

# The Role of Maternal Attachment in the Experience of Labor Pain: A Prospective Study

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**Objective:** To examine the influence of attachment dimensions and sociodemographic and physical predictors in the experience of labor pain. **Methods:** Eighty-one pregnant women were assessed during their third trimester of pregnancy and during labor. The perceived intensity of pain in the early stages of labor (3 cm of cervical dilatation) and before the administration of patient-controlled epidural analgesia was measured using a visual analog scale. Pain was also assessed indirectly based on anesthetic doses. Attachment was assessed using the Adult Attachment Scale–Revised. **Results:** Attachment anxiety and avoidance were positively and significantly correlated with labor pain and anesthetic consumption. In the multivariate models, attachment anxiety was a significant predictor of higher pain at 3 cm of cervical dilatation ( $\beta = 0.36, p = .042$ ) and before the administration of patient-controlled epidural analgesia ( $\beta = 0.51, p = .002$ ). Older age ( $\beta = 0.31, p = .005$ ), a shorter duration of labor ( $\beta = -0.41, p = .001$ ), and attachment avoidance ( $\beta = 0.41, p = .004$ ) were significant predictors of higher anesthetic use. **Conclusions:** The study findings suggest that perceived labor pain and anesthetic use are strongly associated with attachment, rather than demographic and physical factors. These data support the importance of understanding the experience of labor pain within an attachment theoretical framework. **Key words:** adult attachment, analgesia, labor, pain.

AAS-R = Adult Attachment Scale–Revised; BMI = body mass index; PCEA = patient-controlled epidural analgesia; VAS = visual analog scale.

## INTRODUCTION

Labor pain is a systemic and multifactorial process that consists of perceptual, affective, cognitive, and emotional dimensions that influence pain expression through cortical and limbic inputs for supraspinal modulation (1). Because of labor pain's intensity and impact on women's health and life (2), multiple therapeutic approaches have been developed to address labor pain, and neuroaxial blocks are frequently used (3). Patient-controlled epidural analgesia (PCEA) is an important therapeutic development and is increasingly used worldwide (4). The PCEA allows patients to be active agents in managing their pain, by self-administering doses of analgesics according to their individual needs, and within safe limits that are programmed into an infusion pump (4).

Recent advances in PCEA involve the administration of lower anesthetic concentrations and produce excellent clinical results (5), even when initiated in the early stages of labor (6). The technical characteristics of PCEA promote respect for noninvasion and the expression of the individuality of the woman, who has control over the process, and enable objective pain data to be recorded. In this context, maternal satisfaction with childbirth may be increased by allowing a woman greater control over her analgesia (4).

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The experience of labor pain is a result of the complex processing of multiple physical and psychosocial factors. These factors, which are often interconnected, do not have an independent influence on pain perception during labor (7). Instead, each factor occurs within the context of the total functioning of the woman and helps in creating a unique labor experience. As a result, psychological factors are of considerable importance. Psychological research in the context of labor pain has primarily focused on factors such as fear and anxiety, which have been correlated with increased pain and reduced tolerance to pain (8–11). Recently, theoretical (12–14) and empirical evidence (15–23) has highlighted the potential of attachment theory in providing valuable insights regarding individual differences in pain response and adaptation. Thus, incorporating attachment into psychosomatic research can provide a unique perspective on the contribution of interpersonal constructs to health behaviors (24). Because attachment constructs are theoretically and empirically distinct from other psychological constructs, such as emotional states (25), this assessment may help identify women who are at a higher risk for reporting more pain or more problematic adaptation to pain during childbirth.

Pregnancy and childbirth constitute a significant life transition that, according to attachment theory, should activate the attachment system and elicit a complex interplay of cognitions, emotions, and attachment behaviors, to increase proximity to attachment figures (26). The attachment patterns are formed during infancy and early childhood and are based on the interactions with primary caregivers, particularly those surrounding affect regulation and the management of stress-inducing events (27). Attachment can be seen as a stable propensity of an individual to establish an emotional bond to others (attachment figures) for safety and security. Accordingly, interpretation and meaning given to the world, including symptoms such as pain, range from positive to negative personal representations of the self (conceptually similar to attachment anxiety) and from positive to negative personal representations of others (conceptually similar to attachment avoidance) (28).

Although the role of attachment patterns during the transition to parenthood has been supported empirically (26,29,30),

studies examining how attachment relates to labor pain are still lacking. Childbirth is considered to be one of the most intense and painful experiences of a woman's life. Because pain is often described as an unpleasant feeling or emotional experience and is appraised as a form of physical and emotional threat to one's well-being, women may use attachment behaviors to regulate negative emotions and to manage threatening or stress-inducing situations, to increase their sense of security (25). These behaviors may have important implications for understanding individual differences in pain and are crucial for the prevention and initiation of early intervention and pain management (31).

As mentioned, various studies have examined how attachment patterns relate to pain. Research has produced mixed findings; although some studies have found significant associations between attachment patterns and pain disability (15,16) and intensity (16,17), others have reported no association between attachment and pain intensity (15,18,19). There is evidence suggesting that attachment anxiety has a more consistent effect on pain than attachment avoidance (14). Specifically, attachment anxiety has been associated with higher levels of pain (16,17), less perceived control over pain (20), more pain-related suffering (17), and higher levels of pain-related fear and pain-related catastrophizing (20–22). In contrast, attachment avoidance has been associated with lower pain self-efficacy (19).

Other variables are also important in understanding labor pain. There is evidence suggesting an inverse association of labor pain intensity with maternal age (8,32). Furthermore, although some findings have shown that, on average, nulliparous women report greater pain than do parous women during labor (32,33), others have not found such an association (34). Other obstetric factors that have been shown to be associated with pain include fetal presentation (35), dystocia (36), higher fetal weight (32), and the artificial induction of labor (37). A history of dysmenorrhea and menstrual back pain has also been documented as a gynecological predictor for obstetric pain (8,32). Although some data have suggested a positive association between labor pain and the prepregnancy body mass index (BMI) (32), this relationship has not been confirmed in other studies (38,39). Finally, some studies have also stressed the importance of childbirth training in decreasing labor pain (32,40). This training can increase the levels of endogenous opioids (41), help in setting more accurate expectations about uterine contractions, and teach women how to use active coping methods such as controlled breathing during labor (40).

The purpose of this study was to examine the influence of maternal attachment, sociodemographic, and physical predictors in the experience of labor pain. Based on the literature review, it was expected that attachment dimensions, particularly attachment anxiety, would be significantly associated with higher pain intensity (assessed directly and indirectly by consumption of anesthetics), as would younger age, nulliparity, higher prepregnancy BMI, dysmenorrhea, a history of low back pain, higher fetal weight, and nonparticipation in childbearing preparation classes.

## METHODS

### Participants and Procedures

Ethical approval to conduct this prospective and observational study was obtained from the Ethics Committee of the Maternity Alfredo da Costa (Lisbon, Portugal) as well as from the National Commission of Data Protection. All participants were informed of the purpose of the study, and those who agreed to participate provided written informed consent. Participants received no compensation for their participation.

General inclusion criteria were as follows: age  $\geq 18$  years, normal and singleton pregnancy, nulliparous or parous (three or less pregnancies), absence of obstetric indices for fetal-pelvic incompatibility, absence of a history of cesarean delivery for dystocia, absence of psychopathological disorders and substance abuse, absence of contraindications to epidural techniques and prior analgesia with opioids, and American Society of Anesthesiologists' physical statuses I and II (according to the American Society of Anesthesiologists' physical status classification system).

The sample collection took place between April 2010 and November 2011. Participants were assessed at the following three time points: within their third trimester of pregnancy ( $\geq 26$  weeks), before the PCEA protocol was administered, and after the PCEA protocol was administered. In the first assessment, sociodemographic and obstetric-gynecological data were collected. In addition, participants completed the Adult Attachment Scale-Revised (AAS-R). The second and third assessments included the collection of data on labor, delivery, the newborn, the analgesic technique, and pain assessment. A total of 132 pregnant women who were consecutively recruited by convenience sampling accepted the invitation to participate in the study. Of those, 51 participants were excluded because they did not complete all phases of the study (completion rate, 61.4%), of which 47 women were excluded because of an incomplete antenatal assessment (e.g., incomplete sociodemographic, psychometric, and biological data) and 4 because of an interruption in the analgesic protocol during labor. Therefore, the final sample consisted of 81 pregnant women. Women who were excluded from the analyses were more likely to be nulliparous ( $\chi^2(1) = 4.31$ ;  $p = .038$ ; Cramer  $V = 0.18$  [69.6% versus 50.6%]) and to report lower attachment anxiety scores ( $t(125) = -3.06$ ,  $p = .003$ , Cohen  $d = 0.57$ ; mean [M; standard deviation {SD}] = 2.21 [0.72] versus 2.66 [0.84]). Based on Cohen's (42) recommendations, this sample size provides adequate statistical power for detecting medium to large effect sizes using correlational and multiple regression analyses.

All participants received the standard PCEA protocol adopted at the institution. The protocol consisted of ropivacaine 0.6 mg ml<sup>-1</sup> plus sufentanil 0.5 µg ml<sup>-1</sup>. After an initial dose (10–12 ml), the epidural catheter was connected to an infusion pump (Smart Pump CADD—Solis; Smiths Medical MD, Inc, St Paul, MN), programmed with a background infusion of 3 ml h<sup>-1</sup>, a 5-ml patient-controlled bolus, a lockout of 15 minutes, and an hourly limit of 20 ml h<sup>-1</sup>. This regimen was maintained both in the early and late stages of labor. However, women who experienced inadequate analgesia received supplemental doses of a solution of ropivacaine 0.06% (without sufentanil). The participants were instructed on the use of the PCEA pump before the epidural catheter was inserted. The instructions included specific directions to each woman to press the button whenever she began to feel discomfort. According to the same institutional protocol, after epidural analgesia was established, all women received an oxytocin infusion.

### Measures

#### *Sociodemographic and Clinical Information*

Sociodemographic, obstetric-gynecological history, physical variables, and data about childbirth preparation classes were gathered during the interview. Additional data were collected during the second and third assessments, including cervical dilatation at the beginning of analgesia, oxytocin use before analgesia, and the duration of labor. After birth, the newborn's weight and Apgar scores at 1 and 5 minutes were also collected.

#### *Pain*

The perceived intensity of labor pain was measured using the visual analog scale (VAS), with one anchor at 0, which represented "no pain at all," and a second anchor at 100, which represented "the worst pain imaginable." The first

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TABLE 1. Descriptive Statistics for Categorical Variables (*n* = 81)

	<i>n</i>	%
Nulliparous	41	50.6
Childbirth preparation training	67	82.7
Back pain	22	27.2
Dysmenorrhea	10	12.3
Oxytocin use before analgesia	56	69.1
Mode of delivery		
Vaginal	57	70.4
Instrumental	13	16.0
Cesarean	11	13.6
Apgar score <7		
At 1 min	8	9.9
At 5 min	2	2.5

measurement was obtained before the administration of the PCEA when the patient was at 3 cm of cervical dilatation (VAS initial), and the second measurement was taken at the beginning of analgesia (VAS analgesia) at two consecutive uterine contractions (mean of the two scores). After the PCEA was initiated, pain was also indirectly assessed by analyzing the anesthetic consumption, which was defined in terms of the average dose per hour. This indicator indirectly reflects labor pain because it is determined by the needs of the patient, who is free to administer the required additional analgesia. Local anesthetic requirements were obtained from the PCEA recordings, and all records were transcribed as individual reports using the CADD software (Solis Medication Safety software).

## Adult Attachment

Adult attachment was assessed with the Portuguese version of the AAS-R (43). The AAS-R consists of 18 items that are scored on a 5-point scale (1 = *not at all characteristic of me* and 5 = *extremely characteristic of me*) and organized into two dimensions (*Anxiety* and *Avoidance*) (44). Individuals with high scores on the *Anxiety* dimension tend to display an excessive concern with their own distress and negative emotions and tend to overreact to their negative feelings to elicit support from others. Individuals with high scores on the *Avoidance* dimension seek distance (at the cognitive and behavioral levels) from the stressful event, appearing less sensitive; avoid closeness and interdependence in relationships; and avoid seeking emotional or instrumental support from others (45). Examples of items in each scale include the following: "I want to get close to people, but I worry about being hurt" (*anxiety*) and "I find it difficult to allow myself to depend on others" (*avoidance*). A recent literature review (46) reported that AAS-R had a good reliability and validity, is widely used, and has potential utility for psychosomatic research. In this sample, Cronbach  $\alpha$  values were .87 (*Avoidance*) and .89 (*Anxiety*).

## Covariates

Potential confounders, identified as those theoretically linked or significantly correlated with the dependent variables at  $p < .05$  in a univariate analysis, were entered as covariates. Thus, all models controlled for age, parity, prepregnancy BMI, dysmenorrhea, low back pain, newborn birth weight, and participation in childbearing preparation classes. For analyses concerning analgesic consumption, the mode of delivery and the duration of labor were also added to the model. Categorical variables were dummy coded before inclusion in the models.

## Statistical Analyses

Data analyses were conducted with IBM SPSS, version 20.0. Descriptive statistics with means and SD are reported for continuous variables, and frequencies are reported for categorical variables. A paired-samples *t* test was used to assess changes in the pain score over time. Associations between study variables were examined using Pearson correlation. To assess the association

between attachment dimensions and the increase in pain intensity over time, a change score was calculated by subtracting the VAS initial score from the VAS analgesia score. This association was then analyzed using Pearson correlation. Predictors of labor pain were examined in a hierarchical multiple regression analysis. The dependent variables were the measures of pain (VAS scores and anesthetic consumption), and the predictor variables were the sociodemographic and physical variables and the attachment dimensions. In the first step, sociodemographic and physical variables were included in the regression analysis. In the second step, the attachment dimensions were included to explore the additional effect of these dimensions on the pain scores. Based on established procedures (47), attachment dimensions were centered (i.e., rescaled so that the mean of each scale was 0) to reduce multicollinearity. The multicollinearity was assessed using tolerances and variance inflation factors. As suggested by Cohen et al. (48), the effect size that was attributable to the increment in  $R^2$  was also calculated. The effect sizes were calculated with Cohen *d* for Student's *t* test and Cohen  $f^2$  for the multiple regression analysis. The effect sizes are presented for all analyses (small: Cohen  $d \geq 0.20$ , Cohen  $f^2 \geq 0.02$ ; medium: Cohen  $d \geq 0.50$ , Cohen  $f^2 \geq 0.15$ ; large: Cohen  $d \geq 0.80$ , Cohen  $f^2 \geq 0.35$ ) (42).

## RESULTS

### Participant Characteristics

The study sample consisted of 81 pregnant women in the third trimester of pregnancy (median, 33 weeks) with a mean age of 32.07 years. All women were married or cohabitating, and most had secondary ( $n = 30$ ; 37%) or higher education ( $n = 37$ ; 45.7%). Additional clinical, obstetric, and newborn characteristics are shown in Tables 1 and 2.

### Labor Pain

The report of pain intensity before analgesia administration was significantly higher than the pain at 3 cm of cervical dilatation ( $t(80) = -10.53$ ,  $p < .001$ , Cohen  $d = 0.11$ ). Neither attachment anxiety ( $r = -0.15$ ,  $p = .19$ ) nor avoidance ( $r = -0.15$ ,  $p = .17$ ) was significantly associated with this increase in pain intensity.

Although the VAS initial scores ranged from 21.0 to 100, 28.4% ( $n = 23$ ) of scores were at or above 80, and 5 participants (6.2%) rated their pain peak at 100. The VAS analgesia score ranged from 55 to 100. Fifty ratings (61.7%) were at 80 or above, and 19.8% ( $n = 16$ ) rated their pain peak at 100. Women who rated their peak at 100 reported significantly higher attachment anxiety ( $M [SD] = 3.39 [0.53]$ ) than did those who did not ( $M [SD] = 2.48 [0.48]$ ;  $t(79) = -4.25$ ,  $p < .001$ , Cohen  $d = 1.78$ ). Similar results were found for avoidance ( $M [SD] = 3.34 [0.49]$

TABLE 2. Descriptive Statistics for Continuous Variables (*n* = 81)

	M (SD)	Range
Age, y	32.07 (5.09)	19–45
BMI (pregnancy), kg m <sup>-2</sup>	24.47 (3.77)	16.30–18.21
Cervical dilatation before analgesia, cm	3.48 (0.50)	3–4
Duration of labor, min	409.88 (182.81)	90–876
Newborn birth weight, grams	3190.89 (343.14)	2465–3860
Attachment: Anxiety	2.66 (0.84)	1.00–4.17
Attachment: Avoidance	2.88 (0.61)	1.58–3.92

M = mean; SD = standard deviation; BMI = body mass index.

versus  $M [SD] = 2.77 [0.59]$ ;  $t(79) = -3.55$ ,  $p = .002$ , Cohen  $d = 1.04$ ).

### Correlation Between Labor Pain and Anesthetic Consumption

A range of analyses was conducted to explore the associations between the pain scores, anesthetic consumption, attachment dimensions, and any of the sociodemographic and physical variables (Table 3). The VAS pain scores were significantly positively correlated with anesthetic consumption. Of note, older age was positively associated with anesthetic consumption. The duration of labor was negatively correlated with anesthetic consumption. All pain scores and anesthetic consumption were significantly correlated with both attachment anxiety and avoidance.

The attachment dimensions were not significantly correlated with most sociodemographic and clinical variables. However, a significant association was found between attachment anxiety and age ( $r = 0.33$ ,  $p = .002$ ). In addition, both attachment anxiety and avoidance were significantly correlated with the number of boluses ( $r = 0.60$  [ $p < .001$ ] and  $r = 0.69$  [ $p < .001$ ],

respectively) and the ratio of PCEA demands/PCEA delivered ( $r = 0.60$  [ $p < .001$ ] and  $r = 0.55$  [ $p < .001$ ], respectively). Attachment avoidance and anxiety dimensions were also significantly correlated ( $r = 0.77$ ,  $p < .001$ ).

### Predictors of Labor Pain and Anesthetic Consumption

To assess the combined contribution of sociodemographic, physical, and attachment dimensions on the pain scores, separate hierarchical multiple regression analyses were conducted. The final models are summarized in Table 4. The preliminary analyses of the collinearity statistics in the regression models (tolerance values  $> 0.31$  and variance inflation factor  $< 3.20$ ) suggested that multicollinearity did not compromise the interpretability of these results (49).

Regarding the initial VAS, the results indicated that none of the variables included in the first step were significant. In the second step, attachment anxiety was statistically significant and was responsible for 23% of the additional variance (the effect size attributable to the addition of attachment dimensions [Cohen  $f^2$ ] was 0.33). For the VAS analgesia scores, the results demonstrated significant coefficients for age. Older age was associated with higher pain intensity. In the second step, attachment anxiety was statistically significant and accounted for 33% of the additional variance (Cohen  $f^2 = 0.61$ ).

A similar analysis was conducted for anesthetic consumption. In the first step, older age and a shorter duration of labor were associated with a higher hourly dose of ropivacaine and accounted for 33% of the variance. After including attachment dimensions, the duration of labor remained significant, and age was marginally significant ( $p = .064$ ). Attachment avoidance was also a significant contributor (Cohen  $f^2 = 0.57$ ) and accounted for 25% of the additional variance. Together, the duration of labor and attachment avoidance accounted for 57% of the total variance.

### DISCUSSION

Because it is an intense stress-inducing event, labor pain may activate a woman's internal resources, particularly attachment system, as a means of adaptation (25). To assess this hypothesis, the current study examined the associations between attachment dimensions and labor pain, in addition to sociodemographic and physical predictors, based on the premise that insecure dimensions (i.e., higher attachment anxiety and avoidance) may represent significant predictors of labor pain. To date, this is the first study that has confirmed a significant association between attachment and labor pain and substantiated the relationship between the two attachment dimensions and pain (either directly assessed by VAS or indirectly through the analgesic consumption). Because this association has not been considered in other studies that addressed the implications of psychological factors for labor pain, this study makes a contribution to the growing body of literature examining adult attachment in the context of pain.

The most significant results of this study show that attachment dimensions are positively associated with both direct and

**TABLE 3. Descriptive Statistics and Pearson Correlation Coefficients for the Study Variables**

Variables	VAS initial, $r(p)$	VAS Analgesia, $r(p)$	Analgesic Consumption, $r(p)$
VAS initial	—		
VAS analgesia	0.65 (<.001)	—	
Analgesic consumption	0.19 (.095)	0.35 (.001)	—
Age	0.17 (.13)	0.25 (.022)	0.31 (.004)
Parity	-0.09 (.41)	-0.11 (.35)	-0.02 (.84)
Low back pain	-0.16 (.17)	-0.14 (.20)	-0.01 (.90)
Dysmenorrhea	-0.02 (.86)	0.02 (.84)	0.04 (.72)
Prepregnancy BMI	-0.03 (.81)	-0.05 (.67)	0.12 (.29)
Childbirth preparation	-0.01 (.92)	-0.02 (.85)	0.04 (.71)
Oxytocin use before analgesia	—	—	0.01 (.95)
Mode of delivery	—	—	0.19 (.093)
Duration of labor	—	—	-0.46 (<.001)
Newborn birth weight	0.02 (.87)	0.00 (.99)	0.11 (.34)
Attachment: Anxiety	0.53 (<.001)	0.65 (<.001)	0.49 (<.001)
Attachment: Avoidance	0.46 (<.001)	0.53 (<.001)	0.46 (<.001)
M (SD)	66.25 (20.08)	84.11 (12.85)	12.02 (3.70)
Range	21.00–100.00	55.00–100.0	5.66–21.45

VAS = visual analog scale; BMI = body mass index; M = mean; SD = standard deviation.

Parity (0 = nulliparous, 1 = parous), low back pain (0 = no, 1 = yes), dysmenorrhea (0 = no, 1 = yes), childbirth preparation (0 = no, 1 = yes), oxytocin use before analgesia (0 = no, 1 = yes), mode of delivery (0 = vaginal, 1 = instrumental/cesarean).

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**TABLE 4. Hierarchical Multiple Regression Analyses for Variables Associated with Pain Scores and Anesthetic Consumption**

	$\beta$	$p$	$F$	$p$	$\Delta R^2$
VAS initial					
Step 1			0.91	.51	0.08
Age	0.23	.057			
Parity	-0.15	.23			
Prepregnancy BMI	-0.05	.66			
Dysmenorrhea	-0.04	.77			
Low back pain	-0.15	.21			
Childbirth preparation	-0.01	.91			
Newborn birth weight	0.06	.64			
Step 2			3.57	.001	0.23
Anxiety	0.36	.042			
Avoidance	0.18	.30			
VAS induction					
Step 1			1.51	.18	0.13
Age	0.32	.008			
Parity	-0.18	.15			
Prepregnancy BMI	-0.08	.50			
Dysmenorrhea	-0.00	.99			
Low back pain	-0.16	.17			
Childbirth preparation	-0.04	.74			
Newborn birth weight	0.05	.71			
Step 2			6.70	<.001	0.33
Anxiety	0.51	.002			
Avoidance	0.13	.38			
Analgesic consumption					
Step 1			3.83	.001	0.33
Age	0.31	.005			
Parity	-0.01	.96			
Prepregnancy BMI	0.02	.87			
Dysmenorrhea	-0.02	.83			
Low back pain	-0.04	.71			
Childbirth preparation	0.08	.48			
Mode of delivery	0.13	.24			
Duration of labor	-0.41	<.001			
Newborn birth weight	0.13	.24			
Step 2			8.39	<.001	0.25
Anxiety	0.14	.34			
Avoidance	0.41	.004			

VAS = visual analog scale; BMI = body mass index.

Parity (0 = nulliparous, 1 = parous), low back pain (0 = no, 1 = yes), dysmenorrhea (0 = no, 1 = yes); childbirth preparation (0 = no, 1 = yes), mode of delivery (0 = vaginal, 1 = instrumental/cesarean).

indirect indicators of pain, above and beyond demographic and physical factors. This association supports the study's initial predictions, expands the understanding of labor pain beyond the already known variables, and emphasizes the role of psychological factors and of attachment theory as a valuable conceptual framework for understanding labor pain.

In the multivariate models for the VAS initial and VAS analgesia, only attachment anxiety accounted for significant variances in labor pain. These findings are consistent with the

study hypothesis and with prior studies suggesting an association with perceptions of higher pain intensity (16,17). These findings are also consistent with other studies that have found that individuals who are anxious about the availability of support perceive their pain more negatively (18) and cope poorly with pain (20). Although evidence suggests that individuals with higher attachment anxiety and avoidance scores are more likely to experience higher levels of pain, these effects seem to be more consistent for attachment anxiety than for attachment avoidance (14). This finding may occur because women who perceive others as unwilling to provide support (and perceive themselves as unworthy of support) tend to appraise pain as more threatening, to amplify their pain and its implications to receive more care and support from others, and to rely on less effective coping strategies (14,22). Together, these results support the conclusions of earlier studies that portray attachment security as a more adaptive trait and attachment insecurity as a vulnerability to more negative experiences of pain (19).

Based on the results of this study, attachment avoidance has a smaller association with pain scores than attachment anxiety because the former was only significantly associated with anesthetic consumption. Although to the authors' knowledge, no studies have examined this association, these findings are partially consistent with the evidence that has linked attachment avoidance to lower pain self-efficacy (19). These results are reflective of the negative view of others held by individuals with attachment avoidance and also reflect their views on self-reliance; these individuals have a tendency to doubt the capacity of others to provide support, to minimize threats, and to view themselves as more capable of coping on their own (45). Because adult attachment has been developmentally linked to self-efficacy (50), it is possible that insecure dimensions may be associated with diminished control over pain, and greater anesthetic consumption may thus reflect a means to manage pain. An alternate explanation may be related to prior evidence from studies in other samples that have identified a link between attachment avoidance and substance use (51). Consistent with the evidence relating attachment avoidance to greater use of external regulators of affect (24), the higher analgesic consumption among women with avoidant attachment can be understood as an attempt to minimize dependence on others and to suppress negative affects through "self-medication."

As mentioned, multiple sociodemographic and physical factors can influence the intensity of labor pain (7,8,10,32), and research focusing on the psychological component should also take these factors into consideration. Along with attachment dimensions, older age was significantly associated with greater labor pain; however, this result was not consistent with prior literature (32). Because age is frequently assumed to be a minor predictor, an alternate hypothesis is that the interaction of age with other variables may help to explain this inconsistency. Particularly, in this study, older age was significantly associated with higher scores in attachment anxiety. Future studies should therefore examine this association more comprehensively. In addition, these characteristics may have also influenced our results regarding parity, which did not indicate any significant

association between nulliparity and pain, as was reported in prior studies (10,32,33). However, this finding is consistent with another study that also failed to identify an association between nulliparity and labor pain (34). It was also expected that a history of dysmenorrhea would be a significant predictor of higher labor pain; however, no significant associations were observed. The low percentage of women with dysmenorrhea (12.3%) may explain the absence of a significant effect on pain scores and pharmacological consumption. It is possible that the association between the length of labor and lower hourly consumption of anesthetics may be an indication of the efficiency of the PCEA ultralight dose (4–6). In this study protocol, low anesthetic volumes in the continuous background infusion and in the self-administered bolus were used for labor analgesia. Analgesia was administered early in the active phase of labor (preanalgesia cervical dilatation, 3.46 cm [0.50]) using an initial dose of significant volume (10–12 ml). Because the initial dose is reflected in the computation of the hourly consumption, that may have influenced the volumes in short-term deliveries.

This study had several methodological strengths. First, the respect for the ethical limits of a naturalistic investigation was reflected in the method and had operational implications. Specifically, because pain is multidimensional, it can be difficult to assess; therefore, measures were selected to allow a valid communication (direct or indirect) of painful symptoms and their variations through an approximately standardized description. When using a PCEA, the use of unidimensional scales to record pain intensity is a common procedure, especially at predetermined intervals or in defined moments of cervical dilatation (4). The PCEA allows for some degree of autonomy and provides a space of intimacy, allowing the woman to control the therapy to establish a sense of comfort during labor. In this study, it was chosen not to interfere in this environment because regular assessments cannot reveal the dynamics of individual oscillations, and the intrusion of the researcher could have interfered with the painful experience. Thus, the VAS was used in designated time points (before analgesia, at 3 cm of cervical dilatation, and at the time of analgesia administration [VAS analgesia]). In the PCEA, self-administrations are triggered early once the woman experiences the beginning of a nociceptive increase in pain; at these times, the pain scores are usually very low (4). Therefore, the rhythm of boluses and the consumption of analgesics represent rigorous indicators of individual differences. Second, the assessment of attachment during pregnancy and the underlying longitudinal design of this study allowed for clearer demonstration of the directionality of the association between attachment and the study main outcomes. Third, the inclusion of multiple determinants into one model was useful in explaining labor pain and analgesic consumption.

Despite these strengths, there are also some limitations that should be considered when interpreting these findings. First, a convenience sampling method was used, and the available participants may not be representative of the pregnant population. Second, the modest sample size limits the strength of the conclusions and limits its power to detect small but potentially important differences. According to Cohen (42), post

hoc power calculations demonstrated that the achieved sample size allowed for the detection of moderate to large effects. In addition, the reasonably high and biased dropout rate (e.g., the participants that were excluded were more likely to be nulliparous and to report lower scores on attachment anxiety) must be considered because it may have compromised the validity of these findings. Accordingly, the current study should be replicated with larger samples to confirm and further clarify the findings reported herein. Third, attachment was assessed using a self-report measure. Because attachment reflects an individual's subjective perceptions of their close relationships, it is possible that participants may be vulnerable to reporting bias. Therefore, it may be useful to replicate these findings with alternative methods of data collection, such as the Adult Attachment Interview (52). The assessment of attachment patterns using this interview may strengthen the validity of these findings. Finally, other psychological constructs that were not assessed may have a significant impact on the relationships examined. Because of the evidence indicating associations between attachment and other psychological constructs, such as anxiety and fear, it may have been valuable to include these variables in the current study. It is worth noting, however, that although an association between these constructs exists, the associations are modest (22,23), which suggests that these constructs are not redundant. Further research should incorporate these variables along with others, such as individual characteristics (e.g., personality traits such as neuroticism) and social support. In the absence of these measures, caution should be exercised when interpreting the observed effects as a reflection of attachment.

The findings of this study may also translate into relevant clinical implications. First, these findings support the attachment model as a reliable framework to elucidate the interplay between psychological models of self and others, pain, and intrapartum anesthetic consumption. The assessment of attachment has the potential to early identify women who are at a high risk for experiencing more pain during childbirth and of coping with pain in a less effective manner. Because secure attachment representations are an important inner resource in the face of stress-inducing events, an understanding of attachment patterns and a better knowledge of psychosocial factors will allow for more effective interventions and better pain management. The efficient management of pain requires not only the use of pharmacological agents but also careful attention to individual and relational factors that may account for variabilities in the pain experience. The use of nonpharmacological methods of labor pain management, such as emotional preparation/support and training interventions to teach coping skills, may be helpful for women. This focus may create an opportunity for obstetric care health professionals to educate patients about pain management, provide coping strategies for increasing perceived personal control and self-efficacy, and individualize care, which will avoid a “one size fits all” approach (13). For example, women with higher attachment anxiety, who are more likely to catastrophize about pain, may benefit from interventions that focus on reducing excessive support seeking, modifying the appraisal of pain (to see it as

less threatening), and developing more adaptive pain-coping skills. In contrast, women with higher attachment avoidance may benefit from interventions that are adjusted to their discomfort with intimacy as well as from interventions that encourage them to communicate their emotions; these interventions may decrease the need to regulate their emotions by using more analgesics. Thus, these results can promote a major shift in institutional practices and therapeutic procedures to recognize pregnancy as a complex process of biological changes and psychological reorganization.

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## REFERENCES

- Janig W, Habler HJ. Physiology and pathophysiology of visceral pain. *Schmerz* 2002;16:429–46.
- Hiltunen P, Raudaskoski T, Ebeling H, Moilanen I. Does pain relief during delivery decrease the risk of postnatal depression? *Acta Obstet Gynecol Scand* 2004;83:257–61.
- Ranasinghe JS, Birnbach DJ. Progress in analgesia for labor: focus on neuroaxial blocks. *Int J Womens Health* 2010;1:31–43.
- Halpern SH, Carvalho B. Patient-controlled epidural analgesia for labor. *Anesth Analg* 2009;108:921–8.
- Ledin Eriksson S, Gentile C, Olofsson CH. PCEA compared to continuous infusion in a ultra-low-dose regimen for labor pain relief: a randomized study. *Acta Anaesthesiol Scand* 2003;47:1085–90.
- Wang F, Shenm X, Guo X, Peng Y, Gu X, Labour Analgesia Examining Group. Epidural analgesia in the latent phase of labour and the risk of cesarean delivery: a five-year randomized controlled trial. *Anesthesiology* 2009;11:871–80.
- Lowe NK. The nature of labor pain. *Am J Obstet Gynecol* 2002;186 (suppl 5):S16–24.
- Fridh G, Kopare T, Gaston-Joahansson F, Turner Norvell KT. Factors associated with more intense labor pain. *Res Nurs Health* 1988;11:117–24.
- Saisto T, Kaaja R, Ylikorkala O, Halmesmaki E. Reduced pain tolerance during and after pregnancy in women suffering from fear of labor. *Pain* 2001;93:123–7.
- Reading AE, Cox DN. Psychosocial predictors of labor pain. *Pain* 1985; 22:309–15.
- Lang AJ, Sorrell JT, Rodgers CS, Lebeck MM. Anxiety sensitivity as a predictor of labor pain. *Eur J Pain* 2006;10:263–70.
- Meredith P, Ownsworth T, Strong J. A review of the evidence linking adult attachment theory and chronic pain: presenting a conceptual model. *Clin Psychol Rev* 2008;28:407–29.
- Meredith PJ. A review of the evidence regarding associations between attachment theory and experimentally induced pain. *Curr Pain Headache Rep* 2013;17:326.
- Porter LS, Davis D, Keefe FJ. Attachment and pain: recent findings and future directions. *Pain* 2007;128:195–8.
- Davies KA, MacFarlane GJ, McBeth J, Morriss R, Dickens C. Insecure attachment style is associated with chronic widespread pain. *Pain* 2009; 143:200–5.
- McWilliams LA, Cox BJ, Enns MW. Impact of adult attachment styles on pain and disability associated with arthritis in a nationally representative sample. *Clin J Pain* 2000;16:360–4.
- MacDonald G, Kingsbury R. Does physical pain augment anxious attachment? *J Soc Pers Relat* 2006;23:291–304.
- Ciechanowski P, Sullivan M, Jensen M, Romano J, Summers H. The relationship of attachment style to depression, catastrophizing and health care utilization in patients with chronic pain. *Pain* 2003;104: 627–37.
- Meredith P, Strong J, Feeney JA. Adult attachment, anxiety, and pain self-efficacy as predictors of pain intensity and disability. *Pain* 2006; 123:146–54.
- Meredith P, Strong J, Feeney JA. The relationship of adult attachment to emotion, catastrophizing, control, threshold and tolerance, in experimentally-induced pain. *Pain* 2006;120:44–52.
- McWilliams LA, Asmundson GJ. The relationship of adult attachment dimensions to pain-related fear, hypervigilance, and catastrophizing. *Pain* 2007;127:27–34.
- Meredith PJ, Strong J, Feeney JA. Evidence of a relationship between adult attachment variables and appraisals of chronic pain. *Pain Res Manag* 2005; 10:191–200.
- Andrews NE, Meredith PJ, Strong J. Adult attachment and reports of pain in experimentally-induced pain. *Eur J Pain* 2011;15:523–30.
- Maunder RG, Hunter JJ. Attachment and psychosomatic medicine: developmental contributions to stress and disease. *Psychosom Med* 2001;63: 556–67.
- Mikulincer M, Shaver PR. Attachment in Adulthood: Structure, Dynamics, and Change. New York: Guilford Press; 2007.
- Wilson CL, Rholes WS, Simpson JA, Tran S. Labour, delivery, and early parenthood: an attachment theory perspective. *Pers Soc Psychol Bull* 2007;33:505–18.
- Bowlby J. Attachment and Loss. Vol 1. Attachment. 2nd ed. New York: Basic Books; 1982.
- Brennan KA, Clark CL, Shaver PR. Self-report measurement of adult attachment: an integrative overview. In: Simpson JA, Rholes WS, editors. Attachment Theory and Close Relationships. New York: Guilford Press; 1998:46–76.
- Alexander R, Feeney J, Hohaus L, Noller P. Attachment style and coping resources as predictors of coping strategies in the transition to parenthood. *Pers Relationships* 2001;8:137–52.
- Simpson JA, Rholes WS, Campbell L, Tran S, Wilson CL. Adult attachment, the transition to parenthood, and depressive symptoms. *J Pers Soc Psychol* 2003;84:1172–87.
- Nielsen CS, Staud R, Price DD. Individual differences in pain sensitivity: measurement, causation, and consequences. *J Pain* 2009;10:231–37.
- Melzack R, Kinch R, Dobkin P, Lebrun M, Taenzer P. Severity of labour pain: influence of physical as well as psychologic variables. *Can Med Assoc J* 1984;130:579–84.
- Lowe NK. Differences in first and second stage labor pain between nulliparous and multiparous women. *J Psychosom Obstet Gynaecol* 1992;13: 243–53.
- Ohel I, Walfisch A, Shitenberg D, Sheiner E, Hallak M. A rise in pain threshold during labor: a prospective clinical trial. *Pain* 2007;132 (suppl 1):S104–8.
- Benavides L, Wu JM, Hundley AF, Ivester TS, Visco AG. The impact of occiput posterior fetal head position on the risk of anal sphincter injury in forceps-assisted vaginal deliveries. *Am J Obstet Gynecol* 2005;192: 1702–6.
- Panni MK, Segal S. Local anesthetic requirements are greater in dystocia than in normal labor. *Anesthesiology* 2003;98:957–63.
- Hildingsson I, Karlström A, Nystedt A. Women's experiences of induction of labour-findings from a Swedish regional study. *Aust N Z J Obstet Gynaecol* 2011;51:151–7.
- Lowe NK. Critical predictors of sensory and affective pain during four phases of labour. *J Psychosom Obstet Gynaecol* 1991;12:193–208.
- Ranta P, Jouppila P, Spalding MJ, Jouppila R. The effect of maternal obesity on labour and labour pain. *Anaesthesia* 1995;50:322–6.
- Leventhal EA, Leventhal H, Shacham S, Easterling DV. Active coping reduces reports of pain from childbirth. *J Consult Clin Psychol* 1989;57: 365–71.
- Flórido J, Oltras CM, Fjardo MC, Gonzalez-Escanuela E, Villaverde C, Gonzalez-Gomez F. Plasma concentrations of beta-endorphin and adrenocorticotrophic hormone in women with and without childbirth preparation. *Eur J Obstet Gynecol Reprod Biol* 1977;73:121–5.
- Cohen J. A power primer. *Psychol Bull* 1992;112:155–9.
- Canavarro MC, Dias P, Lima V. A avaliação da vinculação do adulto: uma revisão crítica a propósito da aplicação da Adult Attachment Scale-R (AAS-R) na população portuguesa. *Psicologia* 2006;20:155–87.
- Collins N. Working models of attachment: implications for explanation, emotion, and behavior. *J Pers Soc Psychol* 1996;71:810–32.

45. Lopez F, Brennan KA. Dynamic processes underlying adult attachment organization: toward an attachment theoretical perspective on the healthy and effective self. *J Couns Psychol* 2000;47:283–300.
46. Ravitz P, Maunder R, Hunter J, Sthankiya B, Lancee W. Adult attachment measures: a 25-year review. *J Psychosom Res* 2010;69:419–32.
47. Aiken LS, West SG. *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, CA: Sage Publications; 1991.
48. Cohen J, Cohen P, West SG, Aiken LS. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. 3rd ed. Mahwah, NJ: Lawrence Erlbaum; 2003.
49. Field A. *Discovering Statistics Using SPSS*. 2nd ed. London: Sage Publications; 2005.
50. Feeney BC. A secure base: responsive support of goal strivings and exploration in adult intimate relationships. *J Per Soc Psychol* 2004;87: 631–48.
51. Schindler A, Thomasius R, Sack PM, Gemeinhardt B, Küstner U, Eckert J. Attachment and substance use disorders: a review of the literature and a study in drug dependent adolescents. *Attach Hum Dev* 2005;7: 207–28.
52. Hesse E. The Adult Attachment Interview: protocol, method of analysis, and empirical studies. In: Cassidy J, Shaver PR, editors. *Handbook of Attachment: Theory, Research, and Clinical Applications*. 2nd ed. New York: Guilford Press; 2008:552–98.