Supplementary Material for Bovbjerg DH, et al. Revised Manuscript:

"Persistent breast pain in post-surgery breast cancer survivors and women with no history of breast surgery or cancer: Associations with pain catastrophizing, perceived breast cancer risk, breast cancer worry, and emotional distress"

I. MATERIAL AND METHODS

A. Participants

Women were recruited from June 2009 to October 2012 at the Duke University Medical Center (DUMC) and the University of Pittsburgh Medical Center (UPMC). Eligibility criteria for the Survivor Group included: age 21 and older, treated with breast conserving surgery, within 6-15 months post-treatment, and diagnosis of stage I-IIIA breast cancer. Eligibility criteria for the Non-cancer Group included: age 40 and older, no history of cancer, and no prior breast surgery.

A total of 526 breast cancer survivors (Survivor Group) provided informed consent (participation rate 83.4%). Of the consented breast cancer survivors, 417 survivors were included in the final sample (1 withdrew, 83 were excluded, and 25 did not complete breast pain questions). A total of 643 women with no history of breast surgery or cancer (Non-cancer Group) provided informed consent (participation rate 83.9%). Of the consented women in the Non-cancer Group, 2 women withdrew from the study and 18 women were later excluded (i.e., were found to have a cancer history or prior breast surgery). Thirty-six women were excluded from the present analyses because they did not complete study questions regarding breast pain, resulting in a final sample of 587 women in the Non-cancer Group.

Breast cancer stage and treatment history in the survivor group were as follows: 61.9% of women had Stage I, 25.7% Stage II, and 11.8% Stage III breast cancer; 85.4% were ER/PR positive; 93.8% received radiation therapy; 44.1% received chemotherapy, and 78.2% were taking adjuvant endocrine therapy. Women were, on average, 10.3 months post-surgery (SD=1.9). The vast majority (92.8%) of survivors had sentinel lymph node biopsies, while 16.8% had axillary lymph node dissections. Lymphedema was reported by 10.8% of breast cancer survivors (see Supplementary Table A4 for more detailed information).

B. Procedures

Mammography clinic schedules and patient medical records were reviewed, under a HIPAA waiver, to assess eligibility. Potential participants were sent a letter from the breast imaging clinic introducing the study and providing contact information for research staff in the event they had questions about the study prior to their appointment or if they did not wish to be approached about the study on the day of their mammogram. Women were approached about the study upon completion of registration paperwork at the breast imaging clinics and informed consent procedures were performed in a private area. Following our previously published procedures [1, 2], information about breast pain, worry that breast pain indicates cancer, perceived breast cancer risk, depression and anxiety symptoms, and mammography-specific distress were obtained prior to the mammogram procedure; the pain catastrophizing scale was completed after the mammogram procedure; self-reported demographic information was collected at a convenient time during the appointment.

C. Self-report questionnaires

*Breast pain**:*** Three items adapted from the Brief Pain Inventory (BPI) [3] were used as a composite pain score of ongoing breast pain: we averaged ratings of worst breast pain intensity, average breast pain during the past month, and breast pain *right now* to increase reliability and responsivity [4]. Each of the three items was scored on a scale of 0 ('no pain') to 10 ('worst pain imaginable'). The BPI demonstrated adequate reliability and sensitivity in prior studies of mammography pain [5, 6]. Cronbach's alpha in this sample was .91. A single item assessed breast pain duration with answer choices of: 'less than 6 months', '6 to 12 months', 'more than 1 year', and 'most of my life'. Persistent breast pain was defined as the report of breast pain for at least 6 months. A composite pain score of three or higher on the BPI was used to operationalize clinically significant pain levels, consistent with prior studies [7-9].

Breast pain-related variables: In addition to intensity and duration of breast pain, participants rated pain unpleasantness, pain frequency, location of pain, pain interference, and medication use for breast pain. Pain unpleasantness during the past month was assessed with a visual analogue scale (100 mm line anchored by 'not bad at all' and 'most intense unpleasantness imaginable'). Frequency of breast pain was rated as never, less than monthly, every month, every week, every day, or every hour, (the latter two were combined for analyses). Women used a detailed map of the chest, shoulders, and upper arms to identify location of breast pain in the past month; for breast cancer survivors, pain was coded as being present on the treated side or the non-treated side of the body. In addition, women used full-body maps to indicate additional areas where they experienced pain during the past month. We tallied the number of non-breast areas marked on the full body map for each participant. Two items adapted from the BPI [3] were used to assess:

a) how much breast pain interfered with daily activities and b) how much pain interfered with sexual activities/intimacy in the past month. Both items were rated on 0 to 10 scales ranging from 0 ‘no interference’ to 10 ‘extreme interference’. The pain interference score is an average of the two items. The inter-item correlation was $r=.55$, $p<.001$. Finally, participants reported how often they took medications to relieve their breast pain (i.e., never, less than monthly, every month, or daily).

Depression and anxiety symptoms: The well-validated and widely-used Hospital Anxiety and Depression Scale (HADS) [10, 11] was administered to assess symptoms of depression (HADS-D) and anxiety (HADS-A). Each subscale includes 7 items; each item is rated on a 4-point scale that ranges from 0 to 3. Total subscale score range from 0 to 21 with higher scores indicating greater symptoms. The HADS-A and HADS-D demonstrate good internal consistency ($\alpha=.83$ and .82, respectively) [10]. Cronbach’s alpha was adequate in this sample (HADS-A $\alpha=.86$; HADS-D $\alpha=.80$).

Mammography-specific distress: A modified version of the Stanford Acute Stress Reaction Questionnaire (SASRQ) [2, 12] was used to assess mammography-specific distress. This 10-item scale assesses symptoms of acute distress including dissociation, intrusion, avoidance, and hyperarousal. The extent to which each symptom was experienced in the past week, including the day of the mammography appointment, was rated on a 6-point scale, ranging from 0 (‘not experienced’) to 5 (‘very often experienced’). Items are summed to create a total symptom score ranging from 0 to 50, with higher scores indicating more distress. The original SASRQ has demonstrated high internal consistency in women undergoing mammography ($\alpha=0.96$) and has

demonstrated adequate test-retest reliability (r=.78) [13]. The 10-item scale used in this study had a Cronbach's alpha of .91.

Pain catastrophizing: Pain catastrophizing specifically linked to the triggering stimulus of pain associated with breast compression during mammography was assessed with a modified version of the Pain Catastrophizing Scale (PCS) [14] following completion of the mammogram, consistent with our previous work [2]. The PCS is a 13-item questionnaire developed to identify catastrophic thoughts in relation to painful experiences. Items are scored on a five-point Likert scale ranging from 0 ('not at all') to 4 ('all the time'). Items were summed to create a total score ranging from 0 to 52. Higher scores indicate that more catastrophic thoughts are experienced. Sub-scores for rumination, magnification, and helplessness can also be produced. The total score and sub-scores of the PCS demonstrate good reliability (α=.93, .91, .75, and .87, respectively) [15]. Cronbach's alpha in the current sample was .92.

Perceived breast cancer risk: Self-reported breast cancer risk was assessed via a four-item perceived risk inventory that has been previously tested for validity and reliability [16] and here modified for use with breast cancer survivors (See Tables A1a & A1b). Participants rated each statement regarding perceived risk of cancer on a 7-point scale, ranging from 1 ('much below average/strongly disagree/no chance') to 7 ('much above average/strongly agree/certain to happen'). Ratings were summed to create a total perceived risk score ranging from 7 to 28. The perceived risk scale has demonstrated high internal consistency (α=.89) [16]. Cronbach's alpha in this sample was .92.

[INSERT TABLES A1a & A1b ABOUT HERE]

Breast cancer worry: A single item assessed how much women worried that breast pain might indicate breast cancer (unaffected women) or recurrence of breast cancer (survivors). See Table A2. Participants rated their worry on a scale of 0 (‘no worry’) to 10 (‘extreme worry’) [1].

[INSERT TABLE A2 ABOUT HERE]

D. Statistical analyses

Analyses were conducted using SPSS statistical software version 23 (IBM, Armonk, NY, USA). In addition to descriptive statistics, we conducted bivariate analyses (e.g., chi-square, analysis of variance, and independent t-tests as appropriate) to examine whether breast cancer survivor and non-cancer groups differed ($p<.05$) on demographic or medical variables. Four groups were compared: breast cancer survivors with persistent breast pain (PBP+ Survivor Group); breast cancer survivors without persistent breast pain (PBP- Survivor Group); women without histories of breast surgery or cancer with persistent breast pain (PBP+ Non-cancer Group); and women without histories of breast surgery or cancer without persistent breast pain (PBP- Non-cancer Group). Variables that differed ($p<.05$) by group in bivariate analyses were included as covariates in subsequent analyses; these included race (coded as 0=non-white; 1=white), age, Body Mass Index (BMI), education (coded as 0=vocational training or less education; 1=college degree or more education), and menopausal status (coded as 0=pre/peri-menopausal; 1=post-menopausal). We used logistic regression analyses to examine differences in presence of persistent breast pain for the Survivor Group versus the Non-cancer Group. Group differences in breast pain-related variables, symptoms of anxiety and depression, pain catastrophizing, mammography-specific distress, worry that pain indicates cancer, and perceived breast cancer

risk were examined using logistic regression, ordinal regression, and analysis of covariance (ANCOVA) models as appropriate. Pairwise group comparisons were examined using a Bonferroni correction (overall α=.05 for each dependent variable).

Structural equation modeling (SEM) was used to evaluate relationships between persistent breast pain, pain catastrophizing, worry that pain indicates cancer, perceived breast cancer risk, and emotional distress. Separate models were conducted for breast cancer survivors and women without histories of breast surgery or cancer using Mplus software, version 6.12. To estimate parameters, we used maximum likelihood estimation with robust standard errors and a mean- and variance-adjusted test statistic (i.e., MLMV) for variables with non-normal distributions (i.e., worry that pain indicates cancer) [17]. Emotional distress was represented as a latent construct in each model. Latent variables are unobserved variables that are implied by covariances among 2 or more indicators (i.e., observed variables) [18]. Three observed variables (i.e., levels of anxiety, depression, and mammography-specific distress symptoms) were used to create the latent emotional distress variable. The structure of the model appears in Figures 1 and A1. Each arrow in the model represents a hypothesis about relationships among the variables. Race, age, BMI, education, and menopausal status were included in each model as covariates because these variables were related ($p<.05$) to having persistent breast pain and the observed variables for emotional distress in bivariate analyses. Number of body pain locations (excluding breast) was also included as a covariate in the model to control for the potential relationships between other pain conditions and study variables. Direct paths were included in the model from each of the control variables to the emotional distress latent variable and the observed variables for worry, pain catastrophizing, and perceived risk. Disturbance terms were allowed to correlate for the

observed anxiety, depression, and mammography-specific distress variables. Finally, the Sobel test [19] was used to test the significance of the indirect effects. We also examined the significance of indirect effects using 95% confidence intervals [20, 21].

SEM tests the goodness of fit between the hypothesized model and the sample data. Several fit indices were used to examine model fit: root means square error of approximation (RMSEA; <.08 indicates acceptable fit), the standardized root mean square residual (SRMSR; <.08 indicates acceptable fit), and the comparative fit index (CFI; >.90 indicates acceptable fit) [22, 23]. We also examined total R^2 for each endogenous variable in the model.

II. RESULTS

A. Comparison of demographic and medical characteristics

Table A3 summarizes and compares demographic characteristics of the four groups defined with regard to breast cancer (Survivor Group vs. Non-cancer Group) and presence/absence of persistent breast pain (PBP+ vs. PBP-). These four groups significantly ($p<.05$) differed on age, BMI, race, education, and menopausal status. Pairwise comparisons between groups showed that the PBP+ Non-cancer Group was significantly younger and less likely to be post-menopausal than the other three groups. The PBP- Non-cancer Group was significantly younger and had more formal education than PBP- Survivor Group. The PBP- Non-cancer Group also had significantly lower BMI and were more likely to be African American/Black compared to PBP+ Survivor Group.

[INSERT TABLE A3 ABOUT HERE]

Table A4 summarizes and compares medical characteristics of PBP+ vs. PBP- women in the Survivor Group. PBP+ women in the Survivor Group were significantly more likely to have had a sentinel lymph node biopsy than those in the PBP- Survivor Group.

[INSERT TABLE A4 ABOUT HERE]

B. Persistent breast pain-related variables

Table A5 provides comparisons of PBP-related variables by the four groups defined by their breast cancer history and presence/absence of PBP. Pain intensity significantly differed across the four groups ($F(3,951)=192.3$, $p<.001$, $\eta^2=.4$). Group comparisons found that pain intensity did not differ between the PBP+ Survivor Group (M=2.4, SD=1.7) and PBP+ Non-cancer Group (M=2.1, SD=1.6). Pain unpleasantness significantly differed across groups ($F(3,911)=130.4$, $p<.001$, $\eta^2=.3$), and showed a pattern of differences similar to those found for pain intensity.

[INSERT TABLE A5 ABOUT HERE]

Ordinal regression models were conducted to examine whether breast pain frequency, breast pain duration, and use of medication for breast pain differed across the groups based on breast cancer history and presence of persistent breast pain. Each model controlled for age, BMI, education, race, and menopausal status. For breast pain frequency, group accounted for a significant amount of variance in breast pain frequency (Wald $\chi^2(3)=429.5$, $p<.001$, McFadden pseudo $R^2=.3$). Compared to the PBP+ Survivor Group, the PBP+ Non-cancer Group had less frequent breast pain (b= -0.9, SE=0.2, Wald $\chi^2(1)=15.7$, $p<.001$, OR=.4, 95% CI=.3 to .6).

For breast pain duration, analyses were limited to women with persistent breast pain to compare the duration of pain between the PBP+ Survivor Group and the PBP+ Non-cancer Group. Group based on cancer history accounted for a significant amount of variance in breast pain duration (Wald $\chi^2(1)=59.5$, $p<.001$, McFadden pseudo $R^2=.3$). Compared to the PBP+ Survivor Group, the PBP+ Non-cancer Group had longer durations of breast pain (b=3.1, SE=0.4, Wald $\chi^2(1)=59.4$, $p<.001$, OR=22.3, 95% CI=10.1 to 49.1) with 28.4% of breast cancer survivors and 91.3% of women without a cancer history having pain for more than 12 months. Frequency of medication use for breast pain did not differ between the PBP+ Survivor Group and PBP+ Non-cancer Group ($p=.85$).

Logistic regression analysis was conducted to examine group differences in pain interference controlling for age, BMI, education, race, and menopausal status. Pain interference did not differ between the PBP+ Survivor Group and PBP+ Non-cancer Group ($p=.33$). Women in the PBP- Survivor Group were more likely to report pain interference than those in the PBP- Non-cancer Group (OR = 8.9, CI=4.6 to 17.1, $p<0.001$).

In the PBP+ Survivor Group, 89.6% had pain in the treated breast, 19.9% had pain in the underarm of the treated side, 6.6% had lateral chest pain on the treated side, and 2.8% had pain in the center of the chest. Only 12.8% of women in the PBP+ Survivor Group reported also having pain on the untreated side of their bodies: 11.4% in the untreated breast, 1.9% in the underarm of the untreated side, and 1.0% had lateral chest pain on the untreated side. When asked about pain locations in the whole body, the PBP+ Survivor Group reported a mean count of 2.8 (SD=3.1) pain locations (other than the breast). In the PBP+ Non-cancer Group, 93.2%

reported pain in the breast tissue, 22.3% in the underarm, 5.8% had lateral chest pain, and 8.7% had pain in the center of the chest. The majority (81.7%) of women in the PBP+ Non-cancer Group reported experiencing bilateral breast pain. When asked about pain locations in the whole body, the PBP+ Non-cancer Group reported a mean count of 3.5 (SD=4.7) locations with pain (excluding the breast). The number of body locations with pain (excluding the breast) significantly differed across the four groups based on breast cancer history and presence of persistent breast pain ($F(3,951)=13.0$, $p<.001$, $\eta^2=.04$). Pairwise group comparisons found that the number of body locations with pain were significantly higher among women with persistent breast pain compared to those without persistent breast pain. Number of body locations with pain did not differ between the PBP+ Survivor Group and PBP+ Non-cancer Group.

C. Structural equation models

Factor loadings for the emotional distress latent variable ranged from .59 to .76 in the Survivor Group (see Figure 1). Loadings can be interpreted in a manner similar to conventional common factor analysis. These loadings are all in acceptable ranges with each item loading relatively highly on its respective latent variable [22]. Figure 1 displays the model for the Survivor Group with standardized path coefficients. We hypothesized that pain catastrophizing, worry, and perceived risk would mediate the relationship between PBP and emotional distress. Structural equation modeling allows for indirect effects to be calculated. If an indirect effect is statistically significant, it can be considered to support the hypothesis that a variable mediates the relationship between PBP and the dependent variable. The indirect effect of PBP on emotional distress *via pain catastrophizing* was statistically significant: PBP → pain catastrophizing → emotional distress ($\beta=.05$, 95% CI=.01 to .08, $Z=2.7$, $p=.008$). This indirect effect comprised

22% of the total effect of PBP on emotional distress. The indirect effect for PBP on emotional distress *via worry* was also statistically significant: PBP → worry → emotional distress (β=.15, 95% CI=.09 to .20, Z=5.2, $p< .001$). This indirect effect comprised 65% of the total effect of PBP on emotional distress. Consistent with the weak association found between PBP and perceived risk, the indirect effect for persistent breast pain on emotional distress *via perceived risk* was not significant ($p=.07$). We also hypothesized that worry and perceived risk would mediate the relationship between pain catastrophizing and emotional distress. The indirect effect for pain catastrophizing on emotional distress *via worry* was statistically significant: pain catastrophizing → worry → emotional distress (β=.10, 95% CI=.05 to .16, Z=4.0, $p< .001$). This indirect effect comprised 21% of the total effect of pain catastrophizing on emotional distress. The indirect effect for pain catastrophizing on emotional distress via perceived risk was also statistically significant, but was much smaller in magnitude: pain catastrophizing → perceived risk → emotional distress (β=.03, 95% CI=-.001 to .05, Z=1.9, $p=.06$). This indirect effect comprised 6% of the total effect of pain catastrophizing on emotional distress.

Figure A1 displays the model with standardized path coefficients for the Non-cancer Group. Factor loadings for the emotional distress latent variable ranged from .50 to .68 in the Non-cancer Group. The overall fit of our hypothesized model in the Non-cancer Group was acceptable. For the model conducted in the Non-cancer Group, RMSEA=.07, SRMR=.03, and CFI=.92. Overall, the proposed model accounted for 49% of the variance in emotional distress, 36% of the variance in worry, 9% of the variance in perceived risk, and 5% of the variance in pain catastrophizing. Having PBP was significantly related to higher pain catastrophizing (β=.16, $p=.002$), greater worry (β=.51, $p<.001$), and higher perceived risk (β=.15, $p=.001$). While path

coefficients indicated that PBP was not directly associated with emotional distress (β=-.09, *p*=.10), the total effect (including direct and indirect effects) for PBP indicated a significant positive relationship with emotional distress (β=.26, *p*<.001). Higher pain catastrophizing was directly related to greater worry (β=.12, *p*=.01) and greater emotional distress (β=.41, *p*<.001), but was not related to perceived risk (*p*=.35). Greater worry (β=.31, *p*<.001) and higher perceived risk (β=.21, *p*<.001) were significantly related to greater emotional distress.

[INSERT FIGURE A1 ABOUT HERE]

The indirect effect for PBP on emotional distress via pain catastrophizing was statistically significant: PBP → pain catastrophizing → emotional distress (β=.07, 95% CI=.02 to .11, Z=2.7, p=.007). This indirect effect comprised 27% of the total effect of PBP on emotional distress. The indirect effect for PBP on emotional distress via worry was also statistically significant: PBP → worry → emotional distress (β=.16, 95% CI=.08 to .24, Z=3.9, *p*<.001). This indirect effect comprised 62% of the total effect of PBP on emotional distress. The indirect effect for PBP on emotional distress via perceived risk was also statistically significant: PBP → perceived risk → emotional distress (β=.03, 95% CI=.006 to .06, Z=2.4, *p*=.02). This indirect effect comprised 12% of the total effect of PBP on emotional distress. Finally, the indirect effect for pain catastrophizing on emotional distress via worry was statistically significant: pain catastrophizing → *worry* → emotional distress (β=.04, 95% CI=.003 to .07, Z=2.1, *p*=.03). This indirect effect comprised 9% of the total effect of pain catastrophizing on emotional distress. The indirect effect for pain catastrophizing on emotional distress via perceived risk was not significant (*p*=.37).

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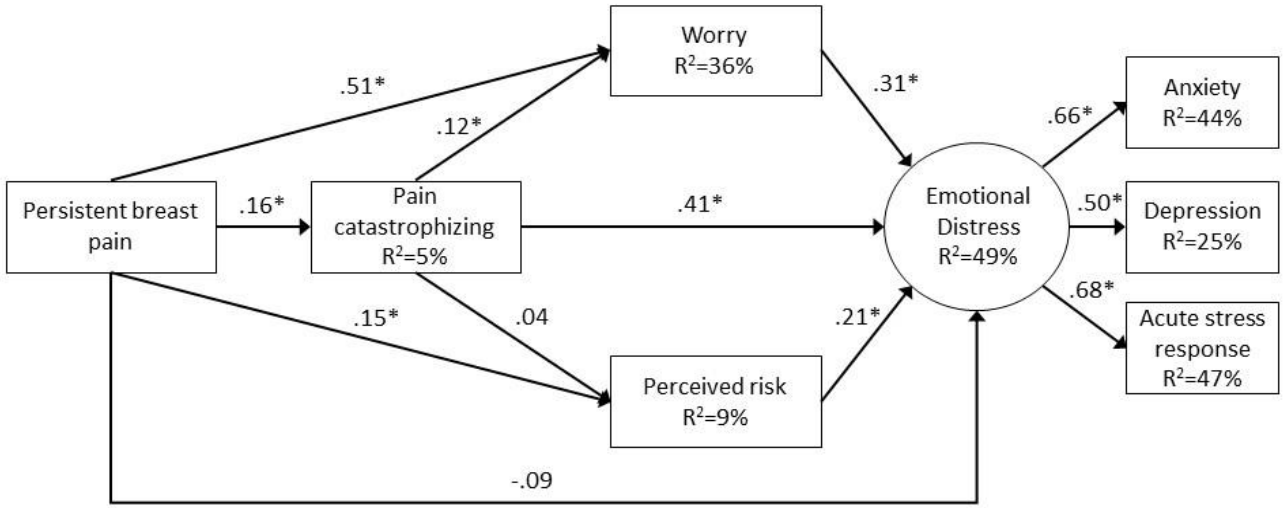
Supplemental Figure A1. Structural equation model for non-cancer group.



*p<.05.

Persistent breast pain total effect (including direct and indirect effects) = .26, p<.001

Note: Standardized path coefficients are displayed. Analyses included race (0=non-white, 1=white), age, BMI, education (0=no college degree, 1=college degree or more education), menopausal status (0=pre/peri menopausal, 1=post-menopausal), and number of body pain locations (excluding breasts) as covariates. Persistent breast pain group coded as 0=non-cancer group without persistent pain, 1=non-cancer group with persistent pain. Direct paths were included in the model from each of the control variables to the emotional distress latent variable and the observed variables for worry, pain catastrophizing, and perceived risk. Disturbance terms were allowed to correlate for the observed anxiety and depression variables, and the anxiety and mammography-distress distress variables.

Supplementary Table A1a. Survivor Group perceived breast cancer risk self-report questionnaire

1. Compared to other women your age what do you believe is the likelihood that you will develop a breast cancer recurrence in the future?						
Much Below Average						Much Above Average
1	2	3	4	5	6	7
2. I feel at risk for a breast cancer recurrence.						
Strongly disagree						Strongly agree
1	2	3	4	5	6	7
3. What do you think is your risk for developing a breast cancer recurrence in the future?						
No Chance						Certain to happen
1	2	3	4	5	6	7
4. The chances that I might develop a breast cancer recurrence are pretty high.						
Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Supplementary Table A1b. Non-Cancer Group perceived breast cancer risk self-report questionnaire

1. Compared to other women your age what do you believe is the likelihood that you will develop breast cancer in the future?						
Much Below Average						Much Above Average
1	2	3	4	5	6	7
2. I feel at risk for breast cancer.						
Strongly disagree						Strongly agree
1	2	3	4	5	6	7
3. What do you think is your risk for developing breast cancer in the future?						
No Chance						Certain to happen
1	2	3	4	5	6	7
4. The chances that I might develop breast cancer are pretty high.						
Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Supplementary Table A2. Breast cancer worry self-report questionnaire for Survivor Group (top) and Non-Cancer Group (bottom)

How much do you worry that your breast pain might indicate a recurrence of breast cancer? No Worry 0 1 2 3 4 5 6 7 8 9 10 Extreme Worry □ Please check here if you never experience breast pain
How much do you worry that your breast pain might indicate breast cancer? No Worry 0 1 2 3 4 5 6 7 8 9 10 Extreme Worry □ Please check here if you never experience breast pain

Supplementary Table A3. Sample description

	PBP+ Survivor Group (n=211)	PBP- Survivor Group (n=206)	PBP+ Non-cancer Group (n=103)	PBP- Non-cancer Group (n=484)
	M (SD)	M (SD)	M (SD)	M (SD)
Age*	58.6 (10.1)[a,c]	60.3 (12.1)[a]	54.7 (8.0)[b]	58.0 (9.2)[c]
Body Mass Index (BMI)*	30.0 (7.3)[a]	28.7 (6.3)[a,b]	29.0 (7.2)[a,b]	28.3 (6.6)[b]
	%	%	%	%
Education*	21.8[a,b]			
High school or less	26.5	28.6[a]	13.6[a,b]	20.2[b]
Some college or vocational training	23.7	19.4	20.4	21.2
College degree	26.5	28.2	31.1	23.5
Post graduate education	1.4	22.3	34.0	34.2
Unknown		1.5	1.0	0.8
Race*				
White	91.9[a]	85.4[a,b]	79.6[a,b]	78.4[b]
African American or Black	6.6	11.7	14.6	16.7
Asian	0.5	1.9	1.9	2.7
Other	1.0	0.5	1.0	1.6
Unknown	0	0.5	2.9	0.6
Married or partnered	68.2[a]	70.4[a]	71.8[a]	62.3[a]
Post-menopausal*	82.5[a]	83.0[a]	54.4[b]	76.5[a]

*p<.05 for comparison between breast cancer survivor groups and non-cancer groups. Common superscripts (a, b, c) for a variable across groups indicate no significant differences, whereas different superscripts for a variable indicate a significant difference. For comparisons a Bonferroni correction was used for each variable (i.e., α=.05/6=.008).

Supplementary Table A4. Survivor group diagnosis and treatment description

	PBP+ Survivor Group (n=211)	PBP- Survivor Group (n=206)
	%	%
Stage		
I	64.6	59.2
II	23.3	28.0
III	11.2	12.3
Unknown	0.9	0.5
ER/PR positive	86.3	84.5
Radiation therapy	94.8	92.7
Chemotherapy	43.1	45.1
Endocrine therapy	79.1	77.2
Sentinel lymph node biopsy*	96.2	89.3
Axillary lymph node dissection	15.6	18.0
Lymphovascular invasion	13.5	17.2
Lymphedema	13.2	8.8
	M (SD)	M (SD)
Lymph nodes assessed	5.5 (6.5)	5.4 (5.8)
Lymph nodes with cancer	0.5 (1.5)	0.5 (1.5)
Months post-surgery*	10.5 (1.7)	10.1 (2.1)

*$p<.05$ for comparison between breast cancer survivors with and without persistent breast pain. For comparisons a Bonferroni correction was used for each variable (i.e., $\alpha=.05/6=.008$).

Supplementary Table A5. Pain related variables: Comparison of breast cancer survivor group with persistent breast pain, breast cancer survivor group without persistent breast pain, non-cancer group with persistent breast pain, and non-cancer group without persistent breast pain

	PBP+ Survivor Group (n=211)	PBP- Survivor Group (n=206)	PBP+ Non-cancer Group (n=103)	PBP- Non-cancer Group (n=484)
	M (SD)	M (SD)	M (SD)	M (SD)
BPI breast pain intensity score (0-10 scale)*	2.4 (1.7)[a]	0.9 (1.5)[b]	2.1 (1.6)[a]	0.1 (0.7)[c]
Pain unpleasantness (0-100 scale)*	23.9 (20.3)[a]	8.8 (17.0)[b]	24.2 (23.1)[a]	1.5 (8.6)[c]
Body pain locations (excluding the breast)*	2.8 (3.1)[a]	1.9 (2.6)[b]	3.5 (4.7)[a]	1.7 (2.7)[b]
	%	%	%	%
Breast pain frequency*				
Do not have pain	0[a]	59.6[b]	1.0[c]	91.7[d]
Less than monthly	28.8	17.7	41.7	6.4
Monthly	19.2	5.4	34.0	0.6
Weekly	24.5	7.4	11.7	0.8
Daily	27.4	9.9	11.7	0.4
Use medication to relieve breast pain*				
Never	80.0[a]	90.7[b]	79.4[a]	98.9[c]
Once per month or less	12.1	6.9	17.6	1.1
Daily	7.3	2.5	2.9	0
Pain interferes with activities (% yes)*	36.0[a]	19.6[b]	35.9[a,b]	2.9[c]

*p<.05. Note: Unadjusted percentages and means displayed. Analyses included race (0=non-white, 1=white), age, BMI, education (0=no college degree, 1=college degree or more education), and menopausal status (0=pre/peri menopausal, 1=post-menopausal) as covariates. ANCOVAs were conducted for breast pain intensity and unpleasantness. Ordinal regression models were used for pain frequency, duration, and medication use. Logistic regression was used for pain interference. Common superscripts (a, b, c, d) for a variable across groups indicate no significant differences, whereas different superscripts for a variable indicate a significant difference. For comparisons a Bonferroni correction was used for each variable (i.e., α=.05/6=.008).