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Factors Predicting Adherence to Risk Management Behaviors of Women at Increased Risk for Developing Lymphedema

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Abstract

Purpose—Lymphedema affects 20-30% of women following breast cancer treatment. However, even when women are informed, they do not necessarily adhere to recommended lymphedema self-management regimens. Utilizing the Cognitive-Social Health Information Processing framework, we assessed cognitive and emotional factors influencing adherence to lymphedema risk management.

Methods—Women with breast cancer who had undergone breast and lymph node surgery were recruited through the Fox Chase Cancer Centre breast clinic. Participants ($N=103$) completed measures of lymphedema-related perceived risk, beliefs and expectancies, distress, self-regulatory ability to manage distress, knowledge, and adherence to risk management behaviors. They then received the American Cancer Society publication “Lymphedema: What Every Woman with Breast Cancer Should Know”. Cognitive and affective variables were reassessed at 6- and 12-months post-baseline.

Results—Maximum likelihood multilevel model analyses indicated that overall adherence increased over time, with significant differences between baseline and 6- and 12-month assessments. Adherence to wearing gloves was significantly lower than that for all other behaviors except electric razor use. Distress significantly decreased, and knowledge significantly increased, over time. Greater knowledge, higher self-efficacy to enact behaviors, lower distress, and higher self-regulatory ability to manage distress were associated with increased adherence.

Conclusions—Women who understand lymphedema risk management and feel confident in managing this risk are more likely to adhere to recommended strategies. These factors should be rigorously assessed as part of routine care to ensure that women have the self-efficacy to seek

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Conflict of Interest

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treatment and the self-regulatory skills to manage distress, which may undermine attempts to seek medical assistance.

Keywords

breast cancer; lymphedema; cognitive; affective; adherence; self-care

Introduction

Improvements in the life expectancy of women diagnosed with breast cancer have created new challenges in terms of effectively managing post-treatment complications [1]. An often overlooked complication affecting approximately 20-30% of women treated for breast cancer is lymphedema [2,3], an abnormal accumulation of lymphatic fluid due to lymphatic system damage following radiation to the axilla and/or surgical removal of lymph nodes [4,5]. Physical symptoms may include arm swelling, discomfort, loss of sensation, and impaired functioning [4,3]. Lymphedema also impacts on women psychologically by compromising quality of life, and increasing emotional distress, relationship difficulties and body image concerns [6-12]. Lymphedema is a chronic, but generally treatable [13] condition that typically develops within the first two years following breast cancer treatment, although it can develop at any time after surgery [14,4]; thus, the prospect of lymphedema remains a constant threat over the lifetime of these women.

Internationally accepted guidelines (e.g., American Cancer Society; ACS) recommend that women adopt self-management strategies to minimize strain on the lymphatic system through avoidance of infection, trauma to the arm, excessive muscle strain, and weight gain [5,15]. However, one recent prospective study questions the degree to which exposure to some of these incidents (e.g., travel to hot places, air travel, hang nails, pet scratches and wearing a tight bra) actually lead to onset of lymphoedema symptoms [16]. The woman's ability to recognize early symptoms of lymphedema and to seek prompt medical attention and to enact self-management strategies, are critical to minimize lymphedema occurrence and progression [17,15]. This early-detection approach is cost-effective in the long term as it is less costly to treat and manage early-stage, than advanced, lymphedema [18] and minimizes distress. The present study focuses on patient-centered factors predictive of prompt adherence to medical surveillance as well as the execution of ongoing self-management strategies.

Educating women about lymphedema risk management is a fundamental component of breast cancer survivorship [17], yet current awareness is highly variable [19-22]. Moreover, even when women are well informed, they do not necessarily adhere to recommended self-management regimens [22-24]. As there is no "safe" period when a woman is no longer at risk for lymphedema, women need to integrate risk-management strategies into their everyday lives. Although many of these strategies involve simple lifestyle changes, such as wearing gloves for common household duties or avoiding sun exposure, the need to be ever vigilant for symptoms, and enact appropriate behaviors, places a large self-regulatory load upon the individual [22,25,26]. Furthermore, effectively monitoring for, and executing, the

recommended measures entails a chronic reminder of one's symptom status and diagnosis [27,25,28].

Conceptual frameworks of health behavior, such as the Cognitive-Social Health Information Processing (C-SHIP) model, propose that an individual's adherence to health-protective behaviors (e.g., lymphedema risk management) is determined by characteristic patterns of cognitive-affective responses to health-threats [26]. A woman's encodings (e.g., perceived risk for developing lymphedema, lymphedema-related knowledge), beliefs and expectancies (e.g., response efficacy to prevent lymphedema, perceived consequences of lymphedema; self-efficacy to adhere to risk minimization behaviors), and self-regulatory competencies (e.g., perceived self-regulatory ability to manage lymphedema-related distress) combine with levels of risk-related distress to produce a multifactorial response to health challenges [29-31,28]. Limited short-term evidence within the lymphedema context provides preliminary support for this view. Specifically, adherence to self-management strategies is predicted by the women's encodings, beliefs and expectancies about lymphedema, as well as their self-regulatory ability to manage lymphedema-risk related distress [32].

The goal of the present study was to longitudinally assess the cognitive and emotional factors that relate to adherence to specific lymphedema risk management practices during the first year following breast cancer treatment. Based on earlier work and C-SHIP theory, we predicted that greater lymphedema perceived risk, positive beliefs about lymphedema controllability, and greater self-efficacy in enacting symptom minimization practices, would lower lymphedema--related distress, and greater ability to regulate negative affect associated with lymphedema risk would predict higher adherence to recommended self-management strategies.

Method

Participants and procedure

Eligible participants over 18 years and able to communicate in English, who had undergone breast surgery, including lymph node surgery (Sentinel Lymph Node Biopsy, SLNB or Axillary Lymph Node Dissection, ALND) and adjuvant treatment for primary early-stage breast cancer, were identified through the Breast Evaluation Clinic at Fox Chase Cancer Centre and invited into the study by clinic nursing staff when attending an appointment. Interested participants received a study package to complete at home (i.e., consent form and the baseline questionnaire). Following consent and completion of the baseline questionnaire, all participants received a print copy of the ACS publication "Lymphedema: What Every Woman With Breast Cancer Should Know" (part of standard care at the breast clinic), which was reviewed with a nurse. The booklet describes lymphedema and how to effectively manage lymphedema risk and symptoms. Follow-up questionnaires were posted to participants for completion at 6- and 12-months post-baseline. Up to eight attempts were made to contact participants who did not return questionnaires. A total of 103 women consented to participate in the study. Two participants provided incomplete data and were excluded from the analyses. Following baseline assessment, 20 participants withdrew, and a further 19 participants withdrew before the 12-month assessment, leaving 62 participants who completed all three assessments (60.2% retention). Reasons for dropout included losing

interest in the study, inability to complete questionnaires, and inability to contact participants due to changed contact information. Women who withdrew were more likely to be unaware of the stage of their breast disease ($\chi^2 (N=94) = 11.17, p < .05$); no other differences on baseline characteristics between participants and individuals who dropped out were evident. Approval for the study was obtained through the Institutional Human Review Board at FCCC.

Measures

Demographic and medical history variables—Age, marital status, education level, income and medical history (including breast cancer stage), surgery type, treatment history and family history of breast cancer were documented. As history of lymphedema among family and friends may directly influence adherence to recommended behaviors [22], this variable was also assessed.

Adherence to risk management behaviors—Twelve self-report Yes/No dichotomous items based on the ACS lymphedema risk management guidelines assessed whether a participant was carrying out that behavior at baseline, 6- and 12-months follow-up [e.g., “Are you currently keeping your affected arm very clean and well moisturized?”; 25]

Lymphedema-related knowledge—Knowledge was assessed at all time-points with 19 counterbalanced true/false items (1=correct, 0=incorrect) relating to lymphedema risk management, similar to prior research [19,22]. Higher scores indicated greater knowledge.

Cognitive and affective predictor variables—Guided by the theoretical framework and previous research, cognitive and affective factors relevant to the enactment of lymphedema risk management strategies were assessed at all time-points [30,33,25,34]. Twenty Likert-type items (1=not at all, 5=very much) assessed these factors with respondents indicating their extent of agreement with each statement. A maximum likelihood exploratory factor analysis with direct oblimin rotation was conducted to confirm the subscale factor structure, yielding six components. Cognitive and affective factors identified were created into subscales by calculating the mean of items as follows:

Encoding - Perceived risk for developing lymphedema—Risk was assessed with four items (e.g., “Overall, to what extent do you rate your risk for developing lymphedema?”; “Overall, to what extent do you feel that you are the kind of person who is likely to develop lymphedema?”; “From 0% (no chances at all) to 100% (absolutely certain), what are your overall chances of developing lymphedema in the next year?”; From 0% (no chances at all) to 100% (absolutely certain), what are your overall chances of developing lymphedema in your lifetime?”; $\alpha = .90$) with z -scores used for the calculation of total perceived risk [34] to allow for the combination of different scaled items.

Beliefs and Expectancies—Three subscales related to beliefs and expectancies were measured: Response efficacy to prevent lymphedema (two items, $\alpha = .72$; e.g., “to what extent, do you believe there are things you can do to prevent developing lymphedema?”); Perceived consequences of lymphedema (three items, $\alpha = .78$; e.g., “to what extent do you

feel that developing lymphedema would interfere with your life?”); Self-efficacy to adhere to risk minimization behaviors (three items: $\alpha = .71$; e.g., “to what extent do you believe that you can make the lifestyle changes to carry out the recommended arm and hand procedures to minimize lymphedema risk?”).

Negative affect (distress) related to lymphedema risk—Distress related to lymphedema risk was assessed with six items [25]: “During the past month, how often have your thoughts about your lymphedema affected your mood?”; “During the past month, how often have your thoughts about lymphedema affected your ability to perform your daily activities?”; “During the past month, have you been worried about your risk for lymphedema?”; “When thinking about your risk for lymphedema, do you feel sad or depressed?”; “When thinking about your risk for lymphedema, do you feel scared or anxious?”; “When thinking about your risk for lymphedema, do you feel angry?”. Cronbach's alpha indicated a high level of item consistency ($\alpha=0.91$)

Self-regulatory ability to manage negative affect associated with lymphedema risk—Self-regulation was assessed with two items [25,35]: “You are able to limit the amount of stress you experience when you practice the recommended behaviors that may minimize lymphedema symptoms”; “I am able to calm myself down when I am anxious and worried about developing lymphedema”. Cronbach's alpha indicated high item consistency ($\alpha = .88$).

Data analysis procedures

Initial descriptive analyses were undertaken to identify potential covariates. A mixed-model maximum likelihood logistic regression was undertaken (StataCorp, 2009) with random intercept to account for lack of independence of observations. Data analyses accounted for both time-varying and subject-based (i.e., measured at baseline only) variables, addressing whether variation in time-varying variables over time accounted for variation in behaviors over time and, whether the overall likelihood of behaviors was related to the variables. Subject-based variables were tested for between-subject effects. The intra-class correlation (i.e., between-subject variation) for the main effects model was 0.26 (95% C.I. = 0.19 to 0.35). The interaction was not significant, but both behavior and time were, so analyses were based on a main effects model. To assess the effect of missing data, preliminary analysis was undertaken only with participants with complete data ($n=49$); these results were consistent with those obtained on the full unbalanced sample. Then the time-varying and subject-based variables were tested sequentially in the main effects model, adjusted for identified covariates (i.e., knowledge at each time point and lymph node surgery type). When time-varying measures were significantly related to the behavioral outcomes, further analyses [36], were run to establish whether their effect was within-or between-subjects, or both.

Results

Participant baseline characteristics are displayed in Table 1. On average participants were 55 years old ($SD = 11.5$), educated up to college level (60%), married or partnered (74%),

White (86%), non-Hispanic (98%), and with a household yearly income greater than \$60K (52%). Only type of lymph node dissection (Sentinel Node Biopsy; SNB < Axillary Lymph Node Dissection; ALND) and knowledge were significantly associated with adherence, and were subsequently included as covariates.

Adherence to the risk management behaviors is displayed in Table 2 and Figure 1. The interaction between time and behavior was not significant ($\chi^2_{22} = 23.5, p = .37$). However, there was a main effect for time with overall adherence increasing over time ($\chi^2_2 = 37.60, p < .0005$). Overall mean adherence at baseline was 79%, which significantly increased to 86% and 87%, at the 6- and 12-month assessments, respectively. Multiple comparisons showed significant differences between baseline and both 6- and 12-month assessments (6-months: OR = 2.02, $z = 4.88, p < .0005$; 12-months: OR = 2.36, $z = 5.26, p < .0005$), but not between 6- and 12-months (OR = 1.17, $z = .90, p = .37$). The main effect for behavior overall was significant ($\chi^2_{11} = 364.38, p < .0005$), indicating that adherence differed between the different behaviors. Results of the multiple comparisons between the behaviors are shown in Table 3 (note that critical $p = .01$ to account for multiple comparisons). Overall, these paired comparisons indicated that adherence to wearing gloves was significantly lower than adherence for all other behaviors except use of an electric razor. Similarly there was a trend indicating the razor use was significantly less adhered to than the other variables.

Table 4 displays values of cognitive-affective predictor variables and knowledge over time. Mixed model repeated measures analyses were conducted to determine whether each cognitive-affective variable changed over time. Negative affect significantly decreased, and knowledge significantly increased, but only from baseline to the 6-month assessment. All predictor variables (including covariates) were assessed to determine if they were associated with adherence. Increased self-efficacy to enact the behaviors (OR = 1.82, $p = .0001$), decreased negative affect associated with lymphedema risk (OR = .96, $p = .03$), increased self-regulatory ability to manage lymphedema-risk related distress (OR = 1.25, $p = .0017$), and knowledge (OR = 1.18, $p = .014$) were all associated with increased adherence. A non-significant trend was also evident for beliefs in the response efficacy of enacting behaviors being associated with adherence (OR = 1.24, $p = .055$). Perceived risk for developing lymphedema and perceived consequences of lymphedema were not associated with adherence.

Discussion

This study is the first to investigate adherence to lymphedema risk management strategies and to assess the role of cognitive and affective factors in lymphedema risk management during the critical first year following a woman's breast cancer diagnosis, a time known to present great physical and psychological challenges for the target population [37,38]. Overall, adherence to risk management strategies was high at all assessment points, particularly for behaviors requiring either sporadic enactment (e.g., blood pressure readings), or those requiring very little shift from pre-existing behaviors (e.g., avoiding restrictive clothing, keeping skin well moisturized), which is consistent with earlier work in this area [22]. However, there were inconsistencies in the extent to which the women reported adopting certain recommendations. For example, the general behavioral approach

of avoiding arm and hand trauma was well adhered to, and yet adherence to precautions that interfere with daily routine, such as wearing gloves (a specific behavior to protect the hand from injury/trauma) was enacted by fewer than half of the sample. Furthermore, removing underarm hair with an electric razor was a recommendation with very poor adherence, presumably reflecting reflexive pre-existing habits (i.e., use of non-electric razors and other hair removal methods are more commonly used in the US).

Adherence to the recommended behaviors increased (from an overall mean of 79% adherence at baseline to 86% at 6-month follow-up), as did knowledge about lymphedema risk management, from baseline to the 6-month assessment, following receipt of the ACS booklet. These gains were sustained at the 12-month assessment point. Moreover, the results indicated that levels of self-efficacy, response efficacy and perceived consequences of lymphedema were moderately high across all assessment points. While perceived risk was not related to adherence, women at higher objective lymphedema risk who had undergone ALND were more likely to be adherent than those who had SLNB. Negative affect specific to lymphedema risk significantly decreased over the course of the study, along with a corresponding increase over time in the women's perceived ability to self-regulate lymphedema risk-related distress. The improvements in coping ability evident in this sample of women at increased risk for lymphedema reflects general trends in the broader breast cancer literature reporting steady decreases in distress and improved coping over the first 12 months following diagnosis for a large proportion of affected women [39].

Of particular interest were the findings consistent with predictions by our model, that key cognitive and affective variables were associated with adherence. Specifically, women who were adherent to risk management behaviors were those who cognitively reported higher levels of knowledge about lymphedema risk management and women with higher levels of self-efficacy to enact the recommended behaviors. The relationship between knowledge and adherence levels confirms earlier reports in this context [22,25], and reinforces the importance of lymphedema education as a key determinant of uptake and maintenance of the recommended behaviors [20,40,41]. At the affective and cognitive levels, lower lymphedema-related distress and greater perceived self-regulatory ability to manage this distress were also predictive of greater adherence.

Taken together, these findings suggest that women who are more knowledgeable about lymphedema and feel more confident in their ability to manage lymphedema risk are more likely to adhere to the risk management strategies over time [42]. Moreover, these findings reiterate the widely-held view [43] that information alone is not sufficient to motivate health protective factors. In the lymphedema context, a well-informed woman also needs to hold positive views about her own ability to undertake the recommended strategies and to effectively self-manage short-term distractions and distress arising from the need to regularly undertake these actions [25]. These findings also suggest the need to more rigorously assess and address cognitive and affective factors as part of routine care. Since treating lymphedema symptoms at an early stage is the most effective approach to long-term management of the condition [18], minimizing cost and distress, it is critical that women have both the self-efficacy to obtain this treatment when needed, and the necessary self-

regulatory skills to manage negative affect associated with attending to their lymphedema risk, which may enhance their attempts to seek medical assistance when necessary.

Of interest, the study found no association between perceived risk and perceived consequences and adherence, similar to earlier work in the lymphedema context [22]. More generally, perceived risk does not predict cancer screening in the breast cancer context [44], suggesting that this type of self-construal may not directly impact on self-motivated types of health protective behaviors.

While these findings confirm the importance of lymphoedema risk management education, and highlight the role of cognitive and affective factors as determinants of adherence to the recommended risk management strategies, an important caveat needs to be considered in light of emerging evidence in this area. Findings from a randomized controlled trial assessing the impact of weight lifting exercise have refuted the role of currently-accepted risk factors in lymphedema onset [16]. Specifically, the researchers tracked over a 12 month period the lifestyle-related behaviors and occurrence of incidents believed to increase lymphedema risk in a cohort of women either affected by lymphedema or at-risk. Only sauna use was found to be predictive of arm swelling, with a non-significant trend suggesting that cuts may also be implicated to some extent. The lack of association between factors typically thought to increase lymphedema risk raises questions about the necessity for at-risk women to habitually avoid these specific situations. However, even in light of this research, the findings of the current study still have relevance. Notwithstanding the results from the Showalter et al. [16] study, having the ability to identify early lymphedema symptoms and seeking appropriate medical care will remain an important goal of lymphedema risk management.

When interpreting the findings, it is important to note that there was a relatively high dropout from this longitudinal study, although this was similar to levels of attrition for studies entailing multiple assessment points [45,46]. However, given that the only difference between women who dropped out and those completing the study was understanding of their breast cancer stage, but not their level of baseline lymphedema knowledge, this suggests that the women who remained in the study were representative of individuals at increased risk for developing lymphedema. We also did not include women with a diagnosis of lymphedema in these investigations, and it would be important to determine whether the same cognitive and affective responses are predictors of adherence for affected women.

In conclusion, this was the first study to investigate psycho-educational factors associated with lymphedema risk management behaviors within the first 12 months following breast cancer surgery. The results suggest that lymphedema awareness and education, along with attention to both cognitive and affective responses to the health threat situation, are important patient-centered management strategies. In future work, it will be important to evaluate whether identifying and communicating about the need to improve self-efficacy and affect management, as well as the ability to remain vigilant and attentive to the emergence of lymphedema symptoms, improves prompt medical management.

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Figure 1.
Adherence to lymphedema risk minimization behaviors.

Table 1

Sample characteristics at study entry (baseline)

Variable	Freq (%)	Testing the association with adherence behaviors	
		Odds Ratio	p-value
Breast Cancer stage			
0	2 (2.1)	0.96	0.72
I	43 (45.7)		
II	26 (27.7)		
III	6 (6.4)		
IV	1 (1.1)		
Don't know	16 (17.0)		
Breast surgery type			
Wide local excision	72 (69.9)	1.32	0.28
Mastectomy	31 (30.1)		
Lymph node dissection			
Sentinel node	53 (63.1)	1./9	.020
Axillary node	30 (36.9)		
Radiation Therapy			
Yes	20 (78.7)	0.77	0.33
No	74 921.3)		
Chemotherapy		1.25	0.40
Yes	41 (43.2)		
No	54 (56.8)		
Family member/friend breast cancer diagnosis			0.86
Yes	48 (48.5)	1.04	
No	51 (51.5)		
Family member/friend Lymphedema diagnosis			
Yes	21(21.2)	1.40	0.26
No	78 (78.8)		
Lymphedema knowledge	17.03 (1.45)	1.18	.014

Table 2

Adherence to recommended lymphedema risk minimization behaviors.

Adherence to behavior	Baseline			6 months			12 months		
	Practicing	Freq.	%	Practicing	Freq.	%	Practicing	Freq.	%
<i>Avoiding BP readings and injections on affected arm</i>	Yes	91	91.0	Yes	78	96.3	Yes	61	98.4
	No	9	9.0	No	3	3.7	No	1	1.6
<i>Consulting with doctor if arm, hand, fingers, chest wall swelling appears</i>	Yes	80	81.6	Yes	74	93.7	Yes	54	88.5
	No	18	18.4	No	5	6.3	No	7	11.5
<i>When manicuring nails, avoiding cutting cuticles</i>	Yes	81	83.5	Yes	71	89.9	Yes	54	93.1
	No	16	16.5	No	8	10.1	No	4	6.9
<i>Keeping your affected arm very clean and well moisturized</i>	Yes	88	88.0	Yes	76	95.0	Yes	58	93.5
	No	12	12.0	No	4	5.0	No	4	6.5
<i>Wearing gloves when doing housework or gardening</i>	Yes	48	48.5	Yes	37	45.7	Yes	29	47.5
	No	51	51.5	No	44	54.3	No	32	52.5
<i>Avoiding sun exposure</i>	Yes	82	82.0	Yes	65	81.2	Yes	53	86.9
	No	18	18.0	No	15	18.8	No	8	13.1
<i>Avoiding heavy lifting and carrying bags</i>	Yes	80	80.0	Yes	67	83.8	Yes	52	85.2
	No	20	20.0	No	13	16.2	No	9	14.8
<i>Avoiding wearing tight jewelry</i>	Yes	94	93.1	Yes	78	97.5	Yes	60	98.4
	No	7	6.9	No	2	2.5	No	1	1.6
<i>Avoiding extreme temperature changes</i>	Yes	69	69.0	Yes	69	86.2	Yes	56	90.3
	No	31	31.0	No	11	13.8	No	6	9.7
<i>Avoiding any trauma to the affected arm</i>	Yes	92	91.1	Yes	78	97.5	Yes	61	98.4
	No	9	8.9	No	2	2.5	No	1	1.6
<i>Wearing loose dresses or shirt/blouse sleeves</i>	Yes	93	92.1	Yes	77	97.5	Yes	61	98.4
	No	8	7.9	No	2	2.5	No	1	1.6
<i>Using an electric razor to remove hair from armpit</i>	Yes	46	46.9	Yes	47	63.5	Yes	37	64.9
	No	52	53.1	No	27	36.5	No	20	35.1

Table 3
Paired comparisons between mean adherence levels to risk minimization behaviors (adjusted p-values).

Behaviour	1	2	3	4	5	6	7	8	9	10	11	12
1 No BP reading/injection	-	.03	.03	.04	.001	.02	.02	.04	.02	.05	.05	.002
2 Consult Dr		-	.05	.04	.002	.04	.04	.02	.03	.03	.03	.01
3 Cut cuticles			-	.04	.003	.04	.04	.03	.03	.03	.03	.01
4 Skin care				-	.004	.03	.03	.03	.02	.04	.04	.005
5 Wear gloves					-	.005	.006	.007	.01	.008	.008	.033
6 Sun avoid						-	.05	.02	.04	.021	.02	.01
7 Lifting bags							-	.02	.04	.020	.02	.01
8 Wearing jewelry								-	.02	.04	.05	.01
9 Temp extremes									-	.05	.05	.01
10 Avoid trauma										-	.05	.01
11 Loose clothing											-	.01
12 Use electric razor												-

Table 4

Means of cognitive and affective predictor variables at each assessment point.

Variable	Baseline		6-months		12-months		Change over time?	Predictive of adherence
	Mean	SD	Mean	SD	Mean	SD	F p-value	Odds ratio p-value
Perceived risk for developing lymphedema	-0.11	0.88	-0.09	0.78	-0.11	0.92	0.07	0.99
							0.94	0.96
Response efficacy to prevent lymphedema	3.78	0.84	3.65	1.00	3.86	0.98	1.26	1.24
							0.29	0.055 ^d
Self-efficacy to adhere to risk minimization behaviors	3.93	0.70	4.03	0.69	3.99	0.81	0.172	1.82
							0.84	0.0001 ^{de}
Perceived consequences of lymphedema	4.09	0.74	4.07	0.82	4.01	0.97	0.29	1.04
							0.75	0.72
Negative affect related to lymphedema risk	1.77	0.81	1.54	0.72	1.52	0.74	0.47	0.96
							0.011 ^{ab}	0.03
Self-regulatory ability to knowledge	3.84	0.96	4.03	1.08	4.22	1.08	2.76	1.25

N.B. Adherence association analyses conducted with lymph node dissection type and lymphedema knowledge as covariates.

^aTime 1 vs Time 2 significant difference

^bTime 1 vs Time 3 significant difference ^cTime 2 vs Time 3 significant difference

^dBetween subjects difference

^eWithin subjects difference