescents’ active coping as a potential moderator of the relationship between anticipated pain and postoperative pain. Although anticipated pain and active coping style correlated with postoperative pain, anticipated pain and coping did not correlate significantly, \( r = -0.16, \) ns. The interaction term for Anticipated Pain \( \times \) Active Coping was not a significant predictor of postoperative pain, indicating that anticipated pain and coping style have opposite but relatively independent associations with adolescents’ postoperative pain.

**Discussion**

Our primary aim was to assess relationships between preoperative psychological distress and postoperative pain perceptions and pain behaviors in adolescents. As a group, adolescents in our sample underwent moderate-to-severe surgeries and reported substantial postoperative pain. That pain ratings were fairly high despite aggressive pain management (including rescue analgesic doses as needed) reflects the severity of the surgeries and is consistent with past reports of similar surgical populations (Kotzer & Foster, 2000; Palermo et al., 1998). There was high concordance between adolescents’ preoperative levels of anxiety and anticipated pain and the anxiety and anticipated pain reports of their parents, suggesting that although direct effects of parental emotions on pain outcomes did not emerge, important similarities exist in the ways that adolescents and parents anticipate the surgical experience and subsequent postoperative pain.

Our data partially supported our first hypothesis—that adolescents’ psychological distress and anticipated pain ratings would associate with postoperative pain intensity and PCA use beyond what was accounted for by situational influences such as surgery severity. In our sample, general anxiety did not associate strongly with pain perception or PCA use after surgery. However, pain-specific factors, particularly anticipated pain, did link to postoperative outcomes. Prior research has yielded inconsistent results regarding the effects of preoperative psychological factors on postoperative pain (Gil et al., 1992; Palermo et al., 1998). Compared to previous work, our findings appear to make a stronger argument for the salience of anticipated pain over other factors, such as state and trait anxiety. To explore this finding further, we examined participants’ pain expectancies carefully. Although pain underestimators and overestimators were about equally represented in our sample, the magnitude of overestimation was larger on average than that of underestimation. The relatively high number of pain underestimators in our sample compared to adult samples (Crombez et al., 1996; Rachman & Arntz, 1991) may reflect a developmental phenomenon of adolescents wishing to appear unconcerned about postoperative pain. It is notable that for both the underestimators and the overestimators, strong relationships emerged between level of anticipated worst pain and actual reports of highest pain.

Anticipated pain also related to adolescents’ PCA use. Although surgery severity accounted for the largest portion of variance in PCA demands and injections, anticipated pain was associated with total number of PCA demands, number of successful injections, and the ratio of injections to demands. More anticipated pain linked to more injections and demands but also to a lower ratio of injections to demands. Preoperative state anxiety also related to PCA demands and to the injections:demands ratio, but in the opposite direction; specifically, higher anxiety linked with fewer PCA demands and a higher ratio of injections to demands. The meaning of these various PCA behaviors in adolescents is not well established. The increased injections and demands among teens who anticipated more pain likely reflect these teens’ perceptions of more postoperative pain. We expected the more anxious adolescents to make more frequent PCA demands, but our finding in the opposite direction may suggest that while anticipated pain associates with higher PCA use in our sample, general preoperative anxiety may indicate some fear or hesitation about overusing pain medication—hence, fewer PCA demands.

It is difficult to evaluate PCA behaviors as appropriate or inappropriate without regard for individual circumstances, but perhaps the best indicator of adaptive PCA use is a high ratio of successful injections to total demands. The inverse relationship between anticipated pain and injections:demands ratio in our sample could suggest that adolescents who anticipate and subsequently experience more intense pain are less able to regulate their medication-seeking patterns effectively. In
contrast, higher state anxiety in the face of surgery may be related to a tendency to monitor medication-use behaviors rigidly.

Our data did not support our hypothesis that parents’ preoperative anxiety and expectations would relate to adolescents’ postoperative pain scores. Interestingly, parents’ anticipated pain ratings were more closely linked to surgery severity than adolescents’ ratings were. Compared to adolescents’ reactions, parents’ emotional reactions to surgery may be based more directly on the factual information they receive about the procedure. An intriguing question for further study is whether this distinction represents developmental differences or arises from being the patient versus the family member in the surgical experience.

Our final hypothesis posited that coping style would moderate relationships between psychological factors and pain outcomes. Tests of interaction between anticipated pain and coping styles did not support this prediction, as these two variables were unrelated in our sample. Although adolescents’ use of active coping techniques associated with postoperative pain intensity such that those teens who used more active coping techniques reported less postoperative pain, the relationship between anticipated pain and postoperative pain outcomes is independent of the use of any particular coping style.

Taken together, our results show that anticipated pain plays a significant role in the actual pain adolescents report after surgery. This relationship holds across surgery severity levels and is irrespective of previous surgical experience. Our findings lead us to posit that a self-fulfilling prophecy effect occurs wherein adolescents who expect more pain after surgery may later report more pain than their more-optimistic, or perhaps less-catastrophizing, peers. However, alternative explanations for this phenomenon exist. Self-efficacy has been established as an important influence on pain perception (Bandura, O’Leary, Taylor, Gauthier, & Gossard, 1987; Litt, 1988; Stevens, Ohlwein, & Catanzaro, 2000). Previous studies (e.g., Stevens et al., 2000; Williams & Kinney, 1991) have concluded that self-efficacy is more central than pain expectancies are in determining pain perception; but if use of active coping skills can be taken as a proxy measure of self-efficacy, our findings suggest that while both forces act on pain outcomes, pain expectancies are more closely related to those outcomes. Future studies could clarify these relationships by investigating the level of distress that adolescents associate with anticipated pain. It may be that those teens with stronger active coping skills feel better equipped to manage postoperative pain, regardless of how much pain they anticipate.

Another alternative to our self-fulfilling prophecy theory is that adolescents are simply accurate predictors of postoperative pain—in other words, their anticipated pain ratings may merely reflect accurate expectations. If this were true in an absolute sense, one would expect surgery severity and postoperative pain ratings to be more closely linked than they were in our sample. However, it is quite possible that individuals’ pain tolerance plays a role such that adolescents with lower pain tolerance accurately predict that they will experience worse pain compared to adolescents with higher tolerance. Future research should measure pain tolerance (e.g., through laboratory techniques) as well as self-reported perceptions of pain tolerance to determine the impact of each of these factors on the relationships observed in the present study. A final explanation worthy of mention is a possible within-subject tendency to give similar ratings on the anticipated pain and postoperative pain rating scales. We noted within-subject variation in postoperative pain ratings across days of postoperative assessment, suggesting that individuals used the numeric scale properly and were not biased toward giving the same report across data points; but we cannot entirely rule out a possible influence of method variance bias on our findings.

Some additional limitations bear on these findings. Perhaps most significant, our assessment included only the use of PCA and did not include information pertaining to intravenous or oral rescue doses of analgesic medications in our data analyses. PCA use was our primary interest in this study, but it is important to note that including more data on rescue doses in our data analyses could have provided useful additional information about postoperative pain and analgesia use. Individual variation in amounts of rescue medication received may have affected pain outcomes. Unfortunately, it was impossible to control for frequency of nursing care or therapies that might have prompted requests for rescues. Second, our sample was heterogeneous in regard to surgical procedures. Although this extends generalizability, it introduced extraneous variability across participants. This was controlled statistically with surgery severity ratings, but future studies with more-homogeneous samples could yield valuable comparison data. Regarding pain assessment, we relied on pain severity exclusively. Including measurements of other aspects of pain perception, such as affective components, would be a worthwhile addition in future studies. Furthermore, because our anticipated pain question asked about worst pain expected, we focused on postoperative reports of highest daily
pain. Obtaining anticipated average pain scores would have permitted comparisons to average postoperative pain scores as well, possibly revealing differences in the two methods of quantifying pain intensity.

We collected our postoperative measures over several days to gain a broader time sample than has been used in previous studies. However, variations in length of stay and in discontinuation of PCA machines created discrepancies in the data available across participants. There is value in reflecting the realities of the pediatric postoperative experience, but it comes at the cost of tightly controlled experimental conditions. Additionally, our methodology relied on nurse collection of pain ratings. Although adherence to appropriate pain assessment every 4 hr was a high priority on the surgical floors where our study took place, we could not monitor precise adherence to the schedule in all cases. Last, we examined individual adolescent and parent psychological characteristics only. Measures of family or dyadic (parent–adolescent) functioning would have been a useful addition to the study (see Gil et al., 1992).

This study extends our knowledge of the role of psychological factors in teens’ experience of postoperative pain and highlights potential avenues for intervening to improve adolescents’ surgical experience. A logical next step in this line of inquiry is to examine factors that may influence anticipated pain for adolescent surgical patients, such as the content and timing of information they receive before surgery about postoperative pain and its management. For instance, does anticipated pain increase or decrease when such information is delivered, and does this vary with individual characteristics of the adolescent? Continued investigation of potential influences on teens’ postoperative pain and patterns of analgesia use can lead to our ultimate goal—the development of pharmacological and psychological intervention techniques designed to minimize the experience of postoperative pain and maximize appropriate and effective analgesia use among adolescent surgical patients.

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References


**Note**

*Although our analyses focused on PCA medication use only, we note that most participants (87.7%) received at least one dose of rescue analgesia on PODs 0 and 1, primarily for breakthrough pain associated with nursing care, dressing changes, or therapeutic procedures that varied in frequency across participants. T tests show no differences in pain reports or PCA use between individuals who did and did not receive any rescue medications.*

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