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Project Connect Online:

Mediators of an Internet-based Psychosocial Intervention

for Women with Breast Cancer

A dissertation submitted in partial satisfaction of the

requirements of the degree Doctor of Philosophy

in Psychology

by

Elizabeth Howe Cleary

2013

ABSTRACT OF THE DISSERTATION

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Mediators of an Internet-based Psychosocial Intervention

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by

Elizabeth Howe Cleary

Doctor of Philosophy in Psychology

University of California, Los Angeles, 2013

Professor Annette L. Stanton, Chair

ABSTRACT (limit 350 words)

PURPOSE: Many interventions have been designed to promote psychological adjustment during and following cancer diagnosis and treatment; however, notably few studies have specified the mediating processes through which these interventions work. The primary aim of this research is to examine theoretically and empirically grounded mediators of a web-based psychosocial intervention for women with breast cancer.

METHODS: Women (N = 88) diagnosed with breast cancer (any stage, any time since diagnosis) were randomly assigned to participate in a three-hour workshop for hands-on creation of personal websites. Mediating variables were assessed at baseline, one month

and six months following randomization, and dependent variables were assessed at baseline and six months following randomization. Indirect effects were tested using single and multiple mediator models.

RESULTS: Relative to control participants, women randomized to Project Connect Online (PCO) evidenced significant benefit six months later on depressive symptoms, positive mood, and life appreciation, but not negative mood, perceived strengthened relationships, or intrusive thoughts. Change in coping self-confidence, loneliness, and social support from friends mediated the relationship between the intervention and improvement in depressive symptoms. Coping self-confidence mediated the relationship between the intervention and enhanced positive mood, and social support from friends mediated the relationship between the intervention and increased life appreciation. The intervention did not produce a significant change in the hypothesized mediator of self-reported emotional processing/expression.

CONCLUSIONS: Findings indicate how PCO promoted adaptive change and highlight modifiable factors, including coping self-confidence, loneliness, and social support from friends, which contributed to positive adjustment to breast cancer. Examination of why emotional processing/expression was not associated with change in outcome variables suggests possible additional mediators of the treatment effect and ways in which the intervention can be enhanced.

The dissertation of Elizabeth Howe Cleary is approved

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Table of Contents

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PUBLICATIONS

Stanton, A. L. & **Thompson, E. H.**, Crespi, C. M. (in press). Project Connect Online: Randomized trial of an Internet-based program to chronicle the cancer experience and facilitate communication. *Journal of Clinical Oncology.*

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INVITED PAPERS AND PRESENTATIONS

Stanton, A. L. & **Thompson, E. H**. (2012, February). *Cancer and the Web*, Invited talk. Simms/Mann Center for Integrative Oncology Insights Lecture Series, Los Angeles, CA.

Thompson, E. H. (2011). Never give up? When letting go of goals works. *UCLA Center for the Study of Women Update,* February, 6-11.

Thompson E. H. & Stanton, A. L. (2011, March). *Project Connect Online: A randomized trial to promote social network communication during breast cancer*. Paper presented at the meeting of the American Society of Preventive Oncology, Las Vegas, NV.

Introduction

More than 500 unique studies have examined the efficacy of psychosocial interventions for adults with cancer (Moyer, Knapp-Oliver, Sohl, Schnieder, & Floyd, 2009), yet only 16 published studies (22 when including physical activity interventions) have rigorously assessed how these interventions achieved their effects (Moyer, Goldenberg, Hall, Knapp-Oliver, Sohl, Sarma, & Schneider, 2012; Stanton, Luecken, MacKinnon, & Thompson, 2012). Moyer and colleagues (2012) calculated that just 2% of published intervention studies for adults with cancer examined potential mediators, and of those that did, very few tested theory-based models. Identifying mediating variables can highlight modifiable risk and protective factors for adults living with cancer and inform more effective and efficient interventions. The aim of this study is to examine theoretically grounded and evidence-based candidates for psychosocial mechanisms of Project Connect Online (PCO), a web-based, randomized, controlled trial of a psychosocial intervention for women diagnosed with breast cancer.

Psychological Impact of Breast Cancer

An estimated 13.7 million women and men in the United States are currently living with cancer (de Moor et al., 2013), and it is predicted that 41% of U.S. adults will receive a diagnosis of cancer during their lifetimes (Howlader et al., 2011). De Moor and colleagues (2013) predict that from 2013 to 2020, the number of cancer survivors will increase by 31% to nearly 18 million individuals. Breast cancer is the most commonly diagnosed invasive cancer for women, and it accounts for more than one in four cancers diagnosed in U.S. women (American Cancer Society, 2013). It is predicted that 232,340 new cases of invasive breast cancer will be diagnosed in 2013 (American Cancer Society, 2013). Breast

cancer survivors account for 22% of all cancer survivors, and approximately 2.97 million

women were living with a history of breast cancer in the U.S. in 2012 (de Moor et al., 2013).

Living with and receiving treatment for cancer has a significant impact on

individuals' mental and physical health (see Reilly et al., 2013 for a review) and can lead to

development or exacerbation of depressive or anxiety-related symptoms (Burgess et al.,

2005; Fann et al., 2008; Lim, Devi, & Ang, 2011; Mitchell et al., 2011; Reich Lesur, &

Perdrizer-Chevallier, 2008; Singer, Das-Munshi, & Brahler, 2010). A meta-analysis of

studies in which adults with cancer were assessed through structured clinical interview

demonstrated that 32% of patients in acute care hospitals met criteria for a mental health

disorder (Singer et al., 2010). A systematic review reported that estimated rates of clinical

depression in women who have had surgery for breast cancer range from 10% to 25%,

with some variability dependent on the type of assessment used (i.e., self-report vs.

structured interviews; Fann et al., 2008). Using the Structured Clinical Interview for DSM-

IV (SCID), 48% of women met criteria for major depressive disorder, generalized anxiety

disorder, or both in the year following breast cancer diagnosis (Burgess et al., 2005).

Burgess et al. (2005) found that the rates of clinical depression and anxiety dropped to

25% for years 2-4 following diagnosis and further decreased to 15% five years after

diagnosis. It is clear that breast cancer has a significant impact on women's psychological

functioning years after diagnosis and treatment; accordingly, PCO was designed to improve

the psychological well-being of women living with a breast cancer diagnosis.

Efficacy of Psychosocial Interventions for Adults with Cancer

One of the most recent reviews and meta-analyses of psychosocial interventions for

adults with cancer concluded that across 198 studies, a range of interventions was

associated with small to medium effects on quality of life and emotional distress (Faller, Schuler, Richard, Heckl, Weis, & Küffner, 2013). A review of three meta-analyses on psychosocial interventions for women with breast cancer reported clinically moderate to strong effects on depression and clinically moderate effects on anxiety (Naaman, Radwan, Fergusson, & Johnson, 2009). Recent studies have also examined the efficacy of specific types of psychosocial interventions for adults with cancer. For example, Zainal, Booth, and Huppert (2012) conducted a meta-analysis of mindfulness-based stress reduction (MBSR) interventions for women with breast cancer and demonstrated that MBSR shows a moderate to large, positive effect size on women's mental health. Although the literature examining the efficacy of psychosocial interventions for adults with cancer is broad, the question of how these interventions work remains under-examined.

Mechanisms in Psychosocial Cancer Interventions

Mediators are variables that explain how one variable causes change in another variable. Mediation occurs when an independent variable (e.g., a psychosocial intervention) precedes and causes change in the mediator (e.g., self-efficacy for coping with cancer), which precedes and causes change in the dependent variable (e.g., decrease in depressive symptoms). Underlying mechanisms or processes are operationalized and measured as mediators. For example, an increase in social support may mediate the relationship between a psychosocial intervention and life satisfaction, and underlying causal mechanisms may be specific cognitive or behavioral changes related to social interactions.

Understanding how interventions effect change informs how interventions can be altered to be maximally effective and efficient. For example, a psychosocial intervention for cancer patients with depression may consist of attending group sessions during which

individuals practice mindfulness, learn to challenge negative automatic thoughts, write about the challenges of cancer, and receive support from other group members. Mediational analyses can provide information on whether these components led to change in hypothesized mediators, such as coping self-efficacy, negative cognitions, emotional expression, and perceived social support. Effective components can be retained and ineffective components of the intervention can be improved or removed to produce more efficient and effective interventions. Additionally, understanding mediators of psychosocial interventions may inform researchers about potential moderators of treatment effect (Moyer et al., 2012). For example, if an intervention leads to an improvement in body image, which leads to a subsequent decrease in depressive symptoms, then patients who undergo medical procedures that alter one's body, such as mastectomies, may benefit more from the intervention than patients who do not experience such marked changes to their bodies as a result of treatment.

Directly manipulating a mediator provides an ideal test of its impact; however, direct manipulation of a mediator can be challenging or impossible. For example, researchers could not directly manipulate an individual's body image or perceived social support in the same way that temperature or heart rate could be altered; rather an intervention would have to be designed and employed to effect change in these variables. As an alternative, measuring hypothesized mediating and outcome variables at multiple time points can provide empirical evidence for a causal chain between intervention, mediator, and outcome.

Stanton et al. (2012) and Moyer et al. (2012) conducted systematic reviews of randomized controlled trials that examined mediating processes in psychosocial

interventions for adults with cancer. To be included in the review, trials had to employ randomized controlled designs that tested a psychosocial intervention for adults who had received a cancer diagnosis. Psychosocial interventions included psychoeducation, information provision about cancer and/or treatments for cancer, support provision, or cognitive and behavioral interventions. Moyer et al. (2012) also included interventions designed to promote physical activity, whereas Stanton et al. (2012) excluded such interventions. Both reviews excluded health behavior change interventions (e.g., smoking, diet), medical treatment decision-making interventions, medication adherence interventions, and pharmacologic interventions. Included trials also had to test mediation and include a rationale for the mediation and its hypothesized relationship to the outcome variable. Temporal precedence between the intervention and the mediator had to occur such that a causal effect was possible. Analyses had to include a test of the relation between X (independent variable) to M (mediating variable) and M to Y (dependent variable) adjusted for X.

Stanton et al. (2012) identified studies through electronic databases (PsychINFO, PubMed) using key terms including cancer, neoplasm, intervention, mediat*, mechanism, and psych*. The resulting 1,668 abstracts were reviewed and 65 potential trials were identified for full-text examination. Moyer at al. (2012) employed a similar process to identify relevant trials, resulting in 22 trials included in Moyer et al. (2012) and 16 trials included in Stanton et al. (2012). For the purpose of this dissertation, I used the same search terms and criteria used by Stanton et al. (2012) in April 2013 to locate additional trials published after September 2011; no additional trials that met the criteria outlined above were found.

Both papers present detailed tables outlining study characteristics including the intervention employed, participant characteristics, mediating and outcome variables assessed, means of statistical analyses, and results of mediational analyses. The table from Stanton et al. (2012), on which I am an author, is reprinted with permission from the other three authors (see Table 1). Of the 16 trials included in Stanton et al. (2012), eight trials were conducted with women with breast cancer, five trials included adults with mixed types of cancer (e.g., lung, head, gynecologic), two trials included men with prostate cancer, and one trial included women with gynecological cancer. Cognitive-behavioral and educational (i.e., psychoeducational, information provision) interventions were most commonly tested; other examined interventions included mindfulness mediation, communication training, hypnosis, and systematic relaxation. Researchers assessed a wide range of outcome variables, including depressive symptoms, quality of life, positive affect, pain, self-reported physical symptoms, and biological markers of neuroendocrine and immune functioning. Studies were examined for their rationale regarding selection of mediators, dependent variables and their hypothesized relationships with the intervention, statistical approach to mediation, and results that supported promising mediators. The following conclusions from these two papers highlight promising mediators that deserve examination as well as important best practices for the selection of mediators and statistical analysis.

Selection of mediators. In selecting mediators, researchers should carefully consider and articulate guiding action theory (how the intervention affects the mediators) and conceptual theory (how the mediators affect the outcomes; Chen, 1990; MacKinnon, 2008). Ideally, conceptual theory should be grounded in a theoretical understanding of the

predictors of an outcome variable. When formal theory does not guide hypotheses, research should provide a conceptual rationale. Thoughtful analysis of mediational results can lead to important revisions of action theory or conceptual theory and alterations to the interventions themselves (MacKinnon et al., 2008; Stanton et al., 2012).

In the trials examined in Stanton et al. (2012) and Moyer et al. (2012), studies rarely provided a rationale for why interventions would lead to change in specific mediators or why change in specific mediators would lead to change in outcomes of interest. Moyer et al. (2012) found that just six of twenty-two (27%) psychosocial interventions for patients with cancer referenced a theoretical framework for the selected mediators. Some studies simply provided the rationale that relationships between particular concepts had not been previously examined and thus should be explored.

Statistical approaches to mediation. Of the published 16 studies that examined mediators of psychosocial interventions for adults with cancer, multiple studies relied on suboptimal tests for mediation (Stanton et al., 2012). One misconception is that, as originally suggested by Baron and Kenny (1986), mediational analyses should only be conducted when there is evidence of a significant main intervention effect. First, tests of mediation often have greater power than tests of main effects of the intervention, and thus they should still be conducted even without indication of a significant main intervention effect. Second, mediational analyses in the absence of a main intervention effect can provide valuable information on whether the intervention did not affect the mediating variable as predicted, whether the mediator did not affect the outcome as predicted, or

Table 1. Mediational Findings in Randomized, Controlled Psychosocial Intervention Trials for Adults Diagnosed with Cancer

Study	Sample	Intervention	Mediators	Main effects: analyses	Outcome variables	Mediational analyses	Mediators: results
Andersen et al., 2007	N = 145 women with breast cancer, post-surgery, pre-adjuvant therapy	18 sessions over 16 weeks, 1.5 hour per session, group psycho-intervention (e.g., training in relaxation, assertiveness, coping skills, health behaviors) intensive phase; 8 sessions, 1.5 hours monthly group maintenance (Control: assessment only)	Emotional distress (POMS), Immunity (proliferation of T lymphocytes and T-cell subsets)	ANCOVA and MANCOVA	Functional physical health status and symptoms (KPS and SWOG combined)*	Linear path analysis Mediator effect of X to M and M to Y significant. Sobel test	Decreased emotional distress (but not changes in immunity) mediated the relationship between intervention and improved health/reduced physical symptoms.
Thornton et al., 2009	N = 45 women with stage II or III breast cancer, post-surgery, pre-adjuvant therapy, reported clinically significant depressive symptoms	18 sessions over 16 weeks, 1.5 hour per session, group psycho-intervention intensive phase; 8 sessions, 1.5 hours monthly group maintenance (Control: assessment only)	Depressive symptoms (CES-D: Iowa short form), depressed mood (POMS: depressed mood subscale), fatigue (POMS: fatigue subscale), quality of life related to pain (SF-36: bodily pain subscale), health behaviors (FHQ; 7D-PAR; smoking status)	Mixed-effects modeling	White blood cell count* Neutrophil count* Helper/suppressor ratio*	Regression Bootstrap confidence intervals for the mediated effect	Depressive symptoms, depressed mood, and pain (but not health behaviors) mediated the relationship between intervention and white blood cell count, neutrophil count, and helper/suppressor ratio. Fatigue mediated the relationship between intervention and helper/suppressor ratio only.

Antoni et al., 2006	N = 199 women with nonmetastatic breast cancer, 10-12 weeks post-surgery	10-week, 2-hr session per week, group cognitive-behavioral stress management intervention (Control: educational seminar)	Confidence about being able to relax (MOCS Relaxation subscale) (Note that CBSM did not affect other measured skills.)	Latent growth-curve modeling	Social disruption (subscales of SIP)* Positive states of mind (PSOM)* Benefit finding (Tomich & Helgeson, 2004)* Positive lifestyle change (AuC)* Positive affect (ABS)*	Latent growth-curve modeling Tested whether the path from X to Y became nonsig-nificant	Confidence about being able to relax mediated the relationship between intervention and all outcomes.
Phillips et al., 2008	N = 128 women with nonmetastatic breast cancer, pre-adjuvant therapy	10-week, 2-hr session per week, group cognitive-behavioral stress management intervention (Control: educational seminar)	Perceived ability to relax (MOCS relaxation subscale)	Linear growth modeling	Serum cortisol levels*	Linear growth modeling Test of relation of X to slope in M and test of slope in M to slope in Y	Perceived ability to relax did not mediate the relationship between intervention and reduction in cortisol.
Branstrom et al., 2010	N = 70 women and 1 man with cancer diagnoses who were not currently receiving chemotherapy or radiation	8-week, 2-hour sessions per week, group mindfulness training course (Control: waitlist control)	Five-facet mindfulness questionnaire (FFMQ)	MANCOVA	Perceived stress (PSS) * Positive states of mind (PSOM)* Anxiety (HADS)* Depression (HADS)* Posttraumatic stress symptoms (IES-R)*	Regression BK Reduction in X to Y relation when controlling for M, Joint Significance Test	Self-reported mindfulness mediated the relationship between intervention and perceived stress, positive states of mind, and IES-avoidance.

Christman & Cain, 2004	N = 76 adults with any stage gynecologic, head, neck, or lung cancer, receiving radiation therapy	1) Concrete objective information (COI) about treatment-related symptoms delivered via audiotape and writing, 2) Relaxation instruction (RI) based on progressive muscle relaxation (two audiotapes) (Control: audiotapes with general education about radiation)	Symptom uncertainty (SUS)	ANCOVA	Household activity, recreation and pastime activity, social activity* (all VAS from SIP), emotional distress (POMS)	Regression BK Change in R^2 before and after M was added to the regression model of X to Y	Symptom uncertainty partially mediated the relationship between COI and social activity (Uncertainty not tested as a mediator of RI on social activity).
Creswell et al., 2007 [a]	N = 60 women with stage 1 or 2 breast cancer within 20 weeks after completing treatment	Participants wrote four 20-minute essays over 3 weeks and were assigned to the following conditions: 1) emotional expression or 2) benefit finding (Control: fact writing)	Self affirmation, cognitive processing, discovery of meaning (content coded by three judges)	Regression	Cancer-related medical appointments (self-reported)*, physical symptoms (AuC)*	Regression BK, Joint Significance	Self affirmation (but not cognitive processing and discovery of meaning) mediated the effects of both writing conditions on physical symptoms.
Low et al., 2006 [a]	N = 60 women with stage 1 or 2 breast cancer within 5 months after completing treatment	Participants wrote four 20-minute essays over 3 weeks and were assigned to the following conditions: 1) emotional expression or 2)	Heart rate during writing sessions, essay content analysis: positive emotion words, negative emotion words, cognitive processing words (LIWC),	Regression	Cancer-related medical appointments (self-reported),* physical symptoms (AuC)*	Regression BK, Tested X to M and M to Y	Greater within-session heart rate habituation and use of negative emotions words mediated the relationship between the emotional expression condition and physical

		benefit finding (Control: fact writing)	postwriting mood (POMS)				symptoms. No other significant mediators.
Cruess et al., 2000[b]	N = 34 women with stage I or II breast cancer, <8 weeks post surgery	10-week, 2-hr session per week, group cognitive-behavioral stress management intervention (Control: educational seminar)	Benefit finding (BFS)	ANCOVA	Serum cortisol levels* Distress (POMS – abbreviated)	Path model BK Tested X to M and M to Y for significance	Increases in benefit finding mediated the relationship between intervention and reduced cortisol.
Goedendorp et al., 2010	N= 148 adults with various cancers	Up to 10, 1-hour sessions of individual CBT over 6 months (Control: usual care; condition 2: brief education intervention)	Physical activity (actometer, DOA, QPA)	ANCOVA	Fatigue (CIS fatigue subscale)*	Regression, bootstrapped confidence interval for the mediated effect	Physical activity did not mediate the relationship between intervention and fatigue.
Hawkins et al., 2010	N = 370 women with breast cancer ≤2 months diagnosis	1) Web-based intervention (reactive information, communication, and interactive components), 2) cancer information mentor (10 phone calls over 6 months) or 3) both web-based intervention and mentor calls (Control: internet access)	Autonomy (AuC), competence (AuC), relatedness (AuC)	ANCOVA	Quality of life (WHOQOL-BREF)* significant for group 3 over control condition	Regression Joint Significance	Greater quality of life in group 3 over control was mediated by autonomy, competence, and relatedness.
Helgeson et al., 1999	N = 312 women with stage I, II, or III	8 weekly group sessions of 1) 60 minutes peer	T2: Self esteem (RSES), body image (AuC),	ANCOVA	Mental health (MOS SF-36 MCS),* physical	Regression Significance of X to M	T2: Improved self-esteem (for PCS only) and body image

	breast cancer	discussion, 2) 45 minutes education, 3) combination 45 minutes education and 60 minutes peer discussion (Control: assessment only)	uncertainty (AuC), extent discuss illness (AuC), negative interactions (AuC), negative downward social comparisons (AuC) T3: intrusive thoughts (IES), avoidant thoughts (IES), personal control (AuC), vicarious control (AuC)		health (MOS SF-36 PCS),* positive mood (PANAS),* negative mood (PANAS)* [effects for groups 2 and 3]	and M to Y paths and reduction of X to Y path when M is included	mediated the relationship of Groups 2 and 3 with MCS and PCS. T3: Intrusive thoughts mediated the relationship between Groups 2 and 3 with PCS, MCS, and positive mood. No other significant mediators.
Johnson et al., 1989	N = 84 men with localized prostate cancer who were about to receive radiation treatment for the first time	4 audio tapes with concrete objective descriptions about radiation treatment and side effects (Control: attention control)	Similarity between experience and expectations (AuC), understanding of the experience (AuC)	ANOVA	Disruption in function (SIP recreation and pastime subscale),* negative mood (POMS)	Regression Drop in R^2 for X to Y relation when M is added	Understanding of the experience and perceived similarity between expectation and experience mediated the intervention's effect on functioning.
Manne et al., 2008	N = 353 women with primary gynecological cancer	6 hour-long individual sessions and one telephone booster session of 1) communication and coping intervention (CCI) or 2) supportive counseling (SC) (Control: usual care)	Positive appraisal, acceptance, planful problem-solving, seeking support for emotional reasons, seeking support for instrumental reasons, emotional processing (COPE and EAC items), general emotional expression (EEQ),	Intent-to-treat growth curve analyses	Depressive symptoms (BDI)*	Growth curve modeling, z' and P measures, the product of coefficients measure. Test of the mediated effect.	Increases in positive reappraisal, planful problem-solving, self-esteem, and expression of intimacy and positive emotions mediated the effect of CCI on depressive symptoms. Positive reappraisal mediated the effect of SC on depressive symptoms. No other significant mediators.

			cancer specific emotional expression (EAC items), self esteem (SES)				
Montgomery et al., 2010	N = 200 women with breast cancer scheduled for breast-conserving surgery	15-minute hypnosis session (Control: attention control)	Pain expectancy, nausea expectancy, fatigue expectancy (all VAS), presurgical distress (SV-POMS), presurgical emotional upset, presurgical relaxation	Structural equation modeling	Postsurgical pain,* postsurgical nausea,* postsurgical fatigue* (all VAS)	Structural equation modeling Bootstrapped Confidence Limits for the mediated effect	Change in pain expectancy (but not distress) partially mediated the relationship between hypnosis and postsurgical pain. Presurgical distress (but not nausea expectancy) partially mediated the relationship between hypnosis and postsurgical nausea. Presurgical distress and change in fatigue expectancy each partially mediated the relationship between hypnosis and postsurgical fatigue.
Penedo et al., 2004	N = 92 men with Stage 1 or II prostate cancer treated with radiation or radical prostatectomy	10-week, 2-hour group sessions of cognitive behavioral stress management (CBSM) (Control: educational seminar)	Perceived stress-management skills (MOCS)	Regression	Quality of life (FACT-G)*	Regression Sobel test of the mediated effect	Increase in perceived stress-management skills mediated the relationship between intervention and quality of life.
Penedo et al., 2006	N = 191 men with Stage 1 or II prostate cancer treated with radiation	10-week, 2-hour group sessions of cognitive behavioral stress management	Perceived stress-management skills (MOCS)	Regression	Benefit finding (PCS-Cancer)*, quality of life (FACT-G)*	Structural equation modeling Test of X to M and M to Y	Increase in perceived stress-management skills mediated the relationship between intervention and both

	or radical prostatectomy	(CBSM) (Control: educational seminar)				paths	benefit finding and quality of life.
Traeger et al., 2011	N = 214 men with Stage I or II prostate cancer treated with radiation or radical prostatectomy	10-week, 2-hour group sessions of cognitive behavioral stress management (CBSM) (Control: educational seminar)	Illness cause, illness consequences, personal control, treatment control, illness coherence (IPQ)	Structural equation modeling	Emotional well-being (FACT-G)*	Structural equation modeling Moderator effect of perceived stress in each group with mediated effect in treatment group	For men with high perceived stress pre-intervention, treatment control and illness coherence together mediated intervention effects.
Scheier et al., 2005	N = 152 women with stage 0, I, or II breast cancer, age 50 or younger, within 2 months of completion of non-hormonal adjuvant treatment	4 monthly, 2-hr per session, group psychoeducation (and an active nutrition education arm not examined here), (Control: usual care)	Intrusive thoughts (IES-INT) Self-efficacy for dealing with illness and treatment (AuC) Cancer concerns (30-items from PCBC) Self-concept (AuC) Coping (COPE)	MANOVA and multiple regression	Depressive symptoms (10-item CES-D)* Physical functioning (SF-36: PCS)* Mental health functioning (SF-36: MCS)	Regression Sobel test of significance of the mediated effect.	Final model: Improvements in intrusive thoughts, self-concept, and self-efficacy for managing cancer-related issues mediated the relationship between intervention and depressive symptoms. Reduction of concerns about cancer recurrence and mortality mediated the relationship between intervention and physical functioning. No other significant mediators.

Ward et al., 2008	N = 150 adults with pain from metastatic cancer	Single session, individual educational intervention (RIDcancerPAIN) lasting 20-60 minutes with one follow up phone call (Control: pain education booklet and nurse responded to questions)	Attitudinal barriers to pain management (BQ-II), coping/ medication use (PMI)	ANCOVA	Pain severity (BPI, TPQM),* pain interference with life (BPI), overall quality of life (QLI-CV)	ANCOVA Joint Significance	Reduction in attitudinal barriers to pain management mediated the effect of intervention on pain severity.
Ward et al., 2009	N = 124 patients with cancer reporting moderate to severe pain and significant other pairs	(1) Single session, solo educational intervention (RIDcancer PAIN+) lasting 20-60 minutes with one follow up phone call or (2) same procedures with dyad (Dyad RIDcancerPAIN+) (Control: usual care)	Attitudinal barriers to pain management (BQ-II)	ANCOVA	Pain severity (BPI, AuC), pain interference with life (BPI), global quality of life (G-QOL), negative mood (QLQ-C30), pain relief (single item)	ANCOVA Joint Significance	Reduction in attitudinal barriers to pain mediated the effects of solo and dyad interventions on pain severity, relief, and interference, negative mood, global quality of life.

Notes. POMS = The Profile of Mood States; KPS = The Karnofsky Performance Status; SWOG = Symptom listing used by the Southwest Oncology Collaborative Group; IES-R = Impact of Event Scale-Revised; CES-D = Center for Epidemiologic Studies Depression Scale; MOS SF-36= Medical Outcome Study Short Form Health Survey; PSOM = Positive States of Mind; FHQ = Food Habits Questionnaire; 7D-PAR = 7-Day Physical Activity Recall; MOCS = Measure of Current Status; SIP = Sickness Impact Profile; AuC= author constructed scale; ABS = Affect Balance Scale; BFS = Benefit Finding Scale; FFMQ = Five Facet Mindfulness Questionnaire; PSS = Perceived Stress Scale; HADS = Hospital Anxiety and Depression Scale; LIWC = Linguistic Inquiry and Word Count; SUS = The Symptom Uncertainty Scale; VAS = Visual Analog Scale; SET = Symptom Experience Tool; CIS = Checklist of Individual Strength; DOA = Daily Observed Activity; QPA = Questionnaire Physical Activity; CIS = Checklist of Individual Strength; WHOQOL-BREF = World Health Organization Quality of Life; SF-36 PCS = Physical functioning score; SF-36 MCS = Mental health functioning score; PANAS = Positive and Negative Affect Scale; EAC = Emotional Approach Coping;

EEQ = Emotional Expression Questionnaire; SES = Self Esteem Scale; BDI = Beck Depression Inventory; FACT-B = Functional Assessment of Cancer Therapy; PCS-C= Positive Contributions Scale – Cancer; IPQ = Illness Perceptions Questionnaire; PCBC = Profile of Concerns about Breast Cancer; TOI = Trial Outcome Index; SSQ-6 = Social Support Questionnaire; BQ II= Barriers Questionnaire; TPMQ = Total Pain Quality Management dataset; PMI = Pain Management Index; QLI-CV = Quality of Life Index – Cancer Version; QLQ-30 = Quality of Life Questionnaire. Goedendorp et al. (2010) also included an intervention arm to encourage physical activity, and Scheier et al. (2005) included a nutrition education arm. BK = Baron & Kenny, 1996; Joint Significance is test of relation of X to M and M to Y, adjusted for X. Sobel test is test of mediated effect divided by its standard error.

* = significant main effects of intervention on psychological outcome measure.

--- = studies conducted by the same research group.

[a]Primary findings reported in Stanton et al. (2002).

[b]Primary findings reported in Antoni et al. (2001).

Table reprinted with permission from Stanton, A. L., Luecken, L. J., MacKinnon, D. P., & Thompson, E. H. (2012). Psychological mechanisms in interventions for individuals living with cancer: Opportunity for integration of theory, research, and practice. *Journal of Consulting and Clinical Psychology*, *81*, 318-335.

whether both effects were not significant. Results from such analyses can indicate where refinement of action theory and/or conceptual theory is warranted. The causal steps method (Baron & Kenny, 1986) has been superseded by statistical methods with greater power, and even without a statistically significant direct effect of the intervention, mediational analyses can provide useful evidence about the intervention's efficacy and relationships between variables.

The Sobel test (Sobel, 1982) is often used to assess whether a mediation effect (a x b) is significant. However, it has low statistical power and is unable to detect small or medium effects in intervention studies with samples less than 1,000 (MacKinnon et al., 2002). The Sobel test assumes a normal, symmetrical distribution, but the product of two normal variables is skewed rather than normally distributed. A better powered approach to mediational analyses than the causal steps method is to estimate the indirect effect (the product of the path coefficients a and b) and generate confidence intervals (MacKinnon et al., 2004). The total effect (path c) is the effect of the intervention on the dependent variable. The direct effect (path c') is the effect of the intervention on the dependent variable when controlling for the mediator. The indirect effect is the amount by which the dependent variable changes when the independent variable is held constant and the mediator changes as if the independent variable had increased by one unit. With bootstrapping, random sampling with replacement is used to generate estimates and confidence intervals around the indirect effects (Preacher & Hayes, 2008). If the confidence interval does not include zero, then the indirect effect is significant. Examining mediators separately and together in a multiple mediator model can also be informative, in that it

indicates whether specific variables mediate the effect of an intervention independent of other variables.

Promising mediators. Both Stanton et al. (2012) and Moyer et al. (2012) conclude that psychosocial interventions in adults with cancer promote adjustment through processes including effectively altering cancer-related expectancies and illness representations, increasing self-efficacy for applying coping strategies and skills targeted by the intervention, and bolstering dispositional psychosocial resources. Table 1 outlines the trials that assessed mediational processes for psychosocial interventions for adults with cancer and their results.

Six studies reviewed by Stanton et al. (2012) suggested that cognitive expectancies and illness representations mediated the effect of psychosocial interventions on outcomes including emotional well-being and pain severity (Christman & Cain, 2004; Johnson, Lauver, & Nail, 1989; Montgomery et al., 2010; Traeger et al., 2011; Ward et al., 2008, 2009). Specifically, promoting understanding of radiation treatment and associated side effects and increasing perceived similarity between expectation and experience of radiation mediated the relationship between intervention and reduced disruption in functioning for men with localized prostate cancer (Johnson et al., 1989). Reduction of symptom uncertainty through provision of objective information partially mediated the effects on social activity for adults receiving radiation therapy (Christman & Cain, 2004). A hypnosis intervention for women scheduled for breast-conserving surgery led to a decrease in postsurgical pain through reducing pain expectancy and led to a reduction in postsurgical nausea and fatigue through reducing presurgical distress (Montgomery et al., 2010). A group cognitive-behavioral stress management intervention improved emotional

well-being through increasing prostate cancer patients' understanding of their illness and their beliefs that treatment could help their disease (Traeger et al., 2011). A single session, educational intervention reduced pain severity for 150 adults with metastatic cancer through reducing attitudinal barriers to pain management (Ward et al., 2008). Both single session solo educational interventions and educational interventions with significant others reduced pain severity, interference, and negative mood, and increased pain relief and global quality of life by reducing attitudinal barriers to pain (Ward et al., 2009). In each of these six studies, interventions effectively altered patient's thoughts about their illnesses, which led to improvements in psychological and physical well-being.

Seven studies demonstrated that an increase in patients' perceived coping skills or confidence to use such skills mediated the relationship between intervention and outcomes, which included depressive symptoms, positive affect, and quality of life (Antoni et al., 2006; Branström, Kvillemo, Brandberg, & Moskowitz, 2010; Hawkins et al., 2010; Manne et al., 2008; Penedo et al., 2004, 2006; Scheier et al., 2005). For example, an increase in self-efficacy for managing illness and treatment mediated the effect of a group psychoeducational intervention on depressive symptoms for 152 women with early stage breast cancer (Scheier et al., 2005). Perceived competence mediated the relationship between a web-based and cancer information phone call intervention and improved quality of life for 370 women with early-stage breast cancer (Hawkins et al., 2010). An increase in perceived stress management skills mediated the effects of a cognitive behavioral stress management intervention on benefit finding and quality of life for 191 men with prostate cancer (Penedo et al., 2006). Regarding specific skills, confidence about being able to relax mediated the relationship between a group cognitive-behavioral stress

management intervention and social disruption, positive mood, benefit finding, and positive lifestyle change for women with nonmetastatic breast cancer (Antoni et al., 2006). Ability to apply mindfulness skills mediated the relationship between a group mindfulness training intervention and perceived stress, positive states of mind, and avoidance for adults with different types of cancer (Branstrom et al., 2010). For women with gynecological cancer, increases in the ability to reappraise stressors positively and to apply planful problem solving mediated the relationship between a communication and coping intervention and depressive symptoms (Manne et al., 2008). These studies suggest that different types of interventions appear to bolster psychological adjustment through increasing coping self-efficacy.

Three studies documented how dispositional psychosocial resources, including self-esteem and body image, mediated the relationship between intervention and depressive symptoms or health-related quality of life (Helgeson, Cohen, Schulz, & Yasko, 1999; Manne et al., 2008; Scheier et al., 2005). For example, Scheier and colleagues (2005) demonstrated that improvements in self-concept mediated the relationship between group psychoeducation and a decrease in depressive symptoms for women with early stage breast cancer. An increase in self-esteem mediated the effect of a communication and coping intervention on depressive symptoms (Manne et al., 2008) and the effect of a group education intervention alone and with peer discussion on physical health (Helgeson et al., 1999). An improvement in body image for women with early stage breast cancer mediated the relationship between the group education intervention alone and with peer discussion on both physical and mental health (Helgeson et al., 1999).

Several classes of possible mediators for psychosocial intervention effects have received very little empirical attention, including physiological processes, health behaviors, and interpersonal processes. The current study will examine one mediator targeted by the intervention and supported by prior empirical work (i.e., coping self efficacy; Penedo et al., 2004) and three under-examined mediators (i.e., social support, loneliness, and emotional expression/processing) that have been identified as risk factors (i.e., in the case of loneliness) or protective factors (i.e., coping self efficacy, social support, emotional expression/processing) for adults with cancer.

Weaknesses of existing literature. Stanton et al. (2012) and Moyer at al. (2012) highlighted weaknesses of the existing literature on mediators of psychosocial interventions for adults with cancer. Many studies do not provide a theoretical or empirical rationale for the predicted relationship between an intervention and mediators and between mediators and outcomes. Second, published work has frequently relied on underpowered statistical approaches and has overlooked the utility of examining mediators in the absence of statistically significant main effects of interventions. Third, the existing body of literature on mediators of psychosocial interventions for adults with cancer is small and far from conclusive. The current study aims to add to the existing body of literature by using optimal statistical approaches to examine theoretically grounded and evidence-based candidates for mechanisms of Project Connect Online.

Project Connect Online

Project Connect Online (PCO) is an internet-based intervention designed to promote communication for women diagnosed with breast cancer (Stanton, Thompson, & Crespi, in press). Social support has been identified as a protective factor for women with breast

cancer, but effective communication and provision of well-matched social support may be difficult to achieve (Stanton & Revenson, 2007; Taylor, 2007). For example, women undergoing active medical treatment may lack energy to call, write, or spend time with family or friends. Physical symptoms and side effects from treatment may cause women to withdraw from regular social activities. Friends may be hesitant to ask directly how a patient is doing, and they may have difficulty determining what sort of support would be welcomed. Personal websites offer an opportunity for women with breast cancer to communicate with family and friends when they have the time and energy to do so. Online journaling provides a space for women to share cancer-related emotions and experiences. Website visitors can quickly and easily respond to the author's remarks, and women can peruse written responses when they choose to. Through "how you can help" pages, women can indicate the type of support that would be most useful to them. Several non-profit organizations and hospitals offer patients with cancer the opportunity to create personal websites to manage communication and support (e.g., csn.cancer.org, caringbridge.org, mylifeline.org, carepages.com), but we were unable to identify any empirical studies that examined the impact of using such websites. The goal of the intervention was to promote communication, social support, and emotional expression through online websites, and to increase women's sense that they can effectively manage cancer-related challenges. To our knowledge, PCO is the first randomized controlled trial of an internet-based intervention aimed at increasing support from individuals' existing social networks.

As shown in Figure 1, the study was completed in three phases: 1) semi-structured interviews with eight breast cancer patients who had created personal websites during cancer treatment and survivorship; 2) focus groups with seven breast cancer patients to

discuss barriers, preferences, and concerns about creating websites; and 3) the PCO intervention trial, which consisted of participation in a 3-hour workshop for women assigned to the intervention condition versus a waiting-list control condition.

In the third phase of the study, PCO participants were randomly assigned to either workshop participation or a waiting-list control. Intervention participants created personal websites that they used to communicate with family and friends and to chronicle their experience with breast cancer treatment and survivorship. Websites were created during 3-hour workshops where participants were invited to bring their own laptops or use provided computers. All participants completed questionnaires about their psychological health at study entry and one month and six months later.

Selection of outcome variables. Dependent variables for PCO were carefully selected to allow examination of the impact of intervention on measures of negative adjustment, positive adjustment, and cancer-specific adjustment. As previously mentioned, rates of depression for women with breast cancer are significantly higher than in the general population and are linked to negative social, behavioral, and physical health consequences for patients (Miller, Mogun, Azrael, Hempsted, & Solomon, 2008; DiMatteo, Lepper, & Croghan, 2000; Giese-Davis, Collie, Rancourt, Neri, Kraemer, & Spiegel, 2011). Therefore, depressive symptoms were selected as a key measure of negative adjustment, along with negative mood, which is a hallmark of depression and includes other affective experiences, such as anxiety and fear, which are not captured by assessment of depression.

Indicators of positive adjustment to cancer and other major stressful life events historically have been understudied when compared to indicators of negative adjustment (Cohen & Pressman, 2006; Folkman, S., & Moskowitz, J. T., 2000; Hoyt & Stanton, 2012);

however, a large body of literature demonstrates that many individuals adjust well and, in some cases, even thrive following traumatic life events (Jim & Jacobsen, 2008; Sawyer, Ayers, & Field, 2010; Stanton, Bower, & Low, 2006). In the current study, positive mood was included as an indicator of positive adjustment, because research with healthy adults indicates the importance of positive affect for health consequences relevant to women with cancer, including better health habits and adaptive levels of stress hormones (Cohen & Pressman, 2006; Pressman & Cohen, 2005). In the broader psychological literature, positive affect has been found to buffer against ill effects of negative emotions, bolster social, intellectual, and physical resources, and expand individuals' cognitive and behavioral responses (Fredrickson, 1998; Tugade, Fredrickson, & Barrett, 2004). Effectively promoting positive affect could have important psychological and physiological consequences for women diagnosed with cancer.

Cancer-specific adjustment was assessed through cancer-related intrusive feelings/thoughts, as well as the perceived cancer-related benefits of strengthened relationships and life appreciation. High levels of cancer-related intrusive thoughts are reported by 16% to 28% of cancer survivors (Bleiker et al., 2000; Brewin et al., 1998; Jim et al., 2007; Lewis et al., 2001) and negatively influence the trajectories of depressive symptoms, negative affect, physical functioning, and pain for survivors of breast cancer (Dupont, Bower, Stanton & Ganz, 2013). Intrusive thoughts are associated with worse quality of life both during and after treatment for cancer, rendering them important targets for intervention (Cordova et al., 1995). Prior work has indicated that social support, which was hypothesized to be promoted by PCO, can have a protective effect on the negative impact of intrusive thoughts in the context of cancer (Lewis et al., 2001).

In contrast to cancer-related intrusive thoughts, perception of strengthened relationships and life appreciation are important indicators of posttraumatic growth (Tedeschi & Calhoun, 1996) and are associated with positive psychological and physical adjustment to cancer (Lelorain, Bonnaud-Antignac, & Florin, 2010; Sawyer et al., 2010; Tomich & Hegelson, 2012). Tedeschi and Calhoun (1996) argue that stressful events can promote self-disclosure and an openness to receiving help, which both lead to deepened relationships. PCO may foster a sense of enhanced relationships through promoting effective social support and communication. PCO may also lead to a change in priorities and a greater appreciation of life through facilitating emotional processing of the cancer experience and bolstering perceived social support (Antoni at al., 2001; Cordova et al., 2001; Manne et al., 2004; Thornton & Perez, 2006). Employment of dependent variables that assess positive, negative, and cancer-specific adjustment allows for examination of the effect of PCO on a range of important outcomes with known relationships to physical and mental health.

Results of efficacy analyses. Primary outcome analyses of PCO are presented in detail elsewhere (Stanton et al., in press). Analyses were conducted using analysis of covariance, with the outcome measure at six months as the dependent variable and the measure at baseline, group assignment, medical treatment status (i.e., radiotherapy, chemotherapy, biologic therapy [endocrine therapy not counted]: yes/no) and the interaction between group assignment and medical treatment status as independent variables. Primary dependent variables of interest were depressive symptoms, cancer-related intrusive thoughts, positive affect, negative mood, life appreciation, and strengthened relationships.

Women (N = 88) randomized to Project Connect Online evidenced a significant improvement in depressive symptoms (p = .009, d = 0.6), enhanced positive mood (p = .03, d = 0.5), and greater life appreciation (p = .03, d = 0.5) six months after participation when compared to control participants (see Figure 4 for main effects of PCO on depressive symptoms). Women currently receiving medical treatment for their cancer (N = 11) benefitted significantly more from the intervention on depressive symptoms (p = .03) and positive mood (p = .04) than did women not in active treatment. Figure 5 illustrates the significant interaction for depressive symptoms and positive mood. The intervention buffered the negative effect of being in medical treatment on depressive symptoms and positive mood. Cohen's d effect sizes were calculated as differences in least square means and indicated moderate to large intervention effects using the conventions small d = 0.2, medium d = 0.5, large d = 0.8. Groups did not differ significantly on change in negative mood, intrusive thoughts, or strengthened relationships.

The effects of PCO are noteworthy in that they were demonstrated using intent-to-treat analyses of all randomized participants, including six women who were assigned to the intervention but who declined to attend the workshop. Effects were moderate to large in magnitude and emerged after participation in a brief intervention. Such promising findings highlight the need to examine *how* the intervention worked to allow for further refinement of intervention components, to identify potential moderators of treatment, and to provide empirical evidence to support or contradict underlying theory.

Mechanisms of Project Connect Online

We selected four potential mediators of intervention effects based on theory and prior empirical work. For each mediator, we will discuss the guiding action theory and

conceptual theory that led to its inclusion and its hypothesized relationship to

psychological adjustment. We selected one general indicator of negative adjustment to

cancer (i.e., depressive symptoms), one indicator of positive adjustment to cancer (i.e.,

positive mood), and one cancer-specific indicator of adjustment (i.e., life appreciation; see

Figure 2). We also report results with three secondary dependent variables (negative

mood, cancer-related intrusive thoughts, strengthened relationships) in the discussion

section. Although the intervention did not significantly affect these three dependent

variables, it is valuable to examine the intervention's effect on the mediator (path *a*) and

the mediators effect on the outcome (path *b*) even when the intervention did not
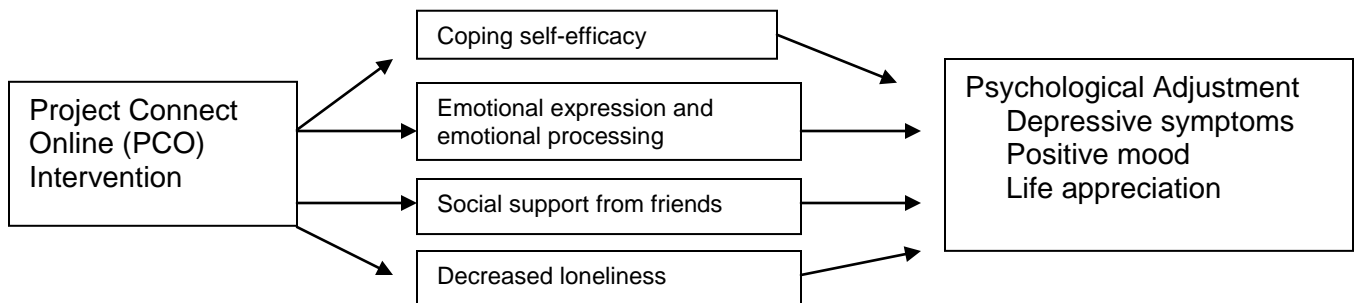
significantly improve the outcome.

Figure 2. Proposed mediators of Project Connect Online

Coping self-efficacy. Coping processes are behavioral or intrapsychic responses to

stress (Taylor & Stanton, 2007) that are used to manage demands perceived to be

challenging or surpassing an individual's resources (Lazarus & Folkman, 1984). Self-

efficacy is one's belief in his or her ability to succeed in a specific situation (Bandura, 1977).

For participants, creating a personal website may develop a new set of skills and provide

opportunities for active coping with cancer through expressing feelings, problem solving,

and reaching out to others. Newly gained skills may include ability to create a website, learning how to upload photographs, journaling about a stressor, actively managing communication online, and facilitating support through requesting preferred types of assistance. By providing women with additional tools and resources for coping, PCO may increase women's perception that they can manage stressors of the breast cancer experience. We hypothesized that PCO would lead to an increase in coping self-efficacy (i.e., women's belief that they have skills to handle challenges of the cancer experience), as women experience successful attempts to manage emotional and physical demands of cancer and broaden their existing coping strategies.

Bandura's (1997) theory of self-efficacy suggests that perceived self-efficacy influences whether and how an individual copes with a stressor. In the cancer context, individuals with high self-efficacy are predicted to approach the challenges of cancer rather than avoiding them. Empirically, coping self-efficacy is associated with positive adjustment to cancer (Arora, et al., 2002; Merluzzi, Nairn, Hedge, Martinez-Sanchez, & Dunn, 2001; Penedo et al., 2003). In several psychosocial interventions for adults with cancer, self-efficacy mediated the relationship between intervention and outcomes including depressive symptoms (Scheier et al., 2005), positive affect (Antoni et al., 2006), and quality of life (Penedo et al., 2004; Penedo et al., 2006). Based on theory and prior empirical evidence, we predicted that an increase in coping self-efficacy would be associated with a decrease in depressive symptoms and an increase in positive mood and life appreciation.

Emotional expression and emotional processing. One of the primary functions of a personal website is to post journal entries which include text and photographs. Writing forms the primary content of a personal website, and through writing, website authors

communicate their experiences and feelings. Several studies have used writing paradigms to facilitate emotional expression in adults with cancer (e.g., Carmack, et al., 2011; Craft, Davis, & Paulson, 2012; Stanton, et al., 2002). Previous qualitative research on personal websites belonging to women with breast cancer demonstrated that their written text included emotional accounts of their cancer experiences (Pitts, 2004). We anticipated that women would share information about the impact of their diagnosis, treatment, and return to activities after treatment, and through thinking and writing about these occurrences, women would both process and express the emotional impact of these experiences. Website visitors may also respond by calling, writing, and visiting with women. Such interpersonal interactions may provide more opportunity for processing and sharing emotions. We predicted that through their writing and increased communication with others, women who participated in PCO would evidence an increase in emotional expression and emotional processing when compared to women in the waiting-list control condition.

Emotional processing and emotional expression are two processes by which stressful events are metabolized (Lepore, 2001; Stanton, Kirk, Cameron & Danoff-Burg, 2000). Cognitive processing theory asserts that stressful life events that are not cognitively processed cause psychological distress, and that incomplete processing results in intrusive thoughts (Horowitz, 1986; Janoff-Bulman, 1989). Stanton and Low (2012b) proposed empirically supported mechanisms by which coping through emotional expression promotes psychological health. These adaptive mechanisms include affect labeling, cognitive reappraisal of the stressor, goal clarification and pursuit, psychological and physiological habituation to emotions, and strengthened social relationships.

Stanton and Low (2012b) reviewed published literature and identifed factors that appear to moderate the impact of emotional expression. For example, characteristics of the social context, such as whether close others are receptive to emotional expression, influence the strength of the relationship between emotional expression and positive outcomes. Social constraint theory (Lepore & Revenson, 2007) posits that individuals without available or receptive social networks will have less opportunity to express their emotions about a stressor and will subsequently fare worse than individuals who are able to process their emotions with others (Cordova et al., 2001; Zakowski, Ramati, Morton, Johnson, & Flanigan, 2004). Additional moderators include characteristics of the stressor (e.g., whether the stressor is uncontrollable or not), characteristics of the emotional expression (e.g., timing of the expression in relation to the stressor), and characteristics of the individual (e.g., gender, dispositional tendencies; see Stanton & Low, 2012b for a review).

Emotional expression has been demonstrated through correlational and experimental studies to be associated with positive adjustment to cancer (Frattaroli, 2006; Morgan, Graves, Poggi, & Cheson, 2008; Stanton Danoff-Burg, Cameron, Bishop, Collins, Kirk, & Twillman, 2000; Stanton et al., 2002; Stanton & Low, 2012a). In contrast, suppression of emotions is associated with poor adjustment to cancer (Classen, Koopman, Angell, & Spiegel, 1996). Researchers have also been identifying moderators of emotional processing and expression in an effort to explain why these processes may be advantageous for some individuals and not for others (Jensen-Johansen et al., 2012; Low et al., 2010; Mosher et al., 2012).

One prior randomized controlled trial conducted with 353 women with gynecological cancer found that emotional expression mediated the relationship between the psychosocial intervention and depressive symptoms (Manne et al., 2008). Women were randomly assigned to either a coping and communication-enhancing intervention or a supportive counseling intervention. Expression of positive emotions and intimacy, such as expressing love, apologizing, or indicating gratitude, mediated the effect of the coping and communication-enhancing intervention on depressive symptoms. Based on theory and empirical evidence, we hypothesized that an increase in coping with breast cancer through emotional processing and emotional expression would be associated with a reduction in depressive symptoms and an increase in positive affect and life appreciation.

Social Support. PCO was designed to increase social support through online communication. The function of a personal website is to share written text and images with one's social network. Website owners were taught how to create a "How you can help" page where they could list supportive behaviors (i.e., help getting to an appointment or receiving a phone call) that they would appreciate from family and friends. Website visitors could respond via comments or email to the website owner, and they may be inspired to reach out in other ways. We hypothesized that women participating in PCO would perceive and experience an increase in the emotional, instrumental, and informational support received from friends. We predicted that PCO would not lead to significant change in social support from partners or family, as we assumed that significant others and close family would not alter their quantity or quality of support provided as a result of the websites. We imagined that women would typically have more face-to-face contact with family, and certainly with

partners, which would make online communication less salient for their relationship quality and perceived support.

Social support theory posits that social support buffers against the ill effects of stressful life events (Cohen & Wills, 1985). The impact of life stressors on psychological well-being is presumed to be greater for individuals with low social support than for individuals with high levels of social support. Social support is theorized to influence psychological adjustment to chronic disease positively through numerous mechanisms, including reduction of emotional distress, reduction of physiological reactivity to stress, promotion of health behaviors, promotion of adaptive appraisals of stressors, and an increase in motivation for approach-oriented coping (Stanton & Revenson, 2012, Uchino, 2006; Wills & Ainette, 2012). A large body of research demonstrates that social support is a key predictor of positive adjustment to cancer (Alferi, Carver, Antoni et al., 2001; Hoyt & Stanton, 2012; Uchino, 2004; see Taylor, 2007 for a review; Wills & Ainette, 2012) and that social isolation is associated with poor adjustment (Lutgendorf & Sood, 2011).

The matching hypothesis (Cutrona, 1990; Cutrona & Russell, 1990) argues that social support is most beneficial when it fits an individual's needs. Based on characteristics of the stressor, such as whether it is uncontrollable or controllable and the life domain in which the loss occurs, specific types of support (i.e., instrumental support, emotional support, tangible support, or esteem support) will be more or less effective in promoting adjustment to the stressor (Cutrona, 1990). We predicted that women in PCO would have better control of the timing and type of social support that they receive than women in the waiting-list control group. For example, women with personal websites can articulate when and what sort of support would be most useful to them through "How you can help"

webpages and through written posts. Women can choose when they have the energy and stamina to read comments from visitors or to share their experiences through online journaling. The potential for PCO to increase the fit between desired and received social support further bolsters the expectation that social support will be associated with positive adjustment. Based on prior research within the cancer context and social support theory, we hypothesized that an increase in social support would be associated with a decrease in depressive symptoms, an increase in positive mood, and in increase in life appreciation.

Loneliness. Loneliness can be defined as "a distressing feeling that accompanies the perception that one's social needs are not being met by the quantity or especially the quality of one's social relationships" (Hawkley & Cacioppo, 2010, p. 218). PCO was designed to decrease loneliness through similar mechanisms that were predicted to bolster social support. Namely, personal websites were predicted to increase a sense of connection and decrease isolation through facilitating communication and support. A recent meta-analysis on interventions to reduce loneliness revealed that the most effective strategies included increasing opportunities for interaction with others and increasing social support (Masi, Chen, Hawkley, & Cacioppo, 2010). PCO was hypothesized to lead to a decrease in loneliness through providing means to connect with others and receive support.

Loneliness is associated with poor physical health, mental health, cognitive functioning and mortality (see Hawkley & Cacioppo, 2010, for a review). In the context of breast cancer survivorship, loneliness is associated with depression, as well as other indicators of negative adjustment including pain and fatigue (Jaremka et al., 2012). Hawkley and Cacioppo (2010) outline a theory of loneliness whereby individuals enter a regulatory loop of perceptions of loneliness leading to vigilance for social threat, resulting

in distancing from opportunities that would indeed provide relief. It is posited that negative social expectations elicit reactions from others that confirm fears of social threat and perpetuate loneliness. The experience of vigilance for social threat, cognitive bias towards interpreting threat, and experienced threat is characterized by stress, negative affect, and pessimism. It follows that reduction of loneliness would be associated with reduced depressive symptoms, increased positive affect, and greater appreciation for life.

Timing of mediators. Mediation assumes a temporal precedence in which the intervention precedes change in the mediator, and change in the mediator precedes change in the outcome of interest (MacKinnon, 2008). We assessed proposed mediators at baseline, one month, and six months after implementation of the intervention. We expected to see small changes in mediating variables one month after participation in the PCO workshop, as women started to write about their experiences, share their websites with others, and receive emotional and instrumental support. We expected greater changes six months after workshop participation, as women would have had greater opportunity to populate their website with content and receive feedback and support from visitors. In our analyses, we examine change in mediating variables from both T1 to T2 and T1 to T3 and predictors of change in outcome variables from T1 to T3. In both cases, the intervention implementation preceded the change in the mediator.

Main Hypothesis. Our primary hypothesis was that an increase in cancer-related emotional expression, coping self-confidence, perceived instrumental and emotional support from friends, and a decrease in loneliness would mediate the relationship between PCO and depressive symptoms, positive affect, and life appreciation. We also explored whether change in mediators had an effect on negative mood, cancer-related intrusive

thoughts, and strengthened relationships, each of which did not change significantly in response to PCO (Stanton et al., 2013).

Methods

Participants

We recruited women from a community medical oncology practice specializing in the treatment of breast cancer. Women were eligible to participate if they were at least 18 years old, had received a diagnosis of invasive or metastatic breast cancer, did not have a personal website, and were able to complete questionnaires in English. Women were not excluded due to lack of familiarity with computers. The trial was originally designed to detect large effects ($d = 0.80$) with 80% power, two-sided $p < .05$, and 20% attrition, requiring 33 participants per group, but was expanded to 44 per group due to available resources to extend accrual.

As shown in Figure 3, of 440 women approached, 10% ($n = 43$) were ineligible, 56% ($n = 309$) declined to hear more about the study, 14% ($n = 63$) declined after learning about the study or did not return a baseline questionnaire packet within one month, and 20% ($n = 88$) were randomized and included in analyses. Of the 88 participants randomized, 86% ($n = 76$) completed the one-month assessment, and 86% ($n = 76$) completed the six-month assessment.

Procedure

The UCLA Institutional Review Board approved all study procedures. Potentially eligible patients were approached in the oncology clinic by the clinic's research coordinator, who followed a standard verbal script. The research coordinator stated that the purpose of the research was "to evaluate a workshop held here to create your own

personal website to communicate with friends and loved ones about your experience."

Physicians providing treatment were unaware of patients' participation.

After receiving verbal consent, the research coordinator shared contact information with the research staff, who called potentially eligible women to describe the study and confirm eligibility. Women who were interested and who met eligibility criteria were mailed informed consent forms and questionnaires, which they returned by mail. Once a baseline packet was received, the participant's assigned condition was revealed to research staff from a simple random allocation sequence produced by a biostatistician uninvolved in the trial. Research staff then called to schedule the intervention session or inform the participant that she would continue assessments and be offered the workshop in six months. Randomization proceeded from September 2008 through October 2009, with assessments completed in May 2010. One and six months after the intervention, women completed and returned follow-up questionnaires by mail. Data entry personnel were unaware of participants' condition assignment. Participants were compensated $50 for each questionnaire that was returned.

PCO intervention. PCO was developed in three phases through: 1) semistructured interviews of eight breast cancer patients who had created personal websites regarding their cancer experience; 2) focus groups of seven breast cancer patients to evaluate barriers, facilitators, and preferences for creating websites; and, 3) once the website template, manual, and workshop protocol were developed, a pilot intervention session was conducted with four breast cancer patients to elicit feedback, with resulting slight modifications prior to launching PCO.

The researchers collaborated with a website development firm (www.notsoldseparately.com), using the WordPress multisite website and blogging platform (www.wordpress.org), to develop a design that allowed for personalization (e.g., website template, links). Each website template contained six functions: (1) a journal (blog) which could contain photos; (2) a page for links to other websites, to be populated by each participant (a list of suggested websites was provided by the researchers [e.g., the oncology clinic, National Cancer Institute, American Society of Clinical Oncology public site]); (3) a How You Can Help page, in which participants could convey actions visitors could undertake (e.g., meal provision, written cards); (4) choice of privacy settings; (5) instructions for visitors on how to post messages and subscribe for automatic notification of website updates; and (6) an online survey to assess visitors' reactions to PCO (data not reported here). The researchers and website development firm also created a 48-page manual with written and visual instructions for website creation and maintenance and online step-by-step video tutorials for creating/maintaining website functions (e.g., adding a link or photo).

After at least three women were randomly assigned to the intervention, two members of the research team (Stanton, Thompson, post-baccalaureate research staff) conducted a three-hour intervention session at the medical oncology practice. Delivered in groups of one to five participants (along with significant others if women elected to bring a family member or friend), the intervention involved: (1) a presentation on potential functions of personal websites (e.g., keep others informed, manage communication, chronicle the experience); (2) proactive discussion of common concerns about maintaining a website (e.g., perceived pressure to post frequent updates or to write only positive

content) (3) demonstration of all website functions (i.e., privacy settings, journal, photo posting, links, "how you can help" page, visitor survey); (4) discussion of how to introduce the website to others; (5) demonstration of online tutorials; and (6) hands-on creation of the website, which involved selecting one of 11 website templates, creating a website title, initiating the first journal post to introduce others to the website. Women were provided a printed take-home manual and a toll-free phone number for technical support from the website development firm. A researcher (EHT) called each participant one week later to respond to questions and promote website use. Phone calls lasted no more than 15 minutes. At the oncology clinic, wireless access was available during clinic hours for participants to update websites, and cameras and laptops were available for check-out from the front desk.

Waiting-list control. Women assigned to the waiting-list control condition completed the baseline and follow-up assessments and otherwise received care as usual. After completion of the six-month assessment, women were offered the opportunity to attend a workshop and create a website. Eight women assigned to the waiting-list control condition elected to create websites following their final assessment.

Measures

At baseline, participants self-reported sociodemographic (i.e., age, education, race/ethnicity, employment, partner status, familial/social network data) and cancer-related variables (i.e., diagnosis date, stage, treatment status, specific treatments).

Dependent variables. Outcome measures were assessed at each assessment point. Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1997; Radloff, 1991). Hann, Winter, and Jacobsen (1999)

documented the scale's reliability and construct validity with women with breast cancer. In the current sample, internal consistency reliability was high at all assessments (α = .89–.91).

Participants completed the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) with regard to their feelings in the past week. As in other studies with cancer patient samples (Sears, Stanton, and Danoff-Burg, 2003; Stanton, Danoff-Burg, & Huggins, 2002; Stanton et al., 2002), we constructed a positive mood index with the eight vigor subscale items (e.g., "cheerful," "lively," "carefree"). Prior studies have demonstrated the scale's high reliability (Sears at al., 2003; Stanton et al., 2002), and within the current study, internal consistency reliabilities were high across time points for positive mood (α = .79–.93). Negative mood was assessed through an index consisting of 53 items (e.g., "unhappy," "grouchy," "discouraged," "uneasy"). For negative mood, internal consistency reliabilities were high across time points (α = .96 - .97).

With the rationale that PCO could promote cancer-related benefits in specific domains, we examined the Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) Appreciation of Life subscale. Women rated items for the degree to which each change had occurred in their lives as a result of the cancer experience. Items included, "I can better appreciate each day" and "I have a greater appreciation for the value of my own life." Tedeschi and Calhoun (1996) provide support for the scale's reliability, concurrent, discriminant, and construct validity. Prior studies have documented its reliability for breast cancer patients (Cordova et al., 2001; Cordova et al. 2007; Sears, Stanton & Danoff-Burg, 2003; Tomich & Hegelson, 2012). For the current sample, internal consistency reliability was high across time points (α = .83–.88). As a secondary outcome, strengthened

relationships was measured through the subscale of the PTGI of the same name. Items included, "I have a greater sense of closeness with others" and "I put more effort into my relationships." Internal consistency reliability for strengthened relationships was high across time points (α = .87-.89).

Cancer-related intrusive thoughts were assessed using the Impact of Event Scale (IES: Horowitz, Wilner, & Alvarez, 1979) 7-item thought intrusion subscale and were examined as a secondary dependent variable of interest. The IES has been used to examine cancer-related intrusive thoughts in numerous samples of women with breast cancer (Dupont et al., 2013; Lewis et al., 2001; Lindgren et al., 2012; Thompson, Stanton, & Bower, 2013). Women indicated how frequently each item was true for them during the past week with regard to their cancer experience. Sample items include, "I had wave of strong feelings about it" and "Other things kept making me think about it." Internal consistency reliability for cancer-related intrusive thoughts was high across time points (α = .87 - .89).

Within assessment points, correlations between depressive symptoms and positive mood ranged from r = -0.49 to -0.56, all p < .01. Appreciation of life was not significantly correlated with depressive symptoms or positive mood at any time point.

Mediator variables. Mediating variables were also assessed at each time point. Emotional expression and emotional processing were assessed through the Emotional Approach Coping Scale with reference to women's experience of breast cancer (Stanton, Kirk, Cameron, & Danoff-Burg, 2000). The emotional expression subscale contains four items, including "I take time to express my emotions" and "I feel free to express my emotions." The emotional processing subscale also contains four items, including "I take time to figure out what I am really feeling" and "I delve into my feelings to get a thorough

understanding of them." Emotional processing and emotional expression were correlated at r = .71 to .76, all p < .01, which is very similar to other samples of women with breast cancer (Stanton et al., 2000). A composite emotional processing and expression subscale was used for mediational analyses. Internal consistency reliability was high at all assessments for combined emotional expression and processing (α = 0.89–0.91).

Coping self-confidence was assessed by a subscale of the Measure of Current Status (MOCS), which was constructed for use in investigating mediational processes in psychosocial interventions for adults with cancer (Penedo, et al., 2003; Antoni, et al., 2006). Participants rate how well they can perform each behavior with regard to "how you respond to challenges and demands associated with your experience of breast cancer." Example items include, "When problems arise I know how to cope with them," and "I am confident about being able to choose the best coping responses for hard situations." Internal consistency reliability was high at all assessments (α = 0.86–0.92).

Social support from friends was assessed with Carver et al. (2006) Sources of Social Support Scale (SSSS) with regard to cancer. Items assessed both emotional and instrumental support as well as specific targets (i.e., friends, partner, and family other than partner). Primary analyses examined social support from friends, and exploratory analyses examined social support from partners and family members. Correlations between support from friends, family, and partner at each time point ranged from r = .29 to .60, all p < .01. Six items assessing support from friends include, "How much do you friends listen to and try to understand your worries about your breast cancer" and "How much do your friends give you assistance with things related to breast cancer (helping you with daily chores, driving you places, dealing with bills and paperwork?)." These same questions were also

asked with regard to "your husband or partner" and "your family." Internal consistency reliability was high at all assessments for social support from friends (α = 0.94–0.97).

Loneliness was assessed using the UCLA Loneliness scale (Russell, 1996). Example items include, "How often do you feel as if nobody really understands you" and "How often do you feel starved for company." Russell (1996) details the psychometric properties of the scale and demonstrates high reliability, convergent validity, and construct validity. In this sample, internal consistency reliability was high at all assessments (α = 0.89-0.90).

Within assessment points, correlations between coping self-confidence and emotional processing/expression ranged from r = 0.50 to 0.57, all p < .01. Correlations between coping self-confidence and social support from friends ranged from r = 0.39 to 0.48, all p < .01. Coping self-confidence and loneliness were correlated from r = -0.53 to -0.57, all p < .01. Emotional expression/processing and social support from friends were correlated from r = 0.23 to 0.26, all p < .05. Emotional expression/processing and loneliness were not significantly correlated at any time point. Correlations between social support from friends and loneliness ranged from -0.46 at T1 (p < .01) to -0.30 at T3 (p < .05).

Fidelity to the PCO workshop protocol was assessed using a 20-item author-constructed measure. Each yes/no item (e.g., "discussed common concerns about using a website and how these can be proactively addressed," "explained privacy settings and demonstrated how to change them") was rated independently by two research staff uninvolved in PCO performance, who listened to taped audio-recordings of the PCO workshops.

Data Analysis

The groups were compared on all baseline variables using chi-square for categorical variables and t-tests for continuous variables. Indirect effects of the intervention on psychological adjustment were tested using changes in measures of adjustment (depressive symptoms, positive mood, and life appreciation) from baseline to six months as dependent variables and (1) changes in the mediators from baseline to one month and (2) changes in the mediators from baseline to six months as mediators. Twelve separate mediational analyses were conducted using the four mediating variables to predict change in the three dependent variables. Secondary analyses were conducted with three additional dependent variables (intrusive thoughts, negative mood, and strengthened relationships).

An SPSS macro ("Indirect") generated 5,000 bootstrapped samples using random sampling with replacement to generate estimates and confidence intervals around the indirect effects (Preacher & Hayes, 2008). The mean of 5,000 calculated indirect effect estimates ($a \times b$) based on the bootstrapped samples was examined. When zero was not included in the 95% confidence interval of the estimate, the indirect effect was deemed statistically significant. A second SPSS macro ("Mediate") was used to test multiple mediators for each dependent variable. Within a multiple mediator model, the indirect effect for each mediator is its unique effect on the outcome when controlling for the other mediators included in the model.

Results

Sample Characteristics

Table 2 provides participant characteristics. The majority of participants were married, non-Hispanic white, college graduates, and employed at least 30 hours per week. On average, participants were 56 years old and had been diagnosed with breast cancer

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more than five years previously. Twenty-one women were in medical treatment, and 17

had metastatic disease. The conditions did not differ significantly (all $p > .05$) at baseline on

any demographic, cancer-related, or dependent variable. Baseline variables did not differ

significantly (all $p > .05$) between women who completed ($n = 76$) or did not complete ($n =$

12) the six-month assessment.

Scores on Mediating Variables

On average, women reported moderately high levels of emotional expression and

processing at study baseline, which was very similar to levels reported by 92 women who

had received treatment for early stage breast cancer (Stanton et al., 2000). At study

baseline, women reported moderate levels of coping self-efficacy, which were lower than

levels reported by a sample of women newly treated for non-metastatic breast cancer

(Antoni et al., 2006). Women reported moderate levels of social support from friends,

which was comparable to a previously reported sample of low-income Hispanic women

who were receiving treatment for breast cancer (Alferi, et al., 2001). On average, women

reported levels of loneliness considered within a normal range and similar to levels

reported by a sample of 188 women with breast cancer, who were of similar average age to

the current sample (Fogel, Albert, Schnabel, Ditkoff, & Neugut, 2002), and a healthy sample

of 311 female and male public school teachers ($M = 19.22$; Russell, 1996).

Scores on Dependent Variables

At baseline, women on average reported depressive symptoms below that of the

cut-off suggestive of clinical depression (a score ≥ 16), although there was variation in

scores on this measure, and some women did score above the clinically suggestive cut-off

for major depression. The mean score on depressive symptoms in this sample was

comparable to a sample of 230 women who had received a diagnosis of early-stage breast cancer (Carver & Antoni, 2004). On average, women reported moderate levels of positive affect, which were slightly higher than levels indicated by a sample of 408 women who had received a diagnosis of early stage breast cancer and had completed treatment at least three months prior to assessment (Grunfeld et al., 2011). Women indicated moderately high levels of life appreciation, which were similar to levels reported by a sample of 65 women who had received a diagnosis of stage I-III breast cancer (M = 10.0; Cordova et al., 2007) and higher than levels indicated by a sample of 100 women with metastatic breast cancer (M = 7.65; Mystakidou et al., 2008). Bivariate correlations between mediating variables and dependent variables are presented in Table 3.

Treatment Fidelity

Eight of the 15 PCO workshops were audiotaped. On the 20-item measure of treatment fidelity (see Appendix), two independent raters established that there was 100% fidelity to the workshop protocol.

Mediational Analyses

Because mediational analyses conducted for this paper were secondary analyses (see Stanton, Thompson, & Crespi, in press, for primary analyses), we conducted post hoc analyses using G*Power (Erdfelder, Faul, & Buchner, 1996) to assess statistical power for the a and b paths, using f^2 effect sizes (Cohen, 1977). With a sample size of 66 (smallest number of participants used for any mediational analysis) and alpha of 0.05, power was .20 to detect a small effect (f^2 = .02), .87 to detect a moderate effect (f^2 = .15) and more than .99 to detect a large effect (f^2 = .35). Thus, there was sufficient power to detect moderate and large effects but inadequate power to detect small effects on the a and b paths.

To determine whether indirect effects were significant, bootstrapping with 5000 replications was used to estimate the standard error (Preacher & Hayes, 2004). Analyses were conducted to examine change in dependent variables from T1 to T3 as predicted by change in mediating variables from T1 to T2 and T1 to T3 for women who participated in the intervention. When all mediational analyses were conducted using change in mediators from T1 to T2 to predict change in dependent variables from T1 to T3, mediation was not significant for any dependent variable. As expected, the effect of PCO on mediators (path a) was not significant in almost all cases, indicating that the intervention did not lead to significant change in mediators one month after workshop participation.

Bootstrapped estimates and confidence intervals from mediational analyses with mediators assessed from T1 to T3 are presented in Table 4. Coping self-confidence, loneliness, and social support from friends were each significant mediators of the relationship between intervention and depressive symptoms. Coping self-confidence significantly mediated the relationship between intervention and positive affect. Social support from friends significantly mediated the effect of the intervention on life appreciation. The intervention did not have a significant effect on change in social support from partners or family.

When intent-to-analyses were repeated on data to include the women who were assigned to the intervention but did not participate ($n = 6$), some statistically significant effects found in the smaller sample did not remain. Social support from friends no longer significantly mediated the relationship between PCO and depressive symptoms (but coping self-confidence and loneliness remained significant mediators). Coping self-confidence no longer significantly mediated the relationship between PCO and positive mood.

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Multiple mediator models. Results from a multiple mediator model for depressive symptoms are presented in Figure 6. Coping self-confidence, social support from friends, and loneliness were entered together as potential mediators of the relationship between intervention and depressive symptoms. The total indirect effect was significant ($z = -2.97$, $SE = 1.53$, $p < .01$, 95% CI: -7.90 to -1.93). The indirect effects associated with coping self-confidence ($B = -1.93$, SE = 0.91, 95% CI: -4.12 to -0.47), social support from friends ($B = -1.19$, SE = 0.93, 95% CI: -2.97 to -0.15), and loneliness ($B = -1.34$, SE = 0.91, 95% CI: -3.84 to -0.06), were each significant, indicating that each variable independently mediated the relationship between PCO and depressive symptoms.

Secondary Analyses

While not a primary focus of the paper, we also examined whether the same mediators (emotional expression/processing, coping self-confidence, social support from friends, and loneliness) mediated the relationships between intervention intrusive thoughts, strengthened relationships, and negative mood. No mediational effects were found for intrusive thoughts or strengthened relationships. Of note, women assigned to PCO on average reported that they "rarely" experienced intrusive thoughts related to their cancer at study baseline, which left little room for improvement on this measure. Results approached but did not meet significance at $p < .05$ for coping self-confidence mediating the relationship between intervention and strengthened relationships.

Intent-to-treat analyses of the intervention demonstrated that the intervention did not have a significant effect on negative mood (Stanton et al., 2013). Outcome analyses with the 75 participants retained at six months demonstrated a significant effect on negative mood that was qualified by an interaction. PCO buffered against the increase in negative

mood that was experienced by women in medical treatment who were assigned to the control condition. Based on a multiple mediator test, the total indirect effect for negative mood was significant ($z = -2.50$, $SE = 3.04$, $p < .05$, 95% CI: -15.09 to -2.46), signifying that coping self-confidence ($B = -3.33$, $SE = 1.92$, 95% CI: -8.48 to -0.60) and social support from friends ($B = -4.29$, $SE = 2.45$, 95% CI: -10.82 to -0.83) both independently mediated the relationship between PCO and negative mood.

Discussion

Changes in theoretically and empirically supported mediators from baseline to six months later were associated with change in outcome measures of PCO. PCO worked not only through enhancing social relationships and sense of connection to friends, but also through increasing women's sense of being able to respond effectively to the challenges of cancer. Change in coping self-confidence, loneliness, and social support from friends mediated the relationship between PCO and change in depressive symptoms. Change in coping self-confidence mediated the relationship between PCO and the increase in positive mood. Change in social support from friends and mediated the relationship between PCO and life appreciation. Data were not indicative of emotional processing/expression mediating the relationship between intervention and any outcome variable. These results provide valuable information about how PCO improved adjustment to cancer for participants on specific indices and where the intervention was ineffective in promoting positive change.

The current study appears to be one of two studies that have examined mediators of web-based psychosocial interventions for adults with cancer (the other study being Hawkins et al., 2010) and the first of such studies that has examined perceived social

support as a potential mediator of treatment effect. This study adds to the small body of literature on mechanisms of psychosocial intervention for adults with cancer by supporting previous findings about the utility of increasing coping self-efficacy for promoting psychological adjustment. As described previously, seven prior studies have demonstrated that an increase in patients' perceived coping skills or confidence to use such skills mediated the relationship between intervention and outcomes (Antoni et al., 2006; Branström et al., 2010; Hawkins et al., 2010; Manne et al., 2008; Penedo et al., 2004, 2006; Scheier et al., 2005). As with the current sample, three prior studies examined self-efficacy as a mediator in samples of women the breast cancer, and evidence from the four additional trials supports the proposition that coping self-efficacy may mediate the effects of psychosocial interventions on outcomes for different types of cancer and for both genders.

Results highlight social support and loneliness as promising mediators that have previously been under-examined. One prior study examined seeking support for emotional reasons and seeking support for instrumental reasons as mediators of a communication and coping intervention, but did not find evidence of significant mediation for the primary outcome measure, depressive symptoms (Manne et al., 2008). Perceived social support may be more salient for adjustment to cancer than endorsement of seeking social support, and web-based interventions may be uniquely suited to bolstering social support from friends. None of the trials identified by Stanton et al. (2012) or Moyer et al. (2012) reported examining loneliness as a potential mediator of treatment effects. Given that both perceived social support and loneliness were significant mediators of PCO, future research

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should continue to examine these mediators and to develop intervention components to target social support and loneliness.

Study results suggest that future research should also examine whether emotional processing and expression can be promoted through web-based interventions and for whom these processes will produce benefit. One prior study (Manne et al., 2008) found that the expression of positive emotion and intimacy mediated the effects of a communication and coping intervention on depressive symptoms, but that cancer-related emotional expression did not mediate effects. They highlight the distinction between general and cancer-specific emotional expression and the importance of understanding whether an individual's social context will be receptive to and helpful in response to emotional disclosure. Text analysis may help researchers determine whether web-based interventions promote general or cancer-specific emotional expression; the utility and feasibility of text analysis is discussed in further detail below.

Multiple Mediator Models

The multiple mediator model for depressive symptoms indicated that coping self-confidence, loneliness, and social support from friends each independently mediated the relationship between PCO and depressive symptoms. Successful reduction of depressive symptoms is an important outcome, both in its own right and in its connection with other important outcomes. Depression is associated with nonadherence to medical regimens for chronic disease (Di Matteo, Lepper, &Croghan, 2000), reduced capacity to return to work (Stein et al., 2008), and increased risk of suicide (Misono et al., 2008). Depression also is associated with worse survival for women with breast cancer (Goodwin, Zhang, & Ostir, 2004), and a reduction in depressive symptoms during treatment is associated with longer

survival for women with metastatic disease (Giese-Davis et al., 2011). This evidence indicates that the intervention worked both by bolstering perceived social integration and support and by increasing women's sense that they could manage the challenges of cancer. Results also suggest that loneliness is not merely the absence of social support, but that these two constructs capture distinct components of relating to others that both influence adjustment to cancer and were both positively altered through PCO.

Conclusions from Mediational Analyses

  Coping self-efficacy. Positive change in coping self-confidence was related to change in indicators of mood (i.e., depressive symptoms, positive and negative mood) but was not significantly related to change in indicators of perceived cancer-related benefits (i.e., life appreciation or strengthened relationships). In prior cancer-specific research, certain perceived coping skills (i.e., ability to relax) mediated the relationship between psychosocial intervention and both positive mood and benefit finding for women with breast cancer (Antoni et al., 2006). More general perceived coping skills (i.e., relaxation ability, cognitive reframing, awareness of tension, use of social support) also mediated the relationship of psychosocial interventions for adults with cancer and benefit finding as an outcome (Penedo et al., 2006). Given that other studies have found that coping self-confidence mediated the relationship between intervention and both mood and benefit finding, it is unclear why in the present sample, no significant effects were found for life appreciation or strengthened relationships. In light of the small number of studies that have included coping self-efficacy as a potential mediator in psychosocial interventions for adults with cancer, further research is needed before conclusions may be drawn.

Emotional Processing and Expression. It is surprising that PCO did not lead to significant change in emotional processing or expression as anticipated. We discuss four potential explanations for this finding and their implications for future research. First, perhaps women who elected to participate in the intervention and create personal websites initially presented with high levels of emotional processing and expression. Knowing that the intervention would require writing about and sharing with others details of their cancer experience, women uncomfortable with the idea of sharing their feelings may have declined to participate in PCO. However, when compared to a slightly younger sample of 92 women with early stage breast cancer, women in this sample reported nearly identical baseline levels of emotional processing/expression (Stanton et al., 2000).

A second possible explanation is that the six-month duration of the study was too short a timeframe to promote change in emotional processing and expression. However, this explanation appears contradicted by a supportive counseling intervention, which demonstrated significant change in emotional processing and emotional expression over a three-month period (Manne et al., 2008). Additional research appears needed to understand the rate at which these processes may change due to expressive writing.

A third explanation is that writing about ongoing cancer-related stressors may have led to more emotional processing and expression than writing about past cancer-related trauma or challenges. Prior research has indicated that writing about current traumas produces greater benefits than writing about past traumas (Smyth, 1998). In the current trial, only ten women in the intervention arm were undergoing current medical treatment. These women may have written about present stressors, while women years past active

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treatment may have been recalling past challenges. Thus, only a proportion of participants may have experienced a significant increase in emotional processing and expression.

A fourth explanation is that women who wrote frequently or who chose to express their feelings and emotional content through their writing evidenced change in emotional processing/expression, whereas women who wrote infrequently or posted more factual information did not. Women were not given specific instructions or suggestions about their website content or how frequently they should post entries. Although the intervention could have promoted expressive writing for some participants, other women could have chosen not to express their feelings or write about emotional aspects of their cancer experience.

Surprisingly, emotional expression and processing were not significantly related to outcome variables. We discuss three possible explanations for these findings. First, perhaps the duration of the study was not long enough to produce an impact on outcome variables through the pathway of emotional processing and expression. This explanation seems unlikely, as several studies have found that brief writing exercises about breast cancer produce changes in important outcome variables within similar or shorter timeframes as the current study (Craft, Davis, & Paulson, 2012; Jensen-Johansen et al., 2012; Low et al., 2010; Stanton et al., 2002).

Second, a meta-analysis of nine experimental studies found that written emotional disclosure typically has a greater impact on physical outcomes than on psychological outcomes for adults with physical or psychiatric illness (Frisina, Borod, & Lepore, 2004). The current study did not assess for changes in physical symptoms, and future research

should include cancer-relevant measures of physical health outcomes including pain, healthcare utilization, and biological markers of functioning.

Third, prior research has demonstrated that emotional processing and expression may be advantageous for some women with breast cancer and not for others (Jensen-Johansen et al., 2012; Low et al., 2010; Mosher et al., 2012). One longitudinal study with 60 women with early-stage breast cancer found that expressive writing was beneficial for women who endorsed low avoidance of cancer-related thought and feelings (Stanton et al., 2002). In contrast, women who indicated high levels of avoidance benefitted from writing about the positive aspects of the experience with cancer. A second experimental study with breast cancer survivors examined potential moderators of an expressive writing intervention and found that women who endorsed less externally oriented thinking experienced greater reductions in cancer-related intrusive thoughts and avoidance than women high on externally oriented thinking (Jensen-Johansen et al., 2012). The authors also examined social constraint and alexithymia (difficulties identifying feelings and difficulties describing feelings subscales) as potential moderators of intervention effect, but results did not support their hypotheses. A third experimental study revealed that expressive writing was beneficial on negative mood for women who were recently diagnosed with metastatic breast cancer and for women endorsing low levels of emotional support (Low et al., 2012a). In contrast, expressive writing negatively influenced the sleep quality of women who had been living with metastatic breast cancer for years. Mosher et al. (2012) found that expressive writing for women with metastatic breast cancer did not lead to improvements in well-being when compared to women who were assigned to write about daily activities and concluded that future research needs to examine potential

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moderators of treatment effect including literacy and timing of intervention in relation to phases of diagnosis, treatment, and survivorship. Along with the significant moderated effects evident in the current trial, these studies illustrate the importance of investigating potential moderators of treatment effect for expressive writing and provide plausible explanations as to why PCO did not impact outcomes through the pathways of emotional processing and expression as predicted. Unfortunately, the sample size of the current trial was not sufficient to allow moderated mediational analyses.

Social Support. An increase in positive support specifically from friends was associated with a reduction in negative affect, depressive symptoms, and an increase in appreciation of life. To our knowledge, this was the first study that examined perceived social support as a potential mediator of a psychosocial intervention for adults with cancer. We hypothesized that PCO would lead to an increase in perceived support from friends but not from family or partners, and indeed, the intervention did not have a significant effect on change in support from either of these two sources. Research has shown that for women with breast cancer, social support from friends can counterbalance unsupportive male partners (Widows, Jacobsen, & Fields, 2000), and that frequently more social support is received from friends than from significant others (Wellisch, Kagawa-Singer, & Reid, 1999).

Given prior evidence suggesting the important function that this source of social support provides and the fact that PCO is the first intervention designed to increase social support from friends, it is promising and notable that PCO demonstrated a positive effect on social support from friends. Notably, of the 66 PCO website visitors who elected to complete a brief online survey, 59% of visitors indicated that they were a friend or acquaintance of the website owner (Thompson & Stanton, 2011). In addition to self-report

measures of social support, future research can incorporate objective measures of received social support, including number and content of comments posted by visitors and number of website visitors to each site. Future research can also examine the impact of PCO on emotional, informational, and instrumental support, and the individual effects of these different types of social support on psychological adjustment.

      Loneliness. Decreased loneliness was related to a reduction in depressive symptoms, but was not significantly related to changes in positive or negative mood. Effectively reducing loneliness for adults with cancer is significant, as longitudinal research has demonstrated that loneliness predicts increases in depression, cognitive decline, morbidity, and mortality (see Hawkley & Cacioppo, 2010 for a review). Additionally, prior research has demonstrated an association between loneliness and pain, depression and fatigue for breast cancer survivors (Jaremka et al., 2012). A meta-analysis of interventions to reduce loneliness demonstrated that randomized interventions that altered negative social cognitions were more effective than randomized interventions that promoted social skills, opportunities for social contact, or social support (Masi, Chen, Hawkley & Cacioppo, 2010). Future research can examine whether altered maladaptive social cognitions or other social processes may mediate the relationship between internet-based interventions for adults with cancer and loneliness.

Study Limitations

      Limitations of the intervention study include a lack of control of attention for the waiting-list control condition and a small sample size, which allowed for the detection of only moderate to large effects (Stanton et al., 2013). It is unclear how study results may generalize to men, other types of cancer, and disadvantaged groups (e.g., low education).

Examining data from two time points instead of three or more prevents conclusion about causal relationships. Results indicate that the intervention caused significant change in both mediating variables and outcome variables. Although we can conclude that change in mediating variables were significantly associated with change in outcome variables, based on the current analyses, we cannot conclude that change in mediating variables caused change in outcome variables. Ideally, mediational analyses would have examined change in mediating variables that preceded change in dependent variables, rather than change that occurred in tandem, as with the present study. A larger PCO intervention should include several assessments conducted further than one month following the intervention to capture change in mediators that would precede change in outcome variables.

Future Research

PCO had a positive influence on depressive symptoms, positive mood, and negative mood through the pathway of coping self-confidence. Remaining is the question of *how* the intervention promoted change in coping self-confidence. We hypothesized that by learning a new skill (i.e., how to create and manage a personal website), women participating in the intervention would feel better equipped to respond to the challenges of cancer. Prior studies have similarly demonstrated a positive impact on coping self-confidence through the teaching of new skills (Antoni et al., 2006; Penedo et al., 2006). Typically *perceived* skills for stress management are assessed, rather than objective skill ability or effective use of skills. Therefore it is unclear whether coping self-confidence is increased through simply learning about skills for coping, through effectively applying newly developed skills to the challenges of cancer, or through other means.

Bandura, Adams, and Beyer (1977) identified three relevant processes by which self-efficacy may increase: enactive attainment, vicarious experience, and social persuasion. Enactive attainment consists of experiencing mastery or successful attempts to cope with a challenge. In the context of PCO, a woman who posts on her "How you can help" page a request for a ride to chemotherapy and benefits from a friend offering to help her may experience a sense of skillfully managing a stressor. Second, vicarious experience consists of seeing others successfully cope with challenges. Participants in PCO were told that a focus group of women with breast cancer reported significant value in maintaining a website. Participants' coping self-confidence may have benefitted from this knowledge that other woman have successfully used their websites to cope with cancer. Third, social persuasion may consist of receiving encouragement or being verbally persuaded that one is capable of coping effectively. PCO participants were presented with information about potential benefits of using a personal website. This, along with support and encouragement received through website visitors, may have positively impacted women's self-efficacy. Future research should operationalize and quantify these pathways and others to understand how this intervention and others lead to increased coping self-efficacy. Additionally, future research should examine both general coping self-efficacy, as well as efficacy for specific skills that PCO is hypothesized to promote (e.g., ability to put one's experience with cancer into words, ability to manage a personal website, ability to ask friends for specific types of support).

In addition to self-report measures of emotional processing and expression, future research should employ text analysis (i.e., Linguistic Inquiry and Word Count [LIWC; Pennebaker, Mayne, & Francis, 1997]) to measure levels of and change in the constructs.

Emotional processing is captured through words that indicated cognitive processing (e.g., realize, consider, know) and emotional expression is measured through affective words (e.g., happy, love, worried, nervous). Objective measurement of emotional processing and emotional expression would provide data on whether the intervention effectively promotes these processing, the rate of change in these processes, and whether there is a dose-dependent relationship between emotional processing/expression and outcome variables. Text analysis is currently underway for PCO.

Understanding which intervention mechanisms lead to change can elucidate potential moderators of treatment effect (Moyer et al., 2012). For example, knowing that loneliness is a mediator of PCO suggestions that according to Hawkley and Cacioppo's (2010) regulatory loop of loneliness, adults endorsing vigilance to social threat and negative expectations about others may benefit the most from website creation. Future research can use results from mediational analyses to inform examination of potential moderators of intervention effects.

Moyer et al. (2012) noted that only two published studies of psychosocial and physical activity interventions for cancer survivors have examined chains of mediating relationships. It is possible that the Project Connect intervention could lead to more rapid change in certain mediating variables (i.e., perceived social support), which would then lead to subsequent changes in other mediating variables (i.e., decreased loneliness), which might consequently result in changes in key outcomes measures (i.e., decreased depressive symptoms). Another example is grounded in the stress-support matching hypothesis, which posits that well-matched social support promotes adaptive coping, which in turn results in positive adjustment to stressors (Curtrona & Russel, 1990). PCO may lead to an

increase in social support, which would foster adaptive coping, which would subsequently result in positive adjustment. A third example is that PCO could positively affect the use of approach-oriented coping, which could subsequently lead to an increase in coping self-efficacy. Exploration of such chains of mediation requires measurement of mediators at several time points and clear articulation of theoretical and empirical grounding for hypotheses.

Conclusion

PCO represents the first experimental study of a brief, novel intervention with great potential for dissemination. Participation in a three-hour workshop and subsequent use of a personal website led to an increase in coping self-confidence, an increase in perceived support from friends, and a decrease in loneliness. Changes in these mediating variables were associated with reduced depressive symptoms and increased positive mood and life appreciation. These promising findings suggest that the intervention should be expanded to include additional time points for assessment and objective measures of hypothesized mediating variables. Results contribute to the small body of literature on mediators of psychosocial interventions for adults with cancer by supporting previously identified mechanisms of change (i.e., coping self-efficacy) and highlighting under-examined mediators for future investigation (i.e., social support, loneliness, emotional processing and expression). Broadly speaking, this study illustrates the importance for intervention researchers to incorporate strategic measurement of theoretically and empirically derived mediators into their trials. Understanding how and why interventions work and how they can be improved will ultimately contribute to more effective and efficient interventions for adults with cancer and further refinement of underlying theory.

Tables

Table 2. Characteristics of participants, mediating variables, and outcome variables at baseline (N = 88)

	Control group participants (N = 42)	Project Connect Online participants (N = 46)
Characteristic	N (%) or M ± SD (Range)	N (%)
Age, years	56 ± 10 (37-76)	55 ± 12 (28-76)
Race		
Non-Hispanic white	33 (83%)	39 (87%)
African American	2 (5%)	1 (2%)
Asian American	4 (10%)	0 (0%)
Latina	0 (0%)	5 (11%)
American Indian	1 (3%)	0 (0%)
College graduate	30 (71%)	29 (63%)
Employed ≥30 hours per week outside home	24 (57%)	21 (46%)
Married/partnered	25 (60%)	34 (74%)
Time since first breast cancer diagnosis		
Less than 2 years	14 (33%)	7 (15%)
2-5 years	9 (21%)	18 (39%)
5-10 years	14 (33%)	16 (35%)
10 or more years	5 (12%)	5 (11%)
Metastatic breast cancer diagnosis	8 (22%)	9 (21%)
Current primary medical treatment	11 (26%)	10 (22%)
Coping self efficacy	2.46 ± .72 (0.97-3.80)	2.55 ± .79 (0.87-4.00)
Emotional expression and processing	3.05 ± 0.59 (1.63-4.00)	2.90 ± 0.69 (1.63-4.00)
Social support from friends	3.04 ± 0.89 (1.17-4.92)	2.74 ± .76 (1.17-4.33)
Loneliness	18.74 ± 5.98 (10.00-33.00)	18.46 ± 6.55 (10.00-34.00)
CES-D	12.36 ± 9.83 (0-36)	10.77 ± 8.72 (0-34)
≥16 on CES-D	14 (33%)	10 (22%)
POMS-Positive affect	17.57 ± 6.41 (5-30)	16.02 ± 8.07 (0-32)
PTGI-Life appreciation	10.93 ± 3.37 (3-15)	11.43 ± 3.12 (3-15)

Note: Table adapted from Stanton, Thompson, & Crespi, in press. CES-D = Center for Epidemiologic Studies Depression Scale; POMS = Profile of Mood States; PTGI = Posttraumatic Growth Inventory.

Table 3. Bivariate correlations between mediators and outcomes variables at Time 1 and Time 3

	T1 Coping self-confidence	T1 Emotional pro/exp	T1 Social support - friends	T1 Loneliness	T1 CES-D	T1 Positive Affect
T1 Coping self-confidence						
T1 Emotional pro/exp	.50**					
T1 Social support - friends	.48**	.26*				
T1 Loneliness	-.57**	-.11	-.46**			
T1 CES-D	-.47**	-.16	-.27*	.69**		
T1 Positive Affect	.47**	.22*	.38**	-.33**	-.49**	
T1 Life Appreciation	.08	.07	.12	.01	-.01	.15
	T3 Coping self-confidence	**T3 Emotional pro/exp**	**T3 Social support - friends**	**T3 Loneliness**	**T3 CES-D**	**T3 Positive Affect**
T3 Coping self-confidence						
T3 Emotional pro/exp	.57**					
T3 Social support - friends	.39**	.23*				
T3 Loneliness	-.53**	-.16	-.30*			
T3 CES-D	-.51**	-.18	-.24*	.59**		
T3 Positive Affect	.53**	.32**	.39**	-.30*	-.52**	
T3 Life Appreciation	.30**	.20	.07	-.01	-.09	.16

Notes: Emotional pro/exp= emotional processing and expression; CES-D = Center for Epidemiologic Studies Depression Scale.
*p < .01. **p < .05.

Table 4. Bootstrapped estimates and confidence intervals for test of indirect effects

Dependent variable (*N*)	Path c (IV to DV) Total effect *B (SE)*	Effect of IV on M (*a*) *B (SE)*	Effect of M on DV (*b*) *B (SE)*	Direct effects (c') *B (SE)*	Indirect effect (*a* x *b*) 95% CI
Depressive symptoms (CES-D)					
Emotional expression and processing (68)	-4.35 (.06) R^2 = .04	0.15 (0.12)	-2.70 (2.24)	-3.93 (2.27)	-1.19 to .40
Coping self confidence (68)	-4.35 (.06) R^2 = .04	0.32* (0.15)	-6.53** (1.73)	-2.27 (2.12)	-4.03 to -0.27
Social support from friends (68)	-4.35 (.06) R^2 = .04	0.39** (0.16)	-3.70** (1.74)	-2.88 (2.30)	-3.53 to -0.07
Loneliness (68)	-4.35 (.06) R^2 = .04	-1.79* (0.87)	0.95** (0.30)	-2.65 (2.18)	-4.45 to -0.04
Positive Mood (POMS)					
Emotional expression and processing (70)	3.47 (.03*) R^2 = .05	0.17 (0.12)	0.42 (1.63)	3.40* (1.64)	-0.56 to 0.56
Coping self confidence (70)	3.47 (.03*) R^2 = .05	0.30* (0.14)	3.18* (1.32)	2.51 (1.60)	0.06 to 2.20
Social support from friends (70)	3.47 (.03*) R^2 = .05	0.43* (0.15)	1.75 (1.26)	2.71 (1.69)	-0.26 to 1.91
Loneliness (70)	3.47 (.03*) R^2 = .05	-1.40 (0.89)	-0.24 (0.23)	3.14 (1.63)	-0.28 to 1.46
Appreciation of Life (PTGI)					
Emotional expression and processing (70)	1.00 (.08) R^2 = .03	0.17 (0.12)	.31 (0.57)	0.95 (0.58)	-0.10 to 0.30
Coping self confidence (70)	1.00 (.08) R^2 = .03	0.30* (0.14)	1.17* (0.46)	0.65 (0.56)	-0.01 to 0.95
Friend positive support (70)	1.00 (.08) R^2 = .03	0.43** (0.15)	.85 (0.44)	0.63 (1.08)	0.04 to 0.94
Loneliness (70)	1.00 (.08) R^2 = .03	-1.40 (0.89)	-0.09 (.08)	0.88 (0.57)	-0.09 to 0.59

Notes: Regression coefficients reported are unstandardized. CES-D = Center for Epidemiological Studies-Depression scale; POMS = Profile of Mood States; PTGI = Posttraumatic Growth Inventory; IV = independent variable; DV = dependent variable; M = mediator; R^2 = adjusted R^2.
*p < .01. **p < .05.

Table 5. Bootstrapped estimates and confidence intervals for multiple mediator model

	Depressive symptoms (CES-D)				
Dependent variable (*N*)	Path c (IV to DV) Total effect *B (SE)*	Effect of IV on M (*a*) *B (SE)*	Effect of M on DV (*b*) *B (SE)*	Direct effects (c') *B (SE)*	Indirect effect (*a* x *b*) 95% CI
Coping self confidence (68)	-4.35 (.06) $R^2 = .04$	0.32* (0.15)	-6.34** (1.59)	0.19 (2.06)	-4.12 to -0.47
Friend positive support (68)	-4.35 (.06) $R^2 = .04$	-1.79* (0.87)	0.73* (0.28)	0.19 (2.06)	-2.97 to -0.15
Loneliness (68)	-4.35 (.06) $R^2 = .04$	0.39* (0.16)	-3.10* (1.54)	0.19 (2.06)	-3.84 to -0.15

Notes: Values within parentheses indicate significance of t-tests. CES-D = Center for Epidemiological Studies-Depression scale; IV = independent variable; DV = dependent variable; M = mediator; R^2 = adjusted R^2.

p < .01. ***p* < .05.

Figures

Figure 1. Project Connect phases

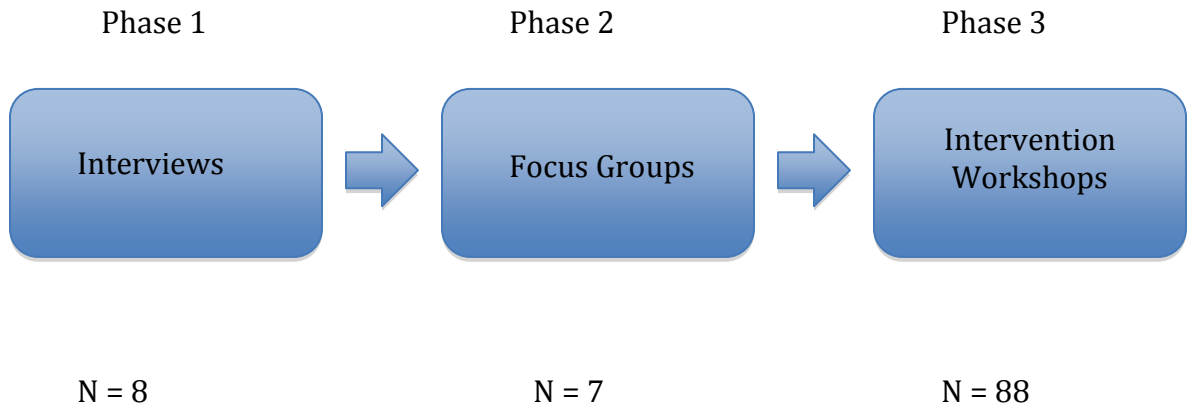| Phase 1	Phase 2	Phase 3
Interviews	Focus Groups	Intervention Workshops
N = 8	N = 7	N = 88

Figure 3. Project Connect Online accrual and retention.
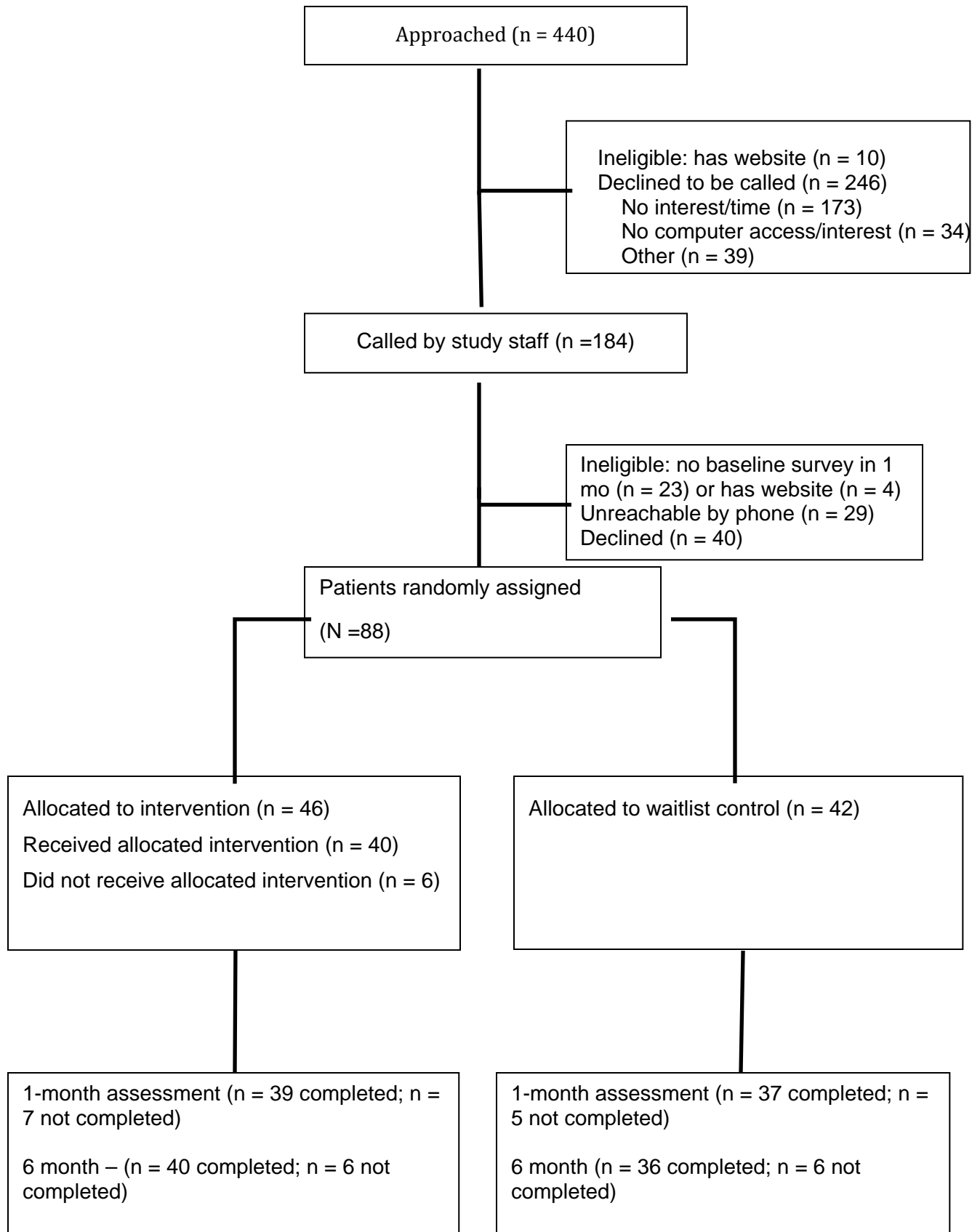Figure adapted from Stanton, Thompson, & Crespi, 2013.

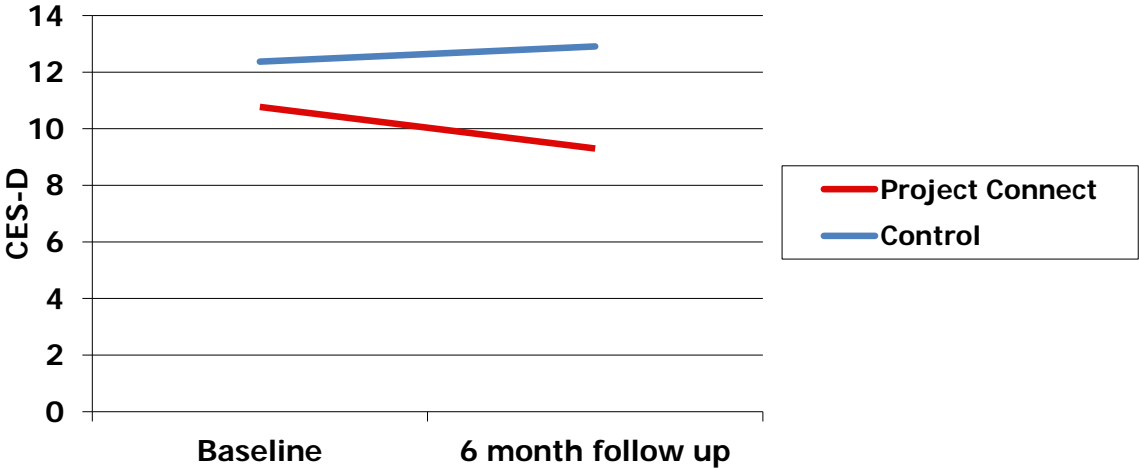**Figure 4**. Main effects of PCO on depressive symptoms

Figure 5. Predicted scores on depressive symptoms (CES-D) and positive mood (POMS), controlling for basline values, as a function of intervention (Project Connect Online vs standard care control) and current medical treatment (yes/no)
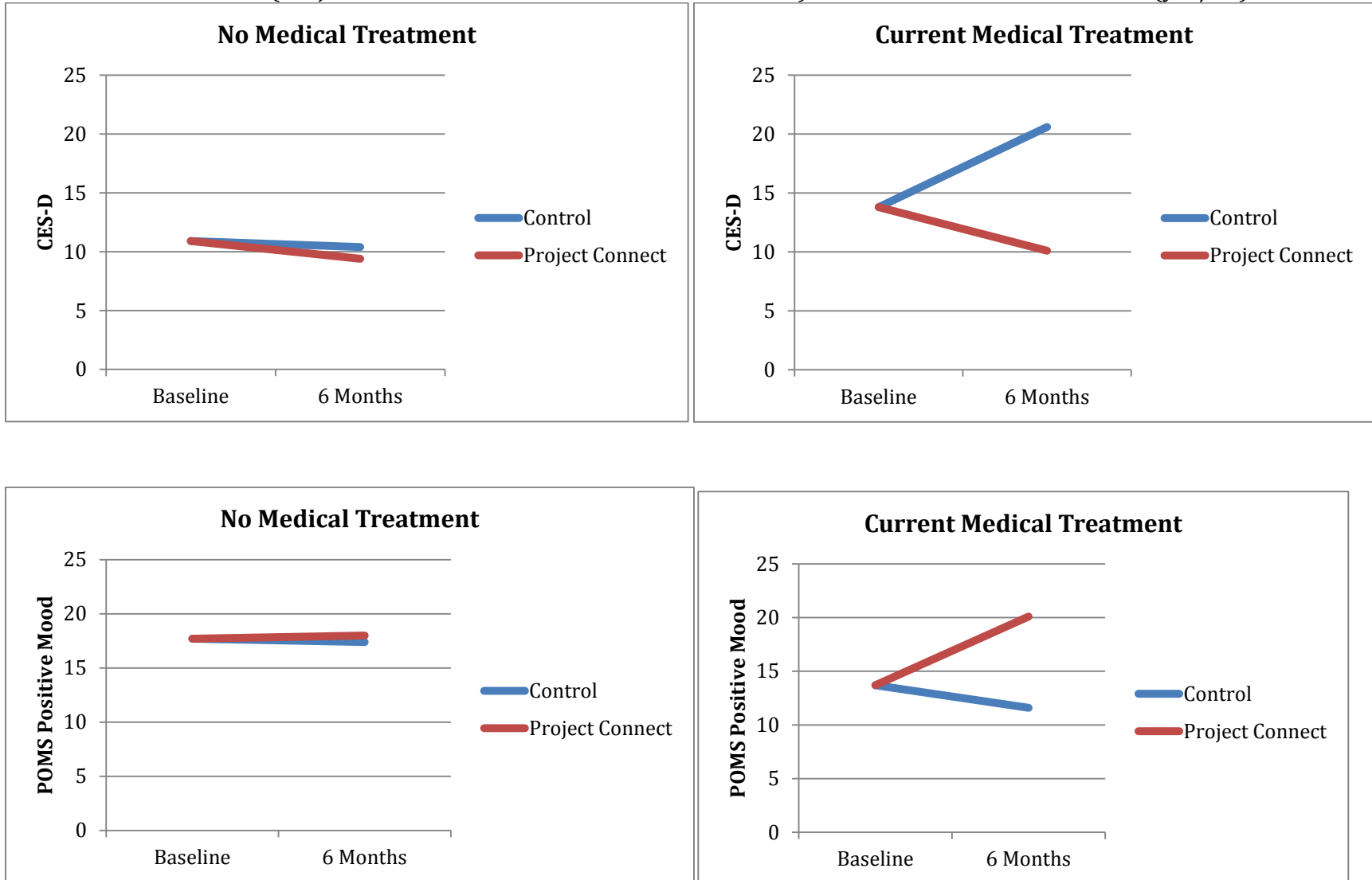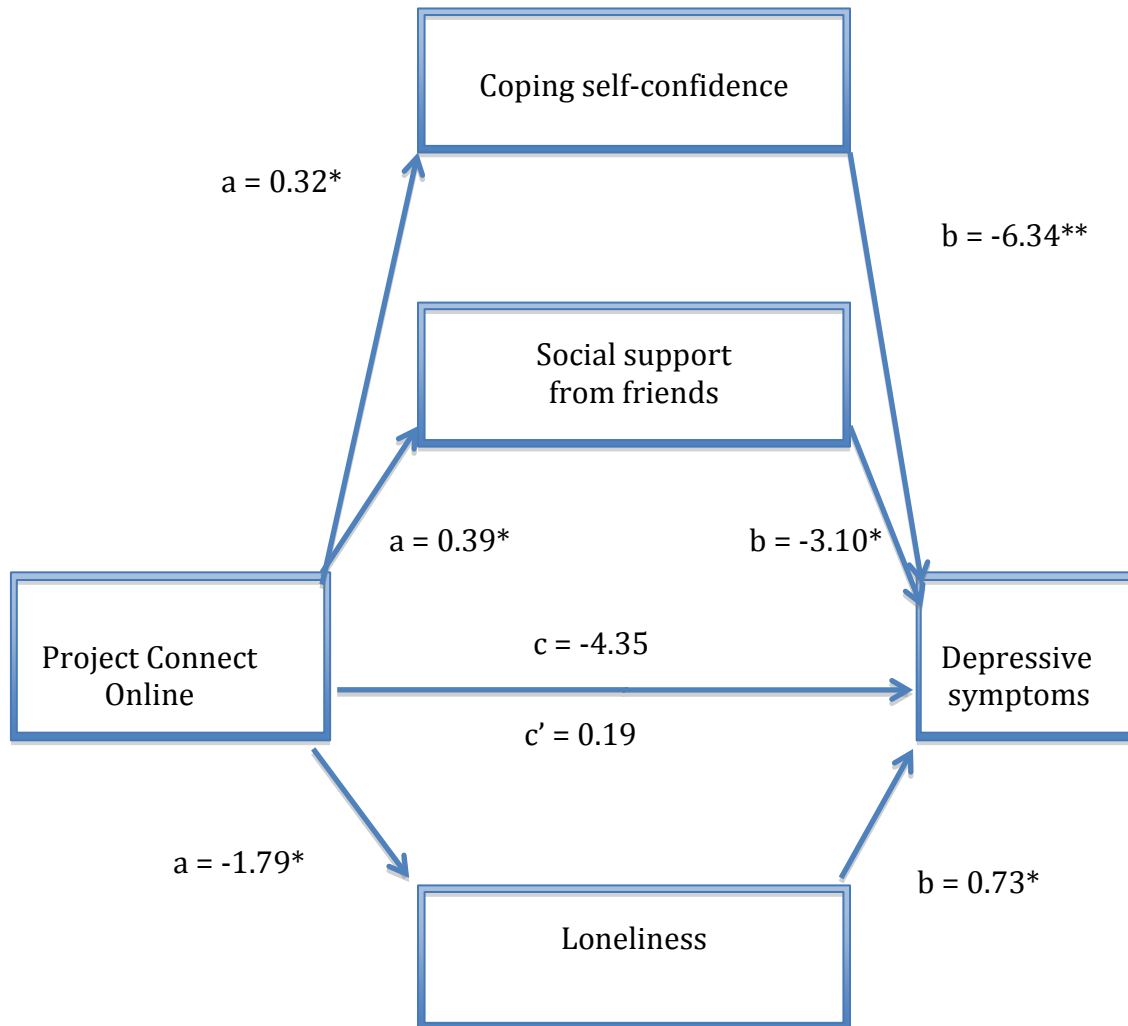
Figure 6. Multiple mediator model for depressive symptoms

Note: Unstandardized coefficients provided. c = the total effect of the intervention on the dependent variable. c' = the effect of the intervention on the dependent variable when controlling for the mediator (direct effect).
*p < .01. **p < .05.

Appendix: Measure

Project Connect Training Sessions - Fidelity to Treatment

Rater Initials   _____   Workshop date _____

1. Leader introduced herself and project rationale   Yes   No

2. Allowed women to introduce themselves   Yes   No

3. Discussed possible purposes for using a personal website   Yes   No

4. Discussed common concerns about using a website
and how these can be proactively addressed   Yes   No

5. Explained the four ways of learning about websites
 (training session, manual, tutorials, technical support)   Yes   No

6. Taught women how to log into their websites   Yes   No

7. Played a tutorial and explained how to find tutorials   Yes   No

8. Showed women how to change their title and tagline   Yes   No

9. Helped women choose a background theme   Yes   No

10. Explained privacy settings and demonstrated how to change   Yes   No

11. Explained "About Me" page and how to alter   Yes   No

12. Taught how to publish a post   Yes   No

13. Taught how to add a photo   Yes   No

14. Taught how to add a website link   Yes   No

15. Taught how to create a "How you can help" page   Yes   No

16. Described what to include in a welcome email or post   Yes   No

17. Provided example introduction letter   Yes   No

18. Discussed trouble shooting – forgotten password, Flashplayer   Yes   No

19. Provided time for women to work on their first post   Yes   No

20. Mentioned scheduling 1 week follow-up calls   Yes   No

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