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Journal

Cancer Nursing, 37(6)

ISSN

0162-220X

Authors

Kyranou, Marianna
Puntillo, Kathleen
Dunn, Laura B
et al.

Publication Date

2014-11-01

DOI

10.1097/ncc.0000000000000131

Peer reviewed

Published in final edited form as:
Cancer Nurs. 2014 ; 37(6): 406–417. doi:10.1097/NCC.0000000000000131.

Predictors of Initial Levels and Trajectories of Anxiety in Women Prior to and For Six Months Following Breast Cancer Surgery

Dr. Marianna Kyranou, RN, PhD, **Dr. Kathleen Puntillo, RN, PhD**, **Dr. Laura B. Dunn, MD**, **Dr. Bradley E. Aouizerat, PhD, MAS**, **Dr. Steven M. Paul, PhD**, **Dr. Bruce A. Cooper, PhD**, **Dr. John Neuhaus, PhD**, **Ms. Claudia West, RN, MS**, **Dr. Marylin Dodd, RN, PhD**, and **Dr. Christine Miaskowski, RN, PhD**

School of Nursing (Drs. Kyranou, Puntillo, Aouizerat, Paul, Cooper, Dodd, and Miaskowski and Ms. West); School of Medicine (Drs. Dunn and Neuhaus); and the Institute for Human Genetics (Dr. Aouizerat), University of California, San Francisco, CA

Abstract

Background—The diagnosis of breast cancer in combination with the anticipation of surgery evokes fear, uncertainty, and anxiety in most women.

Objective—In patients who underwent breast cancer surgery, study purposes were to examine how ratings of state anxiety changed from the time of the preoperative assessment to 6 months after surgery and to investigate whether specific demographic, clinical, symptom, and psychosocial adjustment characteristics predicted the preoperative levels of state anxiety and/or characteristics of the trajectories of state anxiety.

Interventions/Methods—Patients (n=396) were enrolled preoperatively and completed the Spielberger State Anxiety inventory monthly for six months. Using hierarchical linear modeling, demographic, clinical, symptom, and psychosocial adjustment characteristics were evaluated as predictors of initial levels and trajectories of state anxiety.

Results—Patients experienced moderate levels of anxiety prior to surgery. Higher levels of depressive symptoms and uncertainty about the future, as well as lower levels of life satisfaction, less sense of control, and greater difficulty coping predicted higher preoperative levels of state anxiety. Higher preoperative state anxiety, poorer physical health, decreased sense of control, and more feelings of isolation predicted higher state anxiety scores over time.

Conclusions—Moderate levels of anxiety persist in women for six months following breast cancer surgery.

Implications for Practice—Clinicians need to implement systematic assessments of anxiety to identify high risk women who warrant more targeted interventions. In addition, ongoing follow-up is needed in order to prevent adverse postoperative outcomes and to support women to return to their preoperative levels of function.

Correspondence: Christine Miaskowski, RN, PhD, FAAN, Department of Physiological Nursing, University of California, 2 Koret Way – N631Y, San Francisco, CA 94143-0610 415-476-9407 (phone); 415-476-8899 (fax); chris.miaskowski@nursing.ucsf.edu.

Conflicts of Interest: The authors have no conflicts of interest to declare.

INTRODUCTION

The diagnosis of breast cancer in combination with the anticipation of surgery evokes fear, uncertainty, and anxiety in most women. Previous research found that the majority of women with breast cancer experience moderate to high levels of anxiety before surgery followed by a gradual reduction over the year after surgery.[1–12] Unfortunately, direct comparisons across these prevalence studies are not possible due to differences in the use of generic or symptom specific measures to assess anxiety, differences in inclusion and exclusion criteria, as well as differences in the number and timing of the assessments.

In an effort to improve early detection of anxiety in women undergoing breast cancer surgery, a number of demographic and clinical characteristics were evaluated to determine their associations with this symptom. Across these studies, being younger,[3,10,13,14] and having children[3] increased a woman's risk for psychological morbidity in the year after breast cancer surgery. Furthermore, in one study,[10] women who were married or partnered were less likely to experience distress than women who were single, divorced, or widowed. However, in another study, this association was not significant.[3] Finally, no association was found between years of education and patterns of distress in women undergoing breast cancer surgery.[12,13,15]

Findings regarding the relationships between clinical characteristics and psychological distress prior to and following surgery are inconsistent. In some studies, tumor size and stage of disease were not associated with psychological distress before or after surgery,[13–16] whereas in others studies a positive association was found.[5,12] In addition, no differences in psychological adjustment were found between women undergoing breast conserving surgery compared to mastectomy.[4,6,9,10,16] In contrast, adjuvant treatment,[3,16] as well as postmenopausal status,[3] and physical complaints (e.g., fatigue, pain) in the period after surgery[3,12,16–18] were associated with higher levels of psychological distress.

Findings from several studies suggest that various psychosocial adjustment characteristics may contribute to the severity and trajectories of psychological distress before and after breast cancer surgery. In fact, personality characteristics, such as neuroticism, are associated with higher levels of distress across various phases of the disease trajectory.[9,19] Similarly, coping mechanisms,[13,20] perceived social support,[5] sense of control,[5,17,21] and illness perceptions[9] influence levels of anxiety after breast cancer surgery. Of note, a psychiatric history[3,15] and increased levels of preoperative or immediate postoperative distress[3,5,9,22] predicted worse psychological outcomes after surgery.

The primary limitation of the aforementioned studies on changes in distress after breast cancer surgery is that these studies used general measures of "psychological distress" that do not provide specific information on anxiety separate from other distressing symptoms (e.g., depressive symptoms). In order to delineate the type of distress women face and to be able to assist patients during the recovery period, instruments specific for anxiety (e.g., Spielberger State-Trait Anxiety Inventory (STAI)[23]) need to be used before and after surgery. In addition, newer methods of longitudinal data analysis (e.g., hierarchical linear

modeling (HLM)) can be used to identify predictors of initial levels and trajectories of anxiety.[24,25]

Given the paucity of longitudinal studies that used a symptom specific measure of anxiety, the purposes of this study, in a sample of women who underwent breast cancer surgery, were to examine how ratings of state anxiety changed from the time of the preoperative assessment to 6 months after surgery and to investigate whether specific demographic, clinical, symptom, and psychosocial adjustment characteristics predicted the preoperative levels of state anxiety and/or characteristics of the trajectories of state anxiety over a period of 6 months after the surgery.

METHODS

Participants and Settings

This descriptive, longitudinal study is part of a larger study that evaluated for neuropathic pain and lymphedema in women who underwent breast cancer surgery.[26–28] Patients were recruited from Breast Care Centers located in a Comprehensive Cancer Center, two public hospitals, and four community practices in Northern California.

Patients were eligible to participate if they were adult women (≥18 years) who would undergo breast cancer surgery on one breast; were able to read, write, and understand English; agreed to participate; and gave written informed consent. Patients were excluded if they were having breast cancer surgery on both breasts and/or had distant metastasis at the time of diagnosis.

A total of 516 patients were approached and 410 enrolled in the study (response rate 79.5%). For the current analysis, complete data from 396 women were available. For those women who declined participation, the major reasons for refusal were: too busy, overwhelmed with their cancer diagnosis, or insufficient time available to complete the baseline assessment prior to surgery.

Theoretical Framework

The theoretical framework for the overall study was the Theory of Symptom Management (TSM),[29–31] which was developed by faculty members in the Center for Symptom Management at UCSF. In this model, the symptom experience includes an individual's perception of the symptom, evaluation of the meaning of the symptom, and response to the symptom. The symptom management strategies dimension includes both self-care strategies individuals do for themselves, as well as the treatments that clinicians prescribe. The outcomes dimension specifies that outcomes emerge from the symptom management strategies as well as from the symptom experience. The TSM places the experience of symptom management in the context of the domains of nursing science, namely person, health and illness, and environment.

In this specific analysis, the symptom experience dimension of the theory was evaluated in that patients' perceptions of anxiety were assessed prior to and for six months after breast cancer surgery. As was done in previous HLM analyses of other symptoms,[25,32–36] the

experience of anxiety was evaluated within the context of the person (i.e., demographic characteristics) and health and illness (i.e., clinical characteristics, other symptoms associated with cancer treatment, psychosocial adjustment characteristics) domains of nursing science.

Instruments

A demographic questionnaire obtained information on age, gender, marital status, education, ethnicity, employment status, and financial status. Patient's functional status was assessed using the Karnofsky Performance Status (KPS) scale, which ranges from 30 (I feel severely disabled and need to be hospitalized) to 100 (I feel normal, I have no complaints or symptoms). The KPS has well established validity and reliability.[37]

The Self-Administered Comorbidity Questionnaire (SCQ) is a short and easily understood instrument that was developed to measure comorbidity in clinical and health service research settings.[38] The questionnaire consists of 13 common medical conditions that were simplified into language that could be understood without any prior medical knowledge. Patients were asked to indicate if they had the condition using a "yes/no" format. If they indicated that they had a condition, they were asked if they received treatment for it (proxy for disease severity) and did it limit their activities (indication of functional limitations). Patients were given the option to add two additional conditions not listed on the instrument. For each condition, a patient can receive a maximum of 3 points. Because the SCQ contains 13 defined medical conditions and 2 optional conditions, the maximum score totals 45 points if the open-ended items are used and 39 points if only the closed-ended items are used. The SCQ has well-established validity and reliability and has been used in studies of patients with a variety of chronic conditions.[39–41]

The Spielberger State-Trait Anxiety Inventories (STAI-T, STAI-S) consist of 20 items each that are rated from 1 to 4. Scores for each scale are summed and can range from 20 to 80. A higher score indicates greater anxiety. The STAI-T measures an individual's predisposition to anxiety determined by his/her personality and estimates how a person generally feels. The STAI-S measures an individual's transitory emotional response to a stressful situation. It evaluates the emotional responses of worry, nervousness, tension, and feelings of apprehension related to how a person feels "right now" in a stressful situation. Cutoff scores of ≥31.8 and ≥32.2 indicate high levels of trait and state anxiety, respectively.[23] The STAI-S and STAI-T inventories have well-established criterion and construct validity and internal consistency reliability coefficients.[42,43] In this study, Cronbach's alphas for the STAI-T and STAIS were .88 and .95, respectively.

The Center for Epidemiological Studies Depression Scale (CES-D) consists of 20 items selected to represent the major symptoms in the clinical syndrome of depression. Scores can range from 0 to 60, with scores of ≥16 indicating the need for individuals to seek clinical evaluation for major depression. The CES-D has well-established validity and reliability.[44–46] In this study, Cronbach's alpha for the CES-D was 0.90.

The Lee Fatigue Scale (LFS) consists of 18 items designed to assess physical fatigue and energy.[47] Each item was rated on a 0 to 10 numeric rating scale (NRS). Total fatigue and

energy scores were calculated as the mean of the 13 fatigue items and the 5 energy items. Higher scores indicate greater fatigue severity and higher levels of energy. Respondents were asked to rate each item based on how they felt “right now”. The LFS has been used with healthy individuals[47,48] and in patients with cancer and HIV disease.[49–52] A cutoff score of ≥4.4 indicates high levels of fatigue.[24] A cutoff score of ≤4.8 indicates low levels of energy.[24] The LFS has well established validity and reliability. In this study, Cronbach’s alphas for fatigue and energy scales were .96 and .93, respectively.

The Attentional Function Index (AFI) is a commonly used self-report measure of attentional function.[53] It consists of 16-items that were rated on a 0 to 10 NRS. A higher mean score indicates greater capacity to direct attention.[53,54] Scores are grouped into categories of attentional function (i.e., <5.0 low function, 5.0 to 7.5 moderate function, >7.5 high function).[55] The AFI has well established reliability and validity.[54,56] In this study, Cronbach’s alpha for the AFI was .95.

The General Sleep Disturbance Scale (GSDS) consists of 21 items designed to assess the quality of sleep in the past week. Each item was rated on a 0 (never) to 7 (everyday) NRS. The GSDS total score is the sum of 21 items that can range from 0 (no disturbance) to 147 (extreme sleep disturbance). A GSDS total score of ≥43 indicates a significant level of sleep disturbance.[57] The GSDS has well-established validity and reliability in shift workers, pregnant women, and patients with cancer and HIV disease.[58,59] In this study, Cronbach’s alpha for the GSDS total score was .86.

The occurrence of breast pain prior to surgery was determined by asking the question “Are you experiencing pain in your affected breast?” If women responded yes, they rated the severity of their average and worst pain using a 0 (no pain) to 10 (worst imaginable pain) NRS. Women were asked how many days per week and how many hours per day they experienced significant pain (i.e., pain that interfered with function).

The Quality of Life Scale-Patient Version (QOL-PV) is a 41-item instrument that measures four dimensions of QOL in cancer patients (i.e., physical well-being, psychological well-being, spiritual well-being, social well-being), as well as a total QOL score. Each item was rated on a 0 to 10 NRS with higher scores indicating a better QOL. The QOL-PV has well established validity and reliability.[60–62] In this study, Cronbach’s alpha for the QOL-PV total score was .86. For the physical, psychological, social, and spiritual well-being subscales, the coefficients were 0.70, 0.79, 0.75, and 0.61, respectively.

Individual items from the QOL-PV were used to assess a number of psychosocial adjustment characteristics (i.e., life satisfaction, uncertainty, importance of spiritual activities, feelings of isolation, sense of control, difficulty coping). One item asked patients to rate their overall level of life satisfaction. One question asked patients to rate the amount of uncertainty they felt about the future. Another item asked about the importance of spiritual activities. One had them rate their feelings of isolation. Another question asked patients to rate the level of control they felt over their lives. Finally, one item asked patients to rate their difficulty coping as a result of the cancer and its treatment. Each item was rated using a 0 to 10 NRS with higher scores indicating a more positive appraisal of a particular

characteristic. The specific items were chosen based on the review of the literature of psychosocial adjustment and anxiety in women with breast cancer.[3,5,7–9,13,19,22]

Study Procedures

The study was approved by the Committee on Human Research at the University of California, San Francisco and by the Institutional Review Board at each of the study sites. During the patient's preoperative visit, a clinical staff member explained the study to the patient and determined her willingness to participate. For those women who were willing to participate, the staff member introduced the patient to the research nurse. The research nurse met with the women, determined eligibility and obtained written informed consent prior to surgery. After obtaining consent, patients completed the enrollment questionnaires and average of four days prior to surgery and again at one, two, three, four, five, and six months after surgery. The research nurse met with the patients at the Clinical Research Center or in the patients' homes.

Data Analysis

Descriptive statistics and frequency distributions were generated on the sample characteristics, baseline symptom severity scores, and psychosocial adjustment items using SPSS version 19 (IBM, Armonk, NY). With the exception of the STAI-S (which was assessed prior to surgery and at 1, 2, 3, 4, 5, and 6 months after surgery), all of the demographic, clinical, and psychosocial adjustment characteristics that were evaluated as predictors in the HLM analysis were assessed prior to surgery.

Hierarchical linear modeling (HLM), based on full maximum likelihood estimation, was done using the software developed by Raudenbush and colleagues.[63,64] This analysis is discussed in detail in our previous publications. [25,32–36] In brief, the HLM analysis was done to evaluate for changes over time in ratings of state anxiety. During stage 1, intra-individual variability in state anxiety over time was examined. Three level 1 models were compared to determine whether the patients' anxiety did not change over time (i.e., no time effect), changed at a constant rate (i.e., linear time effect), or changed at a rate that accelerated or decelerated over time (i.e., quadratic effect). At this point, the level 2 model was constrained to be unconditional (i.e., no predictors), and likelihood ratio tests were used to determine the best model.

The second stage of the HLM analysis examined inter-individual differences in the trajectories of state anxiety by modeling the individual change parameters (i.e., intercept, linear slope, quadratic slope) as a function of proposed predictors at level 2. Table 1 presents a list of the proposed predictors that was developed based on a review of the literature of anxiety in patients who underwent breast cancer surgery.[1,3,5,7–9,12–14,16,18,19,22] To improve estimation efficiency and construct a model that is parsimonious, an exploratory level 2 analyses was completed in which each potential predictor was assessed to determine whether it would result in a better model if it alone were added as a level 2 predictor. Predictors with a t value of less than 2, which indicates a lack of significant effect, were dropped from subsequent model testing. All potential significant predictors from the exploratory analyses were entered into the model to predict each individual change

parameter. Only predictors that maintained a statistically significant contribution in conjunction with other variables were retained in the final model. A p-value of <0.05 indicates statistical significance.

Results

The demographic and clinical characteristics of the 396 patients are summarized in Table 2. On average, patients were 55 years of age, well educated, had a KPS score of 93, and an SCQ score of 4. Most of the women self-identified as White (64.6%), were post-menopausal (62.3%), and married or partnered (41.5%). Forty-eight percent of the patients were employed.

Individual and Mean Change in State Anxiety

The first stage of HLM analysis examined how state anxiety changed from the time before surgery to 6 months after surgery. Two models were estimated in which the individual function of time was linear and quadratic. The goodness-of-fit tests of the deviance between the linear and the quadratic models indicated that a quadratic model had the best fit.

Table 3 presents the estimates of the unconditional, quadratic change model. Because the model had no covariates, the intercept represents the estimated level of state anxiety (i.e., 41.093 on a 20 to 80 scale) at the preoperative assessment. The estimated linear rate of change in state anxiety, for each additional month, was −1.86 (p<.000) and the estimated quadratic rate of change per month was 0.128 (p=.014). The weighted combination of the linear and quadratic terms defines each curve. Figure 1A displays the trajectory for anxiety from the preoperative assessment to 6 months after surgery. Anxiety decreased over the course of 6 months, with a larger decline during the first 3 months. It should be noted that the mean anxiety scores for the various groups depicted in all the figures are estimated or predicted means based on the HLM analysis.

Inter-individual Differences in the Trajectories of Anxiety

The second stage of the HLM analysis evaluated how the pattern of change over time in state anxiety varied based on specific demographic, clinical, symptom, and psychosocial adjustment characteristics (see Table 1 for specific variables evaluated). As shown in the final model in Table 3, the characteristics that predicted inter-individual differences in preoperative levels of state anxiety were total CES-D score; four psychosocial adjustment characteristics (i.e., sense of control of things in life, satisfaction with life, difficulty coping as a result of the disease and treatment, and amount of uncertainty); and receipt of CTX during the six months following surgery. The characteristics that predicted inter-individual differences in the slope parameters for state anxiety were self-report of overall physical health, state anxiety, sense of isolation, and importance of spiritual activities. The characteristics that predicted inter-individual differences in both the intercept and slope parameters were sense of control and difficulty coping.

To illustrate the effects of the above predictors on patients' initial levels and trajectories of state anxiety, Figures 1B and 1C display the adjusted change curves for state anxiety that were estimated based on differences in preoperative state anxiety (i.e., lower/higher state

anxiety calculated based on one standard deviation [SD] below and above the mean STAI-T score) and CES-D score prior to surgery (i.e., lower/higher CES-D score calculated based on one SD above and below the mean CES-D score), respectively. Figures 2A and 2B display the adjusted change curves for state anxiety that were estimated based on differences in life satisfaction (i.e., higher/lower levels of life satisfaction calculated based on 1 SD above and below the mean level of life satisfaction) and levels of uncertainty (i.e., lower/higher levels of uncertainty calculated based on one SD above and below the mean level of uncertainty), respectively.

Figures 2C and 2D display the adjusted change curves for state anxiety that were estimated based on differences in sense of control and difficulty coping, respectively. Figures 3A through 3D display the adjusted change curves for state anxiety based on the following predictors: receipt of adjuvant chemotherapy (3A), physical health (3B), importance of spiritual activities (3C), and feelings of isolation (3D).

Discussion

This study is the first to use HLM to examine individual trajectories of state anxiety prior to and for 6 months following breast cancer surgery and to investigate whether demographic, clinical, symptom, and psychosocial adjustment characteristics predicted preoperative levels and the trajectories of state anxiety over the period of 6 months. Consistent with previous reports,[1–12] initial analyses found that on average, women who underwent surgery for breast cancer experienced declining levels of state anxiety during the 6 months following the surgery.

Prior to surgery, the average level of state anxiety was 41.1 (on a 20 to 80 scale), which is comparable to two studies that assessed state anxiety in women undergoing a variety of surgical procedures for breast cancer.[10,65] As depicted in Figure 1A, and consistent with one report,[10] gradual improvements in state anxiety occurred over the 6 months following surgery with an average STAI-S score of 34.6 at 6 months. Taken together, these findings suggest that women with breast cancer experience moderate levels of anxiety for several months following surgery.

Despite the overall decline in state anxiety, a large amount of inter-individual variability was found in preoperative levels of, as well as in changes in anxiety over time. As shown in Figure 1B, higher levels of state anxiety prior to surgery predicted a steeper decline in state anxiety following surgery than lower levels of preoperative state anxiety. However, trait anxiety was not a predictor of either initial levels of state anxiety or changes in state anxiety over the six months following breast cancer surgery. It is interesting to note that in several studies, neuroticism, which is associated with higher levels of state anxiety, was a predictor of poorer psychological adjustment in patients with breast cancer.[7,9,19,66–68] It is possible that other psychosocial adjustment characteristics evaluated in this study (e.g., difficulty coping, sense of isolation) outweighed the effects of trait anxiety. Future studies need to evaluate how strongly neuroticism correlates with both preoperative levels of trait and state anxiety and whether this personality characteristic influences changes in anxiety.

While the mean preoperative CES-D score of the patients in this study was below the clinically meaningful cutoff, higher levels of depressive symptoms were associated with higher levels of state anxiety before surgery that persisted over 6 months (Figure 1C). This finding is consistent with previous reports that found that higher preoperative levels of psychological distress were associated with poorer psychological outcomes after breast cancer surgery.[3,5,16,21,69] Nevertheless, the use of valid questionnaires in this study, to assess both anxiety (i.e., STAI-S) and depressive symptoms (CES-D), in a large sample of patients with breast cancer, provides additional support for this association. The finding that preoperative levels of depressive symptoms and state anxiety independently predicted preoperative levels of or the postoperative trajectories of state anxiety, respectively, suggests that anxiety and depressive symptoms are distinct conditions that warrant independent assessments.[70]

Consistent with a previous report of patients who underwent general surgical procedures,[71] lower levels of life satisfaction were associated with higher preoperative levels of state anxiety (Figure 2A). Kopp and colleagues noted that a high degree of life satisfaction was associated with a more optimistic view of the world.[71] In addition, in studies of breast cancer survivors,[7,72] optimistic personality was associated with higher levels of psychosocial well-being. Future studies need to examine the relationships among anxiety and personality characteristics (e.g., optimism) and life satisfaction in women undergoing breast cancer surgery.

Consistent with a previous report that found a positive association with uncertainty, assessed immediately after a mastectomy and anxiety after hospital discharge,[73] higher levels of uncertainty about the future was associated with higher levels of preoperative anxiety (Figure 2B). Similarly, in a study of breast cancer survivors,[74] uncertainty predicted worse psychosocial functioning. The observed relationship between uncertainty and preoperative levels of state anxiety adds support to Mishel's theory of uncertainty of illness which postulates that higher levels of uncertainty are associated with poorer psychosocial adjustment and that interventions aimed at reducing uncertainty would have positive effects on this adjustment.[75]

Two psychosocial adjustment characteristics (i.e., sense of control (Figure 2C), difficulty coping (Figure 2D)) were found to be predictors of both the intercept and slope for state anxiety. As expected, a lower sense of control prior to surgery was associated with higher preoperative levels and a steeper decline in state anxiety. This finding is consistent with a previous study[21] that found that the strongest predictor of a decline in psychological distress following breast cancer surgery was the rate of change in perceived control over a period of 12 months. These observations are in agreement with reported negative associations between psychological distress and perceived control in patients with a variety of cancer diagnoses.[76]

Similarly, higher ratings of difficulty coping as a result of the cancer diagnosis and its treatment were associated with higher levels of state anxiety prior to surgery and a slightly steeper decline in state anxiety over time. While the effect of this characteristic was relatively small, the findings are consistent with a study that evaluated the contribution of

coping strategies to women's levels of anxiety following a diagnosis of breast cancer.[13] Lower levels of preoperative anxiety/depression, as well as the use of problem focused coping strategies were associated with lower levels of anxiety/depression at 3 months. However, because anxiety and depression were analyzed together one cannot determine which symptom made the larger contribution to women's patterns of adjustment. Additional support for the inter-relationship between anxiety and difficulty coping comes from a study by Henselmans and colleagues[17] who found that lower levels of mastery were associated with higher levels of psychological distress and that the effect of mastery on psychological distress was mediated by threat appraisals and coping self efficacy. Taken together, these findings suggest that an evaluation of women's coping styles, as well as education on strategies to enhance coping skills might result in decreases in anxiety prior to and following breast cancer surgery.

Two psychosocial adjustment characteristics (i.e., importance of spiritual activities (Figure 3C), feelings of isolation (Figure 3D)) predicted only the slope parameters of the anxiety trajectory. In this study, women for whom spiritual activities were more important demonstrated a steady decline in state anxiety over 6 months after surgery. In contrast, for women for whom spiritual activities were less important, anxiety levels declined slightly more rapidly for about three months and then plateaued over the remaining three months (Figure 3C). Results from a longitudinal study on the role of spirituality in response to the diagnosis and treatment of breast cancer[77] suggest that women who were less involved in spiritual/religious activities prior to the diagnosis of breast cancer and who attempted to mobilize these resources under the stress of diagnosis may experience a negative process of spiritual struggle and doubt that, in turn, has implications for their long-term adjustment. This observation may explain the predicted pattern of changes in anxiety in women in our study for whom spiritual activities were less important.

In this study, lower ratings of feelings of isolation predicted a slightly greater decline in anxiety symptoms over time compared to women who felt more isolated. This finding is congruent with results of a study that evaluated predictors of psychosocial adjustment in the year after a diagnosis of breast cancer.[22] The presence of social support was the only variable that predicted successful adjustment to a diagnosis of breast cancer. Similarly, in a qualitative investigation of the needs of women newly diagnosed with breast cancer, psychosocial support was identified as one of these women's greatest needs.[78] These findings suggest that patients need to be instructed to mobilize their support systems and/or to participate in a breast cancer support group. In addition, nurses could support patients who live alone or do not have an extended social network through scheduled follow-up phone calls and/or home visits. Increased psychosocial support might reduce psychological distress in these women.

A suprising finding from this study is that in the final analysis, only two clinical and no demographic characteristic prediced baseline levels and trajectories of state anxiety. Consistent with previous reports,[3, 6] women who received adjuvant chemotherapy reported higher levels of state anxiety throughout the study (Figure 3A). Patients' ratings of their overall health during the preoperative visit (Figure 3B), predicted changes in the trajectory of state anxiety over the six months of the study. In this study, better ratings of overall

physical health were associated with a slightly steeper decline in state anxiety scores over the 6 months following surgery. The small contribution of self-reported physical health to the trajectory of anxiety after surgery might be explained by the overall good health status of the patients in this study (i.e., high mean KPS score (i.e., 93.2 (10.3)), and the relatively low SCQ score (i.e., 4.3 (2.8)). The prospect of improving health status (e.g., with physical exercise) as a way to prevent anxiety after breast surgery presents an exciting area for future investigation.

While this longitudinal study evaluated changes in anxiety in a large sample of women using a valid and reliable measure for anxiety, a number of limitations need to be acknowledged. The generalizability of the study findings is limited primarily to Caucasian, middle-aged, and highly educated women who were diagnosed with early stage breast cancer. Given that many of the women who declined to participate stated that they were too overwhelmed with the experience of cancer, the current study may have underestimated preoperative levels of state anxiety. Because the monthly assessments in the follow-up period were not scheduled at specific points in the patients' treatment trajectory, times of higher psychological distress may have been missed.[7,19,79] Finally, individual items of the QOL-PV scale were used as indicators of psychosocial adjustment. Despite the fact that these single items are valid measures of subjective states,[80,81] multidimensional measures of the various psychosocial adjustment characteristics should be used in future studies.

Directions for Future Research

Taken together, these findings suggest that most of the women who undergo breast cancer surgery experience moderate levels of anxiety for 6 months following the surgical procedure. Additional research is warranted to determine for how long these moderate levels of anxiety persist and the impact of subsequent treatments on these patients' level of anxiety. It is interesting to note that the majority of the predictors of anxiety were psychosocial adjustment characteristics and not demographic or clinical characteristics. These findings warrant replication in future studies. If they are replicated, they have clinical implications for patient assessments. In addition, future studies could test the efficacy of psychoeducational interventions, designed to enhance social support and coping strategies.

Implications for Clinical Practice

Increased levels of anxiety, during the diagnosis of and surgery for breast cancer, are part of an anticipated reaction to acute stress. Based on our findings, women with higher levels of depressive symptoms, feelings of uncertainty, difficulties coping as a result of disease or treatment, a lower sense of control, and decreased satisfaction with life (i.e., intercept predictors) are at risk for higher levels of anxiety before surgery. Clinicians could implement systematic assessments of anxiety, as well as the characteristics identified in this study to identify high risk women who warrant more targeted interventions. In addition, ongoing follow-up is needed in order to prevent adverse postoperative outcomes and to support women to return to their preoperative levels of function. Future studies could evaluate the efficacy of interventions aimed at modifiable risk factors.

Acknowledgments

This study was funded by grants from the National Cancer Institute (CA107091 and CA118658). Dr. Christine Miaskowski is an American Cancer Society Clinical Research Professor. This project is supported by NIH/NCRR UCSF-CTSI Grant Number UL1 RR024131. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.

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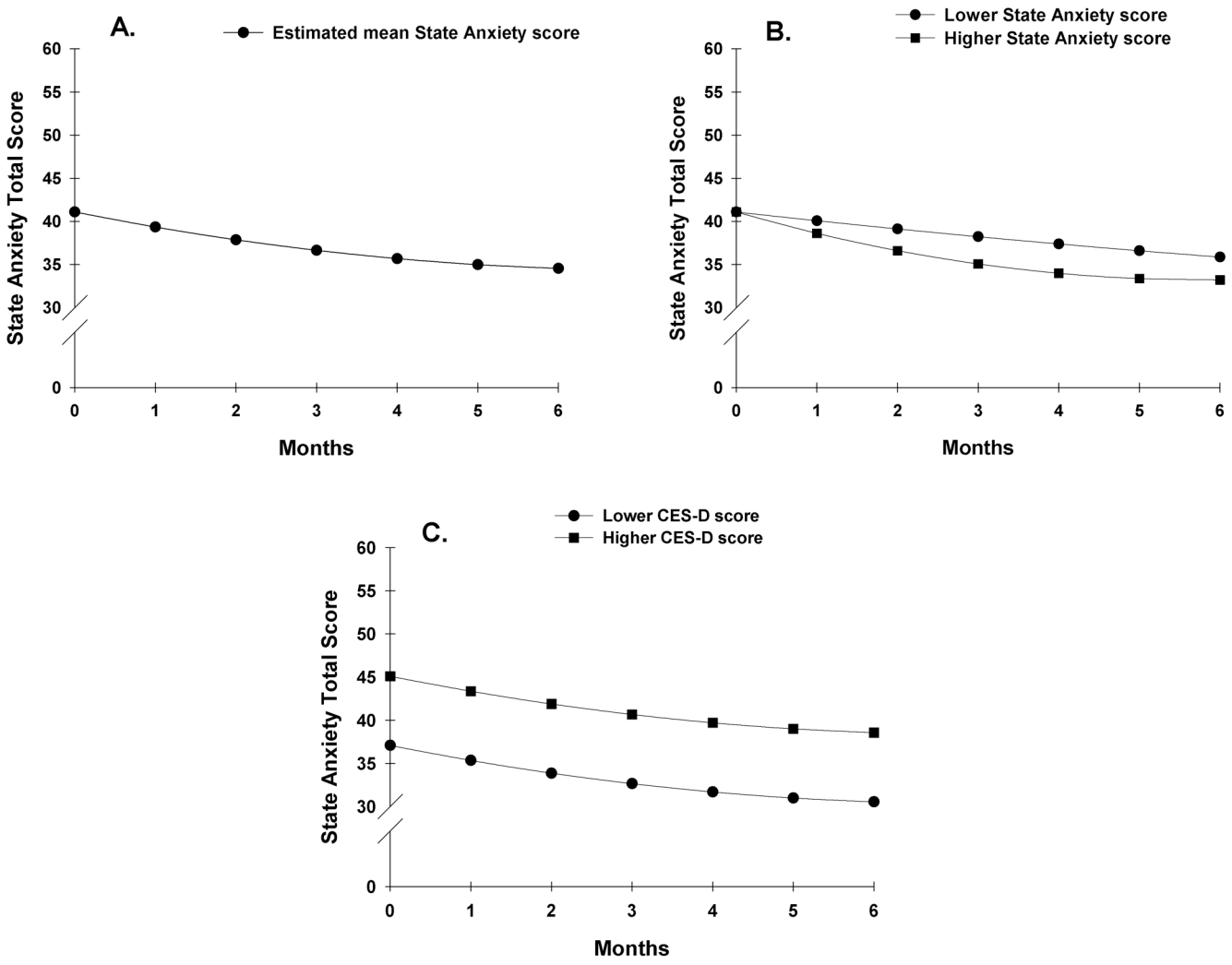

Figure 1.

Trajectory of state anxiety as measured with the Spielberger State Anxiety Inventory over the six months of the study (1A). Influence of preoperative state anxiety (1B) and depressive symptoms (1C) scores on inter-individual differences in state anxiety.

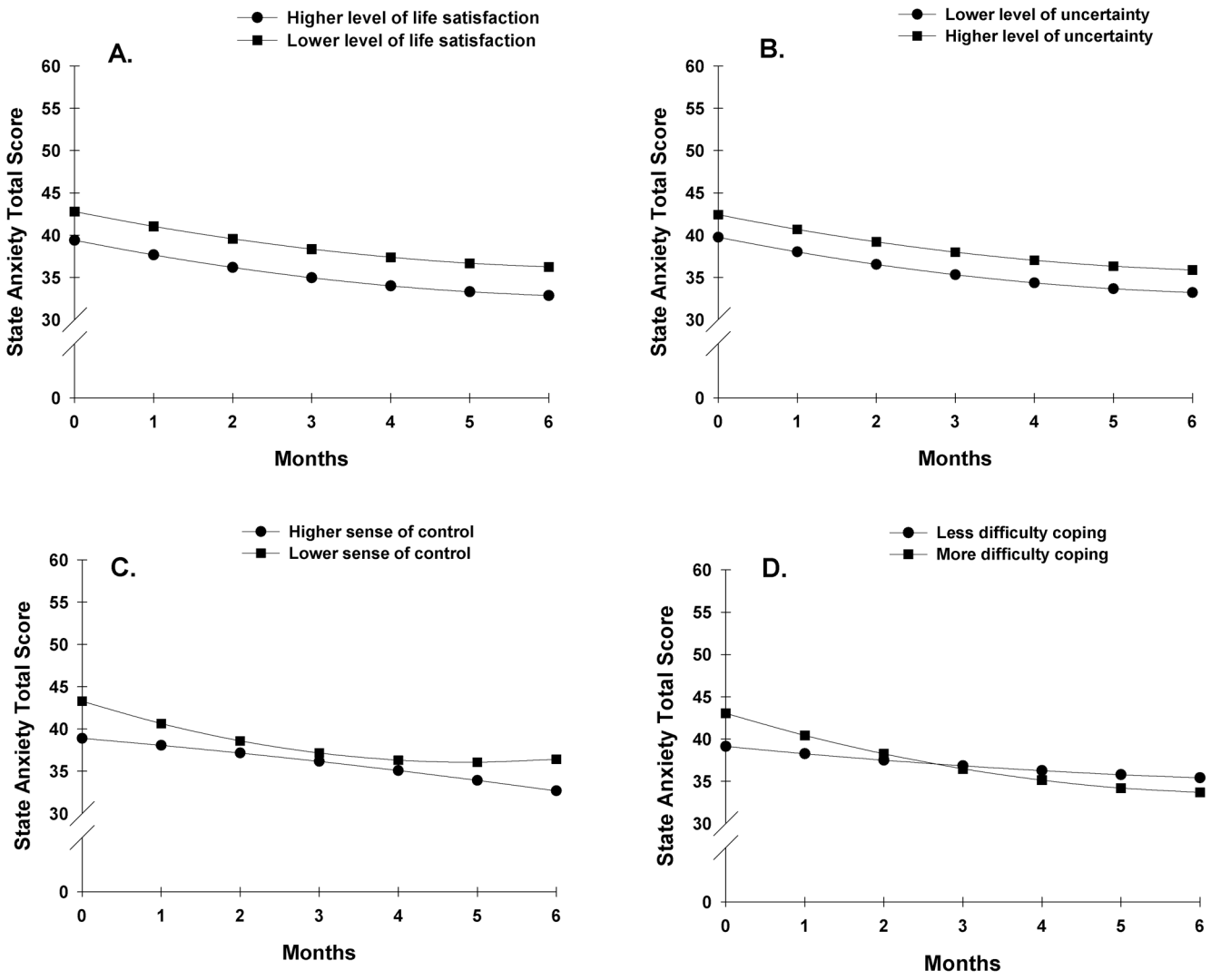

Figure 2.

Influence of preoperative ratings of life satisfaction (2A), uncertainty (2B), sense of control (2C), and difficulty coping (2D) on inter-individual differences in state anxiety.

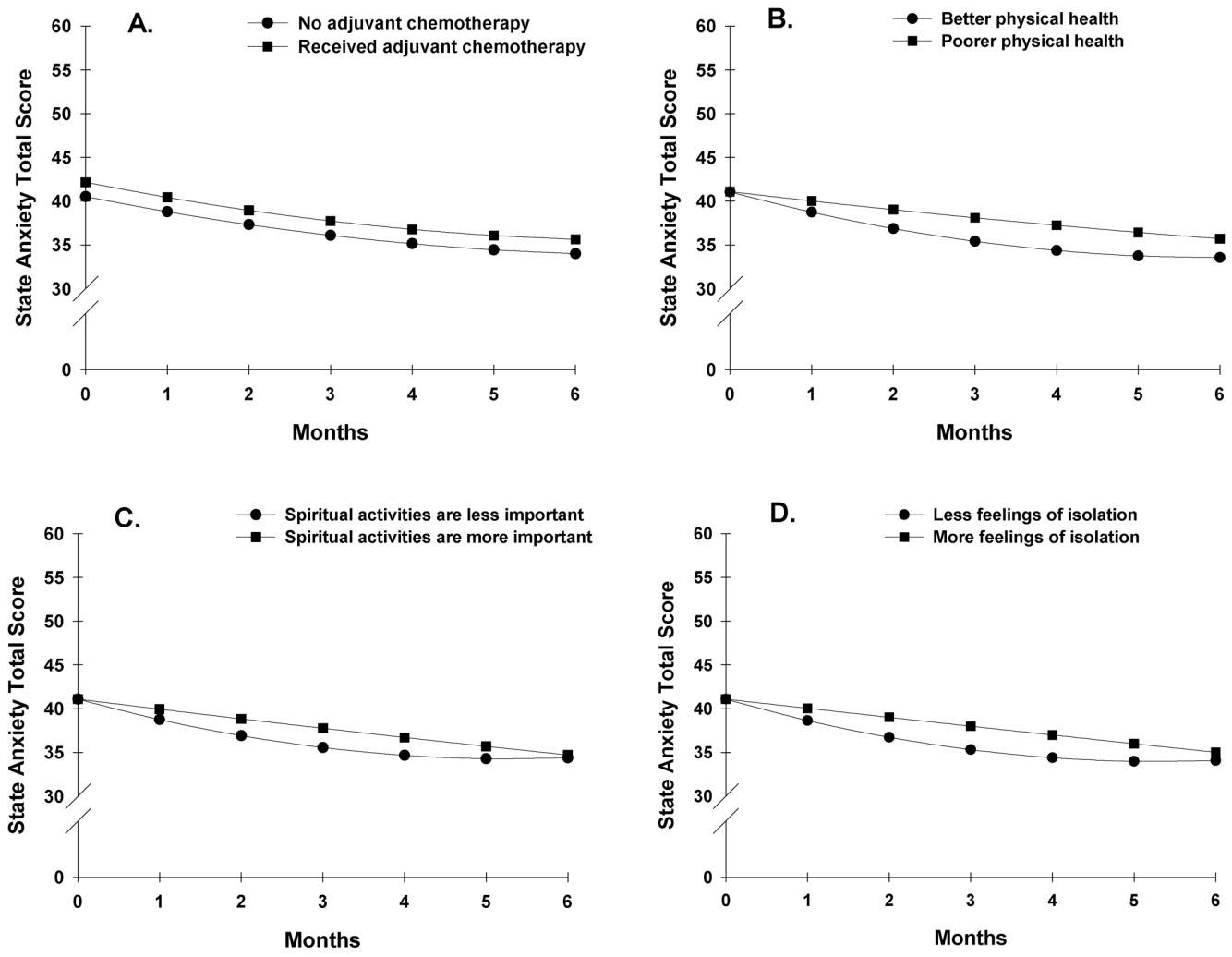

Figure 3.

Influence of receipt of adjuvant chemotherapy (3A) and preoperative ratings of physical health (3B), importance of spiritual activities (3C), and feelings of isolation (3D) on inter-individual differences in state anxiety.

Table 1

Potential Predictors of the Intercept (I), Linear Coefficient (LC) and Quadratic Coefficient for Anxiety Using Preoperative Characteristics

Characteristic	I	LC	QC
Demographic characteristics			
Age	■		
Lives alone			
Education			
Marital status			
Ethnicity	■	■	■
Employment status			
Clinical characteristics			
Body mass index			
Karnofsky Performance Status score	■		
Self-Administered Comorbidity Questionnaire score		■	■
Stage of disease			
Neoadjuvant chemotherapy			
Type of surgery			
Sentinel lymph node biopsy		■	■
Axillary lymph node dissection			
Breast reconstruction at the time of surgery			
Menopausal status	■	■	■
Adjuvant radiation therapy in first six months			
Adjuvant chemotherapy in the first six months	■		
Symptoms			
Trait anxiety score	■		
State anxiety score	■	■	■
Center for Epidemiological Studies-Depression Scale score	■	■	
Attentional Function Index score	■		
Lee Fatigue Scale - Fatigue score	■		
Lee Fatigue Scale - Energy score	■		
General Sleep Disturbance Scale score	■		
Presence of breast pain prior to surgery			
Worst pain score			
Average pain score	■		
Number of days per week in pain			
Number of hours per day in pain			
Severity of hot flashes			
Severity of changes in appetite			
Psychosocial adjustment characteristics			

Characteristic	I	LC	QC
Level of life satisfaction	■		
Amount of uncertainty about the future	■	■	
Importance of spiritual activities		■	■
Feelings of isolation	■	■	■
Evaluation of overall physical health	■	■	■
Control of things in your life	■	■	■
Difficulty coping as a result of disease/treatment	■	■	■

■ = From the exploratory analysis, had a t value of ≥2 and were included in subsequent model testing.

Table 2

Demographic and Clinical Characteristics of the Patients (N = 396)

Characteristic	**Mean (SD)**
Age (years)	54.9 (11.6)
Education (years)	15.7 (2.7)
Self-Administered Comorbidity Questionnaire score	4.3 (2.8)
Karnofsky Performance Status score	93.2 (10.3)
Rate your overall physical health (0 = extremely poor to 10 = excellent)*	7.1 (2.3)
	%
Ethnicity	
Non-white	35.4
Married/partnered	41.5
Lives alone	24.1
Employed	47.5
Postmenopausal	62.3
Stage of disease	
Stage 0	18.3
Stage I	38.0
Stage IIA, IIB	35.4
Stage IIA,IIIB,IIIC,IV	8.3
Type of surgery	
Breast conversation	79.9
Mastectomy	20.1
Sentinel lymph node biopsy	82.4
Axillary lymph node dissection	37.4
Underwent reconstruction at time of surgery	21.6
Received neoadjuvant therapy	19.8
Received radiation therapy during the 6 months following surgery	56.3
Received chemotherapy during the 6 months following surgery	33.4
Experienced recurrence during the 6 months following surgery	0.0
Mean symptom severity score at enrollment	Mean (SD)

Characteristic	Mean (SD)
Trait anxiety score	35.3 (8.8)
State anxiety score	41.8 (13.5)
Center for Epidemiological Studies Depression score	13.7 (9.8)
General Sleep Disturbance Scale score	48.3 (21.6)
Lee Fatigue Scale score	3.1 (2.3)
Lee Energy Scale score	4.9 (2.5)
Attentional Function Index score	6.6 (1.9)
Psychosocial Adjustment Characteristics from the QOL-PV[a]	
How difficult is it for you to cope as a result of your disease and treatment? (0 = extremely difficult to 10 = not at all difficulty)	6.7 (2.7)
Do you feel like you are in control of things in your life? (0 = not at all to 10 = completely in control)	6.1 (2.7)
How satisfying is your life? (0 = not at all satisfied to 10 = completely satisfied)	7.3 (2.6)
How much isolation is caused by your illness or treatment? (0 = a great deal to 10 = none)	8.0 (2.7)
How important to you are other spiritual activities such as meditation? (0 = not at all important to 10 = very important)	5.3 (3.8)
How much uncertainty do you feel about the future? (0 = extreme uncertainty to 10 = not at all uncertain)	5.0 (3.2)

[a] Items are listed as they are worded on the Quality of Life Scale – Patient Version (QOL-PV)

Abbreviation: SD = Standard deviation

Table 3

Hierarchical Linear Model of Anxiety

Variable	Coefficient (SE)	
	Unconditional Model	Final Model
Anxiety		
Fixed Effects		
Intercept	41.093 (.634)[d]	40.534 (.506)[d]
Time[a] (linear rate of change)	−1.861 (.352)[d]	−1.865 (.309)[d]
Time^2 (quadratic rate of change)	.128 (.052)[b]	.129 (.047)[c]
Time invariant covariates		
Intercept:		
Receipt of chemotherapy		1.639 (.737)[b]
Depressive symptoms		.415 (.050)[d]
Sense of control		−.831 (.227)[d]
Life satisfaction		−.763 (.229)[c]
Difficulty coping		−.746 (.212)[d]
Level of uncertainty		−.426 (.130)[c]
Linear:		
Overall physical health × time		−.349 (.127)[c]
Preoperative state anxiety × time		−.062 (.027)[b]
Sense of control × time		.408 (.150)[c]
Importance of spiritual activities × time		.190 (.071)[c]
Difficulty coping × time		.362 (.153)[b]
Sense of isolation × time		−.303 (.106)[c]
Quadratic:		
Overall physical health × time^2		.044 (.021)[b]
Preoperative state anxiety × time^2		.008 (.004)
Sense of control × time^2		−.065 (.023)[c]
Importance of spiritual activities × time^2		−.030 (.012)[c]
Difficulty coping × time^2		−.030 (.024)
Sense of isolation × time^2		.046 (.017)[c]
Variance components		
In intercept	111.756[d]	30.677[d]
In linear rate	18.876[d]	8.081[d]
In quadratic fit	.281[d]	.106[b]
Goodness-of-fit deviance (parameters estimated)	18373.726 (10)	17981.296 (28)
Model comparison (x^2_4)		392.43 (18)[d]

Abbreviations: SE = Standard error

Time^2 refers to the quadratic rate of change

[b] p <.05;

[c] p <.01;

[d] p <.001

[a] Time was coded zero at the time of the preoperative visit