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## Older Breast Cancer Survivors: Factors Associated with Self-reported Symptoms of Persistent Lymphedema Over 7-years of Follow-up

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### Abstract

**Introduction**—Lymphedema of the arm is a common complication of breast cancer with symptoms that can persist over long periods of time. For older women (over 50% of breast cancer cases) it means living with the potential for long-term complications of persistent lymphedema in conjunction with the common diseases and disabilities of aging over survivorship.

**Methods**—We identified women 65-years diagnosed with primary stage I-IIIa breast cancer. Data were collected over 7-years of follow-up from consenting patients' medical records and telephone interviews. Data collected included self-reported symptoms of persistent lymphedema, breast cancer characteristics, and selected sociodemographic and health-related characteristics.

**Results**—The overall prevalence of symptoms of persistent lymphedema was 36% over 7-years of follow-up. Having stage II or III (OR=1.77, 95%CI 1.07–2.93) breast cancer and having a BMI>30 (OR=3.04, 95%CI 1.69–5.45) were statistically significantly predictive of symptoms of persistent lymphedema. Women 80-years were less likely to report symptoms of persistent lymphedema when compared to younger women (OR=0.44, 95%CI 0.18–0.95). Women with symptoms of persistent lymphedema consistently reported worse general mental health and physical function.

**Conclusion**—Symptoms of persistent lymphedema were common in this population of older breast cancer survivors and had a noticeable effect on both physical function and general mental health. Our findings provide evidence of the impact of symptoms of persistent lymphedema on the quality of survivorship of older women. Clinical and research efforts focused on risk factors for symptoms of persistent lymphedema in older breast cancer survivors may lead to preventative and therapeutic measures that help maintain their health and well-being over increasing periods of survivorship.

### Keywords

Breast cancer; lymphedema; older women; persistent lymphedema; survivor; symptoms

## INTRODUCTION

Lymphedema of the arm is one of the most common complications of breast cancer with symptoms that can persist over long periods of time.(1–6) The overall incidence of lymphedema of the arm (hereafter lymphedema) following breast cancer treatment is reported to be 26% with a range from 0% to 56% at 2-years post-surgery.(7).(8, 9) Reports of incidence are inconsistent due to variations by treatment type, time since treatment, and a lack of uniform diagnostic criteria.(3, 8) According to the American Cancer Society, of the two million breast cancer survivors in the U.S., approximately 400,000 must cope with lymphedema on a daily basis.(10) Lymphedema secondary to breast cancer is often considered benign and not life-threatening, but when symptoms persistent, has been shown to have long-term physical and psychosocial consequences.(1, 5, 8, 11–20) These include cosmetic disfiguration, physical discomfort, limited arm movement leading to loss of functional ability, increased risk of infection, impaired quality of life, and sexual dysfunction, all of which serve as a constant reminder of the cancer experience.(13, 16, 18, 21–25) Lymphedema is difficult to manage as a chronic condition, and for older women (over 50% of breast cancer cases)(26) it means living with the potential for long-term complications of lymphedema in conjunction with the common diseases and disabilities of aging. The impact of which may be considerable based on the conceptual framework of the International Classification of Functioning, Disability, and Health.(27)

For these reasons, understanding risk factors for symptoms of persistent lymphedema (SoPL), specifically in older breast cancer survivors, is of great consequence. Risk factors for lymphedema in mixed age-group populations include axillary lymph node dissection (ALND), radiation therapy, age, infection, pre-existing cardiovascular conditions, and obesity, although their relation to persistence is unclear.(28–35) Moreover, to our knowledge, no long-term follow-up studies have been conducted to investigate risk factors of SoPL exclusively among older breast cancer survivors. We addressed this void by prospectively evaluating the predictors of SoPL in a population of older breast cancer survivors over 7-years of follow-up. We hypothesized that the set of predictors specific to SoPL in older survivors would differ from those previously reported in shorter follow-up mixed age populations and that SoPL would have a negative effect on mental health and physical function.

## MATERIALS AND METHODS

### Study Population

The longitudinal study design and subject recruitment procedures have been reported elsewhere.(36–38) In brief, newly diagnosed breast cancer patients were identified through regular review of pathology reports at hospitals or collaborating tumor registries in four geographic regions (Los Angeles, Minnesota; North Carolina, and Rhode Island) with Institutional Review Board (IRB) approval of the study in each setting. Women were eligible for the study if: they had stage I disease and a tumor diameter of 1 cm or greater, stage II-IIIa disease; they were age 65-years or older on the date of diagnosis; and permission from the attending physician to be contacted for study participation had been obtained. Additional inclusion criteria included: no prior history of primary breast cancer; no simultaneously diagnosed or treated second primary tumor at another site; English speaking and competent for interview with satisfactory hearing. Eligible participants were mailed an enrollment package and were called by a research staff member from each site who explained the study's purpose and participation requirements; potential subjects were given an opportunity to decline participation and those who verbally agreed to participate were asked to return a signed consent form approved by the IRB at each site, resulting in a baseline study population of 660 women. Women who were lost to follow-up before their

27-month contact or who had insufficient lymphedema data were excluded, leaving 400 women in the analytic study population. Figure 1 shows the study population flow.

### Data Collection Procedures

Telephone interviews were conducted at 3 (baseline), 6, 15, 27, 39, 51, 63, 75, and 87-months after definitive surgery. A definitive surgery-date based on medical record review was assigned for each subject. Trained interviewers conducted the interviews, which took an average of 45-minutes to complete, and ascertained sociodemographic information, psychosocial status, health status, and breast cancer therapies received. Tumor and treatment information (excepting chemotherapy and tamoxifen use obtained by interview) and comorbid conditions at the time of diagnosis were collected by medical record review at least 3-months after the date of definitive surgery.

### Analytic Variables

**Symptoms of lymphedema**—Patient interviews at 15, 27, 39, 51, 75, and 87-months post definitive surgery assessed lymphedema using a single question that asked “In the past four weeks, how bothered are you by swelling or lymphedema in either arm?” Subjects responded on a five-level scale reporting 0=Not at all, 1=a little, 2=a fair amount, 3=much, or 4=very much (1–4 responses indicating symptoms). SoPL was defined as a positive response at least two interviews over the follow-up period. Symptoms of transient lymphedema were categorized as a positive response at 15-month interview but not at any other follow-up interviews and no positive responses at any interview as having no symptoms over follow-up.

**Sociodemographic characteristics**—We classified patient age as 65–69, 70–79, or 80+ years of age; race as white or non-white; education as <high school, high school, or >high school; marital status as married or not married; having adequate finances to meet needs (yes/no); employment status as working full/part-time for pay or unemployed; and health insurance as receiving Medicaid or not.

**Breast cancer characteristics**—We classified stage as I, II–III, using the TNM classification.(39) We classified primary tumor therapy as BCS followed by radiation therapy, BCS alone, or mastectomy. ALND was considered as yes/no as were receipt of chemotherapy and adjuvant tamoxifen therapy.

**Health-related characteristics**—We determined the number and type of underlying diseases present at the time of diagnosis using definitions developed for the Index of Co-Existent Diseases.(40) A measure of total disease burden as reflected by the presence of as many as fourteen comorbid conditions was categorized into the following groups: 0, 1–2, 3–4, or 5 or more. Self-perceived health status before diagnosis was assessed using a single-item measure “In general, would you say that your health before your breast cancer was diagnosed was excellent, very good, good, fair or poor?” Self-rated health was dichotomized as excellent, very good, or good (good) versus fair or poor (poor). Body mass index (BMI) was derived from the patients’ baseline self-reported weight and height, and was analyzed as a continuous variable ranging from 18.9–41.7 kg/m and dichotomously as versus >30. We asked subjects whether or not they exercised regularly at the 6-month interview. Regular exercise was defined as some activity for at least one-half hour a day at least three times a week whose main purpose was to exercise, aside from exercises prescribed by their doctor or physical therapist specifically for breast cancer. Physical function was assessed by the Physical Function Index 10 (PFI10, scaled from 0–100, with higher scores indicating better function) from the Medical Outcomes Study (MOS) SF-36.(41) General mental health was assessed by the Mental Health Index (MHI5), a 5-item measure of mental health from the

MOS SF-36 scored on a 0–100 scale (higher scores indicating better mental health).(42) This scale has been widely used in many populations with chronic disease and cancer; a score of 80 considered good general mental health and an 8-point change clinically significant.(36, 38, 43–46)

### Analytic Strategy

We obtained descriptive statistics (univariate, proportion, frequency) on all study variables. We then examined the bivariate relations between the independent variables and the outcome variable using Spearman correlations and chi-square tests. Next, we conducted analyses comparing continuous variables at each interview time point of subjects with SoPL to those without using student t-tests. Two variable (crude) and multivariable logistic regression models were used to evaluate associations between the outcome and the independent variables. Independent variables demonstrating an association with the outcome variable we evaluated for potential inclusion in multivariable models. The final subset of candidate independent variables was selected by the model building strategy described by Greenland.(47) Subjects with missing data for independent or outcome variables were excluded from the models. Finally, we conducted lost-to-follow-up analyses by comparing the baseline population (N=660) to our final analytic population (N=400) using chi-square and student t-tests. All analyses were performed using SAS version 9.1(48) and all p values were two-sided.

## RESULTS

### Characteristics of the Study Population

Sociodemographic, breast cancer, and health-related characteristics of the baseline study population (N=660) are shown in Table I. Approximately one quarter of the population came from each of the four study sites. The majority were 70-years of age. Most were white and had a high school education or greater. Just less than half were married and the majority had adequate finances to meet their needs. Only a small proportion was working full- or part-time at baseline. About half of the women had stage I disease; the majority received ALND and either a mastectomy or breast conserving surgery (BCS) followed by radiation. The majority had two or less comorbid conditions and reported good health. Over one-half of the women reported exercising regularly at baseline, and 21% had a BMI of 30. On average, these women exhibited high levels of general mental health and physical function.

We followed 400 women for up to 7-years after definitive surgery (5.8 mean vs. 7.0 median number of years of follow-up). Table II lists the characteristics of the analytic study population by symptoms of lymphedema status. The overall prevalence of SoPL was 36% (145/400), with nearly one-quarter reporting it in all interviews. Only 18 women (4.5%) met our definition of symptoms of transient lymphedema, limiting statistical comparisons due to small numbers. Those with symptoms of transient lymphedema were proportionally younger, more were married and had adequate finances, while fewer received BCS with radiation or reported good self-rated health before diagnosis. On average they had lower PFI10 and higher MHI5 scores than women with SoPL.

### Baseline Predictors of Symptoms of Persistent Lymphedema

The crude and adjusted results of the logistic regression models for baseline predictors of SoPL are presented in Table III. Women with stage II–III disease (odds ratio[OR]=1.77, 95% confidence interval[CI] 1.07–2.93), and those having a BMI >30 (OR=3.04, 95% CI 1.69–5.45) at baseline were statistically significantly more likely to report SoPL over

follow-up. Women 80+ years old were less likely to report SoPL when compared to younger women (OR=0.44, 95% CI 0.18–0.95).

### Symptoms of Persistent Lymphedema, Physical Function and Mental Health over Follow-up

Figures 2 and 3 show the pattern of physical function (PFI10) and general mental health (MHI5) scores by SoPL status over the study period. Women with SoPL consistently reported worse physical function and general mental health over follow-up. There was on average an 11-point difference (range 6–13 points) in PFI10 scores and a 6-point difference (range 3–9 points) in MHI5 scores, with statistically significant differences at all interview time points.

Baseline physical function and general mental health scores did not predict SoPL. Yet, women with an average 10-point decrease or more in PFI10 and MHI5 scores over follow-up were more likely to report SoPL (OR=1.97, 95% CI 1.23–3.15; OR=2.53, 95% CI 1.55–4.12, respectively) when adjusting for other factors. Moreover, in adjusted logistic regression models comparing women with an average 10-point decrease or more in PFI10 and MHI5 scores over follow-up to those without, persistent lymphedema was the single strongest statistically significant predictor of decreased scores over follow-up (OR<sub>PFI10change</sub>=2.32, 95% CI 1.47–3.65; OR<sub>MHI5change</sub>=2.86, 95% CI 1.78–4.61).

### Lost-to-follow-up analysis

Table 1 characteristics of women in the baseline population were compared to those in the analytic population. There were no statistically significant differences in characteristics other than mean age and Medicaid; mean age of the baseline population was minimally higher (73.9±6.0 SD vs. 73.2±5.5 SD, p=0.04) and a higher proportion at baseline reported having Medicaid (6.2% vs. 3.3%, p=0.04).

## DISCUSSION

We determined the prevalence and examined characteristics associated with SoPL in a longitudinal study of older breast cancer survivors. Over 7-years of follow-up, 36% of breast cancer survivors reported SoPL and these women consistently reported lower physical function and general mental health when compared to women without. The odds of reporting SoPL in the oldest group (80+ years) were lower compared to young old women (65–69 years). The only statistically significant risk factors identified for SoPL in older survivors were breast cancer stage and having a BMI>30.

The set of risk factors for SoPL that we identified is not entirely in agreement with that identified in previous research.(2, 8, 49–51) We found advanced age (80+ years) to be protective whereas others, with mainly younger mixed-age populations, have found increasing age to be related to lymphedema risk.(33, 35, 49, 52) In addition, many previous studies have found ALND to be a strong and significant predictor of lymphedema risk, but in our study ALND was not statistically significantly related. This may be at least in part due to the fact that our study, in contrast to others,(4, 8, 49, 53) distinguished between transient and persistent lymphedema. Additional potential reasons include that previous studies were conducted when more extensive ALND was being performed and that we had limited study power (81% of our subjects had ALND). The difference in predictive factors that we found in comparison to other studies raises questions regarding the relationship among advanced age, ALND and SoPL.

Since currently no definitive cure for lymphedema exists, prevention by limiting and/or eliminating risk factors is of prime importance.(49) In the case of the older women in our

study, only one risk factor (BMI>30) is modifiable. Similar to findings by Werner, Petrek and others, among more than 15 potential predictive factors, obesity was one of the most important risk factors for lymphedema.(29–33, 54) Focusing clinical recommendations and interventions on weight control via dietary and exercise interventions in older breast cancer survivors may be the most effective preventative and therapeutic measures. Underscoring this is recent research showing that weight loss achieved by dietary advice to reduce energy intake reduced breast cancer-related lymphedema significantly.(34) Further research is needed to evaluate the efficacy of such treatments among older survivors and particularly for those suffering from persistent versus transient lymphedema.(8) Weight loss and weight gain prevention can also benefit breast cancer survivors by reducing the risk for earlier recurrence and poorer survival.(55, 56) Thus, attention to these issues can become part of an important teachable moment for overweight breast cancer patients as they transition into follow-up and survivorship care, ensuring that primary care physicians as well as oncologists understand the detrimental effects of obesity in this patient population.(57–59)

SoPL in this population of older survivors had a noticeable effect on both physical function and general mental health. It is easy to understand why lymphedema is reported to be one of the most feared long-term complications of breast cancer treatment.(8) Furthermore, the interrelationships among lymphedema, physical functional impairment and mental health are important. Increasing age has been shown in previous research to be a risk factor for both lymphedema and functional impairment. Functional impairment may be aggravated by SoPL. In turn, both functional impairment and/or lymphedema, especially over prolonged periods, may negatively affect mental health, as suggested by the consistently lower general mental health and physical function scores of the women in this study with SoPL. As survival continues to improve for older women, mental health issues may take on increasing importance as does finding effective interventions to prevent and treat their SoPL.

Several limitations of this study should be considered when interpreting our findings. First, we used a single question to define SoPL based on self-report. This may have caused misclassification. However, previous studies have demonstrated valid results with similar self-report measures (5, 9, 60–63) and self-report is most often used in clinical practice.(64, 65) Additionally, since we defined SoPL longitudinally using multiple reports over time, the effect of misclassification would be expected to be minimized since it is unlikely that women would mistakenly report lymphedema symptoms or diagnosis over a number of years. Second, our SoPL question represents a subjective assessment without a non-breast cancer comparison group that only captures those who were bothered by lymphedema or its symptoms. There can be a substantial disconnect between prevalence of lymphedema based on objective diagnostic assessment and being bothered by symptoms. If, in fact, there is a proportion of women with arm symptoms that are not caused by breast cancer related lymphedema, as reported in a Canadian study of a younger population(66) then the prevalence reported here would be overstated. However, the women reporting SoPL in this study reported symptoms in the same side as their breast cancer surgery, suggesting minimal misclassification of breast cancer related SoPL. Nonetheless, our use of a subjective measure also makes our data difficult to compare with other studies. Third, results might vary by severity and/or type of symptoms, but we were unable to consider differences across categories of lymphedema severity due to small numbers and question wording. Fourth, the high attrition rate (260/660) may have affected the validity of our findings. However, the comparison of baseline and analytic populations on Table 1 characteristics showed minimal differences. Last, our study population was a largely white, well-educated group of older women, limiting generalizability to other populations of older breast cancer survivors.

Our findings provide insight into the problem of SoPL in older breast cancer survivors. However, caution must be used in drawing conclusions about the meaning of the findings;

further research involving clinically confirmed lymphedema, long-term follow-up, and larger and more heterogeneous populations is needed. Notwithstanding, this research provides initial evidence of the impact of SoPL on the quality of long-term survivorship of older women. Clinical and research efforts focused on risk factors for persistent separate from transient lymphedema in older breast cancer survivors may lead to preventative and therapeutic measures that help maintain their health and well-being over increasing periods of survivorship. Targeting long-term post breast cancer care for high-risk individuals could help to focus the resources available in clinical practice to those patients most likely to benefit.

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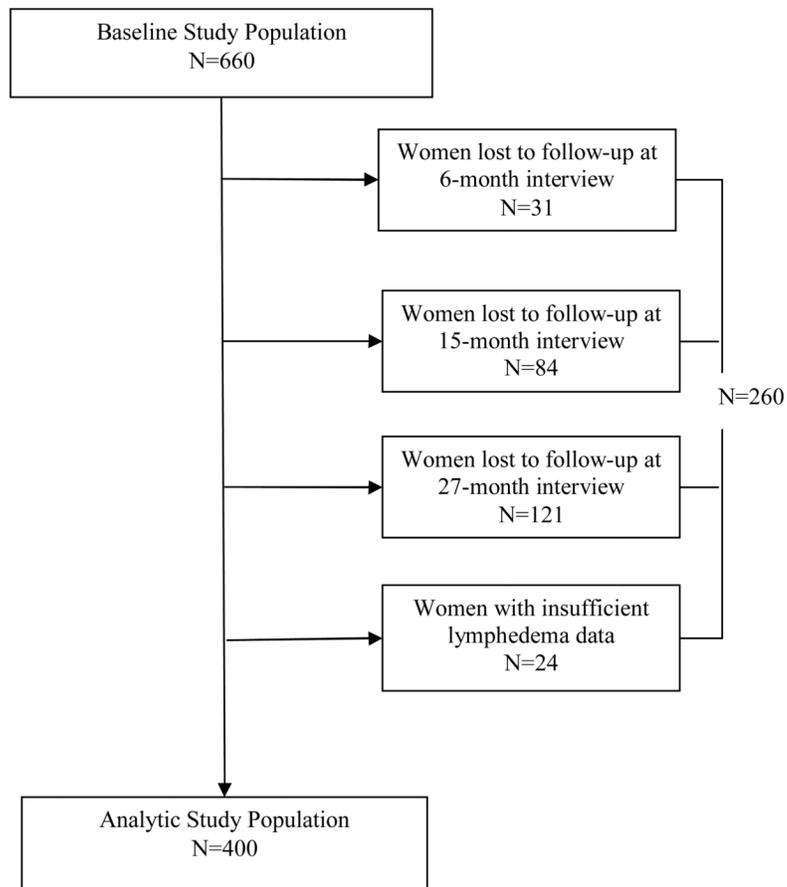
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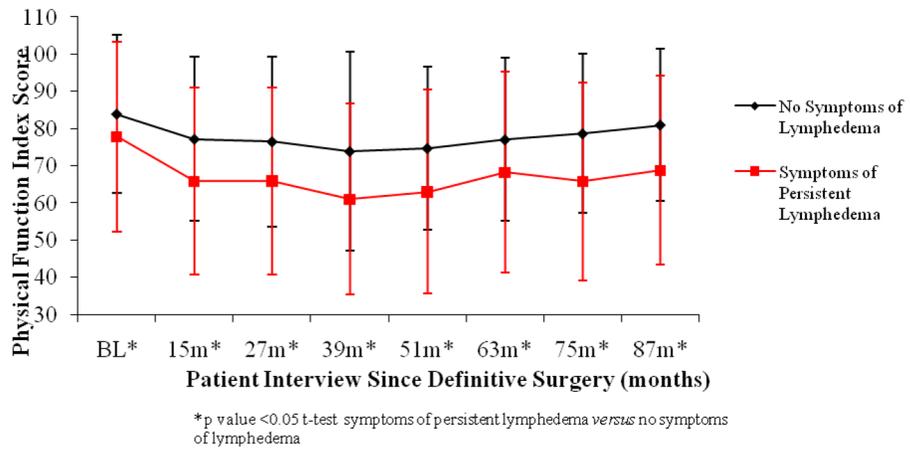
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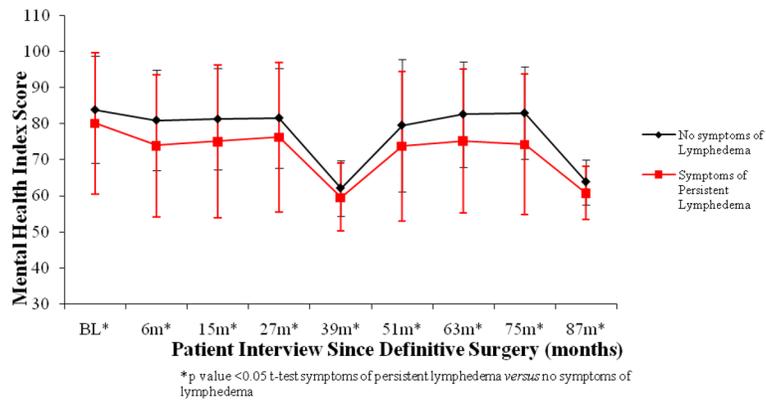
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**Figure 1.** Study population flow chart of a 7-year longitudinal study of older breast cancer survivors, 1998–2006.



**Figure 2.** Mean scores with standard deviations of the Physical Function Index for subjects with symptoms of persistent lymphedema and no symptoms of lymphedema over 7-years of follow-up



**Figure 3.** Mean scores with standard deviations of the 5-item Mental Health Index for subjects with symptoms of persistent lymphedema and no symptoms of lymphedema over 7-years of follow-up

**Table I**

Baseline sociodemographic, breast cancer, and health-related characteristics of the baseline population (N=660) in a 7-year longitudinal study of older breast cancer survivors, 1998–2006

<b>Characteristic at Baseline:</b>	<b>N (%)</b>
<b><i>Sociodemographic:</i></b>	
Enrollment site	
LA	150 (23)
RI	163 (25)
MN	188 (28)
NC	159 (24)
Age	
65–69 years	172 (26)
70–79 years	372 (56)
80+ years	116 (18)
Race	
White	620 (94)
Other	40 (6.1)
Education	
Less than 12 years	115 (17)
12 years	228 (35)
More than 12 years	316 (48)
Married	304 (46)
Adequate finances	587 (90)
Employment	65 (10)
Medicaid	40 (6.2)
<b><i>Breast Cancer:</i></b>	
Stage	
I	336 (51)
II–III	324 (49)
Therapy	
Mastectomy	333 (50)
BCS with radiation	265 (40)
BCS without radiation	52 (7.9)
Other	10 (1.5)
ALND	532 (81)
SLNB	29 (4.4)
Chemotherapy	145 (22)
Tamoxifen	498 (75)
<b><i>Health-Related:</i></b>	
Comorbidity – number of conditions	
0	86 (13)
1–2	340 (52)

<b>Characteristic at Baseline:</b>	<b>N (%)</b>
3-4	172 (26)
5 or more	57 (8.7)
Good self-rated health before diagnosis	564 (85)
Exercise regularly	283 (43)
BMI >30	140 (21)
PFI10 (mean $\pm$ SD)	79.5 $\pm$ 25.1
MHI5 (mean $\pm$ SD)	80.7 $\pm$ 17.8

LA, Los Angeles, CA; RI, Rhode Island; MN, Minnesota; NC, North Carolina; SD, Standard Deviation; BCS, Breast Conserving Surgery; ALND, Axillary Lymph Node Dissection; SLNB, Sentinel Lymph Node Biopsy; BMI, Body Mass Index; PFI10, MHI5, 5-item Mental Health Index

**Table II**

Sociodemographic, breast cancer, and health-related characteristics of the analytic population (N=400) by symptoms of lymphedema status in a 7-year longitudinal study of older breast cancer survivors, 1998–2006

<b>Characteristic at Baseline:</b>	<b>No Symptoms of Lymphedema N=237 N (%)</b>	<b>Symptoms of Persistent Lymphedema N=145 N (%)</b>	<b>Symptoms of Transient Lymphedema N=18 N (%)</b>
<b><i>Sociodemographic:</i></b>			
Enrollment site			
LA	51 (22)	31 (22)	2 (11)
RI	54 (23)	34 (24)	6 (33)
MN	71 (29)	41 (28)	4 (22)
NC	61 (26)	39 (26)	6 (33)
Age			
65–69 years	65 (27)	44 (30)	7 (39)
70–79 years	134 (57)	90 (62)	10 (56)
80+ years	38 (16)	11 (7.6)	1 (5.6)
Race			
White	226 (95)	135 (93)	18 (100)
Other	11 (4.6)	10 (6.9)	0 (0)
Education			
Less than 12 years	32 (14)	29 (20)	3 (17)
12 years	77 (32)	48 (33)	6 (33)
More than 12 years	128 (54)	68 (47)	9 (50)
Married	118 (50)	72 (50)	11 (61)
Adequate finances	222 (94)	129 (89)	18 (100)
Employment	23 (9.7)	16 (11)	1 (5.6)
Medicaid	6 (2.6)	6 (4.3)	1 (5.6)
<b><i>Breast Cancer:</i></b>			
Stage			
I	135 (57)	62 (43)	9 (50)
II–III	102 (43)	83 (57)	9 (50)
Therapy			
Mastectomy	123 (52)	81 (56)	12 (67)
BCS with radiation	114 (48)	64 (44)	6 (33)
ALND	193 (81)	128 (88)	15 (83)
Chemotherapy	47 (20)	41 (28)	4 (22)
Tamoxifen	188 (79)	110 (76)	14 (78)
<b><i>Health-Related:</i></b>			
Comorbidity – number of conditions			
0	35 (15)	16 (11)	3 (17)
1–2	127 (54)	77 (53)	8 (44)
3–4	58 (24)	35 (24)	4 (22)
5 or more	17 (7.2)	17 (12)	3 (17)
Good self-rated health before diagnosis	217 (92)	116 (80)	12 (67)

Characteristic at Baseline:	No Symptoms of Lymphedema N=237 N (%)	Symptoms of Persistent Lymphedema N=145 N (%)	Symptoms of Transient Lymphedema N=18 N (%)
Exercise regularly	121 (51)	67 (46)	7 (39)
BMI >30	26 (11)	43 (30)	8 (44)
PFI10 (mean $\pm$ SD)	83.9 $\pm$ 21.3	77.8 $\pm$ 25.5	73.2 $\pm$ 30.9
MHI5 (mean $\pm$ SD)	83.9 $\pm$ 14.9	80.1 $\pm$ 19.6	84.0 $\pm$ 18.8

ALND, Axillary Lymph Node Dissection; LA, Los Angeles, CA; RI, Rhode Island; MN, Minnesota; NC, North Carolina; SD, Standard Deviation; BCS, Breast Conserving Surgery; BMI, Body Mass Index; PFI10, MHI5, 5-item Mental Health Index

**Table III**

Baseline predictors of lymphedema comparing subjects with symptoms of persistent lymphedema (N=145) to those without symptoms of lymphedema (N=237) in a 7-year longitudinal follow-up study of older breast cancer survivors, 1998–2006

Characteristic at Baseline:	OR <sub>crude</sub> (95%CI)*	OR <sub>adjusted</sub> (95%CI)*
<b>Demographic:</b>		
Age		
65–69 years	1.0	1.0
70–79 years	0.99 (0.62–1.58)	1.14 (0.67–1.93)
80+ years	0.43 (0.20–0.93)	0.44 (0.18–0.95)
Education		
Less than 12 years	1.0	1.0
12 years	0.69 (0.37–1.28)	0.64 (0.32–1.29)
More than 12 years	0.59 (0.33–1.05)	0.70 (0.36–1.36)
Adequate finances	0.55 (0.26–1.14)	0.72 (0.32–1.61)
<b>Breast Cancer:</b>		
Stage		
I	1.0	1.0
II or III	1.77 (1.17–2.69)	1.77 (1.07–2.93)
Therapy		
Mastectomy	1.0	1.0
BCS with radiation	0.85 (0.56–1.29)	1.00 (0.63–1.62)
BCS without radiation	..#	..#
ALND	1.72 (0.94–3.14)	1.43 (0.74–2.79)
Adjuvant therapy		
Chemotherapy	1.59 (0.98–2.58)	1.09 (0.58–2.06)
Tamoxifen - prescribed	0.82 (0.50–1.34)	0.88 (0.51–1.52)
<b>Health:</b>		
Comorbidity number of conditions		
0	1.0	1.0
1–2	1.33 (0.69–2.56)	1.07 (0.53–2.16)
3–4	1.32 (0.64–2.73)	1.00 (0.46–2.20)
5 or more	2.19 (0.89–5.36)	1.21 (0.43–3.40)
BMI >30	3.42 (1.99–5.88)	3.04 (1.69–5.45)
Exercise regularly at 6 months	0.82 (0.54–1.25)	1.11 (0.70–1.76)
PFI10	0.99 (0.98–1.00)	0.99 (0.98–1.00)
MHI5	0.99 (0.98–1.00)	1.00 (0.98–1.01)

OR, odds ratio; CI, confidence interval; BCS, breast conserving surgery; ALND, axillary lymph node dissection; BMI, body mass index; PFI10, Physical Function Index; MHI5, 5-item Mental Health Index.

\* Model adjusted for all variables listed in table.

# Variable not assessed due to small numbers.