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Changes in sexual problems over time in women with and without early-stage breast cancer

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Abstract

Objectives—We aimed to evaluate whether age-matched women with and without early-stage breast cancer differentially experience sexual problems over time and whether changes in patients' problems differ by surgery type.

Methods—We conducted four interviews (4–6 weeks, 6 months, 1 year and 2 years) after surgery (patients) or a negative/benign screening mammogram (controls). Mixed-effects models with repeated ordinal measurements tested effects of time and diagnostic group (stages 0, I, IIA vs. controls) and, for patients, effects of time and type of surgery (mastectomy vs. lumpectomy), on a newly developed 9-item sexual-problems measure. Two-sided *P*-values < 0.05 were considered significant.

Results—Using data from 1033 women (17.3% stage 0, 33.4% stage I/IIA, 49.3% controls; mean age 57.1; 23.1% non-white; 64.7% married), two factors measuring problems with sexual attractiveness and sexual interest/enjoyment emerged in exploratory factor analysis ($\alpha \geq .74$ for each subscale and the 9-item measure). Patients and controls reported few sexual problems on average, but compared with baseline, controls were more likely to report sexual problems on the 9-item measure over time, and stage I patients were less likely to report problems with sexual attractiveness over time (each $P < 0.05$). Patients with mastectomy (35.7%) were 2.7 times more likely to report sexual problems on the 9-item measure at 2-year follow-up compared with baseline ($P = 0.0339$).

Conclusions—Patients and controls experienced few sexual problems over time and, in fact, controls were more likely to report sexual problems at subsequent interviews, whereas patients did not.

Keywords

Breast cancer; Sexual problems; Ductal carcinoma *in situ*; Healthy comparison groups; Quality of life

Sexual functioning in women with breast cancer has received considerable attention.^{1–7} Measures of sexual functioning have examined sexual desire, interest, attractiveness, arousal, orgasm, and satisfaction.^{6, 8–10} While various measures of sexual functioning have been used in studies of women with invasive breast cancer, studies have not compared sexual problems among women with ductal carcinoma *in situ* (DCIS), a pre-invasive breast cancer, women with early-stage invasive breast cancer (EIBC), and women of similar age without breast cancer over time. Sexual problem outcomes may differ among women with and without invasive breast cancer due to adjuvant treatment plans or type of surgery, yet little is known about these outcomes in non-invasive breast cancer patients.

Among the variables studied most often in relation to sexual functioning among breast cancer survivors is type of surgery, but studies have shown mixed results. Some studies have reported few or no differences in sexual functioning by type of surgery,^{11–14} whereas other studies have found that women who had breast-conserving surgery (BCS) reported greater sexual interest,^{2, 15} sexual activity,⁹ and enjoyment of one's sex life at various times after definitive surgery¹⁶ compared with women who had a mastectomy. In two cross-sectional studies, patients receiving mastectomy regardless of breast reconstruction reported greater problems with sexual attractiveness compared with patients receiving BCS,¹⁷ and patients with breast reconstruction reported less sexual activity and sexual responsiveness compared with patients having BCS or mastectomy without reconstruction in patients with locally advanced breast cancer.¹⁸ In a more recent longitudinal study, sexual pleasure scores were found to have increased for all three surgical groups over a two-year follow-up period in patients with early-stage breast cancer.¹⁹ Given the mixed findings from cross-sectional and longitudinal studies and the lack of a comparison group of same-aged women without breast cancer in many of these studies, we examined how type of surgery affects sexual problems longitudinally in early-stage breast cancer patients.

Although women with DCIS and EIBC receive similar surgical treatment options,^{20, 21} and women with DCIS generally have an excellent prognosis,²² it is unknown whether various surgical treatments differentially affect psychosocial outcomes (e.g., sexual problems) in women with DCIS and women with EIBC. Little is known about psychosocial outcomes in DCIS survivors, and few studies have examined sexual problems in women with DCIS.^{23–25} Previous studies either contained small samples of patients with DCIS^{24, 25} or did not include women with invasive breast cancer.^{23, 24} A few cross-sectional studies examined sexual-functioning outcomes in patients and healthy comparison groups,^{3, 6} but to our knowledge, there have been no longitudinal cohort studies comparing sexual problems in women with DCIS, women with EIBC, and a comparison group of women without breast cancer.

Therefore, we conducted a longitudinal study to examine changes in sexual problems in women with DCIS and EIBC and in same-aged women without breast cancer (controls). Although measures of a variety of sexual problems,^{8, 10, 26–30} had been developed at the time the study was initiated, there were no validated, brief multi-item measures available that measured perceived sexual problems in both breast cancer patients and controls and that distinguished specifically between two aspects of sexual problems of particular relevance to breast cancer survivors after surgical treatment – problems with sexual interest/enjoyment and with sexual attractiveness. We sought to assess the psychometric properties of our new measure of sexual

problems and to identify differences in sexual problems by diagnostic group (DCIS, stage I, stage IIA, and controls) and, in patients only, by type of surgery (BCS and mastectomy with or without reconstruction).

METHODS

Participants

The sample included women who were prospectively enrolled between October 2003 and July 2007 in a longitudinal study evaluating quality of life in women with and women without breast cancer. Potential participants with DCIS or stage I or stage IIA invasive breast cancer were identified with the assistance of their breast surgeons, medical oncologists, or radiation oncologists at the Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine and at Saint Louis University School of Medicine in Saint Louis, Missouri. Potential participants in the control group (i.e. women without breast cancer recruited during the same time period) were identified two weeks after a normal/benign screening mammogram at the Breast Health Center of the Siteman Cancer Center and were frequency-matched by age group (40–49, 50–69, 70 and older) to patient participants. Since DCIS is primarily identified on screening mammogram³¹ and since screening mammography was recommended for women age 40 and older at the time we enrolled participants,³² we limited our sample to women 40 and older. Women with DCIS or invasive breast cancer were included if they (a) had a first primary *in situ* or invasive breast cancer, (b) had completed their definitive surgical treatment (patients) or screening mammogram (controls), (c) had not received neoadjuvant chemotherapy, (d) spoke English, (e) and had no evidence of cognitive impairment (i.e. scored <11) on the Orientation-Memory-Concentration Test,³³ which was administered to women 65 years of age or older to screen for eligibility.

Procedures

This study was approved by the Institutional Review Boards at Washington University School of Medicine and Saint Louis University School of Medicine. Specially trained interviewers obtained informed consent and administered computer-assisted telephone interviews 4–6 weeks (T1), six months (T2), one year (T3), and two years (T4) following participants' definitive surgery (patients) or routine screening mammogram (controls). During the telephone interviews, we collected demographic data and administered newly developed measures of sexual problems, menopausal symptoms, side effects of surgery, and body image as well as previously validated measures of depression, comorbidity, and state anxiety. All items developed for this study were worded so that women with and without breast cancer could respond to the questions. We obtained patients' clinical data from the medical record.

Measures

Sexual problems—We developed nine items to measure various aspects of women's sexual problems “during the past month,” including problems with an interest in sex, feelings of sexual attractiveness, and ability to enjoy sexual relations (arousal, pain/discomfort, orgasm, and satisfaction) based on the available literature when we designed our feasibility study in 2000.^{8, 10, 27, 29, 30} Responses used a 4-point scale ranging from “not a problem” (1) to “very much a problem” (4), so that higher mean scores indicated more sexual problems. Mean scores were computed for participants answering at least 50% of the sexual-problem items at each interview. In addition, we asked whether or not they had been sexually active in the past six months, because unlike other studies,^{8, 30} we wanted to evaluate these sexual problems regardless of whether a participant reported being sexually active, as perceived sexual problems may contribute to some participants' lack of sexual activity.

To validate our newly developed measure, we also used two items on the Functional Assessment of Cancer Therapy-Breast (FACT-B) measure,³⁴ “You feel sexually attractive” and “Regardless of your current level of sexual activity, please answer the following question: You are satisfied with your sex life.” The FACT-B asks respondents “how true each statement has been for you during the past 7 days” with responses ranging from “not at all” (0) to “very much” (4).

Body image problems—Since studies have shown significant associations between body image and sexual functioning,^{2, 35–37} we also developed a set of eight body image questions, which were based on the literature^{10, 29, 38} and could be answered by patients as well as controls. We asked about being self-conscious or embarrassed about one’s body and problems with clothing fit or appearance. Participants rated the extent to which each statement applied to them in the last month using a 5-point scale ranging from “not at all” (1) to “all of the time” (5). Higher mean scores indicated poorer body image (i.e., more body image problems).

Depressed mood—Since depressed mood has been associated with worse sexual functioning,^{39, 40} we used the validated 20-item Center for Epidemiologic Studies Depression (CES-D) Scale⁴¹ to measure the extent to which participants experienced depressive symptoms “during the past week.” Each item was scored from “rarely or none of the time” (0) to “most or all of the time” (3). After reverse coding four items, a total score was computed, with higher scores indicating greater depressed mood.

State anxiety—The *Beck Anxiety Inventory*[®] (BAI[®]) is a validated 21-item scale measuring the severity of anxiety symptoms experienced in the past week.⁴² Items were rated on a 4-point scale from “Not at all” (0) to “Severely, I could barely stand it” (3). A total score was computed with higher scores indicating greater levels of state anxiety.

Menopausal symptoms and surgical side effects—We developed a list of menopausal symptoms and side effects of surgery based on collaborating physicians’ anecdotal reports and published reports of breast cancer patients’ symptoms⁴³ and surgical side effects.¹⁰ Using a 5-point scale ranging from “not at all” (1) to “very much” (5), we asked all participants about the severity of four menopausal symptoms “in the last month,” including hot flashes, cold sweats, night sweats, and vaginal dryness, which may be experienced/reported by healthy mid-aged women as well as breast cancer patients receiving chemotherapy or endocrine therapy. Using the same response choices, we asked patients about the severity of eight commonly reported side effects of breast cancer surgery, including limited arm mobility/frozen shoulder, tightness/tenderness in chest wall, tightness/tenderness/discomfort in the breast, arm weakness, lymphedema/swelling of the arm, swelling of the chest/breast/axilla, numbness/tingling or pins and needles, and tightness/pulling/stretching in the arm/axilla. Higher mean scores for each scale indicated more severe symptoms or side effects. Previous studies have shown that breast-related⁴⁴ and menopausal symptoms^{2–4, 6, 45–47} have been associated with worse sexual functioning.

Comorbidity—Using Katz’s validated adaptation of the Charlson comorbidity index⁴⁸ we measured participants’ history and presence of comorbid conditions. Each condition is weighted with higher scores indicating a greater comorbidity.

Clinical and demographic data—In addition to the psychosocial measures described above, patients’ clinical data, including pathological stage (DCIS, stage I, or stage IIA), type of definitive surgery (BCS or mastectomy with or without reconstruction), and receipt of radiation, chemotherapy, and endocrine therapy (tamoxifen, aromatase inhibitors) were obtained from surgical pathology reports and the medical record, since side effects of these

treatments might affect sexual functioning, symptom reporting, and other psychosocial outcomes.^{3, 12, 49–55} During the interviews, we also obtained demographic information, including age, marital and employment status, education, race, annual household income, participants' height and weight to compute body mass index (BMI), and menopausal status (pre-menopausal, post-menopausal, don't know).

Data analysis

The factor structure of each of the newly developed measures (i.e., sexual problems, severity of surgical side effects, severity of menopausal symptoms, and problems with body image) was analyzed using exploratory principal components analysis with varimax rotation at each interview. We used Lautenschlager's parallel analysis criteria⁵⁶ to determine the number of factors and Cronbach's alpha to measure the internal consistency of items on each measure at each interview.

Because the distribution of the new measure of sexual problems was skewed, we ran nonparametric univariate tests to identify significant covariates ($P < 0.05$) of sexual problems to be included in our multivariable analysis and to measure the convergent and discriminant validity of the new sexual problems measure. We used Kruskal-Wallis tests to evaluate the significance of differences in sexual problems by diagnostic group (DCIS, stage I, stage IIA, controls), race (white vs. non-white), marital status (married vs. unmarried), post-menopausal status (yes vs. no), being sexually active in the last six months (yes vs. no), and, in breast cancer patients only, by type of surgery (BCS and mastectomy) and receipt of adjuvant radiation, chemotherapy, and endocrine therapy (tamoxifen or aromatase inhibitors). We examined whether sexual-problem scores differed between patients who had mastectomies with or without breast reconstruction or between patients who had unilateral or bilateral mastectomies to justify combining all women with mastectomies in one group. Chi-square tests examined the associations among the categorical variables; Spearman *rho* (*rs*) correlations examined relationships among the continuous variables (sexual problems, age, BMI, depressed mood, anxiety, surgical side effects, menopausal symptoms, comorbidity, and body-image problems). We examined associations among the various predictor variables of interest and excluded some correlated variables from the multivariable mixed models to avoid overfitting the data based on their associations with each other and with the dependent variables of interest.

Since the distribution of responses to the new sexual-problems measure was skewed, mean sexual problems scores were categorized into an ordinal-scaled measure of sexual problems with three levels for the multivariable analysis. Continuous sexual-problems scores less than 1.5 were categorized as "not a problem" (1). Scores ranging from 1.5 to less than 2.5 were categorized as "a little of a problem" (2). Finally, sexual problems scores greater than or equal to 2.5 were categorized as "somewhat or very much of a problem" (3). Independent predictors of the ordinal-scaled measure of sexual problems were identified using an ordinal random-effects regression model that was based on the proportional odds assumption and considered the correlation between the repeated measurements of a subject across time.^{57, 58} PROC NLMIXED in SAS was used to fit random-effects regression models with repeated ordinal measurements.^{59, 60} To determine if the trend of sexual problems for women differed among the diagnostic groups (DCIS, stage I, stage IIA, controls), the diagnostic-group-by-time interaction term was included in the multivariable model. For breast cancer patients only, we examined the trends of scores for sexual problems for women with different types of surgery (mastectomy and BCS) by incorporating the type-of-surgery-by-time interaction term into the multivariable model. Inclusion of missing data is allowed in the random-effects regression model because PROC NLMIXED uses a likelihood-based estimation method that does not require complete data for all time points.⁵⁷ Analyses were performed using SPSS v. 16.0 (SPSS

Inc., Chicago, IL) and SAS v. 9.12 (SAS Institute, Cary, NC). Statistical tests were two-sided and $P < 0.05$ was considered significant.

RESULTS

Of 1718 eligible patients and controls invited to participate, we enrolled 549 (71.1% of 772) patients and 547 (57.8% of 946) controls in the study, and they completed the first telephone interview between October 2003 and July 2007. A greater proportion of participants compared with non-participants were white (76.2% vs. 59.0%; $P < 0.001$) and married (61.1% vs. 49.9%; $P < 0.001$). Participants and non-participants did not differ significantly by age ($P = 0.073$) or, in patients only, by pathologic cancer stage ($P = 0.837$) or type of surgery (BCS vs. mastectomy; $P = 0.095$).

Of the 1096 participants who completed the first interview, 25 patients and 38 controls were excluded from this analysis because they responded to less than 50% of the sexual-problem items in all four interviews. These women were more likely to be older (mean age 68.1 vs. 57.1 years; $P < 0.001$) and non-married (12.4% vs. 1.5%; $P < 0.001$) compared with women who answered at least 50% of the sexual-problem items in at least one of the interviews. Thus, we included in our analysis 524 patients and 509 controls who completed at least 50% of the sexual-problem items during one or more of the four telephone interviews.

Of the 1033 participants with sexual-problems data who completed one or more telephone interviews, 1005 participants completed the second interview, 989 participants completed the third interview, and 959 women completed the fourth and final interview. Attrition overall was low at 7.2% (33 patients, 41 controls); available data for these women were included in the analysis. Women who dropped out of the study after the first interview were not significantly different in terms of age or diagnostic group from women who completed follow-up interviews, but they were more likely to be non-white ($P < 0.001$) and unmarried ($P = 0.001$). Descriptive statistics of the 1033 participants included in the analysis are shown in Table 1. Interviews were completed a mean 6.7 weeks (T1), 6.2 months (T2), 12.3 months (T3) and 24.4 months (T4) following patients' definitive surgery or controls' screening mammogram. Mean age at enrollment was 57.1 (SD = 10.2, range 40–89) years; 71.7% of participants were post-menopausal at enrollment, and 632 (61.2%) reported being sexually active in the past six months (Table 1). Most participants were white (76.9%), married (63.7%), had completed at least some post-secondary education (71.7%), worked at least part-time (55.6%). Among the 524 patients, 28.7% of 265 stage I patients received mastectomy compared with 39.7% of 179 DCIS patients and 50.0% of 80 stage IIA patients ($P = 0.001$).

Factor Analysis of Newly Developed Measures and Scale Reliabilities

In the principal components factor analysis, a two-factor solution consistently emerged at each of the four telephone interviews for patients and controls – a 6-item subscale measuring perceived problems with sexual interest/enjoyment and a 3-item subscale measuring perceived problems with sexual attractiveness (first interview responses shown in Table 2). Items on each subscale and on the 9-item overall measure demonstrated high internal consistency, with Cronbach's alphas ranging from .74 to .76 for the problems-with-sexual-attractiveness subscale, from .85 to .87 for the problems-with-sexual-interest/enjoyment subscale, and from .84 to .87 for the 9-item sexual problems measure at each of the four interviews. A single-factor solution was obtained in separate factor analyses of each of the eight surgical side effects items, the four menopausal symptoms items, and the eight body-image problems items (Appendix A). Cronbach's alpha varied between .77 and .84 for the surgical-side-effects scale (patients only), between .70 and .72 for the menopausal-symptoms scale, and between .87 and .88 for the body-image problems scale at each of the four interviews. Reliabilities of previously

validated measures of depressed mood (alpha range .91–.92) and state anxiety (alpha range .86–.88) were high at each interview.

Since the internal consistencies of the two subscales measuring problems with sexual interest/enjoyment and problems with sexual attractiveness and the 9-item overall measure of sexual problems were sufficiently large to justify use of any one of them as a separate measure, we conducted our analyses using all three measures as outcomes of interest. Mean scores were computed for participants who responded to at least 50% of the items on each subscale and on the 9-item measure at any interview.

The numbers of women who had sexual-problems data available for analysis varied at each interview for the three sexual-problems measures as follows: 880–898 women at T1; 833–859 women at T2; 812–854 women at T3; and 793–820 women at T4. Women who were missing at least one sexual-problems score at any interview were significantly more likely to have reported more severe depressed mood and anxiety and to have been non-white, unmarried, older, and not sexually active in the past six months than women who had all three sexual-problems scores at all four interviews (each $P < 0.01$). There were no significant differences by type of surgery between women who were missing sexual-problems scores for at least one interview and women who had sexual-problems scores at every interview, but fewer women with DCIS had missing sexual-problems scores compared with the other diagnostic groups ($P = 0.012$).

Univariate analyses of sexual-problems outcomes

Univariate tests were run to identify variables to include as covariates in the multivariable mixed models and to measure the convergent and discriminant validity of the new sexual problems scales (Tables 3 and 4). Since there were no significant differences in any of the three sexual-problems scales between patients who had mastectomies with or without breast reconstruction or between patients who had bilateral or unilateral mastectomy (data not shown), we combined all of these patients in one mastectomy group to compare with BCS. Patients who received a mastectomy reported more sexual problems on the 9-item measure and more problems with sexual attractiveness at all interviews than patients who received BCS (each $P < 0.05$); problems with sexual interest/enjoyment differed significantly by type of surgery only at T4 ($P = 0.032$). Patients who received adjuvant chemotherapy reported more sexual problems on the 9-item measure and more perceived problems with sexual attractiveness and sexual interest/enjoyment at one or more of the four interviews ($P < 0.05$). Patients who received adjuvant radiation therapy ($N = 333$) and who were receiving endocrine therapy (tamoxifen or aromatase inhibitors; $N = 327$) reported fewer problems with sexual attractiveness at one or more of the four interviews compared with patients who had not received these adjuvant treatments (each $P < 0.05$). In at least one interview, women who were married and who were not sexually active reported more problems with sexual interest/enjoyment and sexual attractiveness, respectively, compared with women who were not married or who were sexually active (each $P < 0.05$). The likelihood of being sexually active in the past six months declined over time with older age (each $P < 0.001$).

Table 4 shows the Spearman ρ correlations between each of the three sexual-problems outcomes and the continuous variables at T1. The correlation coefficients at the three subsequent interviews were similar in magnitude and direction to those at T1 (data not shown). In addition, to evaluate the construct and discriminant validity of the new sexual-problems scales, we measured the correlations between each scale and two items from the FACT-B: “You feel sexually attractive” and “You are satisfied with your sex life.” As shown, these variables were moderately correlated with each of the three sexual problems outcomes, indicating they are measuring related but different constructs.

Menopausal status and comorbidity were not included in the multivariable regression models due to potential over-fitting of data, since being postmenopausal was positively associated with age and severity of menopausal symptoms at T1 (each $P < 0.001$) compared with being premenopausal, and comorbidity, which was very low among all participants (Table 1), was positively associated with BMI and age at each interview (each $P < 0.05$). Employment status and education were not significantly associated with the 9-item overall measure of sexual problems or either subscale at any interview and were not included as covariates in the multivariate models. Although race and annual household income were associated with sexual problems, we did not include them in the multivariable models to avoid overfitting the data, because they also were associated with several variables that we deemed more relevant to our outcome and amendable to potential intervention; women who were nonwhite and who had a lower annual household income reported greater depressed mood and anxiety and were less likely to have been sexually active in the past six months and married (each $P < 0.001$) at T1.

Change over time in sexual problems by diagnostic group—Using a mixed-effects regression model with repeated ordinal measurements, we analyzed change in each of the three ordinal-scale measures – the 9-item– sexual-problem measure and two subscales measuring problems with sexual attractiveness and problems with sexual interest/enjoyment – by diagnostic group (DCIS, stage I, stage IIA, controls). In these models, we controlled for variables significantly associated with one or more of the three sexual problems outcomes in unadjusted tests (age, marital status, body image, BMI, being sexually active, menopausal symptoms, depressed mood, and state anxiety). As shown in Table 5, controls were more likely to report sexual problems on the 9-item measure (T2–T4), on the problems-with-sexual-attractiveness subscale (T4), and on the problems-with-sexual-interest/enjoyment subscale (T3–T4) each compared with T1. Patients with stage I breast cancer were less likely to report problems with sexual attractiveness at T2–T4 compared with T1. Patients with DCIS and with stage IIA breast cancer were neither more nor less likely to report changes over time in problems with any of the three sexual-problems outcomes compared with their measures at T1. In addition, patients with DCIS and stage IIA breast cancer did not differ significantly from controls at T1 in terms of any of the sexual-problems outcomes; however, patients with stage I breast cancer were 2.7 times more likely at T1 to report problems with sexual attractiveness compared with controls. Covariates associated with greater likelihood of reporting problems on all three of the sexual problems outcomes included greater severity of menopausal symptoms, problems with body image, and depressed mood; not being married was associated with lower likelihood of reporting problems on all three of the sexual-problems outcomes. Older women were less likely to report problems with sexual attractiveness, and women who were not sexually active in the past six months were more likely to report sexual problems on the 9-item measure and on the problems-with-sexual-attractiveness subscale.

Change over time in sexual problems by type of surgery among DCIS and EIBC patients—Among the patients only, we measured the effect of type of surgery (BCS or mastectomy) on each of the three ordinal-scaled sexual-problems measures controlling for variables that were associated with any of the three newly developed sexual-problems outcomes in univariate tests. Receipt of radiation therapy was not included in this patient-only model because of collinearity with type of surgery (standard of care is BCS with radiation). Additionally, patients' stage at diagnosis was not included in this model because of collinearity with receipt of chemotherapy (none of the DCIS patients received chemotherapy). As shown in Table 6, patients who had a mastectomy were more likely to report sexual problems at T4 compared with T1, but no other significant surgery-by-time interaction effects were observed. There also were no significant main effects of type of surgery at T1. In the patient-only models, more problems with body image and greater severity of depressed mood were associated with greater likelihood, and not being married was associated with a lower likelihood, of reporting

problems with each of the three sexual-problems outcomes. In addition, patients who reported more severe surgical side effects were more likely to report sexual problems on the 9-item measure and on the sexual interest/enjoyment subscale; and patients who were not sexually active in the past six months were more likely to report sexual problems on the 9-item measure and on the problems-with-sexual-attractiveness subscale.

DISCUSSION

We administered a newly developed 9-item questionnaire about sexual problems to women with and without early-stage breast cancer in a longitudinal quality-of-life study. Two factors emerged in a principal-components factor analysis, and these subscales as well as the 9-item measure were found to be reliable using Cronbach's alpha at each of the four interviews during the follow-up period. More problems with sexual attractiveness and sexual interest/enjoyment were positively correlated with measures of body image problems, menopausal symptoms, experience of surgical side effects, state anxiety, and depressed mood; more problems with sexual attractiveness also was associated with higher BMI. Correlations between each of the three sexual-problem outcomes and these other measures provide evidence of the discriminant validity of the new measures, since the magnitude of the correlations were moderate to low. The correlation between problems with sexual interest/enjoyment and problems with sexual attractiveness, too, was only moderate in size, indicating that they were measuring different constructs. The measure of problems with sexual attractiveness was most highly correlated with body-image problems ($r_s = .512$) and with the FACT-B item "You feel sexually attractive" ($r_s = -.470$), indicating that they measure something similar; but the coefficients were not high enough (at least .75) to indicate they measured the same construct.⁶¹

We intended to develop a brief measure of two distinct aspects of sexual problems – problems with sexual attractiveness and with sexual interest/enjoyment – in women with or without breast cancer, regardless of whether or not they were sexually active. Sexual problems were of interest to the larger parent study in so far as this construct might be associated with breast cancer patients' and controls' quality of life. We did not intend to develop a measure of sexual dysfunction based on the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria,⁶² although one such measure was developed after we began to recruit participants in August 2003.⁶³ But a similar measure to ours had not been developed when we began the study. The results of our study suggest our newly developed multi-item sexual-problems measure is a brief tool that distinguishes between perceived problems with sexual attractiveness and problems with sexual interest/enjoyment and can be administered to women with or without early-stage cancer. Further validation of our new sexual-problems measure using other validated measures of sexual problems is recommended.

In this study, problems with sexual attractiveness and sexual interest/enjoyment were relatively low across all patients and controls and worsened nominally for all four groups, but worsened significantly over the two years of the study for controls only (Table 5). This worsening in sexual problems is similar to findings of earlier longitudinal studies of breast cancer patients.^{5, 12, 14} Although Ganz et al¹³ reported no change over time in problems related to interest in and performance of sexual activity within the first year after surgery, they found a significant worsening in patients' interest in and performance of sexual activity two and three years following surgery.¹⁴ A decrease in satisfaction with one's sex life five months following surgical treatment for early-stage breast cancer also has been observed.¹² However, none of these studies included same-aged control groups with whom to compare patients' experiences. Our results are important in that we longitudinally tracked early-stage breast cancer patients and women of the same age without breast cancer and found that both patient and control

groups similarly experienced relatively few problems with sexual functioning and that these problems increased similarly, albeit nominally, in both patients and controls over time.

We found that women with stage I breast cancer were less likely to report problems with sexual attractiveness in subsequent interviews compared with T1, but they were more likely to report problems with sexual attractiveness than controls at T1. This finding may be attributed to type of surgery (Table 1), since 39.7% of DCIS patients and 50.0% of stage IIA patients received mastectomy as their definitive surgical treatment, and a larger proportion of stage I patients received BCS (71.3%) compared with DCIS and stage IIA patients combined (57.1%). Perceiving more problems with one's body image and sexual attractiveness might have influenced a patient's choice of BCS over mastectomy as their surgical treatment. In the multivariable model with patients only, receipt of mastectomy (including mastectomy with reconstruction) was not significantly associated with a greater likelihood of reporting more problems with sexual attractiveness at T4 compared with T1, but was significantly associated with greater likelihood of reporting more sexual problems on the 9-item measure. Although mastectomy may be recommended by one's physician for more widespread DCIS⁶⁴ and for larger tumors with lymph node involvement,²¹ we do not know the reasons why our patients and their surgeons might have chosen one type of surgical treatment over another or what a patient's problems-with-sexual-attractiveness score might have been prior to her surgical treatment. Although choice of mastectomy has been associated with greater patient involvement in the surgical decision-making process,⁶⁵ when a patient is making a decision about type of surgical treatment, the patient's perception for a chance of cure and her surgeon's recommendation ranked higher than her perceived cosmetic appearance and sexual attractiveness.⁶⁶

While studies have reported similar levels of sexual desire, arousal, orgasm, and satisfaction between breast cancer patients and comparison groups without breast cancer,^{3, 6} to the best of our knowledge, other studies have not directly compared DCIS and EIBC patients with controls longitudinally. Our results suggest that differences in problems with sexual interest/enjoyment between early-stage breast cancer patients and age-matched controls were negligible at T1 after accounting for physiological and psychosocial factors and that controls alone were increasingly more likely to report problems on this subscale over the 2-year study (Table 5). This observation might reflect a relative lack of importance in sexual interest/enjoyment among breast cancer patients in this short time frame during and after their diagnosis and treatment.

Our findings also showed that patients who received mastectomy were more likely to report more problems on the 9-item sexual-problems measure two years later, but they did not differ in perceived problems with sexual attractiveness at the first interview compared with patients who received BCS. Some studies have found differences in aspects of sexual functioning by type of surgery,^{9, 16, 18, 39} whereas others have not.^{11–14, 35} Studies show mixed results depending on the aspect of sexual functioning they were measuring.^{15, 17, 67} It has been suggested that the differences in sexual functioning between BCS and mastectomy may not be large,⁶⁸ and the finding, or lack thereof, between types of surgery on various sexual problems may be related to the measure that is used,⁶⁹ as there is no gold standard for measuring women's sexual problems.⁵¹ For example, we found two subscales within our 9-item measure, each subscale measuring a different construct, and our findings from the multivariable model for problems with sexual attractiveness were not the same as our findings from the model for problems with sexual interest/enjoyment. Thus, it seems important to clearly define the sexual-problems constructs that one is measuring.¹⁵ The inconsistent results reported in previous studies were likely due to the use of different measures of sexual functioning or other sexual problems.

In our multivariable models, more severe menopausal symptoms, body image problems, and depressed mood (each measured at T1) were significant predictors of each of the three sexual-problems scales. These findings are consistent with the literature, in that having more severe problems with body image,^{2, 11, 35, 36} menopausal symptoms,^{2-4, 6, 45-47} and depressed mood^{39, 40} have been significantly associated with more sexual problems. Although older women were less likely to be sexually active in our sample, similar to another report,⁷⁰ and not being sexually active in the past six months was associated with being more likely to report problems with sexual attractiveness (in both models with and without controls), older women were less likely to report problems with sexual attractiveness in the multivariable models. Older women also reported less severe depressed mood, body image problems, and menopausal symptoms (Table 4). Thus, regardless of whether or not women reported being sexually active in the past six months, in the multivariable models, older women were less likely to report problems with sexual attractiveness, whereas women with more severe depressed mood, problems with body image, and menopausal symptoms were each more likely to report problems with sexual attractiveness. By attending to and treating women's physiological and psychosocial concerns, which are potentially modifiable factors, physicians might help to improve sexual problems in those women reporting problems.

As with all research, our study has limitations. Although our longitudinal study included patients with non-invasive and invasive breast cancer as well as a comparison group of women of the same age without breast cancer, participants in our study were recruited primarily from a National Cancer Institute-designated comprehensive cancer center and therefore might differ from patients being treated in community or rural hospitals in important ways. Similarly, although the representation of African American and white patients in our sample mirrored their distribution in the St. Louis metropolitan area,⁷¹ few participants were Hispanic or Asian, further limiting generalizability. We used telephone interviews, which have been used successfully in quality-of-life studies with breast cancer patients⁷² and which may have provided a greater sense of anonymity for participants than in-person interviews. This may be especially true for questions about sensitive issues. Although social desirability bias has been reported using telephone surveys⁷³ and face-to-face interviews,⁷⁴ other research supports use of telephone surveys, even for collection of sensitive health information.⁷⁵

Because we included only women with DCIS and EIBC who were 40 years of age or older, we cannot generalize our results to women younger than 40 or to women with more advanced breast cancers. Additionally, women who were not included in the analysis because they responded to less than 50% of the sexual-problems items might have answered some of these questions. Although women who had missing sexual-problems data at an individual interview were more likely to be unmarried and/or not sexually active in the past six months, many women who were unmarried and/or not sexually active answered the sexual-problems items, and they were more likely to report problems with sexual attractiveness, in particular. Thus, our findings might actually have underestimated the effects of being unmarried and/or not sexually active on sexual problems. We also did not inquire about participants' religious affiliation and possible vows of celibacy, which may have been associated with their responses to our questions about sexual problems (or refusal to respond). Additionally, we did not ask about the quality of participants' relationships with their spouses/partners, which other studies have found to be associated with sexual functioning in breast cancer patients.^{2, 4, 7, 36, 47}

CONCLUSIONS

In conclusion, it could be of comfort for breast cancer patients in the first two years after their surgical treatment to understand that both patients and women of the same age without breast cancer experienced few sexual problems over the study period and, in fact, controls were more likely to report sexual problems at subsequent interviews, whereas patients generally did not.

This finding might be due to a change in perspective after patient's diagnosis and treatment; sexual problems might not be perceived to be as important as one's more immediate problems relating to their breast cancer and recovery. Only patients who had mastectomy had a greater likelihood of reporting more sexual problems on the 9-item measure at the 2-year follow-up interview. Our findings suggest that psychosocial factors, which are modifiable, such as having more severe depressed mood, problems with body image, and menopausal symptoms, are more important predictors of sexual problems than either diagnostic group or type of surgery in early-stage breast cancer patients.

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FIG.1. (A)

FIG.1. (B)

FIG.1. (C)

FIG.1. (D)

FIG. 1.

Percentages of women responding to the ordinal-scaled 9-item sexual-problems measure by diagnostic group over time. **(A)** Patients with DCIS were neither more nor less likely to report changes over time in sexual problems. **(B)** Patients with stage I breast cancer were neither more nor less likely to report changes over time in sexual problems. **(C)** Patients with stage IIA breast cancer were neither more nor less likely to report changes over time in sexual problems. **(D)** Controls were more likely to report sexual problems at T2 ($P = .0352$), T3 ($P = .0070$), and T4 ($P = .0012$) compared with T1.

FIG.2. (A)

FIG.2. (B)

FIG. 2.

Percentages of patients responding to the ordinal-scaled 9-item sexual-problems measure by type of surgery over time. **(A)** In patients who received BCS, there were no significant time-by-surgery interactions. **(B)** Patients who received mastectomy were more likely to report sexual problems at T4 compared with T1 ($P = 0.0039$).

TABLE 1

Sample demographics at enrollment, by diagnostic group

	DCIS n = 179 (%)	Stage I n = 265 (%)	Stage IIA n = 80 (%)	Controls N = 509 (%)
Race				
White	142 (79.3)	218 (82.2)	61 (76.2)	373 (73.3)
Black	32 (17.9)	44 (16.6)	19 (23.8)	131 (25.7)
Other	5 (2.9)	3 (1.2)	0 (0.0)	5 (1.0)
Education				
Less than grade 12	12 (6.7)	26 (9.8)	3 (3.8)	27 (5.3)
Grade 12	40 (22.3)	67 (25.3)	16 (20.0)	100 (19.6)
More than grade 12	127 (71.0)	172 (65.0)	61 (76.2)	381 (74.9)
Refused				1 (0.2)
Marital status				
Married	113 (63.1)	165 (62.3)	46 (57.5)	334 (65.6)
Divorced/separated	36 (20.1)	41 (15.4)	17 (21.3)	78 (15.4)
Widowed	15 (8.4)	31 (11.7)	9 (11.2)	41 (8.1)
Never married	15 (8.4)	26 (9.8)	8 (10.0)	53 (10.4)
Member of an unmarried couple	0 (0.0)	2 (0.8)	0 (0.0)	3 (0.6)
Employment status				
Working full-time	78 (43.6)	100 (37.7)	26 (32.5)	235 (46.2)
Working part-time	24 (13.4)	36 (13.6)	8 (10.0)	67 (13.2)
Retired	45 (25.1)	80 (30.2)	15 (18.8)	120 (23.6)
Unable to work/unemployed	16 (9.0)	33 (12.4)	23 (28.7)	54 (10.6)
Homemaker	16 (8.9)	16 (6.0)	8 (10.0)	33 (6.5)
Annual income				
Less than \$25,000	44 (24.6)	67 (25.3)	26 (32.5)	100 (19.7)
\$25,000–\$75,000	67 (37.4)	102 (38.4)	33 (41.2)	193 (38.0)
More than \$75,000	56 (31.2)	72 (27.1)	18 (22.5)	182 (35.8)
Refused/don't know	12 (6.8)	24 (9.1)	3 (3.8)	34 (6.6)
Menopausal status				
Pre-menopausal	54 (30.2)	60 (22.6)	27 (33.8)	143 (28.1)
Post-menopausal	123 (68.7)	204 (77.0)	53 (66.2)	361 (70.9)
Don't know	2 (1.1)	1 (.4)	0 (0.0)	5 (1.0)
Comorbidity				
None	119 (66.5)	170 (64.2)	52 (65.0)	349 (68.6)
1 condition	40 (22.3)	58 (21.9)	17 (21.2)	104 (20.4)
2 or more conditions	20 (11.1)	37 (14.0)	11 (13.7)	56 (11.0)
	DCIS n = 179 (%)	Stage I n = 265 (%)	Stage IIA n = 80 (%)	
Sexually active in the past six months				
Yes		102 (57.0)	161 (60.8)	45 (56.2) 324 (63.7)
No		77 (43.0)	103 (38.9)	35 (43.8) 184 (36.1)
Refused		0 (0.0)	1 (0.4)	0 (0.0) 1 (0.2)

	DCIS n = 179 (%)	Stage I n = 265 (%)	Stage IIA n = 80 (%)	
Type of surgery				
BCS	108 (60.3)	189 (71.3)	40 (50.0)	
Unilateral mastectomy	59 (33.0)	65 (24.5)	33 (41.2)	
Bilateral mastectomy	12 (6.7)	11 (4.2)	7 (8.8)	
Radiation therapy				
Yes	101 (56.4)	185 (69.8)	47 (58.8)	
No	78 (43.6)	80 (30.2)	33 (41.2)	
Chemotherapy				
Yes	0 (0.0)	71 (26.8)	63 (78.8)	
No	0 (0.0)	194 (73.2)	17 (21.2)	
Endocrine therapy				
Yes	76 (42.5)	199 (75.1)	52 (65.0)	
No	99 (55.3)	65 (24.5)	28 (35.0)	
Unknown per medical record	4 (2.2)	1 (0.4)	0 (0.0)	
	Mean (SD)			
Body-mass index, kg/m ²	28.29 (6.59)	28.48 (6.83)	28.84 (7.10)	28.30 (6.85)
Depression	7.23 (8.50)	8.36 (9.75)	11.35 (10.86)	7.03 (8.45)
State anxiety	5.37 (6.32)	6.11 (6.57)	9.86 (9.34)	5.99 (6.53)
Menopausal symptoms	1.64 (0.79)	1.67 (0.82)	1.75 (0.85)	1.64 (0.74)
Body image	1.79 (0.94)	1.72 (0.87)	1.88 (0.90)	1.98 (0.84)
Age, y	57.08 (10.20)	59.16 (10.27)	54.59 (8.75)	56.51 (10.19)
Surgical side effects	1.67 (0.71)	1.63 (0.67)	2.11 (0.82)	
“You feel sexually attractive.” ^a	2.15 (1.32)	2.12 (1.35)	2.65 (1.46)	
“Regardless of your current level of sexual activity: You are satisfied with your sex life.” ^a	3.8 (1.36)	3.87 (1.31)	3.71 (1.48)	

Note. Treatment variables and surgical side effects were obtained only for the patient cohort.

^a Item from FACT-B,³⁴ completed by patients only; mean scores range 0–4.

TABLE 2

Responses to items measuring sexual-functioning problems at the first interview

Item	N (%) ^d choosing each response				Factor loading	
	N	Not a problem	A little problem	Somewhat of a problem	Very much of a problem	1^b 2^c
1. You have a lack of interest in sex.	970	582 (60.0)	165 (17.0)	132 (13.6)	91 (9.4)	.676 .235
2. You are unable to relax and enjoy sex.	890	657 (73.8)	95 (10.7)	84 (9.4)	54 (6.1)	.731 .254
3. You have difficulty becoming sexually aroused.	903	590 (65.3)	129 (14.3)	109 (12.1)	75 (8.3)	.859 .099
4. You have pain or discomfort with intercourse.	869	681 (78.4)	70 (8.1)	72 (8.3)	46 (5.3)	.530 .131
5. You have difficulty having an orgasm.	873	616 (70.6)	88 (10.1)	106 (12.1)	63 (7.2)	.810 .050
6. You have not felt satisfied after sex.	856	641 (74.9)	84 (9.8)	91 (10.6)	40 (4.7)	.801 .130
7. You do not feel sexually attractive.	996	740 (74.3)	103 (10.3)	101 (10.1)	52 (5.2)	.345 .734
8. You believe you are not sexually attractive to your spouse/partner.	868	713 (82.1)	65 (7.5)	64 (7.4)	26 (3.0)	.190 .866
9. You do not think your partner is interested in having sex.	825	699 (84.7)	46 (5.6)	44 (5.3)	36 (4.4)	.011 .750

^a% of women responding to each item

^bProblems with sexual interest/enjoyment subscale (Cronbach alpha = .85)

^cProblems with sexual attractiveness subscale (Cronbach alpha = .74)

TABLE 3

Means (SD) of the 9-item overall sexual-problem measure and the two subscales measuring problems with sexual attractiveness and sexual interest/enjoyment at T1^a

	Sexual Problems (9-items)		Problems with Sexual Attractiveness		Problems with Sexual Interest/Enjoyment	
		P		P		P
Race		0.004		0.022		0.003
White	1.50 (0.58)		1.38 (0.66)		1.56 (0.67)	
Non-White	1.43 (0.64)		1.30 (0.62)		1.50 (0.77)	
Education		0.934		0.904		0.630
Less than grade 12	1.50 (0.64)		1.36 (0.69)		1.58 (0.76)	
Grade 12	1.52 (0.64)		1.33 (0.64)		1.61 (0.76)	
More than grade 12	1.48 (0.58)		1.38 (0.66)		1.52 (0.67)	
Marital status		0.001		0.477		0.001
Married	1.51 (0.58)		1.36 (0.64)		1.58 (0.69)	
Non-Married	1.42 (0.62)		1.38 (0.70)		1.45 (0.71)	
Employment status		0.358		0.422		0.534
Working at least part-time	1.50 (0.59)		1.37 (0.65)		1.56 (0.71)	
Not working at least part-time	1.48 (0.60)		1.36 (0.66)		1.53 (0.67)	
Annual income		0.016		0.152		0.012
Less than \$25,000	1.48 (0.67)		1.45 (0.78)		1.51 (0.75)	
\$25,000–\$75,000	1.44 (0.57)		1.31 (0.58)		1.51 (0.68)	
More than \$75,000	1.53 (0.57)		1.39 (0.67)		1.58 (0.66)	
Menopausal status		0.328		0.112		0.571
Pre-menopausal	1.48 (0.60)		1.34 (0.63)		1.54 (0.70)	
Post-menopausal	1.51 (0.59)		1.42 (0.69)		1.56 (0.68)	
Type of surgery ^b		0.012		0.001		0.095
BCS	1.42 (0.56)		1.29 (0.58)		1.48 (0.66)	
Mastectomy	1.59 (0.71)		1.55 (0.81)		1.60 (0.76)	
Radiation therapy		0.328		0.066		0.691
Yes	1.44 (0.56)		1.33 (0.61)		1.51 (0.67)	
No	1.54 (0.71)		1.49 (0.80)		1.55 (0.75)	
Chemotherapy		0.059		0.275		0.058
Yes	1.58 (0.68)		1.44 (0.70)		1.65 (0.80)	

	Sexual Problems (9-items)	<i>P</i>	Problems with Sexual Attractiveness	<i>P</i>	Problems with Sexual Interest/Enjoyment	<i>P</i>
No	1.42 (0.59)		1.37 (0.67)		1.44 (0.62)	
Endocrine therapy		0.844		0.581		0.999
Yes	1.47 (0.59)		1.37 (0.64)		1.52 (0.69)	
No	1.48 (0.64)		1.40 (0.74)		1.52 (0.70)	
Sexually active in the past six months		0.151		(0.079)		0.003
Yes	1.48 (0.57)		1.32 (0.59)		1.56 (0.67)	
No	1.49 (0.66)		1.48 (0.79)		1.50 (0.74)	
Diagnostic Group		0.370		0.591		0.377
Controls	1.50 (0.57)		1.35 (0.61)		1.57 (0.69)	
DCIS	1.47 (0.60)		1.37 (0.70)		1.52 (0.69)	
Stage I	1.48 (0.62)		1.37 (0.67)		1.53 (0.70)	
Stage IIA	1.51 (0.69)		1.47 (0.74)		1.52 (0.72)	

SD, standard deviation.

^aTests of significance are Kruskal-Wallis.

^bIncludes patients only.

TABLE 4

Spearman's rho correlations among the continuous variables at the first interview

	1	2	3	4	5	6	7	8	9	10	11	12
1. 9-item Sexual problems	1.000											
2. Problems with sexual attractiveness	0.684 ^a	1.000										
3. Problems with sexual interest/enjoyment	0.944 ^a	0.455 ^a	1.000									
4. Body image problems	0.487 ^a	0.514 ^a	0.386 ^a	1.000								
5. Surgical side effects	0.213 ^a	0.201 ^a	0.197 ^a	0.133 ^a	1.000							
6. Anxiety	0.365 ^a	0.309 ^a	0.317 ^a	0.339 ^a	0.375 ^a	1.000						
7. Depressed mood	0.383 ^a	0.343 ^a	0.328 ^a	0.400 ^a	0.316 ^a	0.673 ^a	1.000					
8. Age	-0.144 ^a	-0.128 ^a	-0.119 ^a	-0.157 ^a	-0.112 ^a	-0.166 ^a	-0.203 ^a	1.000				
9. Body-mass index	0.017	0.110 ^b	-0.037	0.265 ^a	0.067 ^c	0.087 ^b	0.107 ^b	0.050	1.000			
10. Menopausal symptoms	0.244 ^a	0.104 ^b	0.254 ^a	0.148 ^a	0.111 ^a	0.418 ^a	0.239 ^a	-0.104 ^b	0.018	1.000		
11. Comorbidity	0.039	0.062	0.022	0.056	0.046	0.124 ^a	0.093 ^b	0.178 ^a	0.238 ^a	0.072 ^c	1.000	
12. "You feel sexually attractive"	-0.502 ^a	-0.470 ^a	-0.419 ^a	-0.512 ^a	-0.285 ^a	-0.354 ^a	-0.464 ^a	0.175 ^a	-0.188 ^a	-0.110 ^c	-0.112 ^c	1.000
13. "You are satisfied with your sex life."	-0.444 ^a	-0.328 ^a	-0.398 ^a	-0.292 ^a	-0.161 ^a	-0.344 ^a	-0.372 ^a	0.202 ^a	-0.087	-0.159 ^a	-0.034	0.303 ^a

Note. Data regarding surgical side effects and the two Functional Assessment of Cancer Therapy-Breast³⁴ items (nos. 12 and 13 in this table) are for patients only.

^a $P < 0.001$

^b $P < 0.01$

^c $P < 0.05$

TABLE 5

Mixed-effects regression models with repeated ordinal measurements showing change over time by diagnostic group and independent predictors of each sexual-problems scale

	Sexual problems (9-item overall measure)				Problems with sexual attractiveness subscale				Problems with sexual interest/enjoyment subscale			
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Group*time interaction												
Controls												
T1	reference			reference			reference			reference		
T2	1.64	1.03 to 2.60	0.0352	1.50	0.95 to 2.39	0.0849	1.51	0.99 to 2.31	0.0586			
T3	1.89	1.19 to 3.00	0.0070	1.56	0.97 to 2.49	0.0644	1.92	1.25 to 2.96	0.0030			
T4	2.18	1.36 to 3.49	0.0012	1.67	1.04 to 2.68	0.0351	2.02	1.31 to 3.14	0.0016			
DCIS												
T1	reference			reference			reference					
T2	0.85	0.35 to 2.05	0.7163	1.03	0.40 to 2.66	0.9445	0.71	0.31 to 1.62	0.4146			
T3	0.49	0.20 to 1.21	0.1213	0.91	0.35 to 2.36	0.8481	0.52	0.23 to 1.21	0.1283			
T4	0.46	0.18 to 1.14	0.0935	1.39	0.54 to 3.53	0.4933	0.51	0.22 to 1.19	0.1177			
Stage I												
T1	reference			reference			reference					
T2	0.67	0.30 to 1.46	0.3091	0.34	0.15 to 0.78	0.0109	0.83	0.40 to 1.73	0.6140			
T3	0.75	0.34 to 1.66	0.4813	0.42	0.18 to 0.97	0.0433	0.72	0.34 to 1.51	0.3779			
T4	0.72	0.33 to 1.59	0.4138	0.37	0.16 to 0.86	0.0202	0.78	0.37 to 1.64	0.5083			
Stage IIA												
T1	reference			reference			reference					
T2	0.48	0.14 to 1.63	0.2366	0.75	0.22 to 2.57	0.6447	0.61	0.18 to 2.08	0.4289			
T3	1.35	0.43 to 4.23	0.6058	1.46	0.45 to 4.78	0.5268	2.22	0.71 to 6.92	0.1685			
T4	0.86	0.26 to 2.89	0.8049	1.55	0.47 to 5.14	0.4753	1.57	0.48 to 5.12	0.4523			
At T1												
Controls												
T1	reference			reference			reference					
DCIS	1.44	0.66 to 3.13	0.3564	1.16	0.53 to 2.55	0.7149	1.43	0.67 to 3.02	0.3551			
Stage I	1.48	0.75 to 2.94	0.2600	2.70	1.39 to 5.24	0.0033	1.24	0.63 to 2.42	0.5337			
Stage IIA	1.24	0.44 to 3.50	0.6889	1.54	0.56 to 4.20	0.4003	0.78	0.27 to 2.30	0.6552			
Age	0.98	0.96 to 1.00	0.0711	0.95	0.93 to 0.98	<0.0001	0.99	0.97 to 1.02	0.4719			

	Sexual problems (9-item overall measure)				Problems with sexual attractiveness subscale				Problems with sexual interest/enjoyment subscale			
	OR	95% CI	P		OR	95% CI	P		OR	95% CI	P	
Menopausal symptoms	2.17	1.78 to 2.63	<0.0001		1.28	1.06 to 1.56	0.0112		2.14	1.76 to 2.59	<0.0001	
Body image	3.96	3.24 to 4.83	<0.0001		5.32	4.37 to 6.49	<0.0001		2.83	2.33 to 3.44	<0.0001	
Body-mass index	0.99	0.96 to 1.02	0.4657		1.01	0.98 to 1.03	0.6588		0.97	0.95 to 1.00	0.0979	
Anxiety	1.02	0.99 to 1.05	0.1618		0.99	0.96 to 1.02	0.3799		1.02	0.99 to 1.05	0.1428	
Depressed mood	1.06	1.04 to 1.08	<0.0001		1.06	1.04 to 1.09	<0.0001		1.07	1.04 to 1.09	<0.0001	
Not married ^a	0.26	0.16 to 0.42	<0.0001		0.40	0.26 to 0.62	<0.0001		0.32	0.20 to 0.53	<0.0001	
Not sexually active in past 6months ^b	1.73	1.18 to 2.54	0.0053		3.83	2.65 to 5.54	<0.0001		0.97	0.66 to 1.44	0.8922	

OR, odds ratio; CI, confidence interval; T1, first interview; T2, second interview; T3, third interview; T4, fourth interview; DCIS, ductal carcinoma *in situ*.

^aIncluding widowed, divorced, and never married compared with married as the reference category.

^bCompared with being sexually active in the past 6 months as the reference category.

TABLE 6

Mixed-effects regression models with repeated ordinal measurements showing change over time by type of surgery and independent predictors of each sexual-problems scale^a

		Sexual problems (9-item overall measure)			Problems with sexual attractiveness subscale			Problems with sexual interest/enjoyment subscale		
		OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Surgery*time interaction										
BCS		reference			reference			reference		
T1		1.25	0.70 to 2.23	0.4508	0.84	0.43 to 1.07	0.6057	1.38	0.80 to 2.38	0.2495
T2		1.53	0.86 to 2.72	0.1477	1.24	0.64 to 2.39	0.5243	1.62	0.94 to 2.79	0.0791
T3		1.24	0.68 to 2.25	0.4806	1.09	0.57 to 2.11	0.7863	1.73	1.00 to 3.02	0.0510
Mastectomy		reference			reference			reference		
T1		1.38	0.56 to 3.42	0.4831	1.62	0.62 to 4.19	0.3225	1.32	0.55 to 3.15	0.5367
T2		1.49	0.60 to 3.73	0.3880	1.23	0.47 to 3.19	0.6688	1.74	0.71 to 4.22	0.2225
T3		2.73	1.08 to 6.92	0.0339	2.36	0.91 to 6.08	0.0764	1.80	0.74 to 4.41	0.1950
At T1		reference			reference			reference		
BCS		0.56	0.25 to 1.26	0.1595	1.02	0.47 to 2.24	0.9518	0.50	0.22 to 1.13	0.0957
Mastectomy		0.98	0.95 to 1.02	0.3088	0.95	0.93 to 0.98	0.0025	1.00	0.97 to 1.03	0.9066
Age		1.83	1.45 to 2.32	<0.0001	0.91	0.71 to 1.16	0.4396	1.82	1.43 to 2.31	<0.0001
Menopausal symptoms		3.46	2.69 to 4.45	<0.0001	4.68	3.66 to 5.99	<0.0001	2.56	1.98 to 3.30	<0.0001
Body image		0.98	0.95 to 1.02	0.3500	1.02	0.99 to 1.06	0.2174	0.96	0.92 to 1.00	0.0793
Body-mass index		1.01	0.97 to 1.05	0.5974	1.01	0.98 to 1.06	0.4756	1.01	0.97 to 1.05	0.7462
Anxiety		1.07	1.04 to 1.10	<0.0001	1.07	1.04 to 1.10	<0.0001	1.08	1.05 to 1.11	<0.0001
Depressed mood		0.34	0.19 to 0.61	0.0003	0.58	0.34 to 0.99	0.0440	0.39	0.21 to 0.73	0.0030
Not married ^b		1.79	1.08 to 2.95	0.0236	2.66	1.65 to 4.28	<0.0001	0.92	0.54 to 1.56	0.7613
Not sexually active in past 6 months ^c		1.41	0.82 to 2.42	0.2107	1.26	0.77 to 2.07	0.3598	1.30	0.72 to 2.33	0.3810
Chemotherapy ^d		1.04	0.62 to 1.74	0.8819	0.91	0.57 to 1.46	0.6997	1.02	0.59 to 1.77	0.9502
Endocrine therapy ^e		1.92	1.36 to 2.72	0.0002	1.19	0.85 to 1.66	0.3010	2.15	1.51 to 3.06	<0.0001
Surgical side effects										

OR, odds ratio; CI, confidence interval; BCS, breast-conserving surgery; T1, first interview; T2, second interview; T3, third interview; T4, fourth interview.

^aThese models included patient data only.

^bIncluding widowed, divorced, and never married compared with married/ as the reference category.

^cCompared with being sexually active in the past 6 months as the reference category.

^dCompared with no adjuvant chemotherapy as the reference category.

^eCompared with no adjuvant endocrine therapy as the reference category.

APPENDIX A

Items for newly developed body image problems, menopausal symptoms, and surgical side effects measures

Body Image Items	
1	You are dissatisfied with the way your clothes fit.
2	You think your clothes do not look good on you.
3	You have difficulty finding clothes that fit.
4	You feel self-conscious about being seen nude by your husband/partner.
5	You are embarrassed to look at your nude body.
6	You are embarrassed to wear a swimming suit.
7	You feel self-conscious about your appearance.
8	You feel ashamed of your body.
Menopausal Symptoms	
1	You have hot flashes.
2	You have cold sweats
3	You have night sweats.
4	You have vaginal dryness.
Surgical Side Effects	
1	You have arm weakness.
2	You have lymphedema/swelling of the arm
3	You have swelling of the chest/breast/axilla wall.
4	You have numbness/tingling, pins and needles.
5	You have tightness/pulling/stretching in your arm/axilla.
6	You have limited arm mobility/frozen shoulder.
7	You have tightness/tenderness/discomfort in your chest wall.
8	You have tightness/tenderness/discomfort in your breast.