



Biased Partner Perceptions of Women's Pain Self-Efficacy in Postpartum Pain During Intercourse: A Dyadic Longitudinal Examination

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Abstract: Postpartum pain during intercourse is a prevalent and distressing problem that has substantial consequences for affected couples. Partner perceptions—such as how partners perceive women's pain self-efficacy—contribute to an individual's pain experience. This study examined whether partners under- or over-estimate women's intercourse pain self-efficacy at 3-months postpartum and the implications of this bias for women's pain and couples' sexual functioning at 3- and 6-months postpartum. Women who reported pain during intercourse and their partners (N = 89 couples) completed online measures assessing pain self-efficacy (own or partner perceptions), pain intensity, and sexual functioning at 3- and 6-months postpartum. Analyses were based on the Truth and Bias Model of Judgement and Response Surface Analysis. Partners were accurate in their estimates of women's pain self-efficacy (ie, their estimates were positively correlated with women's), but they also underestimated it by perceiving women to be less efficacious than women themselves reported. When couples showed greater agreement for lower levels of pain self-efficacy at 3 months, women reported greater pain intensity and both partners reported poorer sexual functioning at 3- and 6-months postpartum. Findings may inform interventions that promote pain self-efficacy to improve partner support and couples' sexual functioning.

Perspective: When women report—and their partners perceive—low levels of women's self-efficacy for managing painful intercourse, women report greater postpartum pain during intercourse and couples indicate poorer sexual functioning. These findings suggest that interventions aimed at promoting couples' agreement at high pain self-efficacy may improve their adjustment to postpartum pain.

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Key words: Pain self-efficacy, postpartum pain, pain during intercourse, sexual function, couples.

Childbirth is a significant risk factor for the development of persistent pain problems (eg,^{9,28,85}), including pain during intercourse.^{14,17,34,53,62} Approximately 37% of women report pain during

intercourse at 3-months postpartum, which persists for 31% at 6-months postpartum.⁷³ Pain during intercourse substantially interferes with couples' sexual functioning, and in turn, their quality of life (eg,^{63,73,81}). Biomedical factors such as mode of delivery and severity of delivery pain have been implicated in the persistence of this pain in the first 6-months postpartum.⁷³ Although psychosocial factors (eg, depression) have been identified as crucial determinants in the development and maintenance of pain during intercourse more broadly,⁷ there is a dearth of research examining psychosocial predictors of this pain postpartum.^{34,53} Consistent with biopsychosocial pain models,^{26,32,35} partner perceptions of pain play an important role in its persistence and consequences.^{33,48,55} Cross-sectional research indicates that partners tend to either under- or over-estimate the pain and disability of

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individuals with pain.^{21,41,69,74} Mis-estimations of pain have been associated with greater pain and poorer quality of life in couples.^{21,56,69} However, partner perceptions have not been examined in postpartum pain during intercourse, whereby partners are intimately involved in the pain experience. The purpose of this dyadic longitudinal study is to examine whether partner perceptions of women's self-efficacy for managing pain during intercourse are biased, and whether this bias predicts women's pain and couples' sexual functioning.

Pain self-efficacy refers to a person's confidence in their ability to manage pain.³⁸ Greater pain self-efficacy is a robust predictor of reduced pain and disability across pain populations,^{22,38,45} including pain during intercourse.^{10,23,24} In fact, prior studies suggest pain self-efficacy is a stronger correlate of disability, in this case evidenced by reduced sexual function, than other psychological variables such as those in the fear-avoidance model (eg, catastrophizing).^{22,23,91} Partner perceptions of women's greater pain self-efficacy have been linked to women's lower pain during intercourse.⁴⁸ Yet whether partners are biased in their estimations of women's pain self-efficacy is unknown. In one cross-sectional study, partners of individuals with cancer were split in their tendency to under- or over-estimate the individuals' self-efficacy, and disagreement was associated with greater distress.⁶⁵ In the postpartum, pressures to persist with intercourse despite pain^{4,29,30} and resume sexual activity may limit women's expression of pain, leading partners to overestimate their pain self-efficacy. Conversely, partners may observe the stressors of motherhood,^{25,57,77} potentially exacerbated by pain during intercourse, leading them to underestimate women's pain self-efficacy.

Biased perceptions of women's pain self-efficacy may promote beliefs that the pain is more or less manageable, affecting partner support.⁴¹ Individuals with partners who misestimate their pain report receiving less satisfying support.^{47,52} Problematic support may encourage avoidance of sex,^{71,72} which is linked to greater pain and sexual impairment in women with pain during intercourse.^{2,6,23,34,86} Thus, viewed through a cognitive-behavior lens,^{40,87} biased partner perceptions of self-efficacy may trigger problematic support including avoidance of intercourse and result in greater pain and disability.⁹¹

We hypothesized that partners would be biased, however, whether they under- or over-estimated women's pain self-efficacy was assessed in an exploratory manner as pain estimation research has been mixed.^{41,52,56,74} We predicted that greater partner bias of women's pain self-efficacy at 3-months postpartum would be associated with women and partners' poorer sexual functioning and greater pain for women at 3- and 6-months postpartum.

Methods

Participants

We drew data for the current study from 2 larger longitudinal studies examining pain and sexuality in the transition to parenthood (sample 1 and sample 2), and

an additional subset of couples (sample 3) recruited specifically for the current study (due to our restricted eligibility criteria that limited the number of couples drawn from the other samples). There is one prior publication from one of these studies that did not involve pain during intercourse or dyadic data.⁸⁸ In the 2 larger studies, we recruited couples at 18 to 25-week pregnant, whereas the targeted sample was recruited specifically at 3-months postpartum. At the time of recruitment, eligible women were either pregnant with or had delivered a singleton fetus as their first child, with no complications. Considering evidence suggesting that pain during intercourse develops regardless of mode of delivery,⁷³ we included all types of delivery methods, such as vaginal, caesarean, and assisted (eg, vacuum or forceps). All participants were 18 years of age or older, involved in a romantic relationship and fluent in English. The woman who gave birth had to report current pain during intercourse and their partner had to indicate an awareness of this pain. Partners' awareness of women's pain was assessed in sample 1 and sample 2 via a "yes" or "no" question asking if, to their knowledge, their partner experiences pain during sexual activity. If they indicated "yes," they received the pain self-efficacy measures and were included in the current study. Due to the targeted recruitment process for sample 3, participants were specifically asked during the eligibility screening if they were aware of this pain. Only couples for whom the partner was aware of the pain were enrolled in the study.

There were 34 out of 99 (34%) couples eligible from sample 1. Forty-seven of the 99 (47%) couples did not report pain during intercourse and 18 (18%) had a partner who was not aware of the pain (ie, women reported pain, but partner reported she did not). From sample 2, 35 of 94 (37%) couples were eligible. However, 6 of these couples did not receive the pain self-efficacy measure due to a questionnaire branching error. Thus, 29 out of 94 (31%) were eligible; 42 of 94 (45%) couples did not report pain during intercourse and 17 of 94 (18%) couples had a partner unaware of the pain. From sample 3, 41 couples were screened for eligibility. Of these couples, 30 (73%) were eligible. Eleven couples were ineligible due to reporting no pain during intercourse ($n = 4$), not having yet engaged in penetrative sexual activity ($n = 1$), already participating in 1 of the 2 longitudinal studies ($n = 2$), their partner not being interested in participating ($n = 3$), and having a previous delivery ($n = 1$). Four eligible participants from sample 3 decided not to participate after the screening. Thus, our final combined sample consisted of 89 couples ($N = 178$ individuals).

Procedure

Participants were recruited from a hospital in a mid-sized city at their 18 to 20-week obstetrical ultrasound appointment and via online advertisements. We either invited the partners of pregnant women previously enrolled in a larger study to participate starting at 3-months postpartum, or both women and their partners

were recruited and enrolled at the same time (ie, for the targeted recruitment). Participants received an individualized link via email (sent to their separate accounts) to a survey hosted on Qualtrics, a secure online platform, at 3- and 6-months postpartum. We collected informed consent via an online form presented at their first survey. Both members of the couple completed measures of sociodemographics and in some cases additional measures relevant to the larger studies. At 3- and 6-months postpartum, women completed measures evaluating their pain intensity, sexual functioning, and pain self-efficacy relating to their pain during intercourse. Partners were asked if they were aware of the woman's pain during intercourse and if so, they completed measures of their own sexual functioning and their perceptions of the woman's pain self-efficacy.

All participants received a phone call and email 1 week prior to survey administration to notify them that the survey was incoming. If they had not yet completed the survey, then participants received: 1) a phone call 48 to 72 hours after the survey was sent, 2) an email reminder at 1 week, 3) a phone call at 2 weeks, and 4) a final email reminder at 3 weeks. Across all time-points, participants received online Amazon gift cards after each completed survey, commensurate with the larger study they participated in. The studies received approval from our institution's ethics board.

Measures

Sample Characteristics

Participants reported their age, sex, relationship status and duration, and income. All partners reported that their sex was male. See Table 1 for sociodemographics of the sample. Correlations, means, and standard deviations among all study variables are reported in Table 2.

Pain Self-Efficacy

We measured pain self-efficacy using the pain subscale of the painful intercourse self-efficacy scale (PISES²³). This measure was previously adapted from the well-validated Arthritis Self-Efficacy scale.⁵⁰ Participants indicated their perceived ability to carry out sexual activity or to manage their pain during sexual activity with 6 items on a scale ranging from 0 (*very uncertain*) to 100 (*very certain*), such as: "How certain are you that you can decrease your pain *quite a bit*?" and "How certain are you that you can continue most of your sexual activities?". A mean score across the items was calculated, such that a higher mean score represents greater pain self-efficacy. Partner perceptions of women's pain self-efficacy were measured using the partner version of the pain subscale of the painful intercourse self-efficacy scale.²³ This measure is the same as the woman's version, however, it asks partners to indicate their perception of the woman's ability to carry out sexual activity or to manage her pain during sexual activity, such as: "How certain is your partner that she can decrease her pain *quite a bit*?". In past studies of women with pain during intercourse and their partners, the PISES has demonstrated good reliability and validity—including predictive validity distinct from related constructs such as catastrophizing, pain-related anxiety and avoidance—and a factor structure consistent with the original Arthritis Self-Efficacy version.^{10,23,48} In the present study, the pain subscale of the woman's PISES ($\alpha = .90$) and partner PISES ($\alpha = .91$) demonstrated strong reliability.

Pain

Women rated the average intensity of their pain during intercourse over the past 4 weeks using a visual analogue scale (VAS). The VAS is a self-report measure of average pain intensity on a continuous horizontal scale ranging from 0 (*no pain at all*) to 10 (*worst pain ever*).

Table 1. Sociodemographic Characteristics of the Sample (N = 178 Individuals; 89 Couples Unless Otherwise Noted)

CHARACTERISTICS	M (RANGE) OR N	SD	%
Age			
Women (n = 86)	28.83 (18–39)	4.22	—
Partners (n = 87)	31.01 (19–42)	4.29	—
Relationship duration (n = 88)	7.17 (.50–17.33; years)	3.85	—
Relationship status			
Married	138		77.5%
Common-law	20		11.2%
Engaged	4		2.2%
Living together	14		7.9%
Dating	2		1.1%
Couples' annual household income			
\$0–\$39,999	15		8.42%
\$40,000–\$69,999	25		14.04%
\$70,000–\$99,999	57		32.02%
\$100,000 or above	81		45.51%

NOTE. 3 women and 2 partners did not indicate their age, resulting in missing data for these individuals. One partner did not respond to the relationship duration item.

Table 2. Descriptive Statistics and Bivariate Correlations Among the Study Variables (N = 89 Couples Unless Otherwise Noted)

VARIABLE	1	2	3	4	5	6	7	8
1. PISES-W (3M)	—	.32**	-.37***	-.52**	-.32**	-.32**	-.44***	-.10
2. PISES-P (3M)	—	—	-.16	-.29**	-.34***	-.25*	-.37**	-.27*
3. VAS-Pain (W; 3M)	—	—	—	.43***	.21	.49***	.26*	-.11
4. FSFI (W reverse; 3M) ^a	—	—	—	—	.31**	.26*	.69***	-.05
5. IIEF (P reverse; 3M) ^b	—	—	—	—	—	-.43**	.32**	.49**
6. VAS (W; 6M) ^c	—	—	—	—	—	—	.30**	.35**
7. FSFI (W reverse; 6M) ^d	—	—	—	—	—	—	—	.24*
8. IIEF (P reverse; 6M) ^e	—	—	—	—	—	—	—	—
Mean	71.55	59.74	4.58	18.53	18.10	2.90	16.55	20.10
SD	21.74	24.77	2.21	5.49	11.88	2.16	5.27	13.30
Range	14–100	2–100	1.0–9.4	8.60–30	4–62	.0–9.0	7–27.60	4–65

Abbreviations: W, women; P, partners; 3M, 3 months; 6M, 6 months; PISES-P, Painful Intercourse Self-Efficacy Scale-Partner Version; VAS-Pain, Visual Analogue Scale for Pain.

NOTE. Both measures of sexual functioning were reverse-scored such that higher scores indicate poorer sexual functioning.

^aN = 87.

^bN = 88.

^cN = 74.

^dN = 82.

^eN = 86.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

The VAS is a commonly used tool for assessing pain intensity⁶⁶ that has been used in prior samples of women with postpartum pain during intercourse^{3,15,43} and correlates strongly with other measures of pain intensity.^{36,39} Higher scores indicate greater intensity of pain.

Sexual Functioning

We assessed female sexual functioning using the well-validated female sexual functioning index (FSFI⁷⁵). The FSFI includes 19-items and assesses 6 domains of sexual functioning (ie, desire, arousal, lubrication, orgasm, satisfaction, and pain). Participants respond to each item on a 5-point Likert scale. The measure has been used in past research for women's sexual functioning in the postpartum period.⁸⁸ To reduce overlap with our independent measure of pain during intercourse and to ensure that the pain subscale was not driving the effects for sexual functioning, we removed the pain subscale from the total score of the FSFI. Therefore, total scores could now range from 6 to 30, with higher scores indicating greater sexual functioning. For ease of interpreting the pain and sexual functioning outcomes together (ie, higher scores indicating poorer outcomes for both), we reverse scored sexual functioning such that higher scores reflect *poorer* sexual functioning. The FSFI (with pain removed) demonstrated strong reliability at 3 ($\alpha = .84$) and 6 ($\alpha = .83$) months.

We assessed male partner sexual functioning with the widely used and well-validated International Index of Erectile Function (IIEF⁷⁶). The IIEF is considered to be a gold standard tool for assessing male sexual function^{76,84} and contains 15 items divided into broad domains of erectile function (6 items), ejaculation (1 item), orgasm (1 item), satisfaction (4 items) sexual desire (2 items), and sexual frequency (1 item). Total

scores range from 0 to 75. We again reverse scored IIEF scores such that higher scores reflect *poorer* sexual functioning. The IIEF has shown strong reliability and validity in past research of couples coping with pain during intercourse.¹⁹ The IIEF demonstrated strong reliability in the current study at 3 ($\alpha = .88$) and 6 ($\alpha = .92$) months.

Data Analysis

We conducted the Truth and Bias analyses in SPSS Version 25.0¹⁸ and the response surface analyses (RSA) using the RSA package⁷⁸ in Version 3.5.2 of R.⁸³ Only 1 data-point (1.1%) was missing from each of the partner perceptions of women's pain self-efficacy scale and the male sexual functioning measure at 3 months. We replaced these minimal missing data by the sample mean of the scale.⁸² For women's sexual functioning at 3 months, there were 2 participants who reported "no sexual activity" and 5 participants with 1 to 2 missing data points (ie, they still had 87.5–93% of the full measure), whereas at 6 months, 7 participants reported "no sexual activity" and 1 participant had a single missing data point (ie, they still had 93.7% of the full measure). In line with FSFI scoring recommendations,⁵⁴ participants reporting no sexual activity did not receive a total score and the minimal missing data for the other items were replaced by the mean of the participants' subscale. One participant at 3 months and 3 participants at 6 months did not complete the male sexual functioning measure. Fifteen women did not complete the pain intensity measure at 6 months. Thus, all participants without total scores were not included in the respective models.

To examine our first objective regarding whether partners tended to under- or over-estimate women's pain self-efficacy at 3-months postpartum, regression analyses guided by the Truth and Bias Model of Judgement were conducted.⁸⁹ A regression analysis was utilized (rather

than multi-level modeling) because pain self-efficacy only applies to one member of the couple (ie, both partners did not report on their own pain self-efficacy). This model simultaneously tests 2 distinct influences on perceptions of pain self-efficacy (ie, the outcome measure): directional bias and the truth force. Directional bias is defined as mean differences of a particular judgment compared to a benchmark score.³¹ The truth force represents that benchmark rating, which is the report of one partner that is being judged by the other partner in the relationship. For the present study, women's self-reported pain self-efficacy was used as the benchmark (ie, the truth force) and was compared against the partner's judgment of her pain self-efficacy. Past research has shown that romantic partners can be simultaneously accurate and biased in their perceptions.^{31,59} For example, partners may generally be accurate in perceiving the woman's level of self-efficacy for managing pain during intercourse to be high, moderate, or low, relative to other similar individuals. At the same time, partners might under- or overestimate the overall level of self-efficacy of mothers because they do not have all of the same information that mothers have (ie, their cognitive, affective, and behavioral reactions to the pain) and partners are also affected by their own internal reactions to the pain. Indeed, a robust finding in partner perception research is that partners are accurate in their perceptions (ie, perceptions correlate with true values), but concurrently exhibit a mean-level bias (see review by ³¹), which underscores the importance of examining both accuracy and bias in the same statistical model. Thus, in a regression model we simultaneously examined whether partners were accurate in their estimation of a woman's pain self-efficacy (the truth force) and if they also tended to exhibit mean-level bias in their perceptions of women's pain self-efficacy (directional bias).

In this model, the dependent variable was the partner's judgment of woman's pain self-efficacy, and we entered the following variables as predictors: the woman's actual reported self-efficacy (*truth force*) and women's pain intensity at 3 months. We grand mean centered the partner's judgment of the woman's self-efficacy, as well as the woman's own self-efficacy around the sample mean of the truth variable (ie, the average level of self-efficacy reported by women in the sample). The slope of the model represents whether partners are accurate or not in their perceptions (ie, the truth force). A positive (ie, >0) significant slope indicates agreement between women's report of her pain self-efficacy and the partners' perceptions. The intercept of the model reflects a directional bias. A positive intercept (ie, >0) suggests that partners reported that the women were higher in self-efficacy than the women actually reported (ie, overestimation), and a negative intercept (ie, <0) suggests that partners reported that the women had lower pain self-efficacy than the women actually reported (ie, underestimation).

To assess our second objective of whether partner bias in estimating women's pain self-efficacy at 3-months postpartum predicts 1) women's greater pain intensity and 2) poorer sexual functioning for both members of

the couple, at 3- and 6-months postpartum, we used Response Surface Analysis (RSA).²⁷ We conducted polynomial regressions with RSAs using R.⁸⁰ RSA analyses provide 4 coefficients that reflect whether agreement (ie, accuracy) and bias are associated with outcomes denoted *a1* to *a4*. Per Shanock and colleagues⁸⁰ recommendations, we first centered the mean score of woman's pain self-efficacy and her partner's perception of her pain self-efficacy around the scale midpoint (ie, 50) and created squared versions of these centered variables and a product term (ie, the interaction between woman's report and partners report of women's pain self-efficacy). These 5 variables (women's pain self-efficacy, partner perceptions of pain self-efficacy, squared versions of women and partner perceptions of pain self-efficacy, and their interaction variable), were entered as predictors of women's pain intensity and each partners' sexual functioning. We then examined the 4 surface test coefficient values (ie, *a1*–*a4*).

Our primary analyses of interest were the *a3* (ie, is bias at 3 months in one direction—under or over—better than the other direction for women's pain intensity or couples' sexual functioning at 3 and 6 months?) and *a4* (ie, is greater agreement versus disagreement at 3 months associated with women's pain intensity or couples' sexual functioning at 3 and 6 months?) coefficients. For *a3*, a significant and positive value would indicate that underestimation of self-efficacy is associated with women's higher pain intensity and poorer sexual functioning compared to overestimation. A significant and negative value for *a3* would indicate that overestimation is associated with women's higher pain intensity and couples' poorer sexual functioning compared to underestimation. For *a4*, a significant and positive value would indicate that pain intensity increases and sexual functioning decreases as the discrepancy between women's pain self-efficacy and partners' perceptions of her self-efficacy increases (ie, disagreement is detrimental), whereas a significant negative value would indicate that pain intensity increases and sexual functioning decreases as the discrepancy between woman and partner perceptions decreases (ie, agreement is detrimental).

Although we did not have specific hypotheses regarding *a1* and *a2*, these coefficients provide complementary information regarding the effects of biased perceptions of pain self-efficacy on pain and sexual functioning. A significant and positive value for *a1* would suggest that when partners show agreement in the pain self-efficacy ratings, individuals report poorer sexual functioning and women report higher pain intensity when that agreement is for higher levels of pain self-efficacy compared to lower levels. A significant negative value for *a1* would indicate that when partners show agreement in pain self-efficacy ratings, individuals report poorer sexual functioning and women report higher pain intensity when they show agreement for lower compared to higher ratings of pain self-efficacy. The *a2* coefficient tests for a nonlinear effect along the line of congruence to indicate whether the association between agreement and outcomes differ as ratings of women's pain self-efficacy are at the extreme ends. For example, do women

report lower pain intensity and individuals report greater sexual functioning when couples' ratings agree at mid-range values of pain self-efficacy compared to very high or very low values? All results are illustrated by surface plots generated in *R*. The de-identified data and syntax for all analyses are available here: https://osf.io/5k2q9/?view_only=89e2a19c6f63420da52b9289893f9415.

Results

Descriptive Statistics

We conducted a one-way ANOVA to ascertain whether the means of our variables differed amongst participants from the 3 studies they were recruited from. The means for women's reported pain self-efficacy at 3 months across sample 1 ($M = 71.94$, $SD = 21.32$), sample 2 ($M = 80.21$, $SD = 20.34$), and sample 3 ($M = 61.38$, $SD = 20.14$) were significantly different ($F(2,88) = 5.70$, $P = .005$). The means for women's sexual functioning at 3 months across sample 1 ($M = 19.01$, $SD = 5.43$), sample 2 ($M = 15.72$, $SD = 4.60$), and sample 3 ($M = 21.02$, $SD = 5.25$) were significantly different ($F(2,86) = 7.32$, $P = .001$). The means for women's sexual functioning at 6 months also significantly differed ($F(2,81) = 4.80$, $P = .011$) across sample 1 ($M = 16.48$, $SD = 5.70$), sample 2 ($M = 14.50$, $SD = 4.34$), and sample 3 ($M = 18.83$, $SD = 4.89$). There were no differences in partner perceptions of women's pain self-efficacy at 3 months ($F(2,88) = 1.31$, $P = .28$) and partner sexual functioning at 3 ($F(2,87) = 1.00$, $P = .37$) or 6 months ($F(2,85) = .28$, $P = .76$). We conducted a one-way ANOVA and chi square tests to examine any group differences in our demographic variables based on sample. There were no significant differences in age, sex, relationship duration, or income between samples. However, relationship status was found to be significantly different across samples ($\chi^2(8, 178) = 19.37$, $P = .013$). Thus, we controlled for sample and relationship status by entering them as separate covariates in all models.

Cross-sectional Analyses at 3-Months Postpartum

Model 1: Partner Accuracy and Bias at 3-Months Postpartum

Table 3 presents the results for partner accuracy and bias of women's pain self-efficacy at 3-months

postpartum. Partners were accurate in their perceptions of women's pain self-efficacy as demonstrated by a significant and positively signed slope of the truth force (ie, women's actual self-efficacy scores significantly predicted their partner's perceptions). However, partners also simultaneously underestimated women's pain self-efficacy, by approximately 12 points, as evidenced by a significant and negatively signed intercept. These effects remained significant when sample, women's self-reported pain intensity at 3 months, and relationship status were entered as covariates in the model.

Model 2: Associations Between Partner Bias and Women's Pain Intensity

Next, we tested whether partner estimation of women's pain self-efficacy was associated with women's pain intensity at 3-months postpartum by examining the direction and significance of the $a1$ to $a4$ coefficients using RSA analyses. As shown in Table 4 and Fig 1, there was a significant and negative value for the $a1$ coefficient, suggesting that when couples showed agreement on pain self-efficacy ratings, women reported more intense pain when the agreement was at lower levels of pain self-efficacy than at higher levels. In other words, agreement at lower (vs higher) levels of pain self-efficacy at 3-months postpartum was associated with greater pain intensity for women at 3-months postpartum. This finding held when controlling for sample and relationship status.

Model 3: Associations Between Partner Bias and Women's Sexual Functioning

We then examined the association between partner estimation and women's sexual functioning at 3-months postpartum. As shown in Table 4 and Fig 2, a significant and negative value for the $a1$ coefficient was observed. This value suggests that when couples showed agreement at lower levels of pain self-efficacy rather than at higher levels, women reported poorer sexual functioning. These results held when controlling for sample, women's self-reported pain intensity at 3 months, and relationship status.

Table 3. Model 1: Mean-Level Bias and Accuracy of Partner Perceptions of Women's Pain Self-Efficacy (N = 89 Couples)

	<i>B</i>	<i>SE</i>	<i>T</i>	95% <i>CI</i>	
				LOWER	UPPER
Intercept (Directional bias)	−11.81	2.50	−4.73***	−16.78	−6.85
Woman's own self-efficacy (Truth/Accuracy)	.37	.12	3.20**	.14	.60

** $P < .01$.

*** $P < .001$.

Table 4. Polynomial Regression Coefficients and Surface Values for Models 2–7 Using Response Surface Analysis

	POLYNOMIAL REGRESSION COEFFICIENTS						SURFACE VALUES			
	B_0	B_1W	B_2P	B_3W^2	$B_4W \times P$	B_5P^2	A_1	A_2	A_3	A_4
Model 2 ^a	5.62(.40)	-.04(.02)	-.01(.01)	.00(.00)	.00(.00)	.00(.00)	-.04(.02)**	.00(.00)	-.03(.03)	-.00(.00)
Model 3 ^b	22.23(.90)	-.08(.04)	-.06(.03)	-.00(.00)	.00(.00)	-.00(.00)	-.14(.04)***	-.00(.00)	-.02(.06)	-.00(.00)
Model 4 ^c	19.51(2.00)	-.21(.09)	-.23(.06)	.00(.00)	.01(.00)	.00(.00)	-.45(.08)***	.01(.00)***	.02(.13)	-.00(.00)
Model 5 ^d	3.50(.42)	-.05(.02)	-.01(.01)	.00(.00)	.00(.00)	.00(.00)	-.06(.02)**	.00(.00)	-.04(.03)	.00(.00)
Model 6 ^e	20.52(.88)	-.03(.04)	-.07(.03)	-.00(.00)	.00(.00)	-.00(.00)	-.10(.04)*	-.00(.00)	.04(.06)	-.005(.00)*
Model 7 ^f	18.98(2.55)	-.05(.11)	-.25(.08)	.00(.00)	.01(.00)	.00(.00)	-.30(.10)**	.01(.00)*	.20(.16)	-.00(.00)

NOTE. The coefficients from the polynomial regression are included because these values are used to calculate the surface values. The surface values provide us with information regarding our hypotheses. Standard errors for all coefficients are in brackets. W = woman, P = partner.

^aN = 89.

^bN = 87.

^cN = 88.

^dN = 74.

^eN = 82.

^fN = 86.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

Model 4: Associations Between Partner Bias and Partner Sexual Functioning

We examined the association between partner estimation and their own sexual functioning at 3-months

postpartum. A significant and negative value for the a_1 coefficient was observed (see Table 4 and Fig 3), suggesting that when couples showed agreement on pain self-efficacy ratings, partners experienced poorer sexual

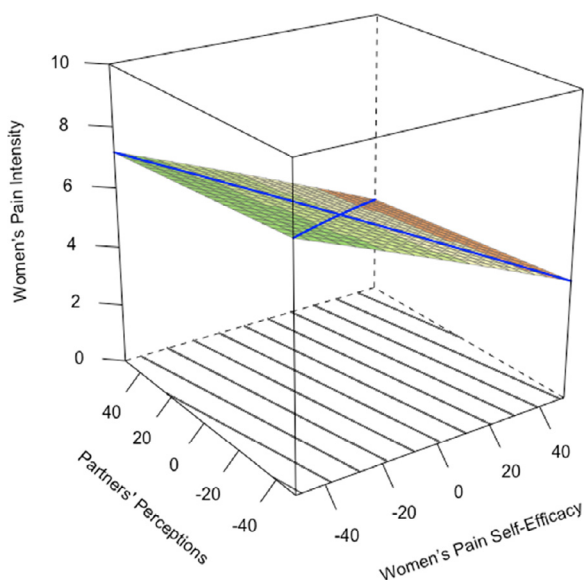


Figure 1. Response surface plot for the association between partner bias and women's pain intensity at 3 months. In relation to our results for a_1 , the vertical line (ie, the line of congruence) reflects the association between agreement and pain intensity. The top end (front most corner) of this line is at a higher value of pain intensity at 3 months. This indicates that greater agreement for lower levels of pain self-efficacy is associated with women's greater pain intensity than agreement for higher levels of pain self-efficacy. This response surface plot demonstrates the same pattern of results for women's pain intensity at 6 months (Model 5).

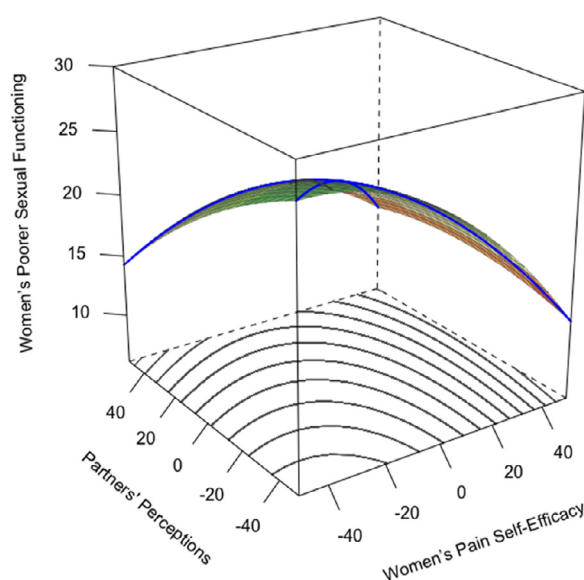


Figure 2. Response surface plot for the association between partner bias and women's sexual functioning at 3 months. Sexual functioning was reverse coded such that higher scores reflect poorer sexual functioning. In relation to our results for a_1 , the vertical line (ie, the line of congruence) reflects the association between agreement and sexual functioning. The top end (front-most corner) of this line is at a higher value of sexual functioning at 3 months. This indicates that greater agreement for lower levels of pain self-efficacy is associated with women's poorer sexual functioning than agreement for higher levels of pain self-efficacy.

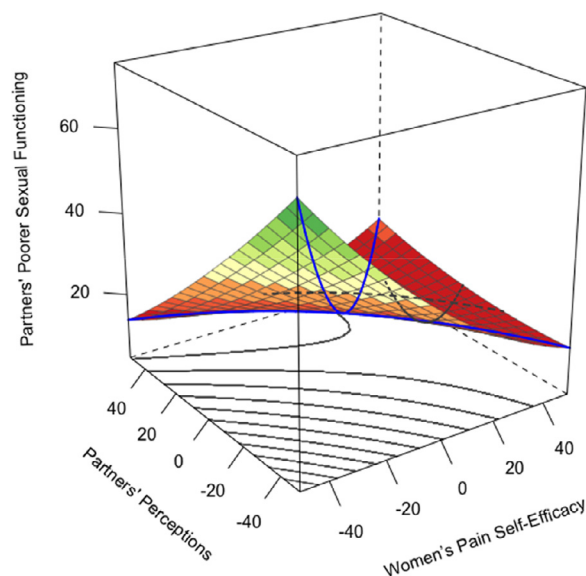


Figure 3. Response surface plot for the association between partner bias and partners' sexual functioning at 3 months. Sexual functioning was reverse coded such that higher scores reflect poorer sexual functioning. In relation to our results for a_1 , the vertical line (ie, the line of congruence) reflects the association between agreement and sexual functioning. The top end (front-most corner) of this line is at a higher value of sexual functioning at 3 months. This indicates that greater agreement for lower levels of pain self-efficacy is associated with poorer sexual functioning for partners, than agreement for higher levels of pain self-efficacy. a_2 tests whether the line of congruence is best represented by a curvilinear association. The significant and positive value of the a_2 coefficient indicates that this is the case and that partners' sexual functioning is poorer when couples agree at extreme levels of pain self-efficacy than at mid-range levels. This response surface plot demonstrates the same pattern of results for partners' sexual functioning at 6 months (Model 7)

functioning when they showed agreement for lower levels of women's pain self-efficacy relative to higher levels.

A significant and positive a_2 coefficient was also observed, suggesting that the association in a_1 is best represented by a nonlinear line. Thus, partners' sexual functioning was poorer when couples agreed at very high or very low levels of women's pain self-efficacy compared to mid-range values. These findings held when controlling for sample, women's pain intensity at 3 months, and relationship status.

Longitudinal Analyses for 6-Months Postpartum

Model 5: Partner Bias at 3 Months Predicting Women's Pain Intensity at 6 Months

We then tested whether partner estimation of women's pain self-efficacy at 3-months postpartum predicted women's greater pain intensity at 6-months postpartum. As shown in Table 4 and consistent with the findings at 3-months postpartum, there was a significant and negative value for the a_1 coefficient, suggesting that when couples showed agreement on pain self-efficacy ratings, women reported more intense pain when

the agreement was at lower levels of pain self-efficacy than at higher levels. In other words, agreement at lower (vs higher) levels of pain self-efficacy at 3-months postpartum predicted greater pain intensity for women at 6-months postpartum. This finding held when controlling for sample, women's self-reported pain intensity at 3 months, and relationship status. This pattern of results is the same as the depiction in Fig 1.

Model 6: Partner Bias at 3 Months Predicting Women's Sexual Functioning at 6 Months

Next, we examined partner estimation at 3-months postpartum as a predictor of women's sexual functioning at 6-months postpartum. In line with the cross-sectional findings, there was a significant and negative value for the a_1 coefficient (See Table 4; Fig 4). When couples showed agreement on pain self-efficacy ratings, women experienced poorer sexual functioning at 6-months postpartum when couples showed agreement for lower levels of pain self-efficacy rather than higher levels.

A significant and negative a_4 coefficient also emerged. This value suggests that women experienced poorer sexual functioning when there was more agreement between women's own reports and partner perceptions, contrary to our predictions. All results held when controlling for sample, women's pain intensity at 3 months, and relationship status. In order to more

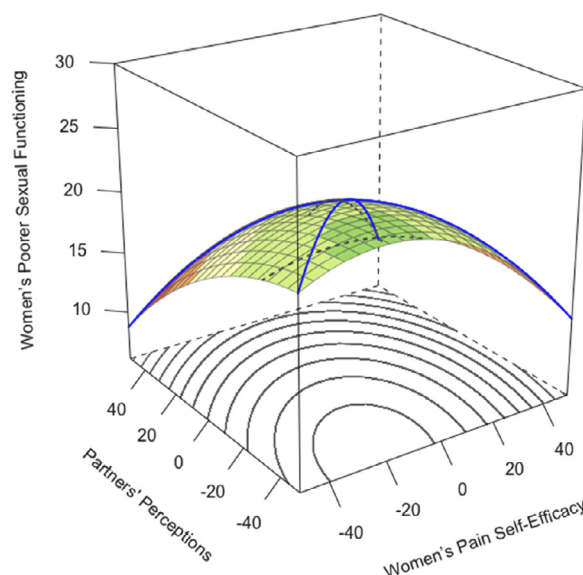


Figure 4. Response surface plot for the association between partner bias and women's sexual functioning at 6 months. Sexual functioning was reverse coded such that higher scores reflect poorer sexual functioning. In relation to our results for a_1 , the vertical line (ie, the line of congruence) reflects the association between agreement and sexual functioning. The top end (front-most corner) of this line is at a higher value of sexual functioning at 6 months. This indicates that greater agreement for lower levels of pain self-efficacy is associated with women's poorer sexual functioning than agreement for higher levels of pain self-efficacy. In relation to our results for a_4 , the line of incongruence (the curved horizontal line) indicates that women have higher values on sexual functioning (ie, poorer sexual functioning) the more partners' perceptions are in agreement with women's own self-efficacy.

conclusively demonstrate a congruency effect (ie, perfect agreement yields the lowest sexual functioning relative to any disagreement) we followed recent recommendations³⁷ that suggest also considering the a_5 coefficient,⁷⁹ or shifted ridge test⁵ versus interpreting an a_4 coefficient on its own. These analyses (see supplemental materials for more details) suggest that our model met the criteria for a congruency effect, confirming that perfect agreement is associated with the poorest sexual functioning. Taken together, results indicated that women's sexual functioning at 6 months is the poorest when partners agree with women's own ratings at low levels of pain self-efficacy.

Model 7: Partner Bias at 3 Months Predicting Partner Sexual Functioning at 6 Months

Consistent with that of the cross-sectional model of partner estimation and their own sexual functioning, there was a significant and negative value for the a_1 coefficient (see Table 4). This value indicates that when couples showed agreement on pain self-efficacy, partners experienced poorer sexual functioning if they showed agreement for lower levels of women's pain self-efficacy than higher levels. Thus, agreement at lower (vs higher) levels of pain self-efficacy at 3-months postpartum predicted poorer sexual functioning for partners 3 months later. As in the cross-sectional findings, there was a significant and positive a_2 coefficient, indicating that partners experience poorer sexual functioning when couples agreed at very high or very low levels of women's pain self-efficacy compared to moderate levels. These findings held when controlling for sample, women's pain intensity at 3 months, and relationship status. This pattern of results is the same as the depiction in Fig 3.

Discussion

Using a longitudinal dyadic design, this study examined whether partners were biased in their perceptions of women's pain self-efficacy for postpartum pain during intercourse and the consequences of this bias for women's pain and the sexual functioning of both members of a couple. Partners were generally accurate in their ability to estimate women's pain self-efficacy at 3-months postpartum. However, consistent with past research,^{31,59,74} they were also biased such that, on average, they underestimated women's pain self-efficacy. When couples showed agreement for lower (vs higher) levels of pain self-efficacy at 3-months postpartum, women reported greater pain and both members of the couple reported poorer sexual functioning at 3- and 6-months postpartum. This study extends the limited literature examining partner perceptions of pain self-efficacy by examining accuracy and bias within a dyadic and longitudinal design.

Although partners were generally accurate in their perceptions of women's pain self-efficacy, on average, they also tended to underestimate women's pain self-

efficacy (by an average of nearly 12 points out of 100). Thus, despite accurately ascertaining women to be above average on pain self-efficacy (for example), partners still perceived women to be less efficacious than the women themselves reported. Partners may observe the stressors of motherhood,^{25,57,60,77} including pain, leading them to underestimate women's pain self-efficacy. Increased communication about the challenges of coping with the pain may facilitate more accurate perceptions and improve couples' adjustment.^{63,67,68} This finding may also be interpreted in light of research indicating that partners tend to overestimate individuals' pain and disability.^{41,47,52} It is possible that partner underestimation of women's pain self-efficacy could be a result of partners' overestimation of the pain itself. Indeed, individuals with partners who overestimate their pain report less self-efficacy for managing their conditions.^{21,56}

Contrary to our hypotheses, partner underestimation was not linked to women's pain or couples' sexual functioning at 3- or 6-months postpartum. It is possible that the effect of underestimation may only exist through a specific mechanism (ie, indirect-only mediation), such as partner support or avoidance.^{51,94} It is also conceivable that underestimation of women's pain self-efficacy may be more relevant for other aspects of the couples' adjustment that were not assessed in the current study, such as pain avoidance, catastrophizing, and distress.^{12,65} Indeed, in the prior study examining effects of disagreement in dyadic perceptions of self-efficacy, disagreement was only related to greater distress in both members of the dyad.⁶⁵

Nonetheless, the current results suggest that agreement between partners regarding women's pain self-efficacy plays a larger role than under- or overestimation for women's pain and couples' sexual functioning. In fact, when couples' perceptions were aligned at lower levels of pain self-efficacy compared to higher levels, women reported greater pain intensity and couples reported poorer sexual functioning. These results are consistent with past research on the associations between self-efficacy, pain, and well-being. Specifically, greater pain self-efficacy—as reported by women or perceived by their partners—is a robust predictor of better outcomes for women with pain during intercourse^{10,23,24,48} and for both members of couples managing health conditions (eg, cancer, arthritis, heart failure, and stroke).^{33,42,58,64,70} The current results extend past research by demonstrating that having *both* members of a couple perceive high levels of women's pain self-efficacy may be beneficial for women's pain and the sexual functioning of each individual. Couples who are in agreement regarding women's greater ability to manage her pain may be more aligned in their coping efforts and ability to adapt their sexual activities to accommodate the pain (eg, focusing on nonpenetrative activities), thereby reducing women's pain and its interference to their overall sexual functioning. Moreover, partners whose perceptions are better aligned with women at higher pain self-efficacy may offer validation and support that is more in line with women's needs (eg, use of lubricants, changing sexual positions). Based on theory and past research,

greater partner support may reduce women's negative affect that arises during painful sexual interactions, which in turn could lower the intensity of their pain.^{16,49,90}

Unexpectedly, when couples demonstrated greater agreement for women's pain self-efficacy at 3 months as opposed to any level of disagreement—for both high and low self-efficacy—women reported lower sexual functioning at 6 months. Although high self-efficacy is typically beneficial, it is possible that when couples agree at high levels they feel pressure to resume regular sexual activity, neglecting other factors that interfere with sexual function during this period, such as fatigue, breastfeeding and changing roles and responsibilities.^{44,46,93} However, it is important to note that combined with the effect of agreement at lower levels of pain self-efficacy discussed earlier, findings suggest that strong agreement at low levels of pain self-efficacy is associated with women's poorest sexual functioning at 6 months. In line with Woby and colleagues' modified fear-avoidance model,⁹¹ when both members of a couple are not confident in the woman's ability to manage her pain, they may avoid sexual activity and experience greater anxiety. Avoidance and anxiety both reinforce and exacerbate disability, in the form of impaired sexual functioning, such as low desire, and arousal and orgasm difficulties.^{11,23,61} Moreover, avoidance of intercourse perpetuated by perceptions of low pain self-efficacy may reduce opportunities for women to practice and implement pain management strategies, increasing pain perception and enabling disability and disuse.

Agreement at moderate levels of pain self-efficacy (rather than very high or very low levels) was also linked with partners' greater sexual functioning at both 3- and 6-months postpartum. Since past research has shown that broad agreement on self-efficacy is important for individuals' distress and caregiver strain,⁶⁵ the current results provide a more nuanced depiction of partner estimation of pain self-efficacy by demonstrating that the consequences of agreement may differ at varying levels of pain self-efficacy. Overall, findings point to the importance of accounting for dyadic rather than individual perceptions in couples' adjustment to postpartum pain during intercourse.

This study represents an important methodological advancement of past research examining partner estimations of pain self-efficacy. The longitudinal dyadic design allowed us to examine the effects of agreement across the postpartum and incorporated the perspectives of both members of the couple. Improving upon prior methods, such as difference scores or correlations,^{56,65} this study utilized a more sophisticated statistical approach for simultaneously ascertaining accuracy and bias in one model. Using RSA, we had the unique capability of determining whether outcomes varied at different levels of pain self-efficacy and if one type of mis-estimation was more detrimental than the other (ie, under-estimation vs over-estimation).^{5,80} Combining data from multiple samples was necessary for the feasibility of accessing this targeted population and contributed to enhanced generalizability, however, there were differences between samples in terms of women's pain

self-efficacy and sexual functioning. Although we controlled for sample in our analyses, it is possible that there were other differences not captured by our study measures. Additionally, the majority of the couples were mixed-sex, married, and in a higher income bracket, limiting generalizability.

Nevertheless, the findings have important clinical implications and contribute to the limited literature on dyadic and psychosocial factors involved in postpartum pain during intercourse. Despite its high prevalence, postpartum pain during intercourse is an often ignored condition that may exacerbate the many novel stressors new parents experience in the transition to parenthood.^{1,25,77,92} The finding that agreement at lower levels of pain self-efficacy was linked with women's greater pain intensity and both partners' poorer sexual functioning highlights the potential utility of interventions that promote women's own and partners' perceptions of pain self-efficacy to improve their adjustment to postpartum pain. Given that partners' perceptions of women's pain self-efficacy were generally accurate, couples may work together to identify thoughts and behaviors that contribute to feeling more confident in their ability to manage the pain. Studies of psychological interventions for pain during intercourse outside of the perinatal period suggest that when women are provided with tools to better manage the pain (eg, enhanced sexual communication, challenging maladaptive cognitions, reducing avoidance, expanding sexual repertoire), they and their partners report greater perceptions of women's pain self-efficacy.^{8,13,20} Better alignment at moderate to high levels of pain self-efficacy (not low levels) may allow the couple to manage the pain more collaboratively.

In conclusion, partners of women with postpartum pain during intercourse exhibited both accuracy and bias in their perceptions of women's pain self-efficacy. The more couples agreed at lower versus higher levels of pain self-efficacy, the greater mother's pain intensity and the poorer the sexual functioning of both couple members. Future research should examine the mechanisms between couples' agreement of women's pain self-efficacy and couples' outcomes in the postpartum, such as avoidance and partner support. The current research identifies a novel interpersonal process—agreement of pain self-efficacy—that contributes to our understanding of the persistence of women's postpartum pain during intercourse and its sexual consequences for both members of a couple.

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Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jpain.2020.01.006>.

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