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13. ABSTRACT (Maximum 200 Words)

This report summarizes accomplishments for a 5-year training program (including 1 year of no-cost extension) in biopsychosocial breast cancer (BC) research. During the 5-year project period, 6 predoctoral and 2 postdoctoral trainees were appointed to the training program and received training in biopsychosocial breast cancer research. Research training was furnished by a multidisciplinary faculty of 6. The training program consisted of 5 components, all of which were implemented successfully over the five year project period. All trainees participated in a biweekly or monthly seminar enabling oversight of trainee activities, didactic presentation of clinical aspects of BC, and discussion of ongoing and anticipated BC-related research projects. Trainees also received supervised guidance in all phases of the research enterprise. Trainees participated in development and/or implementation of a variety of research projects including group-based projects, trainee-specific research projects, and NIH-funded research projects, all related to biopsychosocial aspects of breast cancer. Trainees' professional development was fostered by opportunities to present research findings at professional meetings and opportunities for primary and secondary authorship based upon research projects participated in.

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Introduction

High quality research investigating various psychosocial and behavioral aspects of breast cancer has the potential to reduce breast cancer-related mortality as well as improve quality of life following breast cancer. Critical to the development and implementation of high quality research in this area is the recruitment and training of new researchers. This report summarizes activities and accomplishments during a five year research training program in biopsychosocial aspects of breast cancer. The training program was initiated in 1999 and concluded in 2004. The training program was centered in the Department of Behavioral Science, a basic science department in the University of Kentucky College of Medicine. A multidisciplinary training faculty of six was drawn from three academic units within the College of Medicine (Behavioral Science, Medicine-Hematology/Oncology, and Nursing). Funding was provided to support research training at both the predoctoral and postdoctoral levels each year. Trainees engaged in a variety of supervised research, experiential, and didactic activities under the supervision of training program faculty over the five year project period.

Body

The research training program was initiated July 1, 1999 and concluded June 30, 2004. The final year of the training program constituted a no-cost extension period beyond the original 4-year project period. This report summarizes grant-related activities conducted during the full 5-year project period. Following is a summary of activities associated with both of the overall project tasks outlined in the approved Statement of Work.

Task 1: Implementation of Research Training Program

The training program consisted of five basic components: (1) training in research design, methods, and analysis through supervised participation in breast cancer-related research; (2) formal coursework; (3) individual tutorial in breast cancer-related research; (4) participation in a monthly breast cancer research seminar; and (5) education regarding biological and medical aspects of breast cancer. Each of these components was successfully implemented during each year of the training program.

Predoctoral trainees in the program were required to complete two specific graduate level courses (component #2 from above). These include a course in "Psychosocial Oncology" and a course in "Integrated Research Methods." Dr. Andrykowksi, the PI for the research training program, was the instructor for the "Psychosocial Oncology" course and taught a 2 week portion of the "Integrated Research Methods" cours. This 2 week module focused specifically on the ethics of human research and the ethics of being a scientist. Most predoctoral trainees completed this required coursework prior to or during their appointment to the research training program. On a couple of occasions, predoctoral students completed the required coursework after completion of their research training. The net result was that all predoctoral trainees supported by the training grant successfully completed both of these required courses prior to receipt of their doctoral degrees.

A monthly breast cancer research seminar, lead by the PI of the training program (Dr. Andrykowski), has been conducted as one of the core components of the training program since the inception of the training program in July, 1999 (component #4 from above). This BC research seminar involved both trainees and training program faculty. Other faculty, graduate students, and postdoctoral trainees from the Department of Behavioral Science interested in biopsychosocial breast cancer research were also invited to attend on an ad hoc basis. For example, during project years 4 and 5, two postdoctoral trainees supported by an NIMH research training grant (Dr. Felicity Harper) and the University of Kentucky Cancer Control Program (Dr. Kim Kelly) participated in the monthly research seminar due to their interests in breast cancer research. This monthly breast cancer research seminar was expanded to a biweekly format (i.e., twice per month) during project years three and four. Each meeting of this breast cancer research seminar lasted for 60-75 minutes. This breast cancer research seminar provided: (a) an opportunity for all members of the training program to keep abreast of the research activities of the trainees; (b) a forum for training faculty and trainees to discuss recent and ongoing research in biopsychosocial aspects of breast cancer; (c) an opportunity for faculty and trainees to discuss ideas leading to the development of new breast cancer-related research projects at the University

of Kentucky; (d) an opportunity for didactic instruction regarding medical and clinical aspects of breast cancer; and (e) an opportunity for trainees to practice and receive feedback on oral presentations they were scheduled to make at upcoming national research conferences.

The training plan provided for education regarding biological and medical aspects of breast cancer to be provided through both didactic instruction and experiential activities (component #5 from above). The biweekly research seminar provided an opportunity for trainees (and program faculty) to share and learn basic medical information regarding breast cancer. In addition, all trainees participated in various experiential activities. These included attendance at integrative patient conferences conducted by the University of Kentucky Comprehensive Breast Care Center as well as "shadowing" of clinicians and breast cancer patients as they were involved in the provision and receipt of medical treatment of breast cancer.

During all five years of the training program, both pre- and postdoctoral research trainees were actively involved in specific research projects under the supervision of training program faculty (component #1 from above). Research projects were either "communal" projects in which all trainees participated (or some subset of trainees participated) or were "individual" research projects which were developed and implemented largely by a single trainee.

Examples of communal research projects supported by the training program include (1) an internet-based study of health and psychosocial behavior change following a cancer diagnosis, in this case, a breast cancer diagnosis (project year 4); (2) a longitudinal study of the impact of benign breast biopsy upon performance of breast self-examination (project year 1-2); and (3) a cross-sectional, experimental, laboratory-based study of emotional expressivity in breast cancer survivors and age- and education-matched women without a history of breast cancer (project years 3-4). In addition, all predoctoral and postdoctoral trainees participated in one long-term communal project which was implemented during project year 2 of the training program and continued through project year 5. This ongoing communal project is a prospective and longitudinal study of fatigue, and other physical and psychological symptoms, during and following treatment for breast cancer (R01 CA82822). Trainee involvement in this ongoing communal research project ranged across several phases of the research enterprise including data collection, data entry and preparation, data analysis, and manuscript preparation. Trainees were also involved in preparation and submission of a competing continuation R01 application for this research project, dsubmitted in March, 2003. This competing continuation application was funded with the new 5-year project period beginning June, 2004.

Examples of individual research projects supported by the training program include master's theses completed by predoctoral trainees Wendy Mager in project year 1 ("The Diagnostic Interview and Psychosocial Adjustment in Cancer Survivors) and John Schmidt in project year 4 (The Role of Social and Dispositional Variables Associated With Emotional Processing in Adjustment to Breast Cancer"). Both predoctoral trainees assumed full responsiblity for all aspects of their individual research project, including development and implementation, data analysis and write-up, thus providing them with supervised experience in all aspects of the research endeavor. Parenthetically, both master's theses noted here resulted in peer-reviewed publications with the trainee as primary author. Finally, Kristi Graves, Ph.D., a postdoctoral

trainee appointed to the training program in project year four.developed an individual research project involving a randomized, controlled clinical trial of two different behavioral interventions in enhancing psychological adjustment in breast cancer patients and survivors. The two interventions to be tested include an expressive writing intervention and a 6-session group intervention based upon social-cognitive theory. This project ultimately served as the foundation for Dr. Graves success in receiving a three-year, NIH-funded individual postdoctoral training award to support her continued work in this area.

Task 2: Recruitment and Appointment of Research Trainees

Project years 1-4 included activities related to the recruitment and appointment of both pre- and postdoctoral trainees. Each spring, available predoctoral positions were advertised campus-wide at the University of Kentucky via e-mail and flyers distributed through the Directors of Graduate Studies in various academic departments (e.g., Nursing, Psychology, Sociology, Public Health, Anthropology, etc.). The application process required submission of a brief application form, a cover letter detailing interest in receiving training in biopsychosocial breast cancer research, and a copy of the applicant's current CV. Applications were reviewed by training program faculty and selections made on a consensus basis. Preference was given to current trainees making satisfactory progress in their research training. The number of predoctoral applications received ranged from 5-15 in any year.

Recruitment of a postdoctoral trainee occurred in project year 1 and again in project year 3. Availability of a postdoctoral training position was advertised in several national professional print publications (e.g., American Psychological Association Monitor, American Sociology Society Newsletter). The position announcement was also posted to numerous internet websites and was e-mailed to an extensive list of professional colleagues in the social and behavioral sciences. The position announcement was also posted on our departmental website. The application process consisted of submission of an appropriate cover letter, three academic references, and a current CV. Application materials were reviewed by training program faculty with the top 2-3 candidates identified by consensus and invited to visit the University of Kentucky for an interview. Both postdoctoral application cycles yielded 8-12 applications for the one available position. Abbie Beacham, Ph.D., a health psychologist with clinical training from the University of Louisville, was recruited in project year 1 and was initially appointed to the training program in August, 2000. She completed her training in December, 2002 and accepted a position as an assistant professor in the Department of Psychological and Brain Sciences at the University of Louisville. Kristi Graves, Ph.D., a health psychologist with clinical training from Virginia Polytechnic University was recruited in project year 3 and was initially appointed to the training program in August, 2002. She completed her training in 2003 when she competed successfully for NIH funding for a three-year individual postdoctoral research award. She continued her research training at the University of Kentucky under the supervision of Michael Andrykowski, the PI for the breast cancer research training program, and continued to interact with other trainees in the breast cancer research training program.

Summary of Key Research and Training Accomplishments During Project Period (1999-2004)

- Recruitment and appointment of 6 different predoctoral trainees

- Recruitment and appointment of 2 different postdoctoral trainees

- Successful implementation of all five components of training program

- Securing of formal approval for a one-year "no-cost" extension for a fifth year of the breast cancer research training program (2003-2004).

- Postdoctoral trainee (Beacham) leaves training program to assume faculty position at the University of Louisville.

- Postdoctoral trainee (Graves) leaves training program to accept three year NIH-funded individual postdoctoral research training award.

- Two predoctoral trainees (Studts, Bollmer) complete doctoral degrees during period of appointment.

- Three trainees (Mager, Schmidt, Salsman) complete Master's degrees during period of appointment.

- All trainees supported by the training grant in any project year receive financial support to attend annual meeting of the Society of Behavioral Medicine

- Seven publications in peer-reviewed journals related to breast cancer and involving at least one trainee as primary author or co-author.

- Four manuscripts undergoing peer review related to breast cancer and involving at least one trainee as primary author or co-author.

- Eighteen published abstracts (Annals of Behavioral Medicine, Psychooncology) related to breast cancer and involving at least one trainee as primary author or co-author

- Seven oral (i.e., platform) presentations at international or national conferences with at least one trainee as primary or co-author

Reportable Outcomes

The following summary includes all outcomes associated with the five year training period (1999-2004) that involve at least one trainee supported by the training grant. Names of DOD-supported trainees are in bold.

Manuscripts published in peer-reviewed journals: (7 total)

Schmidt, J.E., & Andrykowski, M.A. (2004). The role of social and dispositional variables associated with emotional processing in adjustment to breast cancer: An internet-based study. Health Psychology, 23, 259-266.

Andrykowski, M.A., Carpenter, J.S., **Studts, J.L.**, Cordova, M.J., Cunningham, L.L.C.., **Beacham, A.**,Sloan, D., Kenady, D., & McGrath, P. (2002). Psychological impact of benign breast biopsy: A longitudinal, comparative study. Health Psychology, 21, 485-494.

Mager, W., & Andrykowski, M.A. (2002). Communication in the cancer "bad news" consultation: Patient perceptions and psychological adjustment. Psycho-Oncology, 11, 35-46.

Andrykowski, M.A., Carpenter, J.S., **Studts, J.L.**, Cordova, M.J., Cuningham, L.L.C., **Mager, W.**, Sloan, D., Kenady, D., McGrath, P. (2001). Adherence to recommendations for clinical follow-up after benign breast biopsy. Breast Cancer Research and Treatment, 69, 165-178.

Cordova, M.J., **Studts, J.L.**, Hann, D.M., Jacobsen, P.B., & Andrykowski, M.A. (2000), Symptom structure of PTSD following breast cancer. Journal of Traumatic Stress, 13, 301-319.

Beacham, A.O., Carpenter, J.S., & Andrykowski, M.A. (in press). Impact of benign breast biopsy upon breast self-examination. Preventive Medicine.

Curran, S.L., **Beacham, A.**, & Andrykowski, M.A. (in press). Ecological momentary assessment of fatigue following breast cancer treatment. Journal of Behavioral Medicine.

Manuscripts submitted for publication in peer-reviewed journals: (4 total)

Ransom, S., Jacobsen, P.B., **Schmidt, J.E.**, & Andrykowski, M.A. (2004). Relationship of problem-focused coping strategies to changes in quality of life following treatment for early stage breast cancer. (Psycho-Oncology).

Harper, F.W.K., **Schmidt, J.E.**, **Beacham, A.O., Salsman, J.M.**, Averill, A.J., **Graves, K.D.**, & Andrykowski, M.A. (2004). Positive change in physical and psychosocial health behaviors after cancer diagnosis and treatment. (Health Psychology)

Graves, K.D., Schmidt, J., Bollmer, J., Fejfar, M., Langer, S., Blonder, L.X., & Andrykowski, M.A. (2004). Emotional expression and emotional recognition in breast cancer survivors: A controlled comparison. (Psychology and Health)

Andrykowski, M.A., **Schmidt, J.S., Salsman, J.E., Beacham, A.O.**, & Jacobsen, P.B. (2004). Use of a case-definition approach to identify cancer-related fatigue in women undergoing adjuvant therapy for breast cancer. (Journal of Clinical Oncology)

Published Abstracts : (18 total)

Harper, F., **Schmidt, J., Beacham, A., Salsman,** J., Averill, A., Boerner, L., **Graves, K.**, & Andrykowski, M. (2004). Positive Psychosocial and Physical Health Behavior Change Following Cancer Diagnosis and Treatment. Annals of Behavioral Medicine, 27 (Suppl.), S180.

Beacham, A., Jacobsen, P., & Andrykowski, M.A. (2004). Change in exercise and fatigue-related disability during adjuvant therapy for breast cancer. Annals of Behavioral Medicine, 27 (Suppl.), S118.

Schmidt, J.E., Jacobsen, P.B., & Andrykowski, M.A. (March). Fatigue course during radiotherapy for breast cancer: What influences fatigue recovery? Annals of Behavioral Medicine, 27 (Suppl.), S118.

Andrykowski, M., **Schmidt, J., Salsman, J., Beacham, A.**, Averill, A., **Graves, K.**, & Harper, F. (2004). Psychosocial and physical health behavior change following cancer diagnosis and treatment [abstract]. Psycho-Oncology, 13 (Suppl.), S21.

Harper, F.W.K., Graves, K.D., *Schmidt, J.*, Beacham, A., *Salsman, J. Averill, A., Boerner, L.*, & **Andrykowski, M.A.** (2004). The role of social support and positive mood in cancer-related distress in breast and lung cancer patients [abstract]. Psycho-Oncology, 13 (Suppl.), S61.

Andrykowski, M., **Beacham, A.**, & Jacobsen, P. (2003). Utility of a case definition approach for studying the incidence, prevalence, and predictors of cancer-related fatigue [abstract]. Psycho-Oncology, 12 (4, Suppl), S91.

Huss, D., Andrykowski, M.A., **Beacham, A.**, & Jacobsen, P. (2003). Effect of NEO personality traints and treatment type on physical and mental health outcomes after breast cancer. [abstract] Annals of Behavioral Medicine, 25 (Suppl.), S59.

Schmidt, J., & Andrykowski, M.A. (2003). The role of social and dispositional variables associated with emotional processing in adjustment to breast cancer: An internet-based study. [abstract] Annals of Behavioral Medicine, 25 (Suppl.), S60.

Beacham, A., Andrykowski, M.A., Malik, U., & Jacobsen, P. (2003). Fatigue-related disability in exercisers versus nonexercisers during breast cancer (BC) treatment. [abstract] Annals of Behavioral Medicine, 25 (Suppl.), S63.

Beacham, A., Andrykowski, M.A., Malik, U., & Jacobsen, P. (2003). Accuracy of perceived exertion ratings during treatment for breast cancer (BC). [abstract] Annals of Behavioral Medicine, 25 (Suppl.), S63.

Andrykowski, M.A., **Beacham, A.**, & Jacobsen, P. (2003). Utility of a case definition approach for studying the incidence, prevalence, and predictors of cancer-related fatigue. . [abstract] Annals of Behavioral Medicine, 25 (Suppl.), S119.

Averill, A., **Beacham, A..O.**, & Andrykowski, M.A. (2002). Psychosocial concerns and clinical program interests of women at a comprehensive breast care center. [abstract] Annals of Behavioral Medicine, 24 (Suppl.), S175.

Beacham, A.O., Andrykowski, M.A., Malik, U., & Jacobsen, P.B. (2002). Longitudinal analysis of exercise patterns in women receiving adjuvant treatment for breast cancer. [abstract] Annals of Behavioral Medicine, 24 (Suppl.), S176.

Schmidt, J., Beacham, A., Bollmer, J., Malik, U., Andrykowski, M.A., & Jacobsen, P. (2002). Evaluation of the Diagnostic Interview for Cancer-Related Fatigue (DICRF) in women with breast cancer. [abstract] Annals of Behavioral Medicine, 24 (Suppl.), S172.

Beacham, A.O., Andrykowski, M.A., Malik, U., & Jacobsen, P.B. (2002). Exercise attenuates fatigue severity ratings in women receiving chemotherapy for breast cancer. [abstract] Annals of Behavioral Medicine, 24 (Suppl.), S219.

Bollmer, J.M., Beacham, A.O., Schmidt, J.E., Malik, U., Andrykowski, M.A., & Jacobsen, P. (2002). Longitudinal study of fatigue after adjuvant treatment for breast cancer. [abstract] Annals of Behavioral Medicine, 24 (Suppl.), S005.

Bollmer, J.M., Schmidt, J.E., Blonder, L.X., & Andrykowski, M.A. (2001). Emotional expression in women with breast cancer: A comparative study. [abstract] Annals of Behavioral Medicine, 23 (Suppl.), S078.

Schmidt, J., Bollmer, J., Blonder, L., & Andrykowski, M.A. (2001). Development of a behavioral approach to assessing emotional expression. [abstract] Annals of Behavioral Medicine, 23 (Suppl.), S173.

Degrees obtained based on training supported by award:

Julie Bollmer, Ph.D., a predoctoral trainee during project years 2-3 completed the requirements for her Ph.D. degree in Social Psychology from the University of Kentucky in June, 2003.

Jamie Studts, Ph.D., a predoctoral trainee during project year 1, completed the requirements for his Ph.D. degree in Clinical Psychology from the University of Kentucky in April, 2001

John Salsman, M.S., a predoctoral trainee during project years 3-4 completed the requirements for his M.S. degree in Clinical Psychology from the University of Kentucky in September, 2002.

John Schmidt, M.S., a predoctoral trainee during project years 2-4 completed the requirements for his M.S. degree in Clinical Psychology from the University of Kentucky in April, 2002.

Wendy Mager, M.S., a predoctoral trainee during project years 1 completed the requirements for her M.S. degree in Clinical Psychology from the University of Kentucky in December, 1999.

Employment opportunities received based on training supported by award:

Abbie Beacham, Ph.D., a postdoctoral trainee during project years 2-4 was appointed as an assistant professor in the Department of Psychological and Brain Sciences at the University of Louisville. Her appointment began in December, 2002.

Julie Bollmer, Ph.D., a predoctoral trainee during project years 2-3 was appointed to a research scientist position with Westat Corporation, a policy research institute located in Rockville, MD. Her appointment began in July, 2003.

Jamie Studts, Ph.D., a predoctoral trainee during project year 1 was appointed as an assistant professor in the Division of Hematology/Oncology and the James Graham Brown Cancer Center at the University of Louisville. His appointment began in July, 2001.

Wendy Mager, Ph.D., a predoctoral trainee during project year 1 was appointed as a postdoctoral fellow in the Department of Psychology at the University of Toledo. Her appointment began July, 2004.

Conclusions

Between 1999-2004, a training program in biopsychosocial breast cancer research was implemented. Training was furnished by a multidisciplinary faculty of six. Each of the five components of the research training program was effectively implemented during the five year project period. A total of 6 predoctoral and 2 postdoctoral trainees were supported by the grant during the five year project period. All predoctoral and postdoctoral trainees received supervised, "hands on" experience in all aspects of conducting biopsychosocial breast cancer-related research. In addition, all predoctoral and postdoctoral trainees had the opportunity to participate in a variety of specific research projects, thus increasing the breadth of their experience. Finally, all predoctoral and postdoctoral trainees had the opportunity for extensive interaction with both patients and health providers in the breast cancer care setting. Reportable outcomes generated by the training program during the five year project period include a total of 7 manuscripts published or in press in peer-reviewed journals, 4 manuscripts submitted for publication in peer-reviewed journals, and 18 published abstracts. All manuscripts and abstracts listed as reportable outcomes focused upon breast cancer and included at least one predoctoral or postdoctoral trainee as a primary author or co-author.

List of Personnel Receiving Financial Support (i.e., pay) From Training Program Grant

A list of individuals who were supported by the Research Training Program during 1999-2004 is shown below. The list is organized by training program faculty who received some small salary support from the program and by trainees who received stipends from the program.

Training Program Faculty

Michael Andrykowski, Ph.D. (PI)
John Wilson, Ph.D. (Co-I)
Pathik Wadwha, M.D., Ph.D. (Co-I)
Dorothy Brockopp, R.N., Ph.D. (Co-I)
Tom Kelly, Ph.D. (Co-I)
Lee Blonder, Ph.D. (Co-I)

Research Trainees

Wendy Mager (predoctoral)
Jamie Studts (predoctoral)
John Schmidt (predoctoral)
Julie Bollmer (predoctoral)
John Salsman (predoctoral)
Emily Brechting (predoctoral)
Abbie Beacham (postdoctoral)
Kristi Graves (postdoctoral)

Health Psychology
2002, Vol. 21, No. 5, 485–494

0278-6133/02/$5.00 DOI: 10.1037//0278-6133.21.5.485

Psychological Impact of Benign Breast Biopsy: A Longitudinal, Comparative Study

Michael A. Andrykowski, Janet S. Carpenter, Jamie L. Studts, Matthew J. Cordova, Lauren L. C. Cunningham, Abbie Beacham, David Sloan, Daniel Kenady, and Patrick McGrath
University of Kentucky

The impact of benign breast biopsy (BBB) on distress and perceptions of risk for breast cancer (BC) was examined. Interviews were conducted with 100 women shortly after notification of biopsy results and 4 and 8 months post-BBB. Compared with matched healthy comparison (HC) women without BBB, the BBB group evidenced greater BC-specific distress at baseline. BC-specific distress declined after BBB, remaining elevated relative to the HC group at the 8-month follow-up. Dispositional (optimism, informational coping style), demographic (education), clinical (family history of BC), and cognitive (BC risk perception) variables were associated with baseline levels of BC-specific distress or persistence of distress. Results support the monitoring process model (S. M. Miller, 1995) and the cognitive social health information processing model (S. M. Miller, Y. Shoda, & K. Hurley, 1996).

Key words: biopsy, psychosocial, behavioral, breast cancer, detection, diagnosis

The value of early detection and diagnosis has been demonstrated for a variety of cancers, including those of the breast, colon, prostate, and cervix. However, although the benefits of early detection and diagnosis are well recognized, it is less well recognized that participation in cancer screening and diagnostic activities can have a negative psychological impact, even when a malignancy is not found (Lerman, Rimer, & Engstrom, 1991; Wardle & Pope, 1992). Concern has been raised about the negative impact of an abnormal or equivocal screening test result (Lerman, Trock, Rimer, Jepson, et al., 1991), when test results raise the possibility that a malignancy might be present or do not immediately reassure that a malignancy is not present. All cancer screening tests yield a certain proportion of such results. Fortunately, the majority of abnormal or equivocal test results are not due to the presence of a malignancy. This does not imply, however, that the impact of such test results is completely benign. Rather, the individual is likely to experience uncertainty regarding his or her health status. This uncertainty may be associated with significant anxiety. Abnormal or equivocal screening test results likely challenge the routine belief that one is healthy and force the individual to confront the possibility of having a potentially life-threatening, malignant disease. Some have suggested that anxiety may remain for months or even years after abnormal or equivocal test results (Lerman, Trock, Rimer, Boyce, et al., 1991).

Abnormal or equivocal test results are a common occurrence in breast cancer (BC) screening. Up to 20% of mammograms performed in large-scale screening programs yield abnormal or inconclusive results (Lerman, Trock, Rimer, Jepson, et al., 1991). Follow-up is typically warranted and might simply involve a repeat mammogram. However, some abnormal results require a diagnostic, surgical procedure, such as excisional breast biopsy or fine needle aspiration (FNA), to rule out malignancy. Positive biopsy rates from series of surgical biopsies range from 10%–40% (Alexander, Candela, Dershaw, & Kinne, 1990; McCreery, Frankl, & Frost, 1991). Thus, most breast biopsy results are benign; that is, no malignancy is found.

Although a woman is undoubtedly relieved when no breast malignancy is found, the biopsy experience may not be completely benign. Rather, benign breast biopsy (BBB) may have distinct negative psychological consequences. These include distress and exaggerated perceptions of personal risk for BC. For some women, the psychological impact can be profound. For example, 5 of 30 women who underwent BBB in a study of the impact of a false positive mammogram described this experience as the worst event of their lives (Gram, Lund, & Slenker, 1990).

Although the psychological consequences of BBB are potentially significant, research examining the impact of BBB is sparse. Few studies have focused on BBB per se. Rather, most studies have examined the impact of participation in a BC screening program in general (e.g., Bull & Campbell, 1991; Cockburn,

Michael A. Andrykowski, Janet S. Carpenter, Jamie L. Studts, Matthew J. Cordova, Lauren L. C. Cunningham, and Abbie Beacham, Department of Behavioral Science, College of Medicine, University of Kentucky; David Sloan, Daniel Kenady, and Patrick McGrath, Department of Surgery, College of Medicine, University of Kentucky.

Janet S. Carpenter is now at the School of Nursing, Vanderbilt University. Jamie L. Studts is now at James Graham Brown Cancer Center, University of Louisville. Matthew J. Cordova is now at Department of Behavioral Medicine, Veterans Affairs Palo Alto Health Care System, Palo Alto, California. Lauren L. C. Cunningham is now at Counseling Associates of Madison, SC, Madison, Wisconsin.

We thank the staff and patients at the Comprehensive Breast Care Center at the University of Kentucky Albert B. Chandler Medical Center for their cooperation and assistance with this research. This research was supported by a predoctoral research training grant from the Department of Defense Breast Cancer Research Program and a postdoctoral research training grant from the National Institute of Mental Health.

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Staples, Hurley, & De Luise, 1994) or have examined the impact of an abnormal mammography result in particular (Austoker & Ong, 1994; Brett, Austoker, & Ong, 1998; Gram et al., 1990; Lerman, Trock, Rimer, Boyce, et al., 1991; Lerman, Trock, Rimer, Jepson, et al., 1991; Lowe, Balanda, Del Mar, & Hawes, 1999; Ong & Austoker, 1997; Ong, Austoker, & Brett, 1997; Smith, Botha, & Goosey, 1991).

Not surprisingly, studies of the impact of an abnormal mammography result suggest the presence of elevated distress following notification of the need for additional follow-up (e.g., Ong & Austoker, 1997; Smith et al., 1991). However, whether distress remains elevated after additional follow-up rules out malignancy is unknown. Elevated levels of distress have been found at follow-up assessments 1 month (Lowe et al., 1999), 3 months (Lerman, Trock, Rimer, Boyce, et al, 1991; Lerman, Trock, Rimer, Jepson et al., 1991), 5 months (Brett et al., 1998), 11 months (Ong et al., 1997), and 18 months (Gram et al., 1990) following an abnormal mammogram result. In contrast, other investigators have found an abnormal mammogram result yields only a transitory increase in distress that dissipates within a few weeks or months (Bull & Campbell, 1991; Cockburn et al., 1994).

Diagnostic surgical procedures such as breast biopsy or FNA are typically used in cases of abnormal results for which the index of suspicion is highest. Thus, it might be assumed that BBB is potentially more stressful than the experience of an abnormal screening result that is not followed by breast biopsy. Not surprisingly, studies have documented the presence of considerable anxiety and distress while awaiting the biopsy procedure (e.g., Lowe et al., 1999; Northouse, Jeffs, Cracchiolo-Caraway, Lampman, & Dorris, 1995) and while awaiting notification of biopsy results (Chen et al., 1996). However, few studies have examined psychological outcomes after notification that biopsy results are benign. Deane and Degner (1998) assessed 70 women soon after they learned their biopsy result. Compared with normative data, women experienced heightened anxiety and uncertainty even after being informed of their benign result. Lindfors, O'Connor, Acordelo, and Liston (1998) compared the psychological status of 80 women having short-interval follow-up mammography after detection of a benign breast lesion with 58 women who underwent BBB. Four to 6 months later, women in the BBB group reported greater stress than the follow-up mammography group. Brett et al. (1998) assessed women in a screening mammography program 1 month and 5 months after mammography. At the 5-month follow-up, 10% of women who received a normal mammogram result evidenced "adverse psychological consequences" (p. 396). Among 64 women receiving an abnormal mammogram result followed by a benign biopsy or FNA, the proportions of women evidencing adverse psychological consequences were 61% and 44%, respectively. These proportions were lower than those evident at the 1-month follow-up, suggesting that deleterious effects of BBB might dissipate over time. Finally, Stanton and Snider (1993) assessed mood pre- and post-breast biopsy in 117 women, 81 of whom received a benign diagnosis. Demographic variables (primarily less education) were the only significant predictors of post-BBB negative affect.

In sum, little is known regarding the psychological impact of BBB per se. The few studies that have focused on BBB suggest elevated distress may be a consequence of BBB. However, these studies are generally limited both methodologically and conceptually. Methodological limitations include small samples, assessment of distress at only a single post-BBB follow-up, failure to assess longer term (e.g., > 6 months) BBB outcomes, failure to control family history of BC in the analyses, and reliance on global distress measures. Conceptually, research has been limited by a focus on the simple documentation of distress after BBB with little attempt to identify variables accounting for variance in psychological response. Research has also been atheoretical, with no attempt to use theory to guide selection of predictor or outcome variables.

A theoretical model relevant to BBB is the monitoring process model (MPM; Miller, 1989, 1995; Miller, Rodoletz, Schroeder, Mangan, & Sedlacek, 1996). According to the MPM, individuals differ with regard to informational coping style, that is, the extent to which and manner in which they seek health-relevant information and respond to threatening events. Individuals characterized by a monitoring coping style (*monitors*) tend to actively scan the environment for health-relevant information. Those characterized by a blunting style (*blunters*) tend to avoid or minimize health-relevant information. Under conditions of low threat, monitors and blunters do not differ much with regard to cognition, affect, or behavior. However, when confronted with a threatening health event, such as breast biopsy, differences emerge. Monitors are likely to respond with distress because of their tendency to actively seek information and to amplify threat both cognitively and emotionally. Blunters are less likely to evidence distress because they tend to avoid and blunt threatening health information.

The tendency to respond to life events with optimism or pessimism may also affect response to BBB. Dispositional optimism is a set of generalized expectancies for positive or negative future outcomes and predicts coping behavior and physical and psychological response to threatening events (Scheier & Bridges, 1995; Scheier & Carver, 1985). It might be expected that women low in dispositional optimism might respond to BBB with increased distress and perceptions of BC risk.

The purpose of the present study is to identify the psychological impact of BBB. In contrast to most previous research, the present study uses a longitudinal design and a comprehensive set of outcome measures. In addition to documenting the occurrence of distress in response to BBB, the present study seeks to identify demographic, clinical, and psychological variables associated with individual differences in psychological outcomes, both initially and across time. We predicted that (a) BBB will result in elevated levels of distress and perceptions of personal BC risk relative to healthy women without a history of BBB, (b) women with a monitoring coping style will evidence greater and more persistent distress in response to BBB, and (c) women characterized by low dispositional optimism will evidence greater and more persistent distress in response to BBB.

Method

Sample

Potential participants in the BBB group were identified from the roster of patients at the University of Kentucky Comprehensive Breast Care Center. Eligibility criteria for the BBB group included (a) over 18 years of age; (b) scheduled to undergo a breast biopsy or FNA for diagnostic purposes; (c) no prior history of BC, breast biopsy, or FNA; (d) able to read

and understand English; (e) telephone in the home; and (f) written informed consent.

Using these criteria, 143 eligible women in a consecutive series were identified between December 1996 and November 1997. Of these, 129 (90%) provided written consent for study participation. Of the 14 women who declined participation, most cited being "too busy" or "too stressed." Fifteen women who provided consent were later deemed ineligible for study. These included 7 women diagnosed with BC, 3 women who did not complete the initial interview, and 5 women did not complete the initial interview within 50 days of BBB. Seventy-six women from the community were recruited to form a healthy comparison (HC) group. Eligibility criteria for the HC group were (a) over 18 years of age; (b) no history of BC, biopsy, or FNA; (c) able to read and understand English; (d) telephone in the home; and (e) written informed consent for participation.

Procedure

Potential participants in the BBB group were identified from the daily clinic roster of the University of Kentucky Comprehensive Breast Care Center. Prior to undergoing a biopsy or FNA, eligible women were introduced to the study by the physician managing their care. Women were then given a detailed explanation of the study by a research staff member. Written informed consent for study participation was then obtained. Following notification of biopsy or FNA results, women with benign findings were telephoned by a research staff member and an initial interview was scheduled. The initial interview was conducted via telephone and was completed a mean of 21.4 days (SD = 9.9, range = 2–47 days) following biopsy or FNA. Additional telephone follow-up interviews were conducted 4 and 8 months after a woman's biopsy or FNA procedure.

Participants in the HC group were recruited through a variety of community print media advertisements. Advertisements solicited women who were interested in participating in a study of women's health. Interested women telephoned the project office and were screened for study eligibility. Eligible women were then scheduled for an initial interview conducted by telephone. All women in the HC group were paid $15 for completion of the study interview.

Assessment Protocol

During the initial interview, both the BBB and HC groups completed measures to assess (a) demographic and BC risk variables, (b) dispositional variables, (c) social support, (d) psychological distress, (e) BC worry, and (f) perceived BC risk. At the 4- and 8-month follow-up interviews, the BBB group completed the psychological distress section (d) of the assessment protocol. The BBB group also completed the BC worry (e) and perceived BC risk (f) sections at the 8-month follow-up. In addition, 2 of every 3 women in the BBB group were randomly assigned to complete these last two sections at the 4-month follow-up.

Demographic and BC risk variables. Information obtained included age, race, marital status, education, and annual household income. Information for estimating both relative (Gail et al., 1989) and lifetime (Benichou, 1993) risk for BC was obtained including age at menarche, parity, history of BBB, and number of first-degree relatives (FDRs) with BBB.

Dispositional variables. These included the Miller Behavioral Styles Scale—Short Form (MBSS–SF; Steptoe, 1989), a measure of informational coping style yielding Monitor and Blunter subscales, and the Life Orientation Test (LOT; Scheier & Carver, 1985), a measure of dispositional optimism. Coefficient alpha was .63 for the MBSS–SF Monitor subscale and .83 for the LOT.

Social support. Women completed the eight-item Duke–UNC Functional Social Support Questionnaire (DUKE-SSQ; Broadhead, Gehlbach, De Gruy, & Kaplan, 1988), a measure of current affective social support. Coefficient alpha was .83.

Psychological distress. Measures of general distress included the 20-item Center for Epidemiologic Studies Depression Scale (CES–D; Radloff, 1977), a measure of current depressive symptoms, and the 37-item short form of the Profile of Mood States (POMS–SF; Shacham, 1983), a measure of current mood disturbance yielding a total mood disturbance score. Women also completed the 15-item Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979), a measure of current avoidant and intrusive cognition regarding a specified stressor—in this case "the possibility that you will develop BC in your lifetime." Used in this manner, the IES can be seen as a measure of psychological distress or preoccupation specific to BC. The IES yields Intrusion and Avoidance subscale (IES–Intrusion and IES–Avoidance) scores. Coefficient alphas were .92 for the CES–D, .85 for the POMS–SF, and .87 and .90, respectively, for IES–Avoidance and IES–Intrusion scores.

BC worry. Worry regarding BC was assessed using items adopted from previous research (Cunningham et al., 1998; Lerman, Trock, Rimer, Jepson, et al., 1991). Women indicated how often they "worried about getting BC someday" (BC–Worry). Responses were made on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*almost all of the time*). Women also indicated how much "worrying about BC affected your mood" and how much "worrying about BC affected your daily activities." For both questions, responses were made on a 4-point Likert scale ranging from 0 (*not at all*) to 3 (*a lot*). Responses to these latter two BC–Worry items were highly correlated (r = .64), and they were summed to form a two-item composite index of BC worry impact (BC–Worry Impact; cf. Lerman, Trock, Rimer, Jepson et al., 1991).

Perceived BC risk. Two subjective estimates of lifetime risk for BC were obtained. Women estimated their personal lifetime risk for BC by providing a percentage between 0 and 100 in response to the question, "What are the chances that you will develop BC some day?" (Personal BC Risk; Lerman et al., 1995). Women also estimated typical lifetime risk for BC by providing a percentage between 0 and 100 in response to the question, "What are the chances that the average woman your age will develop BC some day?" (Typical BC Risk; Andrykowski et al., 2001). The Personal BC Risk and Typical BC Risk items were combined to form a Comparative BC Risk index. This was accomplished by subtracting Personal BC Risk from Typical BC Risk for each woman.

Data Preparation and Analysis

An alpha level of .05 was used as the criterion for statistical significance. Interaction effects in regression analyses were investigated using methods suggested by Jaccard, Turrisi, and Wan (1990). To reduce multicollinearity, all variables were standardized prior to use in the regression analysis. The form and nature of any significant interaction effects was then determined using methods suggested by Jaccard et al. (1990).

Results

BBB and HC groups

Although 114 women completed the initial interview within 50 days of BBB, only 100 women completed all three scheduled study interviews. These 100 women constituted the BBB group in subsequent analyses. Most of the BBB group (62%) underwent breast biopsy, and the remainder underwent an FNA (31%) or both biopsy and FNA procedures (7%). Comparison of these 100 women with the 14 women who failed to complete one or both follow-up interviews revealed no differences with regard to age; education; relative and lifetime BC risk; number of FDRs with BC; or IES, POMS, or CES–D scores at the initial interview (all $ps >$ .10). However, women who did not complete both follow-up interviews were more likely to be non-Caucasian, $\chi^2(1, N = 114) = 20.53$, $p < .01$, and to report greater perceived personal risk for BC at the initial interview, $t(110) = 3.33$, $p < .01$.

Demographic and clinical characteristics for the BBB and HC groups are shown in Table 1. Chi-square and *t*-test analyses indicated that the BC and HC groups did not differ with regard to age, race, number of FDRs with BC, annual household income, employment, or marital status (all *ps* > .05). However, the HC group was significantly more educated than the BBB group, $t(175) = 3.46$, $p < .01$, and the BBB group had a higher objective lifetime risk for BC than the HC group, $t(175) = 4.41$, $p < .01$. This is not surprising, because BBB increases estimates of lifetime BC risk.

Reactions to Biopsy: Immediate Impact

To examine the immediate impact of BBB, responses of the BBB and HC groups at the initial interview were compared using two-group analyses of covariance. Covariates included education and lifetime risk of BC. Dependent variables included total scores on the POMS, CES-D, LOT, and DUKE-SSQ; IES–Intrusion and IES–Avoidance scores; Monitor and Blunter subscale scores from the MBSS–SF; BC–Worry and BC–Worry Impact scores; and the personal, typical, and comparative BC risk variables. Results are shown in Table 2. The two groups differed only insofar as the BBB group evidenced higher scores on the Intrusion and Avoidance subscales of the IES (all *ps* < .05).

To test our hypotheses regarding the relationship between dispositional characteristics, specifically optimism and informational coping style, and psychological distress after BBB, two hierarchical regression analyses were performed. IES–Intrusion and IES–Avoidance scores were the dependent variables because these were the only distress indices that were sensitive to the BBB experience (see Table 2). To ensure a conservative test of our hypotheses, clinical (number of FDRs with BC, lifetime risk for BC [Benichou, 1993]), demographic (age, education, race), and social support

Table 1
Demographic and Clinical Characteristics for BBB (n = 100) and HC (n = 76) Groups

Variable	BBB group	HC group
Age (in years)		
M	44.2	45.3
SD	14.0	14.2
Range	19.0–84.0	21.0–82.0
Education (in years)		
M	13.8	15.3
SD	3.0	2.5
Range	6–20	10.0–20.0***
Relative risk for BC (%)[a]		
M	3.0	2.7
SD	1.4	0.9
Range	1.4–10.1	1.3–5.8
Lifetime BC risk (%)[b]		
M	10.4	7.7
SD	5.0	3.3
Range	2.7–34.2	1.0–17.1***
Married or partnered (%)	72	67
Caucasian (%)	90	97
Family history of BC (%)		
With 1 FDR with BC	15	12
With ≥2 FDRs with BC	3	0
Annual household income (%)		
<$20,000	34	28
$20,000–$40,000	20	22
$40,000–$60,000	16	21
>$60,000	26	28
Medical Insurance (%)		
No insurance	12	11
Medicare/Medicaid	20	10
Private	68	79

Note. BBB = benign breast biopsy; HC = healthy comparison; BC = breast cancer; FDR = first-degree relative.
[a] From Gail et al. (1989). [b] From Benichou (1993).
** $p < .05$. *** $p < .01$.

Table 2
Covariate Adjusted Means and Standard Deviations for BBB (n = 100) and HC Groups (n = 76)

Variable	BBB group	HC group	$F(1, 173)$[a]
POMS–Total			0.14
M	42.1	42.5	
SD	24.4	25.0	
CES–D–Total			0.06
M	10.6	10.2	
SD	10.5	8.7	
IES–Intrusion			7.16***
M	7.0	4.0	
SD	8.2	5.6	
IES–Avoidance			6.09**
M	9.2	5.8	
SD	9.6	8.0	
BC–Worry			0.88
M	1.2	1.4	
SD	1.1	0.9	
BC–Worry Impact			0.36
M	2.0	2.2	
SD	2.3	1.6	
DUKE-SSQ–Total			1.79
M	33.8	32.5	
SD	5.8	4.8	
MBSS–Monitor			0.12
M	5.0	4.9	
SD	1.6	1.8	
MBSS–Blunter			0.71
M	2.8	3.0	
SD	1.3	1.3	
LOT–Total			0.00
M	30.4	30.5	
SD	4.9	5.3	
Personal BC Risk			1.28
M	26.9	30.8	
SD	22.4	20.4	
Typical BC Risk			1.80
M	33.3	37.7	
SD	19.4	21.2	
Comparative BC Risk[b]			0.00
M	6.4	6.4	
SD	20.1	19.4	

Note. BBB = benign breast biopsy; HC = healthy comparison; BC = breast cancer; POMS = Profile of Mood States; CES–D = Center for Epidemiologic Studies Depression Scale; IES = Impact of Events Scale; DUKE-SSQ = Duke–UNC Functional Social Support Questionnaire; MBSS = Miller Behavioral Styles Scale; LOT = Life Orientation Test.
[a] Associated with analysis of covariance, with education and lifetime risk for BC (Benichou, 1993) as covariates. [b] Calculated as Typical BC Risk minus Personal BC Risk.
** $p < .05$. *** $p < .01$.

(Duke-SSQ–Total) variables were used as covariates. (Interaction terms with these six covariates and the group, MBSS–SF–monitor, and LOT–total variables were constructed and examined for their relationship to IES indices. Because no significant relationships were found, none of these interaction terms were included in the analyses.) Three main effect variables were included in the regression analyses: LOT–total and MBSS–monitor scores and a group variable indicating membership in the BBB or HC group. Three two-way interaction terms (Group × LOT, Group × Monitor, LOT × Monitor) and a three-way interaction term (Group × LOT × Monitor) representing the combinations of the three main effect variables were also computed and used in the analyses.

Results for the full 13-variable regression models are shown in Table 3. The 13 variables accounted for a significant portion of the variance in scores for IES–Intrusion (36.2%), $F(13, 162) = 7.06$, $p < .001$, and IES–Avoidance (37.2%), $F(13, 162) = 7.39$, $p < .001$. Education was a significant predictor of both IES indices, with less education associated with greater IES scores ($ps < .01$). The number of FDRs with BC was a significant predictor of IES–Avoidance scores, with greater number of FDRs with BC associated with greater IES–Avoidance scores ($p < .05$). Most importantly, the Group × LOT × Monitor interaction was a significant predictor of both IES–Avoidance and IES–Intrusion scores (both $ps < .05$). Inspection of the variance independently attributable to each variable in the regression model (i.e., square of semipartial [sr^2] coefficient) indicated that this interaction independently accounted for 1.9% of the variance in IES–Avoidance scores and 1.8% of the variance in IES–Intrusion scores. This amount was consistently exceeded only by education, which accounted for about 8%–10% of the variance in the two IES indices, and by the LOT × Monitor interaction, which accounted for about 2%–3% of the variance in the two IES indices. Inspection of the form of the Group × Lot × Monitor interaction for IES–Intrusion and IES–Avoidance scores revealed a similar pattern. In general, a LOT × Monitor interaction was evident only in the BBB group. In the BBB group, informational coping style was most strongly associated with higher IES scores when optimism was low. When optimism was low, the highest IES scores were reported by those with a high monitoring informational coping style. When optimism was high, much smaller differences between high and low monitors were evident. Figure 1 illustrates the Group × LOT × Monitor interaction for IES–Avoidance scores. The form of the Group × LOT × Monitor interaction for IES–Intrusion scores was essentially the same as that for IES–Avoidance scores (Figure 1).

Table 3
Multiple Regression Analysis of IES Scores for the BBB (n = 100) and HC (n = 76) Groups

Variable	IES–Intrusion		IES–Avoidance	
	β	sr^2	β	sr^2
Education	−.37***	.097	−.34***	.085
Age at interview	.01	.000	−.10	.004
No. FDRs with BC	.12	.005	.27**	.026
Lifetime BC risk[a]	.12	.004	−.07	.001
Social support	.05	.002	−.02	.000
Race[b]	.15**	.020	.08	.005
Group[c]	−.14*	.014	−.19**	.023
LOT–Total	.36*	.011	−.07	.000
MBSS–Monitor	.24	.005	.10	.001
Group × LOT	−.40*	.014	−.02	.000
Group × Monitor	−.16	.002	.01	.000
Lot × Monitor	−.55**	.027	−.55**	.026
Group × LOT × Monitor	.45**	.018	.46**	.019
Full model statistics				
Multiple R	.601		.610	
Multiple R^2	.362		.372	
$F(13, 162)$	7.06***		7.39***	

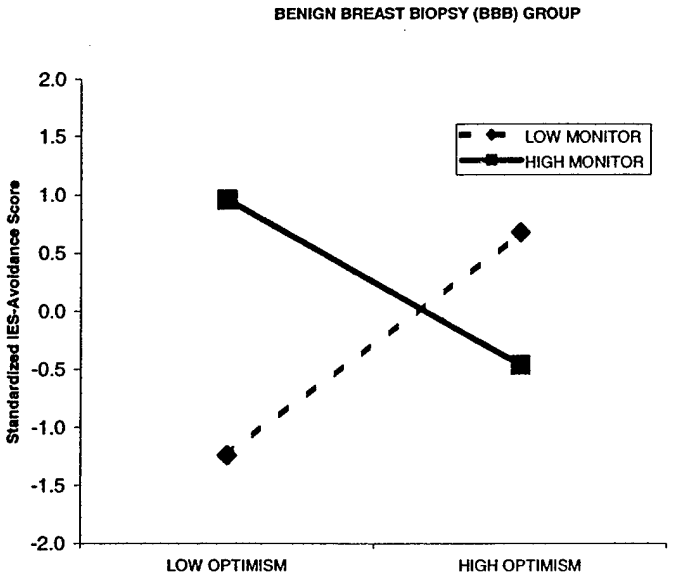
Note. IES = Impact of Events Scale; BBB = benign breast biopsy; HC = healthy comparison; β = standardized coefficient for the full, 13-variable model; sr^2 = squared semi-partial correlation; FDR = first-degree relative; BC = breast cancer; LOT = Life Orientation Test; MBSS = Miller Behavioral Styles Scale.
[a] From Benichou (1993). [b] Coded as 1 = Caucasian and 2 = other. [c] Coded as 1 = BBB group and 2 = HC group.
* $p < .10$. ** $p < .05$. *** $p < .01$.

Reactions to Biopsy: Change Across Time

To examine whether BC-specific distress changed over time in the BBB group, a set of one-way, repeated-measures analyses of variance (ANOVAs) were performed. Time (three levels: initial, 4-month, and 8-month follow-up) was the within-subjects independent variable in all ANOVAs. The dependent variables were total scores on the POMS and CES–D and Intrusion and Avoidance scores on the IES. Analyses for these four variables were based on the sample of 100 women with complete data at all three time points. Results are shown in Table 4. Results indicated a significant main effect for time for scores for IES–Intrusion (Wilks's $\lambda = .871$), $F(2, 98) = 7.27$, $p < .001$, and IES–Avoidance (Wilks's $\lambda = .845$), $F(2, 98) = 9.02$, $p < .001$. Post hoc analyses using the least significant difference (LSD) test indicated that for both IES indices, scores at the 4- and 8-month assessments were significantly lower than scores at the initial interview (all $ps < .001$). IES scores at the 4- and 8-month assessments were not significantly different from each other. In contrast, there was no significant main effect for time for CES–D or POMS scores (both $ps > .25$).

A similar set of repeated-measures ANOVAs were performed using the BC–Worry; BC–Worry Impact; and the Personal, Typical, and Comparative BC Risk measures as dependent variables. Analyses for these five variables were based on the 68 women who provided complete data for these variables at all three time points. (Comparison of these 68 women with the 32 women randomly assigned to not complete the BC–Worry and risk perception measures at the 4-month follow-up revealed no significant differences on demographic or objective BC risk variables, or on distress and BC worry indices or perceived BC risk at the initial interview; all $ps > .10$.) Results are shown in Table 4. Results indicated no significant main effects for time for BC–Worry, BC–Worry Impact, or any BC risk perception indices (all $ps > .15$).

Although the preceding analyses suggest that IES–Intrusion and IES–Avoidance scores for the BBB group decreased between the initial and 4-month follow-up interview, different patterns of change were evident when individual women were considered. For example, 13 women evidenced an increase in their IES–Avoidance score of at least 0.5 *SD* between the initial and 4-month follow-up interviews. To identify variables accounting for individual differ-



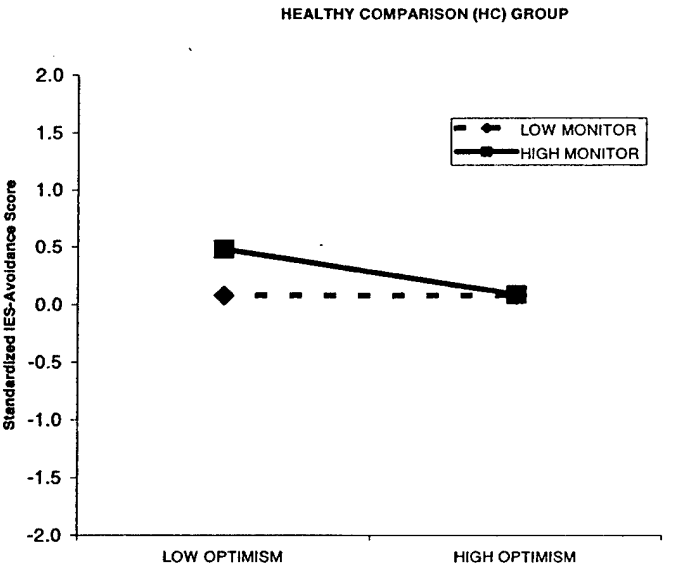


Figure 1. IES–Avoidance subscale scores at the initial interview for the BBB and HC groups as a function of dispositional optimism and informational coping style. IES = Impact of Events Scale.

ences in change in IES scores after BBB, a pair of identical multiple regression analyses were used. Dependent variables were raw change in IES–Avoidance and IES–Intrusion scores between the initial and 4-month follow-up interviews. Eleven predictor variables were used in all three analyses. These included the appropriate IES score at the initial interview; demographic information (race, age, education); objective and subjective BC risk (lifetime risk for BC; Benichou, 1993); number of FDRs with BC; and perceived personal BC risk, dispositional (MBSS–Monitor and LOT–Total scores, LOT × Monitor interaction), and social support (DUKE-SSQ total) variables.

Results are shown in Table 5. The set of 11 predictor variables accounted for a significant proportion of variance in change between the initial and 4-month interviews for both IES–Avoidance (39.7%) and IES–Intrusion scores (44.3%). IES scores at the initial interview were significantly associated with change for both IES indices, with higher IES scores at the initial interview associated with larger decreases in IES scores after the initial interview. In addition, perceptions of personal BC risk and social support were associated with change in IES–Avoidance scores after the initial interview. Specifically, higher perceptions of personal BC risk were associated with smaller decreases in IES–Avoidance scores after the initial interview, whereas greater social support was associated with larger decreases. An identical pattern of results for these two predictor variables was evident for change in IES–Intrusion scores; however, results narrowly failed to achieve the .05 criterion for statistical significance (both $ps < .10$). Finally, greater education was significantly associated with larger decreases in IES–Intrusion scores ($\beta = .21$, $p < .05$).

Table 4
Means and Standard Deviations for Psychological Distress and BC Risk Perception Measures at Three Assessment Points for the BBB Group (n = 100)

Subscale	Initial interview	Follow-up 4-month	Follow-up 8-month	$F(2, 88)$[a]
CES–D–Total				0.17
M	11.4	11.6	11.0	
SD	10.5	11.6	12.2	
POMS–Total				1.31
M	43.6	45.9	42.1	
SD	24.3	27.7	27.8	
IES–Intrusion				7.27***
M	$8.0_{b,c}$	5.9_{b}	5.2_{c}	
SD	8.2	7.5	7.1	
IES–Avoidance				9.02***
M	$10.5_{b,c}$	7.4_{b}	7.2_{c}	
SD	9.6	8.8	8.7	
BC–Worry[b]				1.81
M	1.4	1.5	1.3	
SD	1.2	1.1	1.2	
BC–Worry Impact[b]				1.19
M	2.5	2.4	2.1	
SD	2.4	2.1	2.4	
Personal BC Risk[b]				0.77
M	32.6	33.5	35.4	
SD	22.7	22.6	25.0	
Typical BC Risk[b]				0.40
M	35.4	33.6	34.2	
SD	20.0	19.0	19.3	
Comparative BC Risk[b,c]				0.92
M	2.7	0.1	−1.1	
SD	19.7	19.8	21.1	

Note. Subscript letters indicate pairs of means that are significantly different ($p < .05$) from each other. BC = breast cancer; BBB = benign breast biopsy; CES–D = Center for Epidemiologic Studies Depression Scale; POMS = Profile of Mood States; IES = Impact of Events Scale.
[a] Associated with value of Wilks's lambda in repeated-measures analysis of variance. [b] Analyses based on $n = 68$. [c] Calculated as Typical BC Risk minus Personal BC Risk.
*** $p \leq .01$.

Table 5
Multiple Regression Analysis of Change in IES Scores for the BBB Group Following the Initial Interview (n = 100)

Variable	IES–Intrusion		IES–Avoidance	
	β	sr^2	β	sr^2
Initial IES score	.66***	.280	.62***	.221
Education	.21**	.026	.14	.012
Age at interview	−.21	.014	−.06	.001
Lifetime Risk for BC[a]	−.28*	.019	−.20	.009
Race[b]	.13	.014	.09	.007
No. FDRs with BC[d]	.20	.012	.11	.003
Social support	.15*	.017	.19**	.028
Perceived BC Risk	−.16*	.020	−.20**	.033
LOT–Total	.06	.003	−.01	.000
MBSS–Monitor	−.11	.011	−.03	.001
Lot × Monitor	.05	.002	−.02	.000
Full model statistics				
Multiple R	.666		.630	
Multiple R^2	.443		.397	
$F(11, 88)$	6.37***		5.27***	

Note. Change scores calculated as initial level minus 4-month follow-up level. IES = Impact of Events Scale; BBB = benign breast biopsy. β = standardized beta coefficient for full, 11-variable model; sr^2 = squared semi-partial correlation; BC = breast cancer; FDR = first-degree relative; LOT = Life Orientation Test; MBSS = Miller Behavioral Styles Scale.
[a] From Benichou (1993). [b] Coded as 1 = Caucasian, 2 = other. [d] Defined as number of FDRs with breast cancer.
* $p < .10$. ** $p < .05$. *** $p < .01$.

Discussion

Results provide support for our hypothesis that BBB may have a negative psychological impact. Specifically, comparison of the BBB and HC groups at the initial interview indicated that the BBB group evidenced significantly higher IES–Intrusion and IES–Avoidance scores (see Table 2). Group differences on both IES indices were in the range of 0.5 *SD*—a reasonably large effect. To place our IES scores in context, our mean Intrusion and Avoidance scores at the initial interview of approximately 8.0 and 10.5, respectively, are a bit lower than the mean Intrusion (11.1) and Avoidance (12.8) scores found in a sample of BC survivors a mean of 2 years after completion of BC treatment (Cordova, Cunningham, Carlson, & Andrykowski, 2001).

In contrast to our findings for the IES, no differences between the BBB and HC groups were found at the initial interview for scores on the POMS and CES–D. This apparent discrepancy might be resolved by considering the specificity of distress assessed by these instruments. The POMS and CES–D are generic measures of distress because they are not keyed to assess distress associated with any specific stressor. In contrast, the IES, as used in this study, can be considered a measure of BC-specific distress or preoccupation. In particular, the IES measured distress associated with "the possibility that you will develop BC in your lifetime." Because BBB is likely to engender anxiety regarding personal risk for BC, it is not at all surprising that the IES appeared to be highly sensitive to the impact of BBB, whereas generic measures of depressive symptoms (CES–D) and mood disturbance (POMS) were not. Given this rationale, however, it is puzzling that significant group differences were not found on the BC–Worry and BC–Worry Impact measures. However, these were fairly crude one- and two-item indices, respectively. The failure to obtain group differences on these measures might be attributable to poor measurement rather than the absence of true differences between the BBB and HC groups. Considered together, it seems fair to conclude that the experience of BBB may only increase BC-specific distress or preoccupation. The extent to which this increased BC-specific distress has an impact on quality of life more generally is not known, however, and might be a focus for future research.

Examination of the temporal trajectory of BC-specific distress or preoccupation within the BBB group indicated that distress declined over time (Table 4). Significant declines in IES scores were evident between the initial and 4-month follow-up interview, with no further significant declines evident after that. It is important to note, however, that although BC-specific distress levels 4 to 8 months after biopsy are lower relative to those evidenced in the immediate aftermath of BBB (i.e., at the initial interview), BC-specific distress is still significantly elevated over normal, pre-BBB levels. *t*-test comparison of IES–Avoidance and IES–Intrusion scores for the BBB group at the 4- and 8-month assessments with those of the HC group at the initial interview revealed significant group differences (all $ps < .05$). Whether BC-specific distress ultimately returns to a baseline, pre-BBB level is not known because follow-up in the present study extended only to 8 months post-BBB. However, even if distress levels do indeed eventually return to normal, that distress remains significantly elevated for at least 8 months following BBB is not trivial. From a quality-of-life standpoint, our findings suggest that consideration be given to identifying ways to help women manage the distress generated by BBB.

In general, our results are consistent with those of earlier studies that have found elevated levels of distress following BBB (Brett et al., 1998; Deane & Degner, 1998; Lindfors et al., 1998). Our results are also consistent with the single study that has examined the course of distress following BBB in suggesting that distress declines over time (Brett et al., 1998). Again, however, it is critical to note that the potential negative impact of BBB was evident only for IES scores. No significant differences between the BBB and HC groups and no significant evidence of change over time were apparent when CES–D or POMS scores were considered. The methodological implications of this are straightforward: A comprehensive understanding of the psychological impact of a particular stressful event is facilitated by inclusion of both generic and stressor-specific measures. In this case, inclusion of only generic measures of distress in our assessment protocol would have resulted in a quite different conclusion regarding the psychological impact of BBB. One might note that our recommendation here is similar to that regarding use of a modular approach to quality-of-life assessment (Aaronson, 1991). That is, consideration of both generic and disease-specific measures is necessary to yield a comprehensive view of quality of life.

In contrast to the apparent impact of BBB on BC-specific distress or preoccupation, our data suggest that perceptions of BC risk were largely unaffected by BBB. No significant differences were found between the BBB and HC groups at the initial interview with respect to perceptions of either their personal risk for BC or the typical woman's risk for BC (see Table 2). Furthermore,

in the BBB group, neither measure of BC risk perception changed significantly during the 8-month follow-up period, and intercorrelations among BC risk estimates were fairly high, in the .60 to .80 range, across the different points of assessment. Because ours is the first study to examine how BBB affects BC risk perceptions, these results require replication before firm conclusions can be drawn.

As hypothesized, optimism and informational coping style were associated with response to BBB. However, the hypothesized main effect relationships between these dispositional characteristics and distress after BBB were not found. Rather, results suggested an interaction between these two variables with regard to post-BBB distress (Figure 1). Specifically, the hypothesized relationship between a monitoring coping style and greater post-BBB distress was most evident in the context of low optimism. A monitoring coping style was much less strongly associated with BC-specific distress when optimism was high. Also, it is critical to note the interaction between optimism and a monitoring coping style was evident only in the BBB group. This was evidenced by the significant Monitor × Lot × Group interaction. (Table 3 and Figure 1).

Our results are consistent with the MPM insofar as informational coping style was associated with BC-specific distress only in the BBB group. This supports the MPM's contention that the effects of informational coping style on cognition, affect, and behavior are evident primarily under conditions of threat, in this case, BBB (Miller, 1995; Miller, Rodeletz, et al., 1996). Our results also support the broader conceptualization of response to threatening health events provided by the cognitive–social health information processing model (C-SHIP; Miller, Shoda, & Hurley, 1996). In part, the C-SHIP model posits that the general tendency of monitors to amplify threat both cognitively and emotionally can be modified by other dispositional characteristics. In essence, the C-SHIP model suggests monitoring subtypes may exist. In particular, optimism is suggested as a dispositional characteristic that may moderate the monitor's typical response to a threatening health event (Miller, 1995; Miller, Mischel, O'Leary, & Mills, 1996). Because of their general expectancy for positive outcomes, optimists might avoid the cognitive and emotional amplification of threat associated with a monitoring style. Thus, monitors with high optimism may be less prone to react with distress when facing a threatening health event. Our finding of a significant LOT × Monitor interaction is clearly consistent with this thesis.

In addition to the interaction of optimism and informational coping style, education and, to a lesser extent, family history of BC were predictive of IES scores in the BBB group (Table 3). Women with less education evidenced higher IES–Intrusion and IES–Avoidance scores at the initial interview, whereas women with a history of BC in one or more FDRs evidenced higher IES–Avoidance scores only. In addition, higher perceptions of personal BC risk and poorer social support at the Initial Interview were linked to smaller declines in IES scores over the 8 months following BBB (Table 5). Although specific hypotheses were not advanced, none of these findings are surprising. Both education and social support can serve as coping resources (Hobfoll, 1989), mitigating the negative impact of BBB. Alternatively, more educated women might receive more information and explanation from physicians and clinic staff and this may serve to minimize distress following BBB. Women with a family history of BC are likely to believe they are at greater risk for breast cancer. Indeed, women with one or more FDRs with BC reported significantly higher perceptions of personal BC risk at the initial interview relative to women without a family history of BC (41.5% vs. 26.8%, $p < .05$). Undergoing BBB is likely to further heighten this sense of vulnerability and personal risk, resulting in elevated and more persistent BC-specific distress. Finally, our finding that higher personal BC risk estimates were associated with smaller declines in IES–Total and IES–Avoidance subscale scores is consistent with our previous research linking higher personal BC risk estimates to greater risk of nonadherence, with recommendations for clinical follow-up after BBB (Andrykowski et al., 2001).

Although we believe this report is the most comprehensive examination to date of psychological response to BBB, several limitations of the research should be noted. First, our sample was 90% Caucasian, and replication of our findings in a racially and ethnically more diverse sample would be prudent. Second, there is some suggestion that minority women and women with elevated perceptions of personal BC risk at the initial interview were less likely to complete all study assessments. As a result, caution is advised in generalizing study results to all women undergoing BBB. Third, the lack of a baseline assessment prior to BBB limits the ability to draw firm conclusions about the causal impact of BBB. Although inclusion of our matched HC group suggests that BC-specific distress is elevated as a result of BBB, differences between the HC and BBB groups at baseline could be due to some unmeasured factor and not directly attributable to BBB. Use of a true prospective design would be advised in future studies. Fourth, although our HC group allowed some insight into "baseline" levels of our outcome variables, this group may not have been the optimal control group for this setting. Inclusion of a group of women undergoing BC screening and receiving a "normal" result would have yielded a better perspective upon the psychological impact of BBB. In particular, this group could shed light on whether BC-specific distress or preoccupation might be temporarily elevated in these women as well, simply as a function of the screening process itself. Fifth, the large number of analyses conducted and the less-than-optimal ratio of predictor variables to sample size (i.e., < 10:1) suggest that further replication of our findings is necessary. Finally, we focused on the BC screening setting, and our findings may not be generalizable to screening for other cancers.

In conclusion, results suggest that the experience of breast biopsy may produce increased levels of BC-specific distress, even when no malignancy is found. Significantly, distress remains elevated at least 8 months after BBB. Women likely to evidence elevated and/or persistent distress following BBB can be identified by a combination of dispositional (optimism, monitoring coping style), clinical (family history of breast cancer), cognitive (perceptions of personal BC risk), social (social support), and demographic (education) variables. Other research suggests that breast self-examination practices may be altered after BBB (Haefner, Becker, Janz, & Rutt, 1989; Janz, Becker, Haefner, Rutt, & Weissfeld, 1990), and elevated distress and perceptions of personal BC risk after BBB are associated with nonadherence to recommendations for clinical follow-up of BBB (Andrykowski et al., 2001). Thus, reactions to BBB may have quality-of-life as well as health behavior implications. Although the potential negative impact of BBB does not appear to be of sufficient magnitude to recommend reexamination of guidelines for its use, we do believe that addi-

tional examination of its negative impact is warranted. Rather than reducing use of biopsy in the evaluation of breast lesions, we suggest that attention be devoted to the development of brief, psychoeducational interventions to enhance post-BBB psychological and behavioral outcomes. Such interventions could be based on similar efforts in related settings (Lerman et al., 1995; Miller et al., 1997).

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The Role of Social and Dispositional Variables Associated With Emotional Processing in Adjustment to Breast Cancer: An Internet-Based Study

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Cognitive and emotional processing is seen as critical to successful adjustment to traumatic experiences, such as breast cancer. Cognitive and emotional processing can be facilitated by dispositional and social environmental factors. Emotional intelligence is a dispositional characteristic defined as the ability to understand, accurately perceive, express, and regulate emotions (J. D. Mayer & P. Salovey, 1997). This study investigated psychological adjustment as a function of emotional intelligence, social support, and social constraints in 210 patients recruited via postings to Internet-based breast cancer support groups. Regression analyses indicated high social constraints and low emotional intelligence were associated with greater distress. Evidence suggested high emotional intelligence could buffer against the negative impact of a toxic social environment. Results support a social–cognitive processing model of adaptation to traumatic events and suggest consideration of emotional intelligence may broaden this model.

Key words: social–cognitive processing, emotional intelligence, Internet research, breast cancer

The potential psychosocial impact of breast cancer diagnosis and treatment can be a stressful and traumatic event with long-term consequences (Moyer & Salovey, 1996). Recent conceptualizations of the experience of breast cancer suggest the utility of viewing psychological adaptation as a particular instance of how individuals adapt to stressful or traumatic events more generally (Andrykowski, Cordova, Studts, & Miller, 1998; Green et al., 2000). For example, theories of trauma adaptation suggest cognitive and emotional processing of a traumatic event are critical to long-term psychological adjustment (Creamer, Burgess, & Pattison, 1992). Cognitive and emotional processing is believed to be facilitated by expression of thoughts and feelings regarding the traumatic event in a supportive social context (Creamer et al., 1992). Recent work addressing emotional expression and adjustment to cancer suggests that coping through actively processing and expressing emotion leads to better long-term psychological adjustment (Stanton et al., 2000). On the basis of this model of trauma adaptation, differences in distress after breast cancer diagnosis and treatment might be examined as a function of variables that might facilitate or impede cognitive and emotional processing of the breast cancer experience.

Social–cognitive processing theory (Lepore, 2001; Lepore & Helgeson, 1998) suggests that trauma-related distress may remain elevated if the individual fails to engage in suitable discussion of his or her thoughts and feelings regarding the traumatic experience. Cognitive and emotional processing might fail to occur because an individual lacks the skills or ability to appropriately identify, reflect upon, and express trauma-related thoughts and feelings. Certain dispositional characteristics might be important here. For example, individuals low in trait emotional expressivity (Stanton et al., 2000) or high in alexithymia (Taylor, Bagby, & Parker, 1991) might be less capable of engaging in cognitive and emotional processing of trauma-related material. The sharing of thoughts, feelings, and meanings associated with the trauma experience is facilitated by a supportive social environment. Thus, even when the skills necessary for effective processing of the trauma experience are present, the lack of a supportive social environment may hinder this processing.

On the basis of this analysis, both dispositional and social environmental variables are critical to cognitive and emotional processing of trauma-related material and thus might be important in facilitating psychological adjustment following breast cancer diagnosis and treatment. Emotional intelligence is a dispositional characteristic conceptually linked to the ability to identify and articulate emotional states and may be related to emotional expression tendencies (Mayer & Salovey, 1993). Emotional intelligence is defined as the ability to accurately perceive, understand, and manage emotions (Salovey & Mayer, 1990). Individuals high in emotional intelligence should be better equipped to engage in the cognitive and emotional processing necessary for successful trauma adaptation. However, although conceptually intriguing, research linking emotional intelligence to trauma adaptation is quite limited at present. Salovey, Mayer, Goldman, Turvey, and Palfai (1995) proposed that individuals higher in emotional intelligence would quickly recover from sustained negative affect and intrusive negative thoughts after exposure to graphic video footage from a trauma center. Results showed that individuals high in emotional intelligence were more attentive to their moods, had greater mood clarity, and were better able to engage in mood

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repair, demonstrating that greater ability to activate and modify feelings may lead to successful emotional processing of trauma-related intrusive thoughts (Salovey et al., 1995). Exploration of the relevance of emotional intelligence to understanding adaptation to traumatic events, in general, or to the diagnosis and treatment of cancer, in particular, is clearly warranted.

Characteristics of the social environment critical to cognitive and emotional processing of distressing or traumatic experiences include the presence and extent of social support and social constraints. A supportive social environment that encourages sharing of thoughts, feelings, and meanings associated with traumatic events is crucial for successful long-term psychological adjustment (Lepore, Silver, Wortman, & Wayment, 1996). Conversely, social constraints are defined as the hindrance of an individual's expression of trauma-related thoughts and feelings due to negative responses from others (Tait & Silver, 1989). The result may be interference with cognitive and emotional processing of the trauma experience and poorer psychological adjustment characterized by greater and/or more persistent trauma-related distress (Lepore et al., 1996).

On the basis of the conceptual framework provided by a social–cognitive processing theory of adaptation to trauma (Lepore, 2001; Lepore & Helgeson, 1998; Lepore et al., 1996), the aim of this study was to examine the relationship between dispositional and social environmental characteristics and psychological adjustment in women with breast cancer. We formed three hypotheses:

Hypothesis 1. Breast cancer patients who report more social constraints will report more psychological distress.

Hypothesis 2. Breast cancer patients who report more social support will report lower psychological distress.

Hypothesis 3. Breast cancer patients who are high in emotional intelligence will report lower psychological distress.

In addition, we examined whether emotional intelligence interacts with characteristics of the social environment to influence distress levels. Although low social support and high social constraints are expected to be linked to higher distress, we hypothesized that high emotional intelligence may enable an individual to overcome limitations of a poor social environment.

Method

Sample

Participants were members of five Internet-based breast cancer support groups. To be eligible for inclusion in the study, a woman had to (a) be over 18 years, (b) be over 60 months postdiagnosis of breast cancer, (c) be able to read and understand English, and (d) have Internet access. Data were collected from all individuals who visited the study website and completed at least part of the survey. Only respondents who met eligibility criteria had their data used in final analyses.

Procedure

Permission was obtained from each Internet support group to advertise the research study to their members. Upon receipt of permission, information regarding the study was posted on each group's website or was mailed electronically to each group's mailing list. Interested individuals accessed the survey by logging on to the study website.

Study Questionnaires

Demographic and medical information. Information regarding birth date, race or ethnicity, education, household income, marital status, and geographic residence was obtained. Information regarding date (month and year) of breast cancer diagnosis, disease stage at diagnosis, type of surgery, and adjuvant treatment received was also obtained.

Trait Meta-Mood Scale (TMMS). The TMMS (Salovey et al., 1995) is a 30-item dispositional measure of emotional intelligence. The TMMS is conceptually based on the emotional-intelligence construct (Mayer & Salovey, 1993; Salovey & Mayer, 1990) and was developed by Salovey and colleagues to identify individual differences that characterize emotional intelligence (Salovey et al., 1995). The TMMS yields three subscale scores as well as a total composite score. Items are scored on a 5-point Likert-type scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The Attention to Feelings subscale indexes the amount of attention individuals feel they give to emotions and includes items such as "I pay a lot of attention to how I feel." The Clarity of Feelings subscale measures how clearly individuals feel they understand their emotions and includes items such as "I am usually very clear about my feelings." The Mood Repair subscale measures the individuals' ability to repair unpleasant moods or maintain pleasant ones. Items on this subscale include "I try to think good thoughts no matter how badly I feel." Only the TMMS total score was used in data analyses in the present study. Coefficient alpha was .88 for the total score.

Impact of Event Scale (IES). The IES (Horowitz, Wilner, & Alvarez, 1979) is a 15-item measure of intrusive and avoidant cognition during the past week regarding a specific stressor. The IES yields a total score, and subscale scores for Intrusion and Avoidance. Coefficient alpha in the present study was .85 for the total score, .88 for the Intrusion subscale, and .75 for the Avoidance subscale.

Social Constraints Scale (SCS). The SCS (Lepore, 1997) is a 15-item measure of the extent the social environment inhibits expression of thoughts and feelings regarding a traumatic or stressful event. Coefficient alpha for the SCS in this study was .95.

Duke—UNC Functional Social Support Questionnaire (DUKE–SSQ). The DUKE–SSQ (Broadhead, Gehlbach, De Gruy, & Kaplan, 1988) was designed for use with medical populations and is an eight-item measure of satisfaction with the extent of functional social support received. A total score is computed, and coefficient alpha in the present study was .88.

Hospital Anxiety and Depression Scale (HADS). The HADS (Zigmond & Snaith, 1983) measures anxiety and depression during the past week and was designed for patients with physical illness. The HADS provides subscale scores for depression and anxiety, with seven items each. Coefficient alpha in the present study was .84 (Anxiety subscale) and .83 (Depression subscale).

Data Preparation and Statistical Analysis

Missing data constituted less than 1% of all items. Values for missing data were imputed using substitution of the sample mean. The criterion for statistical significance was set at .05.

Results

A total of 302 respondents completed the study. Of these, 40 (13%) had incomplete data and 52 (17.2%) were more than 60 months postdiagnosis. These 92 respondents were excluded from the study sample. The final study sample of 210 women had a mean age of 47.4 years (SD = 8.4; range = 22.4–68.5) and was a mean of 22.6 months after breast cancer diagnosis (SD = 15.2;

range = 0.5–59.2). Disease stages at diagnosis were as follows: Stage 0 (n = 17, 8.1%), Stage I (n = 64, 30.5%), Stage II (n = 100, 47.6%), Stage III (n = 25, 11.9%), and Stage IV (n = 5, 1.9%). The majority of the sample had undergone either lumpectomy (n = 91, 43.3%) or mastectomy (n = 94, 44.8%), with 25 women (11.9%) having undergone lumpectomy and mastectomy. Adjuvant therapy consisted of chemotherapy alone (n = 55, 26.2%), radiotherapy alone (n = 27, 12.9%), or both (n = 111, 52.9%). Receipt of no adjuvant therapy was reported by 17 women (8.0%). Most respondents were from the United States (n = 167, 79.5%). International respondents were primarily from Australia (n = 16) and Canada (n = 14). Demographic characteristics of the sample are shown in Table 1.

To test hypotheses regarding the relationship between current psychological adjustment and demographic, clinical, and psychosocial variables, we performed four hierarchical regression analyses. Dependent variables in these analyses included Depression and Anxiety scores from the HADS and Intrusion and Avoidance scores from the IES. In each regression analysis, an identical set of 10 independent variables, grouped into demographic, clinical, and psychosocial subsets, was used. Demographic variables included age, years of education, and marital status (single vs. partnered). Clinical variables included months since diagnosis, surgery (lumpectomy vs. mastectomy), adjuvant therapy received (four ordinal groupings: no adjuvant therapy, radiation only, chemotherapy only, and radiation and chemotherapy), and disease stage at diagnosis (0–IV). Psychosocial variables included scores for the TMMS, SCS, and DUKE–SSQ. Means and standard deviations for the major variables are shown in Table 2. Intercorrelations among the 10 predictor variables are shown in Table 3. Results of the regression analyses are shown in Tables 4 and 5.

The set of 10 predictor variables accounted for a significant portion of variance in each of our four distress indices ranging from 23% (IES–Intrusion) to 40% (HADS–Depression) of variance accounted for. For the most part, demographic and clinical variable subsets were not significantly associated with distress indices, as addition of these subsets to the regression models did not yield a significant increment in variance accounted for. The lone exception was the 6% increment in variance in accounted for by addition of the demographic variable subset to the regression model for HADS–Depression scores. Although several individual demographic and clinical variables were significant predictors of one or more distress indices, few strong or consistent patterns were detected. Time since diagnosis was significantly associated with three of the four distress indices with greater time since diagnosis associated with less distress. However, the proportion of unique variance (square of multiple semipartial correlation coefficient, sR^2) accounted for by time since diagnosis was 3.3% or less for all four distress indices.

In strong contrast, the subset of psychosocial variables accounted for a significant increment in variance for each of the four distress indices, even after demographic and clinical subsets had been accounted for. The increment in variance accounted for by the psychosocial variable subset ranged from 18% (IES–Intrusion) to 31% (HADS–Depression). Within the subset of psychosocial variables, SCS score was a significant predictor of all four distress indices, with greater social constraints associated with greater distress. The proportion of unique variance accounted for (i.e., sR^2) by SCS scores ranged from 6.9% (HADS–Depression) to 14.0% (IES–Intrusion). TMMS total score was a significant predictor of three distress indices (the lone exception was IES–Intrusion scores) with the proportion of unique variance accounted for ranging from 7.0% (HADS–Depression) to 12.5% (IES–Avoidance). In all cases, greater emotional intelligence was associated with less distress. Social support was less consistently associated with psychological adjustment as it was a significant predictor only in the regression model for HADS–Depression scores. In this model, higher social support was associated with lower HADS–Depression scores.

Table 1
Demographic Characteristics of Study Sample (N = 210)

Characteristic	n	%
Marital status		
Married/cohabitating	158	75.2
Single/divorced/separated/widowed	52	24.8
Ethnic affiliation		
Caucasian	191	91.0
African American	3	1.4
Asian	2	1.0
Latino/Hispanic	2	1.0
Native American	1	0.5
Other	9	4.3
Missing	2	1.0
Education (years)		
≤ 12	53	25.3
> 12 and ≤ 16	88	41.9
> 16 years	69	32.8
Job status		
Full-time employment	116	52.2
Part-time employment	42	20.0
Homemaker	18	8.6
Retired	11	5.2
Unemployed	6	2.9
Disabled	13	6.2
Missing	4	1.9
Annual household income		
< $20,000	9	4.3
$20,000–$40,000	55	26.2
$41,000–$60,000	46	21.9
$61,000–$80,000	27	12.9
> $80,000	68	32.4
Missing	5	2.4

To examine whether emotional intelligence interacted with social constraints to influence current levels of distress, we constructed four additional regression models using the same four distress indices as dependent variables. For each model, a variable representing the interaction between emotional intelligence and social constraints (i.e., TMMS score multiplied by SCS score) was created. The Emotional Intelligence (EI) × Social Constraints (SC) interaction term was entered as a fourth step in the analyses described above. The EI × SC interaction was a significant predictor of HADS-Anxiety score, $\beta = -.12$, $t(210) = -2.00$, $p < .05$. The incremental variance accounted for by the EI × SC interaction was 1.4%. The form of this interaction is graphically displayed in Figure 1. Although reports of high social constraints are clearly associated with greater HADS-Anxiety scores, this effect is less pronounced among breast cancer patients with high emotional intelligence. This suggests that high emotional intelligence might buffer against the potential negative impact of a social environment characterized by high levels of social constraints.

Table 2
Descriptive Statistics for Study Measures (N = 210)

Measure	*M*	*SD*	Cronbach's α
DUKE–SSQ	32.2	6.5	.88
SCS	31.3	10.8	.95
IES–Total	29.0	13.6	.85
IES–Intrusions	15.8	8.4	.88
IES–Avoidance	13.3	7.7	.75
HADS–Depression	4.0	3.5	.83
HADS–Anxiety	7.2	3.8	.84
TMMS–Total	118.5	14.4	.88

Note. DUKE-SSQ = Duke—UNC Functional Social Support Questionnaire; SCS = Social Constraints Scale; IES = Impact of Event Scale; HADS = Hospital Anxiety and Depression Scale; TMMS = Trait Meta-Mood Scale.

An identical set of four hierarchical regression analyses were then conducted to test whether the EI × Social Support (SS) interaction also added to the prediction of distress. The EI × SS interaction was significant for the HADS–Depression model, $\beta = .15$, $t(210) = 2.62$, $p < .01$, and was associated with a 2.0% increment in variance. The form of the EI × SS relationship is shown in Figure 2. Again, although reports of low social support are clearly associated with higher HADS–Depression scores, this effect is less pronounced among individuals with high emotional intelligence. This suggests that high emotional intelligence might buffer against the potential negative impact of a social environment characterized by low levels of social support.

Discussion

The results of the present study support a social–cognitive processing conceptualization of adjustment to breast cancer. We hypothesized that social and dispositional factors presumably associated with emotional processing and expression would be associated with reported distress in breast cancer patients. Consistent with our hypotheses, patients who reported low social constraints and evidenced higher emotional intelligence tended to report less distress.

Lepore's social–cognitive conceptualization of trauma adaptation (Lepore, 2001; Lepore & Helgeson, 1998; Lepore et al., 1996) posits the importance of a social environment, which enables the individual to express and discuss trauma-related cognitions and emotions. Individuals in this type of social environment would be expected to evidence better psychological adjustment (e.g., less distress) after a stressful or traumatic event. In the present study, reports of low social constraints were associated with reports of less distress. Participants who perceived that family and friends did not want to discuss their cancer experience, or indeed actively discouraged attempts at such discussion, were more depressed, anxious, and reported more breast cancer–related distress. On a macro level, the existence of social constraints on discussion of a woman's breast cancer experience likely interferes with adequate cognitive and emotional processing, resulting in poorer psychological adjustment, in this case, greater distress.

On a more micro level, the existence of social constraints may motivate women to actively avoid thinking about their breast cancer experience, thus inhibiting cognitive and emotional processing of their experience. Prior research has shown a positive relationship between social constraints and avoidant behavior with regard to cognitive processing of cancer-related thoughts and feelings (Lepore & Helgeson, 1998). In the present study, social constraints were positively associated with IES–Avoidance scores, suggesting that breast cancer patients who perceived social constraints were more likely to avoid thinking about or confronting aspects or reminders of their breast experience. The existence of social constraints may also serve to increase cancer-related intrusive ideation. In the present study, social constraints were positively associated with IES–Intrusion scores. On the one hand, such intrusions can be functional as they can lead to activation and processing of the memory network, gradually reducing both the occurrence of intrusive ideation and psychological distress (Creamer et al., 1992). On the other hand, the occurrence of such intrusions in a socially constraining environment might be dysfunctional as the opportunity for appropriate cognitive and emotional processing is limited. In a socially constraining environment, breast cancer–related intrusions may occur but may not be adequately defoxified, resulting in persistent intrusive ideation and chronic distress.

Table 3
Intercorrelations Between Major Independent Variables (N = 210)

Measure	1	2	3	4	5	6	7	8	9	10
1. Age	—									
2. Education	.13	—								
3. Time since dx	.20**	.14*	—							
4. DUKE–SSQ	.01	.09	.04	—						
5. SCS	−.11	−.09	.04	−.48***	—					
6. TMMS	.04	.00	.00	.18**	−.11	—				
7. HADS–Depression	−.21**	−.12	−.18**	−.42***	.44***	−.34***	—			
8. HADS–Anxiety	−.12	−.06	−.10	−.28***	.40***	−.36***	.57***	—		
9. IES–Avoidance	−.15*	−.07	−.18**	−.18**	.42***	−.11	.50***	.62***	—	
10. IES–Intrusions	.02	−.10	−.16*	−.17*	.32***	−.38***	.34***	.39***	.43***	—

Note. DUKE–SSQ = Duke—UNC Functional Social Support Questionnaire; SCS = Social Constraints Scale; TMMS = Trait Meta-Mood Scale; HADS = Hospital Anxiety and Depression Scale; IES = Impact of Event Scale.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4
Hierarchical Regression Analysis of HADS–Depression and HADS–Anxiety Scores (N = 210)

	HADS–depression			HADS–anxiety		
Step and variable	ΔR^2	β^a	sR^2	ΔR^2	β^a	sR^2
Step 1	.06**			.02		
Age		−.14*	.017		−.05	.003
Marital status[b]		.02	.000		−.02	.000
Education		−.02	.000		.01	.000
Step 2	.03			.01		
Stage		.07	.004		−.03	.000
Type of adjuvant treatment[c]		−.04	.001		.04	.001
Type of surgery[d]		.15*	.020		.03	.001
Time since diagnosis		−.18**	.028		−.10	.009
Step 3	.31***			.25***		
DUKE–SSQ		−.23***	.034		−.06	.002
SCS		.31***	.069		.34***	.084
TMMS–Total		−.27***	.070		−.31***	.088
Full-Model Statistics						
Multiple R	.64			.53		
Multiple R^2	.40			.28		
F[e]	13.44***			7.71***		

Note. HADS = Hospital Anxiety and Depression Scale; DUKE–SSQ = Duke—UNC Functional Social Support Questionnaire; SCS = Social Constraints Scale; TMMS = Trait Meta-Mood Scale.
[a] Standardized β coefficient for full, 10-variable model. [b] Partnered (1) vs. not partnered (0). [c] None (0), radiation (1), chemotherapy (2), vs. radiation and chemotherapy (3). [d] Lumpectomy (1) vs. mastectomy (2). [e] dfs = 10, 199.
* $p < .05$. ** $p < .01$. *** $p < .001$.

In contrast with findings for the social constraints variable, support for our hypothesized relationship between social support and distress in breast cancer patients was much weaker. Of the four distress indices examined, the hypothesized inverse relationship between social support and psychological distress was evident only for HADS–Depression scores. Lepore (1992) suggested that social support and constraints are not the inverse of each other, and the correlation between these two variables can approach zero.

Table 5
Hierarchical Regression Analysis of IES–Intrusion and IES–Avoidance Scores (N = 210)

	IES–intrusion			IES–avoidance		
Step and variable	ΔR^2	β^a	sR^2	ΔR^2	β^a	sR^2
Step 1	.03			.01		
Age		−.06	.003		.11*	.011
Marital status[b]		.00	.000		.03	.001
Education		.00	.000		−.07	.004
Step 2	.02			.03		
Stage		.00	.000		.02	.000
Type of adjuvant treatment[c]		.04	.001		−.01	.000
Type of surgery[d]		.05	.002		−.02	.001
Time since diagnosis		−.19**	.033		−.19**	.033
Step 3	.18***			.23***		
DUKE–SSQ		.04	.001		.07	.003
SCS		.43***	.140		.33***	.081
TMMS–Total		−.07	.005		−.36***	.125
Full-model statistics						
Multiple R	.48			.52		
Multiple R^2	.23			.27		
F[e]	5.82***			7.49***		

Note. IES = Impact of Event Scale; DUKE–SSQ = Duke—UNC Functional Social Support Questionnaire; SCS = Social Constraints Scale; TMMS = Trait Meta-Mood Scale.
[a] Standardized β coefficient for full, 10-variable model. [b] Partnered (1) vs. not partnered (0). [c] None (0), radiation (1), chemotherapy (2), vs. radiation and chemotherapy (3). [d] Lumpectomy (1) vs. mastectomy (2). [e] dfs = 10, 199.
* $p < .05$. ** $p < .01$. *** $p < .001$.

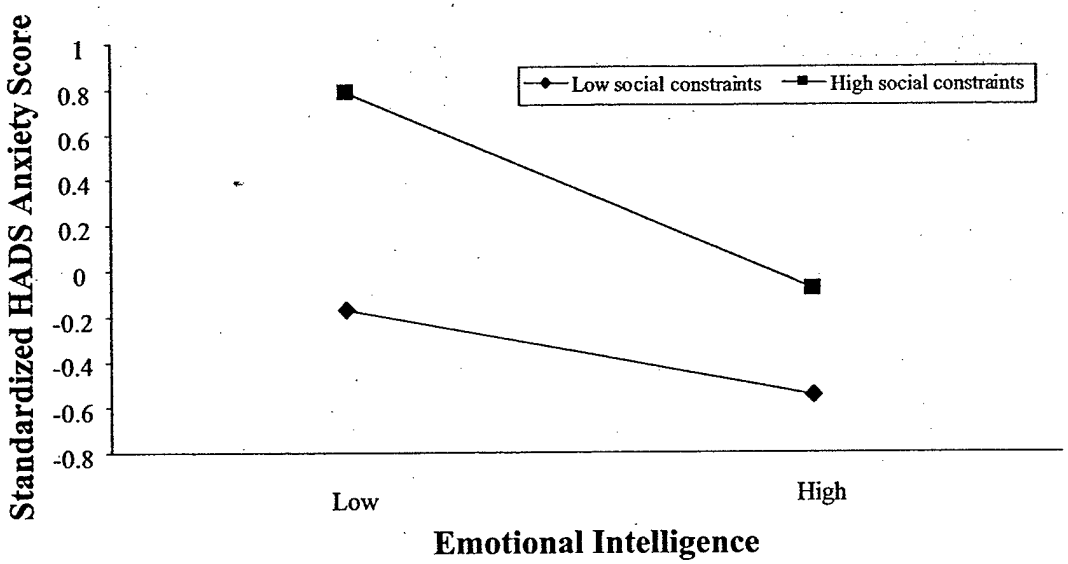

Figure 1. Effects of social constraints and emotional intelligence on Hospital Anxiety and Depression Scale (HADS)–Anxiety scores.

Were this the case, the stronger link between social constraints and distress in breast cancer survivors observed in this study, relative to the link between social support and distress, might suggest social constraints is the more critical aspect of the social environment. However, social constraints and social support scores were correlated at $-.48$ ($p < .001$) in our sample, raising the possibility that the apparent primacy of social constraints might be a statistical artifact rather than a true psychosocial phenomenon. Although future research should sort this out, the present study is significant as it provides further evidence that social constraints is an element of the social environment that merits strong consideration in attempts to understand adaptation to stressful or traumatic events, in general, and cancer, in particular.

Even when the social environment is appropriately supportive, some individuals might be dispositionally more or less capable of engaging in the emotional and cognitive processing presumed necessary for appropriate psychological adaptation to a stressful or traumatic event. Study results generally support our hypothesis that emotional intelligence, a dispositional characteristic related to attention, recognition, and regulation of emotion (Mayer & Salovey, 1993), would be associated with less distress in breast cancer patients. Indeed, we found greater emotional intelligence

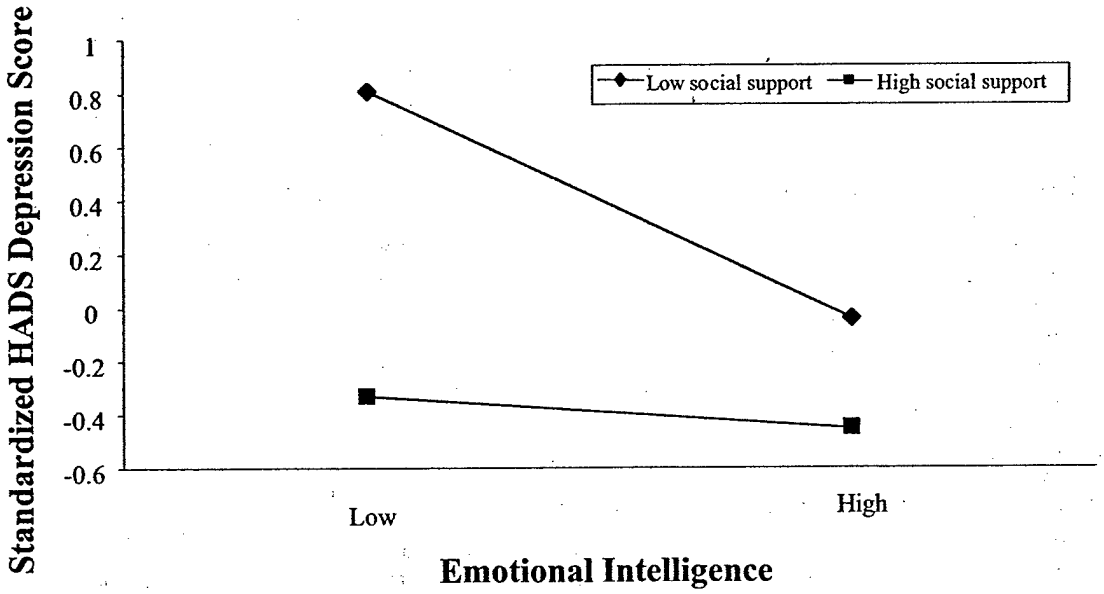

Figure 2. Effects of social support and emotional intelligence on Hospital Anxiety and Depression Scale (HADS)–Depression scores.

was significantly associated with less depression, anxiety, and breast cancer–related avoidance. Interestingly, we found some evidence to support our hypothesis that high emotional intelligence may enable some individuals to overcome, to a degree, the limitations posed by a poor social environment. In both instances, the form of the interaction suggested that high emotional intelligence buffered against the potential negative impact of a toxic social environment, one either high in social constraints or low in social support.

Considered together, our findings support the view that emotional intelligence may play an important role in the process of psychological adaptation to breast cancer. Emotional intelligence may facilitate cognitive and emotional processing of the breast cancer experience by enhancing the ability to attend to, discriminate among, and regulate emotion. Although not investigated in this study, emotional intelligence may also facilitate or impede cognitive and emotional processing by affecting critical aspects of the social environment. For example, women low in emotional intelligence may be less able to effectively identify, communicate, and regulate their emotions and thus may be seen as irrational, demanding, or aversive by their social environment. The social environment might respond in a constraining fashion to limit discussion of a woman's breast cancer experience. Alternatively, women low in emotional intelligence might be less effective in eliciting social support or less capable of recognizing and responding to appropriately supportive responses from the social environment. Although emotional intelligence, as conceptualized here and by others (Salovey et al., 1995), is primarily an intrapersonal construct, its impact upon the social (i.e., interpersonal) environment merits exploration.

As the role of emotional intelligence in psychological adaptation to cancer diagnosis and treatment has not been examined in prior research, our findings with regard to emotional intelligence clearly require replication and further elaboration. It must be recognized, however, that emotional intelligence is still in its infancy as a psychological construct. More recent conceptualizations suggest emotionally intelligent individuals are able to monitor, regulate, and manage their own emotions as well as more accurately identify the emotions of others (Mayer, Caruso, & Salovey, 1999; Mayer & Salovey, 1997). This emerging construal of emotional intelligence as possessing both intrapersonal and interpersonal dimensions may result in an even stronger connection between emotional intelligence and psychological adjustment to stressful or traumatic events. Future research involving the emotional intelligence construct should recognize that it is still evolving with regard to its definition and measurement and thus should strive to include the most appropriate and up-to-date measures.

Health-related behavioral research via the Internet is still novel and predominately untested. The Internet enabled us to enroll a larger sample of breast cancer patients, and to do so more quickly, than would have been possible using traditional methods. Despite these economies, sample representativeness is a fundamental concern. Fortunately, the characteristics of our participants did not differ dramatically from those of participants in similar psychosocial studies of breast cancer. For example, clinical characteristics of our sample are comparable with those of other studies of breast cancer patients (Cordova, Cunningham, Carlson, & Andrykowski, 2001; Epping-Jordan et al., 1999). Furthermore, mean social support scores in the present study (M = 32.2. SD = 6.5) were similar to scores for women with Stage I or II breast cancer recruited from cancer centers in a major metropolitan area (M = 33.2, SD = 6.0; Green et al., 2000). Although mean social constraint scores in the present study (M = 31.3, SD = 10.8) were higher than social constraints scores from 70 women with Stage I, II, or III breast cancer (M = 26.6, SD = 11.0) recruited from a single site (Cordova et al., 2001), our mean scores for intrusive (M = 15.8, SD = 8.4) and avoidant (M = 13.3, SD = 7.7) cognitions were generally comparable with Intrusion (M = 11.1, SD = 9.0) and Avoidance (M = 12.8, SD = 9.5) scores obtained in the Cordova et al. study (2001) as well as scores obtained in the Epping-Jordan et al. (1999) study (Intrusion, M = 14.1, SD = 8.3; Avoidance, M = 11.0, SD = 7.3). Although the possibility exists that our sample from Internet support groups might differ from the population of all women with breast cancer, the data suggest that these differences are not pronounced. Additionally, our intent was to test propositions derived from a conceptual model of trauma adaptation and not to characterize breast cancer patients in general. Thus, although representativeness of Internet study samples is an important issue, we believe that our study findings would be generally robust in the absence of extreme differences between our Internet sample and samples of breast cancer patients recruited through more typical means.

Other concerns relevant to an anonymous, Internet-based study include the possibility of multiple submissions and submission of faulty or garbage data. Although the independence of each record cannot be guaranteed, we feel confident that each record is distinct after reviewing demographic/clinical data for identical variables (e.g., age, education, geographic residence, date of diagnosis). No records were found to have more than four identical demographic/clinical variables. To screen for faulty data, we reviewed demographic/clinical data for indiscriminate responding such as date of birth after date of diagnosis or unacceptable date of birth. No records were found to have been entered indiscriminately. It has been suggested that problems of multiple submissions and faulty data are more likely in an Internet study made available to search engines (Buchanan, 2000). Finally, although we used standardized questionnaires with recognized and acceptable reliability and validity, the reliability and validity of these questionnaires have not been evaluated in the context of Internet administration. The extent to which Internet completion yields reliable and valid data is a key question for future research.

In conclusion, we believe our results enhance understanding of psychological adaptation in breast cancer patients, in particular, and to traumatic and stressful events more generally. On the basis of a social–cognitive processing model of trauma adaptation, our results highlight the importance of both social and dispositional variables associated with cognitive and emotional processing of stressful or traumatic events. The inclusion of a theoretically relevant dispositional characteristic, emotional intelligence, broadens this model and should serve to foster additional research.

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Report

Adherence to recommendations for clinical follow-up after benign breast biopsy

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Key words: adherence, biopsy, breast cancer, clinical follow-up, compliance, psychosocial

Summary

Purpose. Women who undergo a benign breast biopsy are at elevated risk for the subsequent development of breast cancer (BC). Therefore, appropriate clinical follow-up of a benign breast biopsy is important. The present study examines the extent and correlates of nonadherence with follow-up recommendations after a benign breast biopsy.

Methods. Women ($n = 114$) who had undergone a benign breast biopsy completed an initial telephone interview within 50 days of their biopsy (mean = 21 days). Additional telephone interviews were completed at 4 and 8 months post-biopsy. Measures of BC risk perception, general and BC-specific distress, BC-related attitudes and beliefs, social support, optimism, and informational coping style were completed. Specific recommendations for clinical follow-up and evidence of actual follow-up were obtained from medical records.

Results. Of 103 women given a specific recommendation for clinical follow-up, 34% were classified as nonadherent with follow-up recommendations. Logistic regression analyses indicated that nonadherent women were characterized by younger age, recommendations for follow-up by clinical breast examination alone, greater confidence in their ability to perform breast self-examination properly, higher perceived personal risk for BC, and greater BC-specific distress.

Conclusion. Despite the importance of appropriate clinical follow-up of a benign breast biopsy, about one-third of women did not adhere to recommended follow-up. Risk factors for nonadherence suggest potential avenues for interventions to enhance participation in appropriate clinical follow-up.

Introduction

Early detection and diagnosis of female breast cancer is associated with significant reductions in disease-related mortality [1–4]. To facilitate early detection and diagnosis, women are advised and encouraged to participate, as appropriate, in routine breast cancer screening activities such as mammography and clinical breast examination (CBE).

While the potential benefits of breast cancer screening have been demonstrated, some drawbacks exist. It has been estimated that routine mammography screening for breast cancer yields an 'abnormal' result (i.e., suspicious or inconclusive) about 20% of the time [5, 6]. Additionally, CBE may yield an abnormal result, even when mammogram results are normal. The vast majority of these abnormal results are not indicative of a malignant lesion but rather stem from asymmetries in breast tissue or structure, benign cysts or masses, or greater mammographic density attributable to age or use of hormone replacement therapy in postmenopausal women [7]. Typically, such abnormal results are followed by a repeat mammogram or by recommendations for additional clinical follow-up

in 3–6 months. In some cases, however, an abnormal screening result requires performance of a biopsy procedure to distinguish malignant from benign breast disease. Diagnostic breast biopsy procedures include fine needle aspiration (FNA), core needle biopsy, or excisional breast biopsy. Approximately 20% of all diagnostic breast biopsy procedures produce a positive diagnosis of breast cancer. In the overwhelming majority of women the biopsy yields a diagnosis of benign breast disease.

Although a breast biopsy may not reveal a malignancy, some data suggests that women undergoing breast biopsy for benign breast disease are at elevated risk for subsequent development of breast cancer [8–12]. As a result, appropriate clinical follow-up of a benign breast biopsy is important. While consensus may not exist regarding what exactly constitutes appropriate clinical follow-up for these women, some combination of screening mammography and/or CBE within the ensuing 4–6 months is typically recommended.

Despite its potential significance no research has examined the extent of adherence to recommendations for clinical follow-up after a benign breast biopsy. Several lines of reasoning suggest that adherence in this setting might be less than optimal. First, it is well known that significant numbers of individuals fail to adhere to recommendations for participation in routine cancer screening activities [13–15]. Second, research in other cancer screening settings suggests that nonadherence to recommendations for clinical follow-up after being informed of an abnormal cancer screening result is common [16–21]. For example, it is estimated that up to 40% of women with an abnormal Papanicolau (Pap) test result fail to adhere to recommendations for follow-up biopsy or colposcopy [17]. Similarly, in a study of a large breast cancer screening program, 18% of women with abnormal mammogram results received inadequate follow-up [19]. Third, several studies have shown that the biopsy experience is associated with considerable anxiety. Significantly elevated levels of distress have been found in women either awaiting the biopsy procedure [22–27] or awaiting notification of biopsy results [28]. If persistent, such anxiety might interfere with a woman's motivation to adhere to follow-up recommendations [29]. Finally, some evidence suggests that the experience of benign breast biopsy might impact a woman's practice of other cancer screening behaviors [30, 31]. Specifically, Janz et al. [31] found that practice of BSE was altered following the experience of a benign breast biopsy. Women whose lump was detected during routine mammography were likely to increase BSE practice while women whose lump was self-discovered were likely to decrease BSE practice. Similarly, Haefner et al. [30] found that women who had practiced BSE regularly prior to experience of a benign biopsy were more likely to reduce their practice of BSE. Women who had not practiced BSE regularly prior to biopsy were more likely to increase their practice of BSE.

Thus, while the existing literature suggests that a benign breast biopsy can be a distressing experience for many women, the impact of the biopsy experience upon subsequent participation in cancer screening activities is unclear. In particular, the extent of nonadherence with recommendations for clinical follow-up is unknown. The purpose of the present study is to examine the extent of nonadherence to recommendations for clinical follow-up after a benign breast biopsy. In addition to documenting the extent of nonadherence, the present study seeks to identify demographic, clinical, and psychosocial variables associated with risk for nonadherence.

Patients and methods

Patients

Eligible women were identified in a consecutive series from the daily roster of patients seen at the University of Kentucky Comprehensive Breast Care Center. To be eligible for study participation, a woman must have met the following criteria: (a) $\geq$18 years of age; (b) scheduled to undergo or have recently undergone a breast biopsy or FNA for diagnostic purposes; (c) no prior history of breast biopsy or FNA; (d) receipt of benign results following their breast biopsy or FNA; (e) be able to read, write, and understand English; and (f) provide written informed consent for participation.

Using these criteria, 143 women were identified as study eligible during an 11-month period between December, 1996 and November, 1997. Of these, 129 (90%) provided written informed consent for study participation. Of the 14 women who declined study participation, most cited being 'too busy' or 'too stressed' as the reason. Seven women who consented to study participation were subsequently diagnosed with a breast malignancy and were thus ineligible for further study participation. Additionally, three women

failed to complete the initial telephone interview at all and five women did not complete the initial telephone interview within 50 days of their breast biopsy or FNA. These eight women were also dropped from the study. The final study sample, therefore, consisted of 114 women who completed the initial telephone interview within 50 days of study entry (84% of all study eligible women and 93% of eligible women consenting to participate). These women were a mean of 43.8 years of age (SD = 14.0; range = 19–84 years) at the time of the initial interview. They completed the initial telephone interview a mean of 21 days following their breast biopsy or FNA (SD = 9.9; range = 2–47). The majority of women in the study sample underwent a breast biopsy ($n = 70$; 61%), while the remainder underwent an FNA ($n = 37$; 33%) or underwent an FNA followed by breast biopsy ($n = 7$, 6%).

The majority of the study sample was Caucasian ($n = 96$; 84%). The remainder of the sample identified their race as either African American ($n = 15$; 13%) or 'other' ($n = 3$; 3%). The mean number of years of education completed was 13.7 (SD = 2.9; range = 6–20 years). Marital status was as follows: single, never married ($n = 13$; 11%), divorced or separated ($n = 17$; 15%), married ($n = 76$; 67%), widowed ($n = 5$; 4%), or cohabitating ($n = 3$; 3%). Annual household income was as follows: < $20,000 ($n = 43$; 38%), $20,000–$40,000 ($n = 22$; 19%), $40,000–$60,000 ($n = 18$; 26%), and > $60,000 ($n = 27$; 24%). Four women (3%) did not provide information regarding annual income. Health or medical insurance coverage was as follows: Medicare/Medicaid ($n = 22$; 19%); private third party insurance ($n = 28$, 25%); HMO or PPO ($n = 50$; 44%); no health or medical insurance ($n = 14$, 12%).

Twenty-three women (20%) had at least one first degree biological relative (FDR) with a history of breast cancer ($n = 19$ with one FDR and $n = 4$ with 2 FDR's). Mean relative risk for breast cancer [32] in the study sample was 3.00 (SD = 1.5; range = 1.4 to 10.1) while mean absolute lifetime risk for breast cancer [33] was 10.6% (SD = 5.0%; range = 2.7–34.2%).

Procedure

All study procedures were performed in accordance with current ethical standards for the responsible conduct of human research and were approved by the local institutional review board.

Study eligible women were identified in a consecutive series from the daily clinic roster of the University of Kentucky Comprehensive Breast Care Center. Prior to undergoing a benign breast biopsy or FNA, eligible women were introduced to the study by the physician managing her care. Women interested in study participation were then given a detailed explanation of the study by a member of the project research staff. Project research staff were not involved in the woman's medical care. Written informed consent for study participation was then obtained. Following receipt of biopsy or FNA results, women whose biopsy or FNA yielded benign findings were telephoned by a member of the project research staff and a time for the initial telephone interview scheduled. The initial telephone interview, conducted some time after the woman was notified of her biopsy results, required 20–40 minutes to complete. Additional follow-up telephone interviews were completed 4 and 8 months following a woman's biopsy or FNA procedure. Each of the follow-up interviews required 15–25 minutes to complete. Finally, 12 months following a woman's biopsy or FNA, information was abstracted from each participant's medical record including specific recommendations for clinical follow-up, actual participation in follow-up CBE or mammography, and number and nature of interval problems and clinic visits during the past 12 months following the benign biopsy or FNA procedure.

Assessment protocol

During the initial telephone interview, all women completed a set of questionnaires designed to assess: (a) demographic and breast cancer risk variables; (b) events surrounding the biopsy/FNA; (c) dispositional/personality variables; (d) general and breast cancer-specific distress; (e) current social support; (f) breast cancer-related attitudes, beliefs, and behaviors; and (g) subjective breast cancer risk. At the 4 and 8 month follow-up interviews, all women again completed portions 'd' and 'g' of the assessment protocol described above and were asked whether or not they had undergone CBE or mammography since their last study interview. If they had, they indicated where and when they had undergone these screening procedures. While all women participated in a total of three telephone interviews following receipt of their biopsy results (i.e., initial interview, 4 and 8 month follow-up interviews) the remainder of this report utilizes only the data obtained at the initial telephone interview.

Demographic and breast cancer risk variables

Demographic information obtained included current age, race, marital status, educational level, and annual household income. In addition, information regarding risk factors for breast cancer, including age at menarche, parity, prior history of breast biopsy, and number of FDR's with breast cancer, was obtained.

Events surrounding the biopsy/FNA

All women were asked how they were notified of their biopsy or FNA results (telephone, letter, in-person, nurse or MD), whether they were told anything about their personal risk for breast cancer (nothing vs. lower, the same, or higher than the typical woman), what type of medical insurance they possessed (private fee for service, HMO, public, or none) and how satisfied they were with the medical care they received during their biopsy/FNA experience. Satisfaction ratings were obtained on a 10-point Likert scale with one endpoint 'not at all satisfied' and the other endpoint 'completely satisfied'.

Dispositional variables

Specific measures included the short form of the Miller Behavioral Styles Scale (MBSS-SF; [34]), a measure of informational coping style, and the Life Orientation Test (LOT; [35]), a measure of dispositional optimism.

General and breast cancer-specific distress

These included the Profile of Mood States-short form (POMS-SF; [36]), a measure of current, general distress, the Center for Epidemiologic Studies Depression Scale (CESD; [37]), a measure of current depressive symptoms, and the Impact of Events Scale (IES; [38]), a measure of current intrusive ideation and avoidance regarding a specified stressor. In the present study, women were asked to respond to the IES with regard to the stressor 'the possibility that you will develop breast cancer in your lifetime'. As such, the IES served as a measure of breast-cancer specific distress.

Current social support

Women completed the Duke-UNC Functional Social Support questionnaire (DUKE-SSQ; [39]), a measure of affective social support.

Breast cancer-related attitudes and beliefs

Information regarding breast cancer-related attitudes and beliefs was obtained from all women. Women were queried regarding their confidence in their ability to practice BSE correctly (four response options ranging from 'not at all' to 'definitely'), anxiety experienced while performing BSE (four response options ranging from 'none' to 'definite'), and anxiety about the results of future mammograms (four response options ranging from 'not at all' to 'a lot') and whether they would like to be taught how to better perform BSE (yes vs. no). Additional questions used in previous research included whether a woman could have breast cancer without having symptoms or feeling ill (yes vs. no), whether mammograms can find breast cancer early, and whether breast cancer can be cured if found early (four response options for both items ranging from strongly disagree to strongly agree) [40, 41].

Subjective breast cancer risk

Two subjective estimates of lifetime risk for breast cancer were obtained. Women provided an estimate of perceived personal lifetime risk for breast cancer by providing a percentage between 0 and 100% in response to the question 'What are the chances that you will develop breast cancer some day?' (personal BC risk). Second, women provided an estimate of typical lifetime risk for breast cancer by providing a percentage between 0 and 100% in response to the question 'What are the chances that the average woman your age will develop breast cancer some day?' (typical BC risk).

Objective breast cancer risk

Two objective estimates of lifetime risk for breast cancer were computed. For each woman, information regarding age, age at menarche, parity, prior history of breast biopsy (none in all cases here), and number of FDR's with breast cancer was obtained. Using established algorithms, this information was used to estimate both relative [32] and lifetime [33] risk for breast cancer.

Categorization of adherence/nonadherence with follow-up recommendations

Each woman's adherence with clinical recommendations for follow-up CBE was classified into one of three categories: adherent, nonadherent, or not applicable. Adherence with recommendations for follow-up mammography was also classified as adherent, nonadherent or not applicable. The 'not applicable' category was used when no evidence of recommendations for

follow-up CBE or mammography was found in the woman's medical record. Otherwise, a woman was categorized as either 'adherent' or 'nonadherent' with follow-up recommendations based upon comparison of recommendations for follow-up CBE or mammography found in her medical record to evidence of participation in CBE or mammography during the 12 months following benign biopsy or FNA, also found in her medical record. Specifically, if a recommendation for mammography was found in the medical record, a woman was categorized as adherent with mammography recommendations if the medical record also contained evidence of participation in mammography during the 12 months following benign biopsy or FNA. If a recommendation for mammography was found in the medical record, but her medical record contained no evidence of participation in follow-up mammography during the ensuing 12 months, a woman was tentatively categorized as nonadherent. For women tentatively categorized as nonadherent, responses to questions from the 4 and 8 month follow-up telephone interviews regarding recent participation in mammography were examined. If a woman reported during the follow-up interviews that she had not participated in follow-up mammography since her biopsy or FNA procedure she received a final categorization as nonadherent. Otherwise, if the woman indicated during the follow-up telephone interviews that she had recently participated in follow-up mammography, either at the University of Kentucky Comprehensive Breast Care Center or at a different clinic facility, she automatically received a final categorization of adherent with follow-up mammography recommendations. For women receiving a recommendation for follow-up CBE, identical procedures were employed to categorize them as either adherent or nonadherent with follow-up CBE recommendations. Based upon these separate classifications of adherence with recommendations for mammography and CBE, an overall classification of adherent or nonadherent with follow-up recommendations was then made. Women classified as nonadherent with either CBE or mammography recommendations (or both) were classified as nonadherent. All remaining women were classified as adherent.

Concordance between women's self-reports of participation in CBE and mammography following the biopsy or FNA procedure and actual clinic records was quite high. With regard to CBE, women's self reports obtained during the 4 and 8 month follow-up interviews were in complete agreement with clinic records for 95% of women. For only four women, self report of participation in CBE was not supported by documentation in her medical record. All of these women indicated that they had undergone CBE at another clinic facility (these women were categorized as adherent; see above). With regard to mammography, women's self reports were also in complete agreement with clinic records for 95% of women. No woman reported participation in mammography which was not documented in the medical record. However, three women failed to report participation in follow-up mammography which was documented in their clinic record (these women were categorized as adherent; see above). Finally, it should be noted that several ($n=3$) women who were classified as adherent with follow-up recommendations participated in CBE or mammography but not during the clinically recommended time frame. Specifically, several women given recommendations for follow-up CBE and mammography in 6 months actually underwent follow-up 8–10 months following their benign biopsy or FNA. Rather than classifying these women as nonadherent, these three women were given the benefit of the doubt and were classified as adherent.

Statistical analyses

Total scores were computed for the LOT, POMS, CESD, IES, and DUKE-SSQ using standard scoring procedures. Subscale scores on the POMS and the MBSS-SF were also computed using standard scoring procedures. Univariate differences between women categorized as adherent or nonadherent with clinical follow-up recommendations were analyzed using *t*-test analyses for continuous and by chi-square analyses for categorical variables. All chi-square analyses employed Yates correction for continuity. Multivariate differences between adherent and nonadherent women were analyzed using logistic regression. To facilitate interpretation of the resulting odds ratios, all continuous predictor variables representing measures of either distress or social support (i.e., POMS-total, IES-total, CESD, DUKE-SSQ) were dichotomized at the 75th percentile of the distribution of scores in the present sample. An alpha value of 0.05 was employed as the criterion for statistical significance in all analyses.

Results

Women were notified of the results of their biopsy/FNA procedure in several different ways. Most

women reported they were notified of their results by the surgeon who performed the procedure either face-to-face (46% of sample) or over the telephone (23%). Other women reported they were notified of their results by the breast center nurse coordinator either face-to-face (2%) or over the telephone (26%). The remaining 3% of the sample reported that they received notification of their biopsy results via a letter from either their surgeon or the breast center nurse coordinator. Most women (89%) reported that at the time they were notified of their biopsy results, no additional information or discussion was provided regarding their personal risk for breast cancer. The remaining women reported that they were told that their personal risk for breast cancer was 'higher than average' (7%), 'average' (2%), or 'lower than average' (2%). In general, women were quite satisfied with the care they received before, during, and after their breast biopsy procedure. The mean satisfaction score was 9.1 (SD = 1.7; range 2–10) with nearly two-thirds of the sample ($n = 75$; 66%) reporting the maximum score of 10. Only six women (5%) reported a satisfaction score ≤ 5.

Types of follow-up recommendations and prevalence of adherence/nonadherence

Among the 114 women in the study sample, 11 women (10%) were not given any specific recommendation for clinic follow-up. Rather, they were instructed to continue monthly practice of BSE and to call the breast center if any problems developed. All of these women were under the age of 40 years and most had received a biopsy result indicating a fibroadenoma or an intraductal papilloma. The remaining 103 women (90%) were given some recommendation for clinical follow-up, but the specific nature of this recommendation varied. In general, clinic follow-up recommendations were of two types: recommendations for CBE alone ($n = 31$) or recommendations for both CBE and mammography ($n = 72$) (see Table 1). Of the 72 women advised to return for both CBE and mammography, 63 women (88% of women with recommendations for CBE and mammography) were asked to return in 6 months for both CBE and mammography. Seven women were asked to return for both CBE and mammography in either 3 months ($n = 5$; 7%), 4 months ($n = 1$; 1%) or 12 months (n=1; 1%). Finally, two women (3%) were given recommendations for CBE within 2 or 3 months followed by mammography in 9 or 6 months, respectively. Of the 31 women advised to return for CBE alone, 18 (58% of women with recommendations for CBE alone) were asked to return in 3 months. Of the remaining 13 women who received recommendations for CBE alone, five (16%) were asked to return for CBE in 6 months while eight women (26%) were asked to return for CBE in a specific time period ranging from 3 weeks to 2 months.

Table 1 shows the percentage of women who were categorized as adherent or nonadherent as a function of type of follow-up recommendation provided. Of the 103 women given some recommendation for clinical follow-up, 66% ($n = 68$) were categorized as adherent with their follow-up recommendations. The remaining 34% ($n = 35$) were classified as nonadherent with follow-up recommendations. These two groups served as our criterion groups of adherent and nonadherent study participants in subsequent analyses.

Univariate prediction of nonadherence with clinical follow-up recommendations

To identify univariate predictors of nonadherence with clinical follow-up recommendations a series of *t*-tests comparing the adherent ($n = 68$) and nonadherent ($n = 35$) groups were performed. Dependent variables included age, number of years of education, and satisfaction with medical care provided at the time of biopsy/FNA, as well as a variety of psychosocial, dispositional, and breast cancer risk variables assessed during the initial interview. Specific psychosocial variables employed as dependent variables in the analyses included current depressive symptoms (CESD total score), current mood disturbance (POMS total and subscale scores), breast cancer-related intrusive ideation and avoidance (IES total and subscale scores), BC-specific anxiety (BC-WORRY), and social support (DUKE-UNC total score). Dispositional variables included optimism (LOT) and monitor and blunter subscale scores from the MBSS-SF. BC risk variables included both objective (lifetime BC risk, relative risk) and subjective estimates (BC risk-personal, BC risk-typical). Results of these *t*-test analyses are shown in Table 2. In these univariate analyses, women categorized as nonadherent with follow-up recommendations were younger ($t = 4.78$; $p < 0.001$) and reported more depressive symptoms (CESD)($t = 4.78$; $p < 0.05$), greater overall mood disturbance (POMS-total)($t = 2.41$; $p < 0.05$), greater depression ($t = 2.82$; $p < 0.01$), anger ($t = 2.34$; $p < 0.05$), and confusion ($t = 2.20$; $p < 0.05$) on the POMS, and higher BC-WORRY scores ($t = 2.40$;

Table 1. Adherence/nonadherence with clinic follow-up recommendations as a function of type of recommendation(s)

Type of follow-up recommendation(s)	Total no	No of adherent[a] (%)	No of nonadherent[a] (%)
No clinic follow-up; continue BSE	11	–	–
Clinic follow-up: CBE only	31	13 (42)	18 (58)
Mammography only	0	–	–
Clinic follow-up: mammography +CBE	72	57 (76)	17 (24)[b]
Any clinic follow-up recommended[c]	103	68 (66)	35 (34)

Note: $n = 114$ in entire study sample.
[a]Number in parentheses indicates percentage of women in that category row adherent or nonadherent.
[b]Includes one woman who was adherent with recommendation for mammography but was nonadherent with recommendation for CBE.
[c]Includes women given recommendations for CBE only ($n = 31$) or Mammography + CBE ($n = 72$).

Table 2. *T*-test comparison of women adherent ($n = 68$) or nonadherent ($n = 35$) with recommendations for clinical follow-up

Variable	Adherent		Nonadherent		*p*-value[a]
	Mean	SD	Mean	SD	
Age	49.6	12.5	37.3	12.0	0.001***
No of Years education	13.9	3.0	12.9	2.8	0.130
CESD-total	10.1	9.5	15.6	13.3	0.016*
POMS scores					
Total	40.3	23.6	53.5	31.2	0.018*
Depression	4.2	5.4	8.1	8.3	0.006**
Tension	7.7	6.0	10.2	6.9	0.058
Confusion	4.2	4.1	6.2	4.7	0.030*
Anger	5.1	5.7	8.2	7.3	0.021*
Fatigue	7.8	5.5	9.1	5.8	0.245
Vigor	12.8	6.0	12.3	5.2	0.682
IES scores					
Total	15.5	14.6	25.7	17.4	0.002**
Avoidance	8.7	8.6	14.8	9.5	0.001***
Intrusion	6.9	7.5	11.0	9.3	0.017*
BC-WORRY	1.1	1.0	1.7	1.4	0.018*
LOT-optimism	30.2	4.3	30.4	5.4	0.843
MBSS-SF-monitor	4.9	1.7	5.3	1.5	0.213
MBSS-SF-blunter	2.9	1.4	3.1	1.3	0.536
SS-DUKE-UNC	33.9	5.6	31.9	6.6	0.124
Satisfaction with care	9.3	1.4	8.7	2.1	0.115
BC-risk estimates					
Objective lifetime risk	9.4	4.7	12.0	5.5	0.014*
Relative risk	2.9	1.5	3.3	1.8	0.266
BC risk-personal	28.1	23.1	42.8	27.9	0.006**
BC risk-typical	34.8	19.7	38.7	21.7	0.368

[a]Probability associated with *t*-value from independent samples *t*-test; two-tailed test of significance.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

$p < 0.05$). Women categorized as nonadherent also reported more BC-related avoidance and intrusive ideation, as evidenced by higher total scores ($t = 3.15$; $p < 0.01$) on the IES as well as higher scores on the IES intrusion ($t = 2.42$; $p < 0.05$) and avoidance ($t = 3.30$; $p < 0.001$) subscales. Finally, nonadherent women evidenced both a greater objective lifetime risk for BC [33], as calculated from specific breast cancer risk factor information provided by each woman ($t = 2.50$; $p < 0.05$), and reported a higher subjective estimate of lifetime risk for BC (BC risk-personal) ($t = 2.83$; $p < 0.01$).

Differences between the adherent and nonadherent groups on categorical variables were examined in a set of chi-square analyses. Dependent variables included race (Caucasian vs. non-Caucasian) annual household income (< $20K, $20-50K, > $50K), whether the woman had a spouse or regular partner (yes vs. no), medical insurance coverage (any vs. none), type of diagnostic procedure performed (biopsy vs. FNA), how the woman had been notified of diagnostic test results (telephone/letter vs. in-person), the specific type of follow-up recommendation given (CBE alone vs. CBE plus mammography), whether the woman had a FDR with a history of BC (yes vs. no), anxiety during BSE performance (none/little vs. some/definite), confidence in BSE performance (none/little vs. fair/definite), anxiety over future mammograms (none/little vs. some/lot), and belief that mammography can accurately detect BC (agree vs. disagree). Results of these analyses are shown in Table 3. Significant differences between the adherent and nonadherent groups were evident with regard to annual household income (X^2 (2) = 11.45; $p < 0.01$), type of follow-up recommendation given (X^2 (1) = 9.98; $p < 0.01$), confidence in the ability to perform BSE correctly (X^2(1) = 9.67; $p < 0.01$), and beliefs in the ability of mammography to detect breast cancer early (X^2 (1) = 4.78; $p < 0.05$). Specifically, women with lower annual household incomes, greater confidence in their ability to perform BSE correctly, less confidence in the ability of mammography to detect breast cancer early, and recommendations for follow-up CBE only were less likely to adhere to recommendations for clinical follow-up.

Multivariate prediction of nonadherence with clinical follow-up recommendations

A logistic regression analysis was performed in order to identify multivariate predictors of nonadherence with clinical follow-up recommendations. Variables were eligible for inclusion in an initial logistic regression model if their associated p-value in the univariate analyses (Tables 2 and 3) was ≤ 0.15. The entire set of eligible variables was initially entered simultaneously as a single block. Individual variables were then removed in a stepwise fashion in order to arrive at an optimal regression model. Criteria for removal from the model was set at 0.05. Individual variables included in the original model were age (< 50 years vs. $\geq$ 50 years), income (< $20K vs. > $20K), education ($\leq$ 12 years of education vs. > 12 years) confidence in the ability to perform BSE correctly (none/little vs. fair/definite), belief in the ability of mammography to detect breast cancer early (strongly/somewhat agree vs. strongly/somewhat disagree), type of diagnostic procedure performed (biopsy vs. FNA), type of follow-up recommended (CBE vs. CBE plus mammography), worry about breast cancer (not at all/rarely/sometimes vs. often/all of the time), perceptions of personal lifetime BC risk (< 50% vs. $\geq$ 50%), and objective lifetime BC risk (< 12.5% vs. $\geq$ 12.5%). Total scores on the POMS and IES were dichotomized at the 75th percentile (i.e., 25% most distressed women vs. 75% least distressed), while total scores on the DUKE-SSQ were dichotomized at the 25th percentile (i.e., 25% with least social support vs. 75% with most social support). Finally, ratings of satisfaction with biopsy/FNA care were dichotomized at the 25th percentile (25% least satisfied vs. 75% most satisfied).

Results of the logistic regression analysis are shown in Table 4. The entire 15-variable model was able to significantly predict whether or not women were nonadherent with recommendations for clinical follow-up (model X^2 (15) = 51.90; $p < 0.0001$). The 15-variable model resulted in accurate classification of 82.7% of the sample (88.9% of adherent women and 71.4% of nonadherent women). Significant variables in the 15-variable model included confidence in the ability to perform BSE correctly (odds ratio = 2.82; $p < 0.05$), age (odds ratio = 0.1386; $p < 0.05$), and type of follow-up recommendation given (odds ratio = 11.38; $p < 0.05$). Perception of personal lifetime BC risk was marginally significant (odds ratio = 3.5; $p < 0.07$). Specifically, risk for nonadherence with clinical follow-up recommendations was higher in women who professed confidence in their ability to perform BSE correctly, who indicated their personal lifetime risk for BC equaled or exceeded 50%, who were given follow-up recommendations that

Table 3. Chi-square comparison of women adherent ($n = 68$) or nonadherent ($n = 35$) with recommendations for clinical follow-up

Variable	Adherent		Nonadherent		p-value[a]
	No	Percentage	No	Percentage	
Annual household income					0.003**
< $20K	20	49	21	51	
$20–50K	19	66	10	34	
> $50K	27	87	4	13	
Current spouse/partner					0.182
Yes	50	70	21	30	
No	18	56	14	44	
Medical insurance coverage					0.536
Any	61	67	30	33	
None	7	58	5	42	
Race					0.265
Non-Caucasian	9	53	8	47	
Caucasian	59	69	27	31	
Type of diagnostic procedure[b]					0.076
Biopsy	50	72	19	28	
FNA	18	53	16	47	
Type of follow-up recommendation					0.001***
CBE only	13	42	18	58	
CBE + mammography	55	76	17	24	
Test result notification					1.00
Telephone/letter	37	67	18	33	
In-person	31	66	16	34	
FDR With BC					0.27
Yes	13	59	9	41	
No	55	68	26	32	
Anxiety during BSE					1.00
None/little	48	65	26	35	
Some/definite	14	67	7	33	
Confidence in BSE					0.002**
None/little	27	90	3	10	
Fair/definite	40	56	32	44	
Anxiety over future mammograms					1.00
None/little	33	66	17	34	
Some/a lot	35	66	18	34	
Mammography can detect BC					0.029*
Strongly/somewhat agree	67	69	30	31	
Strongly/somewhat disagree	1	16	5	84	

[a]Probability associated with X^2 statistic. All 2×2 chi-square analyses employ Yates' correction for continuity.
[b]Women receiving both biopsy and FNA procedures ($n = 7$) classified in the biopsy group.
*$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$.

Table 4. Logistic regression analysis of nonadherence with clinical follow-up recommendations

Variable	Entire model			Best-fit model		
	OR[a]	95% CI[b]	*p*-value[c]	OR	95% CI	*p*-value
Age	0.14	0.02–0.90	0.04	0.18	0.04–0.79	0.023
Type of follow-up	11.38	1.01–127.73	0.05	5.95	1.79–19.74	0.003
Subjective BC risk	3.53	0.94–13.30	0.06	4.29	1.36–13.53	0.013
Confidence in BSE ability	2.83	1.18–6.80	0.02	2.46	1.22–4.98	0.012
IES-total	2.85	0.66–12.31	0.16	4.03	1.16–14.01	0.029
Income	0.42	0.09–1.93	0.27			
Education	2.04	0.47–8.78	0.34			
Type of procedure	2.53	0.26–24.27	0.42			
Satisfaction with care	0.91	0.21–3.98	0.90			
Objective BC risk	0.40	0.10–1.67	0.21			
Mammography Efficacy	7.77	0.39–156.21	0.18			
POMS-total	1.35	0.24–7.48	0.73			
CESD	0.98	0.13–7.16	0.98			
DUKE-SSQ	0.65	0.12–3.43	0.61			
BC WORRY	4.04	0.67–24.58	0.13			

[a]Odds ratio.
[b]Confidence interval.
[c]*p*-value associated with test of significance for OR.
Note: Variables coded as follows: age (<50 years (1); ≥50 years (2)); type of follow-up (CBE plus mammography (1); CBE only (2)); subjective BC risk (<50% (1); ≥50% (2)); confidence in BSE ability (none/little (1); fair/definite (2)); IES-total (<30 (1); ≥30 (2)); income (< $20K (1); ≥ $20K (2)); education (≤12 years (1); >12 years (2)); type of procedure (biopsy (1); FNA (2)); satisfaction with care (≤8 (1); >8 (2)); objective BC risk (<12.5% (1); ≥12.5% (2)); mammography efficacy (strongly/somewhat agree (1); strongly/somewhat disagree (2)); POMS-total (≤60 (1); >60 (2)); CESD (≤17 (1); >17 (2)); DUKE-SSQ (≤29 (1); >29 (2)); BC WORRY (not at all/rarely/sometimes (1); often/all the time (2)).

involved CBE only, and who were less than 50 years of age.

Stepwise removal of variables from the 15-variable model yielded a best fit model that contained five variables and allowed for significant categorization of women as adherent or nonadherent with follow-up recommendations (X^2 (5) = 41.53; $p < 0.0001$). The five-variable best fit model resulted in accurate classification of 78.6% of the sample (87.3% of adherent women and 62.9% of nonadherent women). The five variables retained in the best fit model included confidence in the ability to perform BSE correctly (OR = 2.46; $p < 0.05$), perceptions of personal lifetime BC risk (OR = 4.29; $p < 0.05$), total score on the IES (OR = 4.03; $p < 0.05$), age (OR = 0.18; $p < 0.05$), and type of follow-up recommendation given (OR = 5.95; $p < 0.01$). Specifically, risk for nonadherence with clinical follow-up recommendations was higher in women who professed confidence in their ability to perform BSE correctly, who indicated their personal lifetime risk for BC equaled or exceeded 50%, who were given follow-up recommendations that involved CBE only, who were less than 50 years of age, and who were among the 25% most distressed women on the basis of IES total scores.

Discussion

Appropriate clinical follow-up of women who have experienced a benign breast biopsy is important. While performance of the biopsy procedure itself does not directly confer additional risk, benign breast disease and a history of previous biopsy is associated with some elevated lifetime risk for BC [8–12]. While the degree of risk appears to vary as a function of histopathological features of the biopsy specimen as well as perhaps other clinical and demographic factors such as a woman's age [9], menopausal status [11], family history of breast cancer [10], or HER-2/*neu* status [42], it is not unreasonable to counsel (and expect) all women undergoing diagnostic breast biopsy to be particularly vigilant with regard to appropriate breast cancer screening [8]. Reflecting the lack of consensus in this area, women in our sample varied with regard

to specific recommendations for clinical follow-up of their benign breast biopsy. However, regardless of the nature of the specific recommendation a woman was given, we believe the fact that one third of our sample did not undergo their recommended clinical follow-up is a significant concern.

Given that nonadherence occurred in a significant proportion of our sample, the questions of 'which women' and 'why' assume critical importance. Results of our regression analyses (Table 4) suggest some answers with regard to the 'which women' question. In the present study, women classified as nonadherent with follow-up recommendations were more likely to be younger and to have received follow-up recommendations involving a return for CBE only. They were also more likely to report elevated perceptions of personal lifetime risk for BC, more confidence in their ability to perform BSE correctly, and higher levels of avoidance and intrusive ideation regarding their lifetime risk for BC at the initial interview, a mean of 3 weeks post-biopsy. In fact, using these five variables alone, we were able to correctly identify 87.3% (55/63) of the adherent women and 62.9% (22/35) of nonadherent women. Importantly, the specific type of diagnostic procedure performed (biopsy vs. FNA) was not associated with the likelihood of adherence with clinical follow-up recommendations either in the univariate (Table 3) or multivariate analyses (Table 4).

In the absence of more in-depth information, answers to the 'why' question should be viewed as speculative. Women may be less likely to adhere with recommendations for CBE follow-up alone, as opposed to recommendations for CBE plus mammography, because the absence of recommendations for concurrent mammography may diminish perceptions of the perceived importance of follow-up. Women who report greater confidence in their ability to perform BSE correctly may be less likely to adhere with follow-up recommendations because they view their effective practice of BSE as supplanting the necessity for clinical follow-up. While some anxiety can be a motivating factor with regard to performance of appropriate health protective behaviors, excessive anxiety can result in fear and avoidance of appropriate protective behavior [29, 41, 43–47]. This may account for the higher likelihood of nonadherence in women reporting more frequent avoidance and intrusive ideation regarding their risk for developing BC. A similar process may underlie our perhaps counterintuitive finding that perceptions of higher lifetime BC risk were linked to a reduced likelihood of adherence with follow-up recommendations. It is often taken for granted that a perception that one is at greater risk for a disease is likely to motivate appropriate health protective behavior. However, elevated perceptions of risk may result in fear and avoidance, particularly when it is believed that protective behaviors are not available or difficult to execute [48, 49]. Finally, younger women may be less likely to adhere with follow-up recommendations for several reasons. As breast cancer risk increases with age, younger women may perceive their risk for developing BC in the near future as minimal, thus reducing the perceived importance of participating in appropriate clinical follow-up of their biopsy. Additionally, the American Cancer Society advocates routine screening mammography for most women beginning at age 40 [50] while the National Institutes of Health does not advocate routine screening mammography until age 50 [51]. As a result, most women under the age of 40 and many women under the age of 50 are likely to have little experience with mammography and CBE. This may impact upon adherence to clinic follow-up recommendations in the biopsy setting in two ways. First, women in their 30's and 40's may perceive follow-up recommendations for CBE and/or mammography as inconsistent with these routine screening guidelines and thus less important for them. Second, the anxiety often associated with the biopsy experience [21, 23–28] may motivate women to avoid future cancer screening. This effect might be particularly likely in younger women with little established history of participation in routine breast cancer screening.

Given the importance of appropriate clinical follow-up after a benign breast biopsy, a critical question is whether and how adherence with clinical follow-up recommendations can be enhanced. Drawing upon previous research in similar settings, a variety of potential intervention options are available [18, 52–59]. These options range in cost, with cost broadly viewed in terms of effort as well as personnel and monetary expense necessary for implementation. At the low cost end of the spectrum are interventions which entail simple provision of written information. For example, in a randomized trial of women receiving abnormal mammogram results, Lerman et al., found that mailing psychoeducational materials prior to the recommended 1-year mammography follow-up resulted in an increase in the proportion of women receiving the recommended mammogram (66% adherence rate vs. 53% adherence rate in control women) [55]. At the higher cost end of the spec-

trum might be interventions which entail group or individualized counseling and education. The focus of intervention here would be management and reduction of any psychological distress associated with the biopsy experience or anticipation of future BC screening, development of appropriate perceptions of personal BC risk, and clarification of specific steps that can be taken to reduce BC risk or enhance early detection of BC. Psychoeducational interventions incorporating some or all of these or similar elements have been implemented with a variety of high risk cancer populations. These include women receiving recommendations for colposcopy follow-up after an abnormal cervical cancer screening result [18, 57], as well as women with a family history of breast cancer [52–54, 59]. While results have generally been promising, they have not been uniformly positive. Schwartz et al., found that individualized breast cancer risk counseling resulted in reduced mammography use among less-educated women, suggesting the need for careful evaluation of intervention efforts [60].

Our findings regarding characteristics of women most likely to be nonadherent can play an important role in efforts to enhance adherence with recommendations for clinical follow-up after benign breast biopsy. On the one hand, our findings suggest characteristics that could be considered in targeting intervention efforts toward women most likely to be nonadherent. This is particularly helpful in situations where resources to intervene with all women are lacking. While perfect prediction of nonadherent women is not possible at the present time, our findings could allow some narrowing of the entire pool of women undergoing benign breast biopsy by identification of those most at risk for nonadherence (or alternatively identification of those most likely to be adherent). On the other hand, our findings could be used to construct the intervention itself. Specifically, our findings suggest cognitive and affective factors or processes that may account for the failure to adhere with follow-up recommendations. For example, we might tentatively suggest that a successful intervention in the biopsy setting might include content elements designed to address the affective response to the biopsy experience, foster appropriate perceptions of BC risk, identify the limits of BSE alone as a BC screening tool, and reinforce the importance of biopsy follow-up in younger women.

To our knowledge, the present study constitutes an initial investigation into the prevalence and predictors of adherence with clinical follow-up recommendations after benign breast biopsy. Further research is clearly warranted to confirm and extend our findings. Further research in this area should also be mindful of the limitations of the present study, notably its relatively small sample size recruited from a single clinic facility, lack of specific *a priori* hypotheses, and the lack of a pre-biopsy assessment. In the present study, the initiitial study interview occurred following receipt of biopsy results. It is certainly possible that a pre-biopsy assessment might yield a different set of variables that distinguish adherent from nonadherent women. However, this does not diminish the significance of our finding that these two groups can be significantly differentiated on the basis of response to the benign biopsy experience assessed during the first month or so following notification of biopsy results.

In conclusion, despite the importance of appropriate clinical follow-up after a benign breast biopsy, we found that slightly over one-third of our sample failed to undergo recommended follow-up. While the precise reasons for this are not known at the present time, our findings regarding demographic and clinical characteristics associated with nonadherence allow some speculation in this regard. This information could be used to identify women who might be appropriate targets for interventions to increase follow-up adherence. This information could also be used to identify critical content elements to be incorporated into any intervention. While undergoing a benign breast biopsy may be alarming to many women, the experience might have salutary effects as well. Indeed, the biopsy experience might constitute a 'teachable moment' [61–63], an excellent opportunity for women to learn about effective breast cancer prevention and detection behavior, in particular, but also about appropriate cancer prevention and detection behaviors, in general.

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Symptom Structure of PTSD Following Breast Cancer

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Identification of posttraumatic stress disorder (PTSD) symptoms and diagnoses in survivors of cancer is a growing area of research, but no published data exist regarding the symptom structure of PTSD in survivors of malignant disease. Findings from investigations of the PTSD symptom structure in other trauma populations have been inconsistent and have not been concordant with the reexperiencing, avoidance/numbing, and arousal symptom clusters specified in DSM-IV. The present study employed confirmatory factor analysis to evaluate the extent to which the implied second-order factor structure of PTSD was replicated in a sample of 142 breast cancer survivors. PTSD symptoms were measured using the PTSD Checklist—Civilian Version (PCL-C). Fit indices reflected a moderate fit of the symptom structure implied by the DSM-IV. These findings provide some tentative support for the DSM-IV clustering of PTSD symptoms and for the validity of cancer-related PTSD.

KEY WORDS: PTSD; breast cancer; symptom structure; confirmatory factor analysis; PCL-C.

Identification of posttraumatic stress disorder (PTSD) symptoms (Andrykowski & Cordova, 1998; Butler, Rizzi, & Handwerger, 1996; Cordova et al., 1995; Jacobsen et al., 1998; Kazak et al., 1997; Kelly et al., 1995; Stuber, Christakis, Houskamp, & Kazak, 1996) and diagnoses (Alter et al., 1996; Andrykowski, Cordova, Studts, & Miller, 1998; Green et al., 1998; Malt &

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Tjemsland, 1999; Pelcovitz et al., 1998) in survivors of cancer is a growing area of research. Findings indicate that a minority (e.g., 5–10%) of adult cancer survivors warrant a formal diagnosis of current cancer-related PTSD; a slightly higher proportion (15–20%) meet criteria for lifetime cancer-related PTSD (Alter et al., 1996; Andrykowski & Cordova, 1998; Andrykowski et al., 1998; Cordova et al., 1995; Green et al., 1998; Jacobsen et al., 1998). Although formal diagnosis of cancer-related PTSD appears to be limited to a small minority of cancer survivors, subthreshold reports of PTSD symptoms are more common. Importantly, cancer-related PTSD symptoms have been associated with reduced quality of life, younger age, lower income, lower social support, greater exposure to previous traumatic events, and more advanced disease at diagnosis (Alter et al., 1996; Andrykowski & Cordova, 1998; Cordova et al., 1995; Green et al., 1998; Jacobsen et al., 1998). Whether these symptoms simply dissipate over time is unclear from cross-sectional studies (Andrykowski & Cordova, 1998; Cordova et al., 1995). Despite this early interest in cancer-related PTSD, no published data exist regarding the factor structure of PTSD symptoms in survivors of malignant disease. This article presents factor analytic data on the symptom structure of PTSD in a sample of women previously diagnosed with and treated for breast cancer.

Empirical evaluation of the PTSD symptom clusters is of concern because of the diagnostic approach taken by DSM-IV (and previously DSM-III-R; American Psychiatric Association [APA], 1987, 1994). According to DSM-IV, PTSD comprises 17 potential symptoms, divided into three clusters: reexperiencing the trauma, avoidance/numbing in response to trauma reminders, and hyperarousal. (The DSM-III-R diagnostic criteria included the same 17 symptoms. One symptom, physical reactivity, belonged to the "arousal" symptom cluster in DSM-III-R, but was moved to the "reexperiencing" symptom cluster in DSM-IV.) This clustering was influenced, in part, by theories of the mechanisms (i.e., reliving/intrusions, numbing/avoidance) that give rise to posttraumatic stress symptoms (Brett & Ostroff, 1985; Horowitz, 1986; Keane, 1993). The DSM-IV diagnostic approach reflects the assumption that PTSD represents a unitary construct, manifested by three distinct symptom clusters (i.e., reexperiencing, avoidance/numbing, and arousal), within each of which symptoms covary (Davidson et al., 1996; Keane, 1993). Although this assumption has been supported by clinical evidence and descriptive data, empirical evaluation of the PTSD symptom clusters continues to be an important focus of inquiry (Keane, 1993). Taylor, Kuch, Koch, Crockett, and Passey (1998) noted that "factor analytic studies of PTSD symptoms can advance our understanding of posttraumatic stress reactions because distinct factors may correspond to distinct mechanisms (Cattell, 1978)" (p. 154). If the DSM-IV PTSD symptom clusters are not supported by empirical data, the DSM-IV diagnostic approach to PTSD, and its underlying assumptions, might need to be reconsidered.

Factor-analytic evaluation of the PTSD symptom clusters is not uncommon, but findings to date have been inconsistent (Buckley, Blanchard, & Hickling, 1998; Foa, Riggs, & Gershuny, 1995; Keane, 1993; Keane, Caddell, & Taylor, 1988; King & King, 1994; King, King, Leskin, & Foy, 1995; King, Leskin, King, & Weathers, 1998; Lauterbach, Vrana, King, & King, 1997; McFall, Smith, Mackay, & Tarver, 1990; Pynoos et al., 1987; Sack, Seeley, & Clarke, 1997; Silver & Iacono, 1984; Taylor et al., 1998; Vreven, Gudanowski, King, & King, 1995; Watson, Kucala, Juba, Manifold, & Anderson, 1991). With six exceptions (Buckley et al., 1998; Foa et al., 1995; Keane, 1993; King et al., 1998; Sack et al., 1997; Taylor et al., 1998), prior studies have analyzed item pools consisting of items assessing the 17 DSM-III-R/DSM-IV PTSD symptoms as well as items assessing related symptoms, such as guilt, depression, suicidal ideation, substance use, and interpersonal difficulties. These heterogeneous item pools may have included too few PTSD items from which to extract stable or "pure" PTSD factors (Taylor et al., 1998). In this light, studies that factor analyzed only the 17 DSM symptoms may provide the best context in which to further evaluate the DSM-IV PTSD symptom structure.

The six factor analytic studies of the 17 PTSD symptoms found mixed support for the DSM-III-R/DSM-IV symptom clusters. Foa et al. (1995) assessed PTSD symptoms in 158 female survivors of sexual or nonsexual assault. Exploratory factor analysis (EFA) yielded three factors that only partially replicated the DSM-III-R clustering: arousal/avoidance, numbing, and intrusion. Keane's (1993) EFA results from a study of 68 Vietnam veterans were also discordant with the DSM-III-R PTSD symptom clusters, yielding four factors (arousal, numbing, and two mixed factors), including only 11 of the 17 potential symptoms. In a study of 194 adolescent Khmer refugees (Sack et al., 1997), EFA resulted in a four-factor solution: arousal, avoidance, intrusion, and numbing. Confirmatory factor analysis (CFA) replicated this factor structure in parents of the sample (Sack et al., 1997). Taylor et al. (1998) assessed victims of motor vehicle accidents (MVAs; $n = 103$) and United Nations peacekeepers in Bosnia ($n = 419$). Separate EFAs for the two samples both yielded two factors, labeled intrusions/avoidance and hyperarousal/numbing. Hierarchical analyses revealed that these two lower-order factors loaded on a single higher-order factor, conceptualized as the umbrella factor of PTSD. Using CFA, Buckley et al. (1998) replicated this two-factor model in a sample of 217 MVA survivors. Finally, using CFA, King and colleagues (1998) concluded that a four-factor, first-order solution (reexperiencing, effortful avoidance, emotional numbing, and hyperarousal) was the best fit to PTSD data from 524 male combat veterans.

In sum, previous attempts to validate the DSM PTSD symptom structure have yielded disparate findings. It has been noted that item variances and the underlying factor structure may vary across trauma populations (Foa et al., 1995). In this light, the heterogeneous results of the studies described above may be attributed, in part, to differences in the characteristics of both the study samples and the stressors they experienced. In these six studies, there was considerable variation in characteristics of samples (e.g., age, gender) and stressors (e.g., type,

duration, time since, age at occurrence). For example, samples ranged in gender from all male (Keane, 1993; King et al., 1998) to all female (Foa et al., 1995) to mixed (Buckley et al., 1998; Sack et al., 1997; Taylor et al., 1998), and varied in age from adolescents and young adults (Sack et al., 1997) to middle-age and older adults (King et al., 1998). Stressors ranged in type and duration from acute assault (Foa et al., 1995) and MVA (Buckley et al., 1998; Taylor et al., 1998) to chronic exposure to combat (Keane, 1993; King et al., 1998) and war atrocities (Sack et al., 1997). Whereas some participants were assessed for PTSD within 3 months of the stressor (Foa et al., 1995), others were assessed decades after trauma exposure (King et al., 1998). In constrast, participants in the present study were all women and were predominantly middle age. All experienced a stressor (i.e., diagnosis and treatment of breast cancer), though by no means uniform, that is generally seen as chronic, and were assessed, on average, 3 years following completion of treatment.

In addition to being influenced by differences in study samples and stressors, findings may vary due to differences in factor analytic approach. It is notable that three of the studies reviewed above used EFA (Foa et al., 1995; Keane, 1993; Taylor et al., 1998), rather than CFA, to identify the PTSD factor structure in their respective samples. EFA is used to identify the underlying dimensions of a measure when there are no a priori expectations about its structure based on theory or prior research (Floyd & Widaman, 1995). CFA explicitly tests the fit of a hypothesized factor structure with the observed covariance structure of the data (Floyd & Widaman, 1995). Although EFA is not necessarily inappropriate for assessing the PTSD symptom structure, CFA is a more powerful and direct method of testing a hypothesized factor structure, such as that of PTSD implied by DSM-IV (for background on factor analytic methods, see Byrne, 1994; Floyd & Widaman, 1995; Hoyle, 1991, 1995; McArdle, 1996). Studies that did employ CFA did not use it to evaluate the replicability of the DSM-IV PTSD symptom clusters, but instead used it to replicate EFA results (Sack et al., 1997) or to test other hypothesized models (Buckley et al., 1998; King et al., 1998). Thus, the extent of fit (or misfit) of the DSM-IV PTSD symptom clusters to these data sets remains unclear.

Further, no data exist regarding the symptom structure of cancer-related PTSD. Such an assessment would improve understanding of the nature of cancer-related PTSD by detailing the constellation of symptoms reported by cancer survivors. Findings also would allow for comparison of the PTSD symptom structure across a broader range of trauma populations. Finally, factor analysis of the PTSD symptom structure in cancer would add to existing data on the validity of the DSM-IV PTSD clusters.

This study evaluates the extent to which the factor structure of PTSD implied by DSM-IV is replicated in a sample of survivors of malignant disease. It builds upon prior investigations in two ways. First, it extends prior evaluations of the DSM PTSD symptom structure, heretofore limited to samples of combat veterans, assault survivors, refugees, and accident victims, to a sample of women who have

completed treatment for breast cancer. Second, it employs CFA rather than EFA to evaluate the extent to which the DSM-IV PTSD symptom clusters are replicated in this population. As noted earlier, the DSM-IV PTSD diagnostic criteria reflect a multidimensional, higher-order model of PTSD, with the second-order construct of PTSD giving rise to three first-order symptom clusters. Relationships among these symptom clusters are expected to the extent that they all reflect the construct of PTSD. According to this diagnostic approach, each symptom belongs to one and only one symptom cluster and shares communality with the other symptoms in only that cluster.

This model considered, four hypotheses are proposed (see Fig. 1 for a path diagram depicting the hypothesized model). First, breast-cancer-related PTSD symptoms will be explained by three first-order factors (i.e., reexperiencing, avoidance/numbing, arousal) and one second-order factor (i.e., PTSD). Second, covariation among the three first-order factors will be explained fully by their regression on

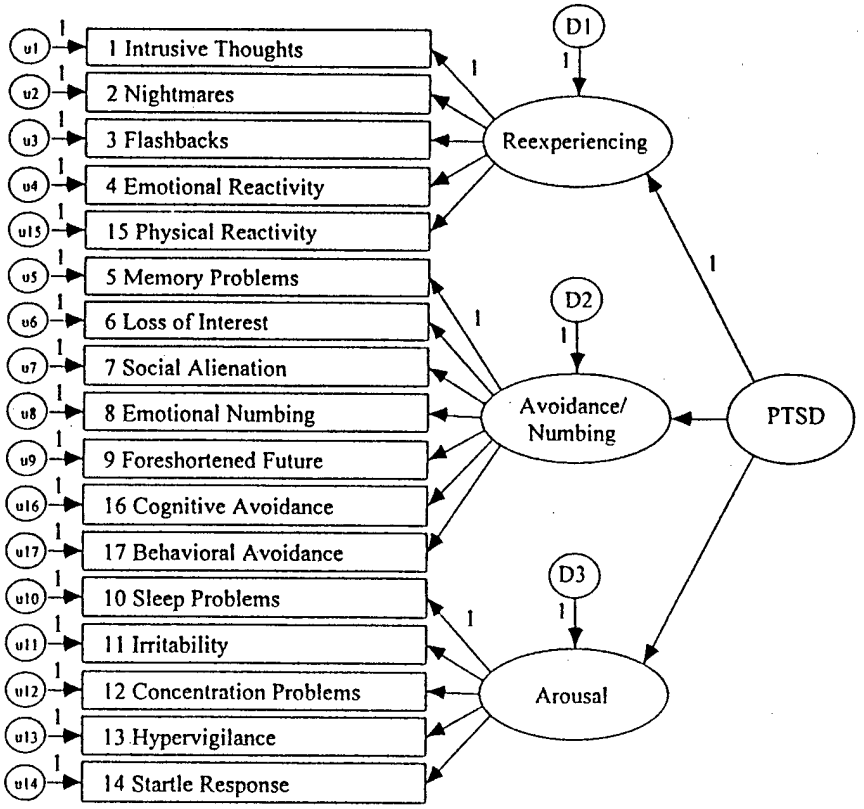

Fig. 1. Hypothesized second-order factorial structure for DSM-IV PTSD symptoms.

the second-order factor. In other words, each of the three first-order factors (i.e., symptom clusters) will load significantly onto the second-order factor (i.e., PTSD construct). Third, each of the 17 DSM-IV PTSD symptoms will have a nonzero loading on its designated first-order factor and zero loadings on the other two first-order factors. PTSD symptoms will be significantly related to the symptom cluster that they are intended to indicate and will not be significantly related to the other two symptom clusters. Finally, error terms associated with the 17 symptoms will be uncorrelated. Thus, item variances not explained by the item's loading on the intended factor will not be correlated with error variance from other items.

Method

Participants

Eligible patients were identified from program records at the Chandler Medical Center at the University of Kentucky and the H. Lee Moffitt Cancer Center at the University of South Florida. To be eligible, participants had to (a) be women older than 18 years; (b) be able to speak and understand standard English; (c) be at least 2 months posttreatment completion for breast cancer; (d) be in disease remission; (e) be, or have been, participants in a previous study of posttreatment quality of life (QOL); and (f) provide informed consent.

One-hundred forty-two women participated in the study. Over 80% of women who met study eligibility criteria consented to participate and provided data. Ninety-nine participants were drawn from the Chandler Medical Center at the University of Kentucky. These women were a mean age of 56.4 years ($SD = 10.4$, range = 35–85) and a mean of 35.6 months ($SD = 17.4$, range = 2–72) posttreatment completion at the time of assessment. Distribution of women by disease stage at diagnosis was Stage 0 ($n = 8$), Stage I ($n = 52$), Stage II ($n = 31$), Stage III ($n = 6$), and Stage IV ($n = 2$). Surgical treatments included lumpectomy ($n = 29$), modified radical mastectomy ($n = 69$), and radical mastectomy ($n = 1$). Nonhormonal adjuvant therapy was distributed as radiotherapy ($n = 24$), chemotherapy ($n = 26$), radiotherapy and chemotherapy ($n = 15$), or no therapy ($n = 34$). The majority of participants in this subsample were Caucasian (94%) and married (63%). Educational attainment was high school degree or less (28%), some college or college degree (39%), and graduate training or graduate degree (33%). Annual household incomes were <$15,000 (23%), $15,000–$30,000 (18%), $30,000–$50,000 (18%), $50,000–$80,000 (23%), and >$80,000 (18%).

Forty-three participants were drawn from the H. Lee Moffitt Cancer Center at the University of South Florida. These women were a mean age of 44.4 years ($SD = 5.6$; range = 32–57) at the time of assessment. All 43 had received an autologous blood or bone marrow transplant (BMT) for breast cancer. Disease stage at time of transplant was Stage II ($n = 13$), III ($n = 16$), and IV ($n = 14$). At the time of assessment, these participants were a mean of 19.4 months ($SD = 15.9$; range = 2–62) post-BMT. The majority of participants in this subsample were Caucasian (98%) and married (72%). Educational attainment was high school degree or less (14%), some college or college degree (65%), and graduate training or graduate degree (21%). Annual household incomes were <$20,000 (10%), $20,000–$39,999 (39%), $40,000–$59,999 (27%), and >$60,000 (24%).

Data from the two samples were combined to yield a larger sample size ($n = 142$) to test the proposed CFA model. Combining data was deemed necessary and justified given that (a) both samples experienced the "stressor" of diagnosis and treatment of breast cancer; and (b) this is the initial investigation of the symptom structure of cancer-related PTSD.

Procedure

Potential participants were contacted via a letter explaining the study. Informed consent was obtained by mail per Institutional Review Board guidelines. Patients agreeing to participate completed either a brief (approx. 30 min) telephone interview (patients from the University of Kentucky, $n = 99$) or mailed questionnaire packet (patients from the University of South Florida, $n = 43$). Both the telephone interview and the mailed packet contained demographic information and QOL measures, including a measure of posttraumatic stress symptoms.

Measures

PTSD symptoms were assessed using the PTSD Checklist—Civilian Version (PCL-C). The PCL-C was developed to assess PTSD symptoms in civilian (i.e., noncombat) populations (Weathers, Huska, & Keane, 1991; Weathers, Litz, Herman, Huska, & Keane, 1993) and has been used previously to assess PTSD symptoms in breast cancer survivors (Andrykowski & Cordova, 1998; Andrykowski et al., 1998; Cordova et al., 1995). The PCL-C consists of 17 items, each corresponding to a DSM-IV PTSD symptom. Respondents indicate how much they have been bothered by each symptom in the past month, using a 5-point Likert scale, from 1 (*not at all*) to 5 (*extremely*). The PCL-C yields a total score and subscale scores for each of the three DSM-IV PTSD symptom clusters: reexperiencing, avoidance/numbing, and arousal (Weathers et al., 1991, 1993). Participants were asked to consider their experience with "being diagnosed with and treated for breast cancer" in completing the PCL-C (cf. Andrykowski & Cordova, 1998; Andrykowski et al., 1998; Cordova et al., 1995).

Two sets of criteria were used to identify respondents likely to merit a formal diagnosis of cancer-related PTSD (Weathers et al., 1991, 1993). The cutoff method uses a total score of 50 or more to identify individuals likely to merit formal diagnosis of PTSD. The symptom method defines ratings of 3 (*moderately*).

4 (*quite a bit*), or 5 (*extremely*) as endorsement of a particular symptom. Following DSM-IV criteria, individuals are considered likely candidates for a diagnosis of PTSD if they endorse one or more reexperiencing symptoms, three or more avoidance and/or numbing symptoms, and two or more arousal symptoms.

In a sample of 123 Vietnam veterans, the PCL-C demonstrated a coefficient alpha of .97, a test–retest reliability of .96, and convergent validity with other PTSD symptom scales, such as the Mississippi Scale (.93) and the MMPI-2 PK Scale (.77; Weathers et al., 1993). Using the cutoff-score method, researchers have shown the PCL-C to have a diagnostic sensitivity and specificity of .82 and .83, respectively, in a sample of combat veterans (Weathers et al., 1991, 1993), .78 and .86 in a combined sample of MVA and sexual assault victims (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996), and .60 and .99 in a sample of breast cancer survivors (Andrykowski et al., 1998).

Analysis of Data

PTSD symptom factor structure tests were based on analysis of covariance structures within the CFA model framework (see Fig. 1) using the EQS program (Bentler, 1992a). First, the second-order factor model was tested. Second, the χ^2 difference test for nested models was conducted to compare the second-order factor model with a first-order, single-factor model. Third, we employed the Lagrange Multiplier (LM) test to identify parameters that might contribute to a significantly better-fitting model. Because post hoc modifications may capitalize on chance (Anderson & Gerbing, 1988; MacCallum, Roznowski, & Necowitz, 1992), only parameters deemed theoretically and psychometrically reasonable were included in model respecification.

Multiple criteria were used to assess model fit (Hoyle & Panter, 1995): (a) χ^2 likelihood ratio statistic; (b) Satorra-Bentler chi-square (S-B χ^2; Satorra & Bentler, 1988); (c) Comparative Fit Index (CFI; Bentler, 1990); (d) Tucker–Lewis Index (TLI; Bollen, 1989); and (e) Root Mean Square Error of Approximation (RMSEA; Steiger, 1990). The S-B χ^2 incorporates a scaling correction for the χ^2 statistic when distributional assumptions are violated (e.g., multivariate kurtosis) and is recommended for nonnormal multivariate data (Bentler, 1992a; Hu, Bentler, & Kano, 1992). The CFI, a revised version of the normed-fit index (Bentler & Bonett, 1980) that adjusts for degrees of freedom, is derived from comparison of the specified model with a null or independence model in which no relationships between variables exist. The CFI ranges from 0 (*poor fit*) to 1 (*perfect fit*): a value >.90 indicates a psychometrically acceptable fit to the data (Bentler, 1992b; Bentler & Bonett, 1980). The corrected or robust CFI (CFI*), computed from the S-B χ^2 statistic for the null model, also is reported. Also known as the Bentler–Bonett nonnormed fit index (Bentler & Bonett, 1980), the TLI typically ranges from 0 to 1; values close to 1 indicate a very good fit (Bollen, 1989; Tucker & Lewis, 1973). RMSEA is an indicator of the amount of discrepancy per degree of freedom for the model. Values less than .05 indicate close model-data fit; a value of .08 or less indicates reasonable fit (Browne & Cudeck, 1993).

Results

Descriptive Statistics, Reliability, and Prevalence

Participants from the University of South Florida ($M = 44.4$ years, $SD = 5.6$) were younger than participants from the University of Kentucky ($M = 56.4$ years, $SD = 10.4$), $t(140) = -7.12$, $p < .05$. University of South Florida participants also had higher mean scores for the PCL-C total score (33.2 vs. 28.2; $t(140) = 2.15$, $p < .05$), Reexperiencing subscale score (9.6 vs. 8.1; $t(140) = 2.07$, $p < .05$), and Avoidance/Numbing subscale score (13.9 vs. 11.2; $t(140) = 2.61$, $p < .05$); arousal subscale scores were not significantly different (9.7 vs. 8.9, $p > ns$).[6]

Combined sample means for the PCL-C total and subscale scores for Reexperiencing, Avoidance/Numbing, and Arousal were 29.7 ($SD = 13.0$; range = 17–81), 8.5 ($SD = 4.1$; range = 5–25), 12.0 ($SD = 5.7$; range = 7–35), and 9.2 ($SD = 4.5$; range = 5–25), respectively. Coefficient alphas for the PCL-C total score and subscale scores for Reexperiencing, Avoidance/Numbing, and Arousal were .93, .86, .85, and .81, respectively. The mean number of PCL-C items endorsed (a rating of "moderately" or greater; Weathers et al., 1991) was 3.5 ($SD = 4.1$, range = 0–16). Of respondents, 72% endorsed at least one PCL-C item; 24% endorsed at least 6 items.

On the basis of the cutoff method (i.e., PCL-C total score >50), 12 participants (8.5%) were identified as likely to merit a formal PTSD diagnosis. On the basis of the "symptom" method (i.e., ≥1 reexperiencing symptom, ≥3 avoidance/numbing symptoms, and ≥2 arousal symptoms), 18 participants (12.7%) were identified as "positive" for current PTSD. An additional 18 participants (12.7%) would likely meet criteria for "partial PTSD" (Carlier & Gersons, 1995), as evidenced by meeting criteria for two of the three symptom clusters on the PCL-C.

[6]Multigroup CFA (Byrne, Shavelson, & Muthen, 1989) was conducted to test the equivalence of the covariance matrices produced by the two subgroups (i.e., participants from the University of Kentucky vs. participants from the University of South Florida). Results from the second-order factor model showed that 13 of the 14 first-order paths tested were invariant across groups. (Only 14 of the 17 first-order path coefficients can be tested for invariance because one loading per variable must be constrained to one for purposes of statistical identification.) Additionally, all three of the second-order paths tested were invariant across groups. These results suggest the equivalence of the two covariance matrices. On this basis, we combined data for the two subgroups for remaining analyses. Complete information regarding the results of the multigroup CFA is available from the authors. We thank an anonymous reviewer for suggesting these analyses.

Table 1. Descriptive Statistics and Zero-Order Correlations Among PCL-C Items ($N = 142$)

PCL Item	*M*	*SD*	Skew	Kurtosis	PCL Item 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	2.04	1.09	1.10	0.65																
2	1.32	0.87	2.94	7.97	.56															
3	1.59	0.98	1.74	2.43	.55	.56														
4	2.04	1.15	1.12	0.52	.62	.51	.62													
5	1.59	1.05	1.77	2.19	.25	.29	.15	.20												
6	1.73	1.20	1.48	0.79	.54	.47	.41	.62	.37											
7	1.62	1.03	1.61	1.53	.51	.42	.45	.61	.30	.73										
8	1.36	0.89	2.67	6.49	.34	.37	.40	.48	.32	.46	.62									
9	2.26	1.28	0.68	−0.72	.40	.43	.47	.50	.30	.51	.51	.49								
10	2.11	1.40	0.95	−0.55	.40	.34	.44	.43	.17	.52	.46	.44	.48							
11	1.78	1.06	1.43	1.32	.43	.41	.40	.56	.24	.51	.63	.59	.48	.49						
12	1.76	1.10	1.37	0.92	.40	.44	.41	.55	.27	.53	.58	.60	.52	.58	.64					
13	1.84	1.18	1.19	0.25	.32	.25	.39	.41	.07	.26	.24	.27	.26	.33	.36	.38				
14	1.68	1.21	1.77	1.96	.47	.52	.57	.50	.23	.50	.42	.41	.43	.49	.42	.64	.37			
15	1.54	1.02	2.11	3.90	.53	.54	.53	.62	.31	.51	.55	.43	.45	.47	.48	.65	.34	.50		
16	1.87	1.25	1.24	0.37	.37	.28	.39	.49	.32	.49	.53	.36	.33	.41	.37	.44	.30	.40	.61	
17	1.57	1.07	1.90	2.62	.46	.36	.50	.51	.31	.56	.54	.52	.45	.45	.58	.59	.28	.49	.60	.69

Note. Item numbers refer to items depicted in Fig. 1; $r \geq .17$, $p < .05$; $r \geq .23$, $p < .01$; $r \geq .29$, $p < .001$.

Model Testing

Descriptive statistics and zero-order correlations for PCL-C items are shown in Table 1. A test of the multivariate normality assumption revealed significant multivariate kurtosis (Mardia's coefficient = 135.34, $p < .001$). Thus, final assessment of goodness-of-fit is based on the S-B χ^2 statistic and its related $\hat{\text{C}}\text{FI}^*$ value. Nonrobust indices of model fit also are reported.

To test the first hypothesis, the model depicted in Fig. 1 (Model A: second-order model with three first-order factors) was compared with an alternative model (Model B: first-order model with one factor) using the χ^2 difference test for nested models. Results (see Table 2) revealed that Model A fit significantly better than Model B, S-B $\chi^2(3, N = 142) = 37.1$, $p < .001$. These findings suggest that the factor structure of PTSD in this sample is better described by the three symptom clusters proposed by DSM-IV than by a single, global PTSD symptom cluster. In Model A, the equivalence of the three standardized first-order loadings on the second-order factor (Reexperiencing = .90; Avoidance/Numbing = .95; and Arousal = .93) implies the existence of the second-order PTSD construct. In support of the second hypothesis, this equivalence suggests that the covariation among the first-order factors is explained by their regression on the second-order PTSD factor. These findings are consistent with the higher-order PTSD construct that gives rise to the three clusters of symptoms.

Consistent with the third hypothesis, each symptom loaded significantly onto its proposed first-order factor (see Table 3). All factor loadings exceeded .40. LM tests revealed that model fit would not be significantly improved by altering the pattern of factor loadings or by allowing items to cross-load onto more than one first-order factor. Results indicate that individual items fit best in the factors to which they were assigned.

Table 2. Summary of Goodness-of-Fit Statistics for Comparative Models of Breast-Cancer-Related PTSD

Comparison Models	χ^2	*df*	CFI	TLI	RMSEA	S-B χ^2	CFI*	Δ from Hypothesized Model (A) S-B χ^2	*df*
A (second-order model)	251.4	116	.90	.88	.091 (.016)	169.5	.88		
B (first-order model with one factor)	305.3*	119	.86	.84	.105 (.015)	206.6*	.81	37.1	3
C (second-order model with one correlated error)	224.2*	115	.92	.90	.082 (.016)	152.3*	.92	−17.2	1

Note. CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; RMSEA = Root Mean Square Error of Approximation; S-B χ^2 = Satorra–Bentler chi-square; CFI* = Robust Comparative Fit Index.
*$p < .01$.

Table 3. Standardized Factor Loadings for Model A: CFA of DSM-IV PTSD Symptoms

Factor and Symptom	Standardized Factor Loading	Disturbance/Uniqueness
Reexperiencing	.90	.12
Intrusive thoughts	.73	.56
Nightmares	.68	.40
Flashbacks	.73	.45
Emotional reactivity	.82	.42
Physical reactivity	.78	.41
Avoidance/Numbing	.95	.06
Memory problems	.41	.92
Loss of interest	.79	.55
Social alienation	.81	.36
Emotional numbing	.69	.42
Foreshortened future	.65	.93
Cognitive avoidance	.66	.88
Behavioral avoidance	.76	.49
Arousal	.93	.10
Sleep problems	.68	1.04
Irritability	.74	.50
Concentration problems	.84	.35
Hypervigilance	.47	1.07
Startle response	.71	.71

Contrary to the fourth hypothesis, LM tests revealed that Model A could yield substantially better fit if the error terms associated with four symptom pairs were free to covary: cognitive avoidance–behavioral avoidance (LM $\chi^2 = 25.20$); physical reactivity–cognitive avoidance (LM $\chi^2 = 14.99$); physical reactivity–concentration problems (LM $\chi^2 = 12.80$); and social alienation–loss of interest (LM $\chi^2 = 11.05$). That is, these four symptom pairs shared error variance, not accounted for by their loading on their designated factor, with one another. To avoid purely statistically driven post hoc model fitting, only error covariances deemed both theoretically and statistically justified were used to respecify the model. Because prior investigations (Buckley et al., 1998; Foa et al., 1995; Keane, 1993; King et al., 1998; Sack et al., 1997, Taylor et al., 1998) have suggested that effortful avoidance may be distinct from numbing, and because the LM χ^2 statistic for the cognitive avoidance–behavioral avoidance symptom pair was distinctively larger than the others, only this correlated error term was added to the model.

Adding the correlated error term enabled us to hone the model to better fit the data. The respecified model (Table 2, Model C) was statistically superior to Model A. S-B$\chi^2(1, N = 142) = 17.2$, $p < .001$. All first- and second-order loadings remained statistically significant, and the general pattern of loadings remained highly similar. Though Model C continued to evince significant statistical misspecification. S-B$\chi^2(115, N = 142) = 152.3$, $p < .001$), alternative fit indices met or exceeded .90; RMSEA narrowly missed the .08 criterion for reasonable model fit (.082).

Discussion

This study represents the first known assessment of the PTSD symptom structure in survivors of cancer. Results provide some support for the second-order factor structure of PTSD implied by the DSM-IV diagnostic criteria. The second-order CFA model, including two correlated errors added through post hoc model respecification, evidenced good fit to the data. Although this respecified model needs to be cross-validated in other samples of cancer survivors (Floyd & Widaman, 1995), in this sample it was superior to a first-order model with a single, global PTSD factor.

These findings address concerns about the validity of cancer-related PTSD. It has been established that cancer survivors endorse cancer-related PTSD symptoms, but whether these symptoms reflect "true" PTSD has been questioned (Green et al., 1998). PTSD symptoms reported by cancer survivors may merely reflect general distress following diagnosis and treatment of malignant disease (Green, Epstein, Krupnick, & Rowland, 1997; Green et al., 1998). Such nonspecific distress could be attributed to depression, anxiety, and other adjustment difficulties following cancer (Green et al., 1997, 1998). However, if this were the case, a CFA model with a global, first-order "distress" factor would be expected to fit the data. Results showed that such a model (i.e., Model B) was a poor fit to the data and was inferior to the proposed second-order, three-factor model. Rather than reflecting generalized, nonspecific distress, cancer-related PTSD symptoms appear to be dimensionally similar to PTSD as conceptualized in DSM-IV.

Although these results provide some tentative support for the tripartite model of PTSD forwarded by DSM-IV, they do not rule out competing models. In particular, our finding of correlated errors between cognitive avoidance and behavioral avoidance symptoms suggests that these "avoidance" symptoms share variance with each other above and beyond variance they share with the "numbing" symptoms. It has been suggested that correlated residuals may indicate additional factors (Anderson & Gerbing, 1988). Several researchers have suggested that numbing and avoidance may represent separate mechanisms in PTSD and thus should not be included within a single symptom cluster (e.g., Buckley et al., 1998; Foa et al., 1995; King et al., 1998; Taylor et al., 1998). Alternative models have either identified separate numbing and avoidance factors (e.g., King et al., 1998; Sack et al., 1997), or have found that numbing and avoidance loaded separately on factors with other symptoms (e.g., Taylor et al.'s [1998] and Buckley et al.'s [1998] reexperiencing/avoidance and arousal/numbing factors and Foa et al.'s [1995] arousal/avoidance factor). The respecified model (Model C) included correlated residuals between behavioral and cognitive avoidance, which may reflect a fourth factor.[7] Because the purpose of this study was specifically to test the fit of the DSM-IV PTSD symptom clusters to data from breast cancer survivors, alternative conceptualizations, including a second-order, four-factor model that separates

[7]We thank an anonymous statistical reviewer for noting this possibility.

numbing and avoidance symptoms, were not tested. However, these findings suggest that the fit of other models to PTSD data from cancer survivors warrants attention.

Prior factor analytic studies of the 17 DSM PTSD symptoms yielded two-factor (Buckley et al., 1998; Taylor et al., 1998), three-factor (Foa et al., 1995; Sack et al., 1997), and four-factor (Keane, 1993; King et al., 1998) solutions, none of which replicated the factor structure implied by the DSM diagnostic criteria. Earlier studies used different factor analytic techniques to answer slightly different research questions, relying on both EFA and CFA to identify the PTSD symptom structure in their respective samples. Those that used CFA did not directly test the fit of the DSM symptom clusters to their data, but rather used CFA to replicate EFA results (Sack et al., 1997) or to test other models (Buckley et al., 1998; King et al., 1998). EFA is primarily an inductive procedure and does not permit strict hypothesis testing (Byrne, 1994; Hoyle, 1991; Mulaik, 1987). When no hypothesized factor structure is suggested, EFA seeks to answer the question, "What is the factor structure of this set of observed variables?" Alternatively, when theory or past empirical findings suggest a given factor structure, CFA seeks to answer the question, "To what extent does this hypothesized factor structure fit these data?" Given that the primary objective of this study was to evaluate how well the implied DSM-IV PTSD factor structure fit data from breast cancer survivors, CFA was deemed the most appropriate strategy (Byrne, 1994).

Comparison of study results is also complicated by variations in method and timing of PTSD assessment and in characteristics of the study samples. This study assessed PTSD symptoms via a self-report questionnaire completed by phone and by mail, whereas others conducted in-person, structured interviews (Buckley et al., 1998; Foa et al., 1995; Keane, 1993; King et al., 1998; Sack et al., 1997; Taylor et al., 1998) or used self-report questionnaires (Taylor et al., 1998). Women in this study were a mean of almost 3 years postcompletion of breast cancer treatment; time since trauma exposure in other studies ranged from 3 months (Foa et al., 1995) to decades (Keane, 1993). This is notable, given that the PTSD symptom structure may vary with time since trauma (Blank, 1993; Green, Lindy, & Grace, 1985). These studies also differ in the "stressor" that participants experienced and in the overall level of PTSD symptomatology reported.

This latter point is important and deserves further discussion. The level of symptom distress on the PCL-C in the present sample, and in other samples of cancer survivors, is relatively low, and may have influenced CFA results by constraining item variances. It has been estimated that 5–10% of cancer survivors warrant a formal diagnosis of current cancer-related PTSD; when the cutoff method was used, 8.5% of this sample met criteria for such a diagnosis. Thus, our analyses were conducted on data obtained from both "PTSD present" and "PTSD absent" survivors of breast cancer. Keane (1993) discussed the confusion related to who should be assessed when examining the symptom structure of PTSD. If PTSD is viewed as a dichotomous outcome (i.e., present vs. absent), by implication only

those identified as having the disorder should be included in analyses. This approach was taken by Keane (1993). On the other hand, inclusion of PTSD and non-PTSD cases would be consistent with a view of PTSD as a continuous outcome variable. Foa et al. (1995), King et al. (1998), Sack et al. (1997), Taylor et al. (1998), and Buckley et al. (1998) ascribed to this view. This issue is made more confusing by the juxtaposition of theories stressing a continuum approach (e.g., Horowitz, 1986) against the dichotomous orientation of DSM-IV (Keane, 1993). Whether the PTSD symptom structure differs depending on whether participants without PTSD are included or not remains an empirical question. Future studies may seek partial resolution of this controversy by conducting separate analyses for mixed PTSD present/PTSD absent and PTSD present subsamples, within a single trauma survivor sample.

The present study is limited by its sample size, by the combination of data from two subsamples of cancer survivors, and by the heterogeneous assessment methodology employed at the two study sites. First, the total sample size ($N = 142$) is less than optimal for testing the proposed models (Hu et al., 1992). Although 5–10 participants per variable (for this study, $N = 85–170$) are commonly used as a guideline in CFA (Floyd & Widaman, 1995), others have proposed that it is best to have 10 participants per parameter estimated (Joreskog & Sorbom, 1989).

Second, participants from the University of South Florida received BMT and were younger than participants from the University of Kentucky. University of South Florida participants had higher mean PCL-C total, reexperiencing, and avoidance/numbing scores than participants at the University of Kentucky. This is not surprising given that younger age and receipt of BMT have been associated with greater PTSD symptomatology following cancer (Cordova et al., 1995; Jacobsen et al., 1998). It is possible that these mean differences in PCL-C scores between the two subgroups may reflect differences in some other unmeasured variables (i.e., Simpson's Paradox; Hsu, 1989) that may have influenced the underlying factor structure of the combined sample. However, results of multigroup CFA for the two subgroups of participants suggested equivalence of their covariance matrices (see note 6). Thus, the differences described above did not appear to influence the *constellation* of PTSD symptoms reported by the two subgroups of participants.

Third, PCL-C administration was via telephone interview at the University of Kentucky and via mail at the University of South Florida. However, it is unlikely that this difference altered the symptom structure, mean levels, or rank-ordering of reported symptoms. Studies have demonstrated the high degree of agreement between telephone and face-to-face interviews, particularly for anxiety disorders (Rohde, Lewinsohn, & Seely, 1997). There are also data that demonstrate the convergent validity between interview and self-report measures of other anxiety disorders (Roemer, Borkovec, Posa, & Borkovec, 1995; Steketee, Frost, & Bogart, 1996). Nevertheless, it is clear that subsequent studies would benefit from standardization of assessment procedures.

In sum, this initial investigation of the symptom structure of cancer-related PTSD supports the factor structure of PTSD implied by the DSM-IV diagnostic criteria. Though others have advocated the revision of the DSM-IV symptom clusters (e.g., Foa et al., 1995; King et al., 1998), these findings suggest that such a change may be premature. However, our results do suggest that attention to alternative models of PTSD, particularly those that identify avoidance and numbing symptoms on separate factors, is warranted. These results also provide evidence that PTSD symptoms reported by cancer survivors do not merely reflect global, nonspecific distress, but rather are structurally consistent with PTSD as detailed in DSM-IV. This lends further support to DSM-IV's inclusion of "life-threatening illness" as an experience that could potentially meet the PTSD stressor criterion (i.e., Criterion A; APA, 1994, pp. 427–428). This also has clinical implications, given that appropriate treatments for PTSD (e.g., exposure, stress inoculation training) differ from those that are appropriate for other disorders (Chambless et al., 1996). Whether the factor structure of cancer-related PTSD differs from that of PTSD in other trauma populations remains a question for future research. Investigations using parallel methodology to evaluate the PTSD factor structure across different populations are needed to address this issue.

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COMMUNICATION IN THE CANCER 'BAD NEWS' CONSULTATION: PATIENT PERCEPTIONS AND PSYCHOLOGICAL ADJUSTMENT

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SUMMARY

The purpose of this study was to explore relationships between breast cancer survivors' experiences during the diagnostic consultation and their subsequent long-term psychological adjustment. Sixty women (M age = 53 years) who had been diagnosed with local or regional breast cancer (Stage 0–IIIA) an average of 28 months prior were interviewed by telephone. Measures included: Cancer Diagnostic Interview Scale, Anxiety subscale of the Hospital Anxiety and Depression Scale, Posttraumatic Stress Disorder Checklist – Civilian Version, Center for Epidemiologic Studies Depression Scale, and ad hoc items regarding memory for, and satisfaction with, the diagnostic consultation. After controlling for demographic and clinical variables, the three CDIS subscales accounted for 12% of the variance in women's PCL-C scores (F change = 3.46, $p < 0.05$). The CDIS-Caring subscale was a significant predictor in the 'best-fit' regression model for each of the three indices of long-term distress (all B's > −0.23, $p < 0.05$). In contrast, the CDIS-Competence subscale was not a significant predictor in any of the 'best-fit' models. Additionally, women's satisfaction with physician behavior during the diagnostic consultation was unrelated to all adjustment measures (r's < 0.10, p's > 0.50). Findings suggest that women's perceptions of physicians' interpersonal skills during the diagnostic consultation are associated with later psychological adjustment. Copyright © 2002 John Wiley & Sons, Ltd.

INTRODUCTION

To some extent, there has always been interest in the physician's 'bedside manner'. It is no surprise that people have always tended to prefer a physician who is not only knowledgeable but is also pleasant and caring. In recent years, however, a new question has emerged: Is the physician with a good bedside manner actually good for your mental health? Can he/she have a major impact on how well you cope with a chronic illness, a painful procedure, or a poor prognosis?

Preliminary research suggests that a physician's interpersonal and communication skills are, in some way, associated with patients' psychological adjustment. In a study by Lerman *et al.* (1993), 84% of breast cancer patients reported difficulties in communicating with their medical teams. Although the average severity of the communication problems was relatively low, more communication problems predicted more disturbance in patient mood three months after the diagnosis, even when initial distress was controlled. Similarly, Silliman *et al.* (1998) found that breast cancer patients' ratings of their physicians' communication skills significantly predicted patients' general and cancer-specific psychological health.

It has also been suggested that certain communication events, such as the disclosure of significant information (e.g. test results, diagnosis, prognosis), are so important that the physician's interpersonal manner during this encounter, alone, might set a patient on a certain coping trajectory. The topic of 'breaking bad news' has become quite popular recently. There are many articles in

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medical journals that offer advice to physicians on how to handle difficult disclosure situations in the most psychologically healthy manner for the patient (e.g. Girgis and Sason-Fisher, 1998). However, only three empirical studies can be found that actually test whether there is a substantial relationship between the physician's communication in a 'bad news' consultation and patients' subsequent adjustment (Butow *et al.*, 1996; Omne-Ponten *et al.*, 1994; Roberts *et al.*, 1994).

Short-term psychological adjustment was associated with the patient's perception of the quality of communication during the disclosure of the cancer diagnosis in the study by Omne-Ponten *et al.*, (1994). They conducted semi-structured interviews with breast cancer patients 4 months, 13 months, and 6 years post-diagnosis. At all three time points, psychological adjustment was assessed using the Social Adjustment Scale. During the third interview, 6 years post-diagnosis, patients were asked whether their cancer diagnostic consultation had been a particularly negative interpersonal interaction. Patients who endorsed this item showed poorer psychological adjustment at the 4- and 13-month assessments but not at the 6-year assessment.

Butow *et al.* (1996) documented a relationship between patient satisfaction with communication in the cancer diagnostic consultation and patients' short-term psychological status. Psychological adjustment of breast cancer and melanoma patients was assessed 3 months after the cancer diagnosis, using the Psychological Adjustment to Cancer Scale. Patients' recollections of, and opinions about, their cancer diagnostic consultation were also assessed an average of 52 months (S.D. = 44 months) post-cancer-diagnosis. Women who reported more satisfaction with the physician's communication during the diagnostic consultation reported less psychological distress at 3 months post-diagnosis.

Roberts *et al.* (1994) reported a connection between cancer patients' perceptions of physician behavior at the time of the diagnostic consultation and patients' short-term psychological well-being. Using the Cancer Diagnostic Interview Scale, breast cancer patients' perceptions of the physician's behavior during the diagnostic consultation were assessed 6 months after breast surgery. Psychosocial adjustment was measured using the Global Severity Index (GSI) of the Symptom Check List-90-R (SCL-90-R). Women's perceptions of their physicians' use of basic psychotherapeutic techniques during the diagnostic consultation were related to psychological adjustment at 6 months post-diagnosis. Specifically, 21% of the variance in GSI scores was accounted for by patients' ratings of their physician's behavior during the diagnostic consultation. The more a patient reported that her physician was warm, caring, informative, and interpersonally skillful, the more likely she was to show better subsequent psychological adjustment. The authors concluded that the physician's use of basic psychotherapeutic techniques during the diagnostic consultation has a significant positive influence on the patient's well-being.

The results of these three studies suggest that cancer patients' perceptions of physician behavior and satisfaction with communication in the diagnostic consultation may be significantly associated with patients' short-term (i.e. 3–13 months post-diagnosis) psychological adaptation. This may be because the diagnostic consultation is an especially salient communication interaction. It marks the beginning of the individual's experience with a life-threatening disease, and possibly the beginning of a lengthy relationship with the physician who disclosed the news. A patient's experiences in the bad news consultation may set him or her on either a relatively positive or negative emotional trajectory, thereby influencing psychological well-being, at least in the short-term.

The relationship between cancer patients' perceptions of the diagnostic consultation and long-term psychological adjustment is less clear. Both Butow *et al.* (1996) and Roberts *et al.* (1994) examined only short-term psychological adjustment (i.e. 3–6 months post-diagnosis). While Omne-Ponten *et al.* (1994) found psychological adjustment at 13 months post-diagnosis to be associated with a negative perception of the diagnostic consultation, this relationship was not present for psychological adjustment at 6 years post-diagnosis. Unfortunately, their use of only a single dichotomous item to assess patients' perceptions of the diagnostic consultation may have weakened their ability to detect any existing relationship. Thus, the relationship between patients' perceptions of the diagnostic consultation and long-term psychological adjustment remains to be established.

In addition, it would be useful to know whether women's perceptions of the diagnostic

consultation are associated more with generalized psychological distress or with more specific adjustment problems, such as depression and/or PTSD-like symptoms. The three studies reviewed above all used only global measures of psychosocial adjustment (e.g. GSI index from SCL-90-R). At this time, it would be important to compare general measures with more specific measures, so that we may be able to pinpoint the psychological processes that may be affected by a physician's interpersonal manner.

Similarly, perceptions of physician behavior during the diagnostic consultation have also been assessed rather globally. As a result, little is known about the relationship between specific aspects of the diagnostic consultation and psychological adjustment. In particular, it may be important to differentiate between patients' perceptions of their physicians' technical competence during the interview and perceptions of the physicians' skill in managing the interpersonal aspects of the communication (e.g. emotional supportiveness and caring). Previous research has suggested that medical patients are capable of distinguishing among physicians' interpersonal, communication, and technical skills, and that these are among the most important dimensions for determining patients' perceptions of the quality of medical care (Cockburn *et al.*, 1991; Di Matteo and Hays, 1980; Thom and Campbell, 1997; Wiggers *et al.*, 1990). Although research has documented the relative importance of these three factors for patient outcomes such as satisfaction (Wiggers *et al.* 1990), trust in the physician (Thom and Campbell, 1997), and compliance with medical recommendations (Willson and McNamara, 1982), no research to date has compared the importance of these factors with regard to patients' psychological adjustment.

In light of the above, the present study examines the relationship between specific aspects of breast cancer patients' perceptions of the diagnostic consultation and their long-term psychological adjustment outcomes. It is hypothesized that: (1) patients' overall perception of physician behavior during the diagnostic consultation will be positively associated with long-term psychological adjustment; and (2) perceptions of a physician's emotional supportiveness during the diagnostic consultation will be more strongly associated with psychological adjustment than perceptions of a physician's technical competence during the consultation.

METHOD

Design and procedure

Study participants were recruited from the Comprehensive Breast Care Center at the University of Kentucky Chandler Medical Center. To be eligible for study participation, a woman had to: (a) be ≥ 18 yr of age, (b) be 10–48 months post-diagnosis of breast cancer ($\leq$ Stage IIIA), (c) be at least 3 months post-treatment (surgery, chemotherapy, and radiation) for breast cancer, (d) be in disease remission, and (e) have no previous history of cancer, other than basal cell skin carcinoma. Eligible women were identified from a research screening questionnaire completed during a routine clinic visit. One hundred eligible women were sent letters describing the study and inviting them to participate; also enclosed in the mailing were two copies of an informed consent form and a stamped, return envelope. Women interested in participating in the study were instructed to read and sign the consent forms, then to return one copy by mail. In addition to the letter, most women also received a follow-up telephone call, intended to answer women's questions about the study and to encourage their participation. Following receipt of a woman's signed consent form, the woman was called and a telephone interview was scheduled. Copies of all study measures were then mailed to the woman and she was instructed to use them as visual aids during the telephone interview. The woman was then called at the appointed time and all study measures were completed. All interview data was recorded manually by the interviewer during the interview. The interviewer was not involved in any aspect of the woman's medical care. Upon completion of the interview, disease and treatment information was extracted from participants' medical records. All study procedures were approved by the local medical institutional review board.

Of the 100 women sent letters inviting them to participate in the study, 65 completed interviews. Reasons for non-participation in the study were as follows: 13 women expressed disinterest in the study; nine women reported they were too busy to participate; five stated that they were unable to participate due to other health problems; five did not respond to the letter and were not reachable by telephone; and three indicated that they did not want to take part in the study because they

disliked talking about their experiences with breast cancer. Of the 65 women interviewed for the study, five were excluded from analyses because they were later found to not meet all eligibility criteria.

Participants

The final study sample consisted of 60 women, ranging in age from 27 to 82 years at the time of the study ($M = 53.7$; S.D. = 11.2). Each had received an initial diagnosis of breast cancer 10–48 months previously ($M = 28$ months, S.D. = 10.5). Most women (87%) had been diagnosed with stage 0–II breast cancer. Seven percent of women had stage IIIa breast cancer, and disease stage data was unavailable for an additional 7% of the study sample. Specific treatments represented in the sample were: lumpectomy and radiation (20%); lumpectomy, radiation, and chemotherapy (27%); mastectomy alone (22%); mastectomy and chemotherapy (23%); and some other combination of treatments (8%). Demographic characteristics of the study sample were as follows: 97% were Caucasian, 75% were married, and 43% were currently employed. Participants had a mean of 13.9 years of education (S.D. = 3.0). Women's annual household income was as follows: less than $20,000 (22%), $20,000–$40,000 (22%), $40,000–$60,000 (24%), and more than $60,000 (30%). Income data was unavailable for the remaining 2% of the study sample.

Materials

Sociodemographic information was collected from each participant during the telephone interview. In addition, the following standardized instruments were completed by all respondents: the Anxiety subscale of the Hospital Anxiety and Depression Scale (HADS), the Center for Epidemiologic Studies Depression Scale (CES-D), the Posttraumatic Stress Disorder Checklist - Civilian Version (PCL-C), and the Cancer Diagnostic Interview Scale (CDIS).

The 7-item Anxiety subscale of the Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983) was used to determine the extent to which women currently experience general anxiety and psychological distress. The HADS has been administered by telephone interview in previous studies (e.g. Helgeson *et al.*, 2000). Sample items include "I get sudden feelings of panic" and "Worrying thoughts go through my mind". Women were asked to respond on a four-point scale, according to how often they have felt that way during the past week. Scores on the Anxiety subscale of the HADS (HADS-Anx) range from 0 to 21. In studies with cancer patients, a cut-point of 8 has been shown to be ideal, yielding a sensitivity of 72–75% and a specificity of 75–81% for identifying significant psychological distress (Kugaya *et al.*, 2000; Razavi et al., 1990). Coefficient alpha in the present study was 0.91.

Participants' current depressive symptoms were measured using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D has been administered by telephone interview in previous studies (e.g. Gonzalez *et al.*, 1995; Lin *et al.*, 1992). The CES-D is a 20-item instrument that assesses a variety of cognitive, affective, behavioral, and somatic symptoms associated with depression. Respondents use a four-point scale to indicate how frequently they experienced depressive symptoms during the preceding week. Sample items include: "I felt that everything I did was an effort," and "My sleep was restless." CES-D scores range from 0 to 60. A cut-point of 21 was found to be ideal for identifying major depression in older patients; it has a sensitivity of 92% and a specificity of 87% (Lyness *et al.*, 1997). Coefficient alpha in the present study was 0.93.

Cancer-related PTSD symptomatology was assessed using the Posttraumatic Stress Disorder (PTSD) Checklist – Civilian Version (PCL-C; Weathers *et al.*, 1991). The PCL-C has been administered by telephone interview in previous studies (e.g. Manne *et al.*, 1998; Andrykowski *et al.*, 2000). The PCL-C is a 17-item instrument that assesses the degree to which an individual currently experiences certain trauma-related anxiety symptoms. The items directly correspond to the diagnostic criteria listed in the Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition (American Psychiatric Association, 1994) for the diagnosis of PTSD. For each PCL-C item, respondents use a five-point Likert scale to indicate the extent to which they have been bothered by that problem during the past month. All women completed the PCL-C with reference to a specific potentially traumatic event, in this study, 'the diagnosis and treatment of breast cancer' (cf., Andrykowski *et al.*, 1998; Smith *et al.*, 1999). It yields a total score and three subscale scores

corresponding to the primary symptom clusters comprising PTSD. Coefficient alpha for the PCL-C total score in the present study was 0.93. Scores on the PCL-C range from 17 to 85. The most efficient cut-off score is 50; this yields a sensitivity of 0.78–0.82 and a specificity of 0.83–0.86 for identifying people who meet the criteria for a formal PTSD diagnosis (Weathers *et al.*, 1991; Blanchard *et al.*, 1996).

The Cancer Diagnostic Interview Scale (CDIS; Roberts *et al.*, 1994) is an 18-item scale that uses a five-point Likert scale response format to measure the degree to which the respondent perceived her physician as having used psychotherapeutic techniques while conducting the cancer diagnostic consultation. The CDIS has been administered by telephone interview in one previous study (Roberts *et al.*, 1994). Sample items include: "My doctor understood my fears and concerns", "My doctor discussed different treatments available for my type of cancer", and "My doctor did not take time to answer all my questions". Reliability estimates for the CDIS are as follows: Cronbach's alpha = 0.92 (Roberts *et al.*, 1994) and test–retest = 0.78 (C. S. Roberts, personal communication, June 3, 1997). Coefficient alpha in the present study was 0.94.

Two additional items were developed solely for use in this study. They assessed additional aspects of the breast cancer diagnostic consultation not measured by the CDIS. For one item (DC-Mem), women were asked to rate their memory for the diagnostic consultation. They responded using a 10-point Likert scale, with endpoints labeled 'very poor' and 'excellent'. For the other item (DC-Sat), women were asked to rate their satisfaction with the diagnostic consultation. They responded using a 10-point Likert scale, with endpoints labeled 'not satisfied at all' and 'extremely satisfied'.

Data analysis

Standard scoring procedures were used for the HADS-Anx, CES-D, PCL-C, and CDIS-Total. In addition, CDIS subscales were generated from a factor analysis of the CDIS, and factor-based scoring was then used to derive subjects' subscale scores. An orthogonal principal components analysis was conducted using varimax rotation. Based upon analysis of the eigenvalues and scree plots, three factors emerged. An item was retained on a factor if its highest loading was on that factor, if the factor loading was > 0.55 for that factor, and if the loading of that item on the other two factors was lower than the loading on the factor of interest by at least 0.20.

Examination of the items composing each of the three extracted CDIS factors suggests that the factors represent the following constructs: physician caring ('Caring'), physician technical competence ('Competence'), and degree of mutual understanding between physician and patient ('Understanding'). Items on the Caring subscale describe a physician who was comfortable with emotions and who spent adequate time with the patient, providing information and welcoming the patient's questions. CDIS items found to belong on this subscale were items 3 (doctor did not take time to answer my questions; reverse-scored), 5 (doctor encouraged my expression of feelings), 13 (wish doctor had given me more time to ask about my cancer; reverse-scored), 16 (doctor preferred to be emotionally detached; reverse-scored), and 17 (doctor appeared annoyed and impatient with my questions; reverse-scored). Coefficient alpha for the Caring subscale was 0.82.

The Competence subscale describes a physician who provides the patient with information about cancer-related tests, procedures, and treatments, and who instills in his/her patients a sense of faith or trust in the doctor. CDIS items found to belong on this subscale were items 6 (was given a lot of information), 8 (doctor discussed different treatments available), 9 (left the office feeling I was in good hands) and 10 (doctor explained the need for tests/procedures). Coefficient alpha for the Competence subscale was 0.85.

The Understanding subscale reflects the extent to which the patient understood the information provided by the doctor, in addition to how well the doctor seemed to understand feelings and concerns voiced by the patient. CDIS items found to belong on this subscale were items 1 (doctor understood my fears, concerns), 2 (felt hopeful after talking to doctor), and 11 (did not understand information doctor gave me; reverse-scored). Coefficient alpha was 0.74.

RESULTS

Descriptive characteristics

Women rated the cancer diagnostic consultation as a highly memorable event. The mean DC-Mem

score was 8.82 on a 10-point scale (S.D. = 1.30, range = 5–10). Forty-three percent of women rated their recall as 'excellent' (10/10) and 85% of women rated their recall very highly (≥ 8/10). No women reported very poor recall (≤ 4/10) for the cancer diagnostic consultation. There was no correlation between time since cancer diagnosis and memory for the diagnostic consultation ($r = -0.01$, n's). Overall, women indicated that they were moderately satisfied with the physician's communication in the diagnostic consultation (M DC-Sat score = 7.34, S.D. = 3.26, range 1–10). A majority of women (62%) indicated a high degree of satisfaction with the interaction (scores ≥ 8) while a sizable minority (16%) reported extreme dissatisfaction with the interaction (scores ≤ 3).

Descriptive statistics for the remaining primary study variables are shown in Table 1. Women's ratings of physician behavior during the diagnostic consultation were only moderately positive. The mean total CDIS score was 68.27. This translates into a mean CDIS item score of 3.79 (range 1–5). This suggests that the typical woman primarily gave ratings of 'neutral' to 'agree somewhat' to items asserting that the cancer diagnostic consultation had been a positive interpersonal interaction, given the stressful circumstances.

Inspection of scores for our measures of long-term psychological adjustment indicated that 47% of the sample scored above the cut-off on at least one measure. The HADS-Anx was the most commonly elevated measure; 45% of women scored ≥ 8 on this scale. Twenty-three percent of our sample scored ≥ 21 on the CES-D. Finally, 10% of our sample evidenced total scores ≥ 50 on the PCL-C.

There was a modest degree of comorbidity of psychological problems within our sample. Fifteen percent of women evidenced scores in the clinical range on two of the measures. Eight percent of women scored above the cut-off on all three psychological adjustment measures.

Table 1. Descriptive data for psychosocial variables

	M	S.D.	Obtained range	Possible range
CDIS Total	68.27	17.47	28–90	18–90
CDIS Caring	18.13	5.70	5–25	5–25
CDIS Competence	14.80	4.85	4–20	4–20
CDIS Understanding	11.16	3.40	4–15	3–15
HADS-Anx	7.83	4.96	0–2	0–21
CES-D	13.30	11.78	0–58	0–60
PCL-C	32.33	13.80	17–79	17–85

Univariate relationships among study variables

Pearson product moment correlations between and among our primary study variables and demographic (age, income) and clinical variables (time since diagnosis, disease stage) are shown in Table 2. There were strong associations among the diagnostic consultation variables. The CDIS scale and subscales were highly intercorrelated (all r's > 0.50, p's < 0.01). For example, women who described their physicians as more caring were also likely to describe him/her as more competent ($r = 0.71$, $p < 0.01$) and more understanding ($r = 0.57$, $p < 0.01$). Women's satisfaction with the diagnostic consultation was highly correlated with the CDIS scale and subscales. Women who perceived their physicians to be more caring, competent, and understanding during the diagnostic consultation reported more satisfaction with the interaction ($r = 0.56$, 0.55, and 0.63, respectively; all p's < 0.01). In contrast, women's memory for the diagnostic consultation was consistently not related to any of the other diagnostic consultation variables (all r's < 0.10).

Diagnostic consultation variables showed some associations with long-term psychological distress measures. There were significant or near-significant associations for all CDIS scales and for all three psychological adjustment measures. The outcome measure most associated with the CDIS scales seemed to be PCL-C scores. PCL-C scores were significantly associated with the CDIS Caring and Understanding subscales ($r = -0.32$, and $r = -0.28$, respectively, p's < 0.05). More physician caring and understanding was predictive of less long-term cancer-related PTSD symptomatology among the women in our sample.

CDIS Caring was the most important CDIS variable for predicting long-term psychological adjustment. In addition to the significant inverse association with PCL-C scores, CDIS Caring scores were also inversely correlated with CES-D scores. Women who perceived their physician to be more caring during the diagnostic consultation reported less long-term depressive symptomatology ($r = -0.28$, $p < 0.05$). Furthermore, there was a near-significant association between Caring and HADS-Anx scores. Women who described their

Table 2. Intercorrelation of demographic, clinical, and psychosocial variables

Variable	Variable (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Age (1)													
Income (2)	0.04												
Time since dx (3)	0.08	−0.23											
Disease stage (4)	−0.06	−0.48*	0.15										
CDIS-total (5)	0.09	−0.13	0.05	−0.05									
CDIS-caring (6)	0.09	0.03	0.00	−0.07	0.89**								
CDIS-competence (7)	0.15	−0.05	0.02	0.06	0.87**	0.71**							
CDIS-understanding (8)	0.07	−0.13	0.11	−0.02	0.77**	0.57**	0.53**						
DC-Mem (9)	0.07	−0.15	−0.01	0.12	−0.05	−0.03	−0.05	0.03					
DC-Sat (10)	−0.06	−0.23	0.15	−0.01	0.77**	0.56**	0.55**	0.63**	−0.02				
HADS-Anx (11)	−0.17	−0.37**	−0.22	0.06	−0.11	−0.25	−0.11	−0.19	0.05	0.01			
CES-D (12)	−0.25*	−0.41**	−0.12	0.09	−0.09	−0.28*	−0.15	−0.07	−0.02	0.09	0.80**		
PCL-C (13)	−0.29*	−0.36**	−0.22	0.04	−0.22	−0.32*	−0.22	−0.28*	0.05	−0.05	0.87**	0.79**	

*$p<0.05$, **$p<0.01$.

physician as more caring during the diagnostic consultation tended to report fewer generalized anxiety symptoms ($r = -0.25$, $p = 0.06$). Although only three of twelve correlations between CDIS scores and psychological distress measures reached statistical significance and three additional correlations reached near-significance, it was noted that all twelve correlations were in the hypothesized (inverse) direction. In contrast to women's perceptions of physicians' behavior during the cancer diagnostic consultation, women's memory for, and satisfaction with, the diagnostic consultation were consistently unrelated to all psychological distress measures (all p's > 0.50).

Multivariate prediction of long-term psychological adjustment

To examine the relationship between perceptions of physicians' behavior during the diagnostic consultation and women's subsequent psychological adjustment, three parallel hierarchical multiple regression analyses were performed. Dependent variables were the total scores on the HADS-Anx, the CES-D, and the PCL-C. At step 1 in each analysis, four control variables were entered as a block: women's age at time of interview, annual household income, time between diagnosis and study interview, and disease stage at diagnosis. At step 2 in each analysis, the three CDIS subscale scores were entered as a block. Results are shown in Table 3.

Table 3. Beta weights and summary statistics for hierarchical multiple regression analyses predicting psychological adjustment

	Outcome variable		
	HADS-Anx	CES-D	PCL-C
Step 1:			
Age	−0.13	−0.22	−0.24*
Income	−0.52**	−0.52**	−0.51**
Time since diagnosis	−0.31*	−0.21	−0.27*
Disease stage at diagnosis	−0.15	−0.14	−0.20
ΔR^2	0.28	0.29	0.30
F change	5.38**	5.56**	5.81**
Step 2:			
CDIS caring	−0.25	−0.34*	−0.25
CDIS competence	0.16	0.08	0.10
CDIS understanding	−0.17	0.06	−0.21
ΔR^2	0.08	0.07	0.12
F change	2.05	1.90	3.46*
Total model			
R^2	0.36	0.36	0.41
F	4.13**	4.15**	5.25**

*$p<0.05$, **$p<0.01$.
Beta weights shown are for full, seven-variable model.

The four control variables accounted for 28.1% of the variance in HADS-Anx scores (multiple $R = 0.53$; $F = 5.38$; $p<0.01$). Entry of the three CDIS subscale scores into the equation resulted in a non-significant 7.6% increment in the variance in

HADS-Anx scores accounted for [$F(3, 52) = 2.05$, $p = 0.12$]. In all, the full seven-variable model accounted for 35.7% of the variance in HADS-Anx total scores [$F(7, 52) = 4.13$, $p < 0.01$]. Annual household income (beta = −0.54) and time since diagnosis (beta = −0.29) were the only significant predictors of HADS-Anx scores (p's < 0.05).

The four control variables accounted for 28.8% of the variance in CES-D scores (multiple $R = 0.54$; $F = 5.56$; $p < 0.01$). Entry of the three CDIS subscale scores into the equation resulted in a non-significant 7.0% increment in the variance in CES-D scores accounted for $F(3, 52) = 1.90$, $p = 0.14$]. In all, the full seven-variable model accounted for 35.8% of the variance in CES-D total scores [$F(7, 52) = 4.15$, $p < 0.01$]. Annual household income (beta = −0.51) and CDIS caring (beta = −0.34) were the only significant predictors of CES-D scores (p's < 0.05).

The four control variables accounted for 29.7% of the variance in PCL-C scores (multiple $R = 0.55$; $F = 5.81$; $p < 0.01$). Entry of the three CDIS subscale scores into the equation resulted in a significant 11.7% increment in the variance in PCL-C scores accounted for [$F(3, 52) = 3.46$, $p < 0.05$]. In all, the full seven-variable model accounted for 41.4% of the variance in PCL-C total scores, F $(7, 52) = 5.25$, $p < 0.001$. Age (beta = −0.26), annual household income (beta = −0.48) and time since diagnosis (beta = −0.29) 0.29) were the only significant predictors of PCL-C scores (p's < 0.05).

To determine the 'best-fit' predictive model for each of our three long-term adjustment measures, individual variables from the seven-variable model described above were eliminated in stepwise, backward fashion (Table 4). The criterion for eliminating variables from the model was set at $p = 0.10$. The 'best-fit' model for predicting HADS-Anx scores accounted for 30.1% of the variance [$F(3, 56) = 8.06$, $p < 0.001$]. Significant individual predictor variables included: income (beta = −0.45), time since diagnosis (beta = −0.32), and CDIS Caring (beta = −0.23), all p's < 0.05.

The 'best-fit' model for predicting CES-D scores accounted for 33.3% of the variance [$F(4, 55) = 6.88$, $p < 0.001$]. Significant individual predictor variables included: income (beta = −0.45) and CDIS Caring (beta = −0.25), p's < 0.05.

The 'best-fit' model that emerged accounted for 36.3% of the variance in PCL-C scores [$F(4, 55) = 7.83$, $p < 0.001$]. Significant individual predictor variables included: age (beta = −0.22), income (beta = −0.40), time since diagnosis (beta = −0.30), and CDIS Caring (beta = −0.29), all p's < 0.05.

Table 4. Beta weights and summary statistics for 'Best Fit' multiple regression analyses predicting psychological adjustment

	Outcome variable		
	HADS-Anx	CES-D	PCL-C
Age	—	−0.20	−0.22*
Income	−0.45**	−0.45**	−0.40**
Time since diagnosis	−0.32**	−0.21	−0.30*
Disease stage at diagnosis	—	—	—
CDIS caring	−0.23*	−0.25*	−0.29**
CDIS competence	—	—	—
CDIS understanding	—	—	—
R^2	0.30	0.33	0.36
F	8.06**	6.88**	7.83**

*$p < 0.05$, **$p < 0.01$.

DISCUSSION

The purpose of this study was to learn how breast cancer patients' experiences during the diagnostic consultation might be related to their subsequent long-term psychological adjustment. We found that patient satisfaction with physician behavior during the diagnostic consultation was unrelated to all measures of women's long-term psychological adjustment. In contrast, some evidence suggested that women's descriptions of their physician's behavior during the diagnostic consultation were significantly associated with long-term adjustment. Specifically, consideration of the three CDIS subscale scores yielded a significant 12% increment in variance accounted for in PCL-C scores beyond that accounted for by demographic and clinical variables (Table 3). Additionally, scores on the CDIS-Caring subscale were a significant predictor in the 'best fit' regression model for each of our three indices of long-term adjustment (Table 4).

Our first hypothesis predicted that women's overall perceptions of physician behavior during the diagnostic consultation would be positively associated with their long-term psychological adjustment. This hypothesis received partial support. The three CDIS subscales yielded an increment of 7–12% in variance accounted for in our

three indices of long-term psychological adjustment, with the 12% increment in variance for PCL-C scores attaining statistical significance (Table 3). These findings are generally consistent with the previous work of Roberts *et al.* (1994). Their study showed that women who perceived physician behavior in the diagnostic consultation that is thought to be more psychotherapeutic also tended to have better short-term psychological adjustment. The present study extends these findings in two ways: by demonstrating that there may still be a modest effect of physician behavior in the *long-term* post-cancer phase, and by suggesting that the effect may be greater on certain *specific* psychological symptoms (i.e. PTSD) than on generalized psychological distress (e.g. HADS).

In contrast, univariate analyses indicated no significant relationship between patients' satisfaction with the diagnostic consultation and any of our indices of long-term psychological adjustment. Previous research has established a relationship between patient satisfaction with the diagnostic consultation and patients' psychological well-being during the short-term, post-cancer phase, but not in the long-term recovery period. Butow *et al.* (1996) demonstrated that satisfaction was positively associated with better adjustment 3 months post-diagnosis. Omne-Ponten *et al.* (1994) found a significant association between satisfaction and adjustment 4 and 13 months post-diagnosis, but no such association 6 years post-diagnosis. When taken together, our present findings and past research lead us to conclude that perceptions of physician behavior during the diagnostic consultation, not patients' satisfaction with physician behavior, are predictive of breast cancer patients' long-term psychological adjustment.

Perception of physician behavior is probably a better predictor of long-term psychological adjustment than patient satisfaction because it seems to be a more reliable and valid indicator of the patient's experience during the diagnostic consultation. The 18-item CDIS is a list of specific physician behaviors that may or may not have occurred during the diagnostic consultation. The multi-item, multi-dimensional, behaviorally-based nature of the CDIS makes it a better measure than the evaluative, single-item measure that is used to assess global patient satisfaction. The construct measured by the CDIS, 'psychotherapeutic' behavior, also borrows from a stronger theoretical and empirical base (i.e. the psychotherapy literature) than does the construct of patient satisfaction. Researchers have recently expressed great concern over the lack of understanding for the variable of patient satisfaction. They claim that it is a complex, multidimensional variable, which does not yet have an adequate theoretical formulation (Avis *et al.*, 1995; Carr-Hill, 1992; Strasser *et al.*, 1992). Others have noted that global ratings of patient satisfaction with medical care tend to be quite high, to be lacking in variability, and to be generally unrelated to efficacy of intervention or patient psychological adjustment (Baider *et al.*, 1997; Oberst, 1984; Wiggers *et al.*, 1990). In this light, perhaps it should not be surprising that we found patient satisfaction with the cancer diagnostic consultation to be unrelated to patients' subsequent psychological distress.

The second study hypothesis was that perceptions of a physician's emotional supportiveness during the diagnostic consultation would be more strongly associated with psychological adjustment than perceptions of a physician's technical competence during the consultation. Our study results strongly support this hypothesis. The CDIS Caring subscale score was a significant predictor of psychological adjustment in all three of our 'best fit' regression models (Table 4). In contrast, the CDIS Competence subscale was not a significant predictor for any of our three indices of long-term adjustment. Thus, women who perceived that their physician expressed more caring and emotional supportiveness when telling them about their cancer diagnosis tended to have fewer cancer-related PTSD symptoms, less depression, and less general distress. However, this was not true for perceptions of physicians' technical skills; the extent to which a woman perceived her physician as technically competent was not predictive of her long-term psychological well-being. This is a novel finding, since no previous research has examined the relative importance of physicians' technical versus interpersonal competence for patients' subsequent psychological adjustment. Previously, groups of primary care patients and cancer patients have indicated that interpersonal and technical skills are highly- and equally-important components of a physician's professional competence (Thom and Campbell, 1997; Wiggers *et al.*, 1990). Compared to this literature, our results diverge, by suggesting that patients' perceptions of physicians' interpersonal manner have more bearing when it comes to patients' long-term emotional health.

Although this study has a number of strengths, it also has limitations that warrant acknowledgement. First, the study is correlational, so no definitive statements can be made about causal relationships between our study variables. Although our underlying hypothesis could be true (i.e. that physician behavior during the diagnostic consultation plays a causal role in determining women's long-term psychological adjustment), there are other possible explanations for the association we found between physician behavior and patient adjustment. One reasonable alternative hypothesis is that patients' recollections of the cancer diagnostic interview are more a function of the person's current psychological status than of the actual event. Distressed individuals may tend to recall and report all kinds of events and situations more negatively than they would if they were not suffering from psychological problems. Since we measured women's *perceptions* of physician behavior (not physician behavior directly), we cannot rule out the possibility of this explanation.

Another hypothesis is that the relationship is a function of the patient's psychological status at the time of the diagnostic consultation and its effects on the physician. Given the relative stability of psychological functioning, it is reasonable to think that women with psychological distress or maladjustment 2 yr after cancer may also have been distressed at the time of their diagnoses. Some physicians may find it aversive to interact with patients who are very upset or who have difficult personality styles; physicians may find it hard to use their best interpersonal skills with such patients during a cancer diagnostic consultation.

Essentially, then, the direction of effect could be from physician behavior to patient adjustment, vice versa, or bi-directional. Of course, the only way to clarify this issue would be to experimentally manipulate the patients' experience in the cancer diagnostic consultation. However, this is precluded by obvious ethical and practical constraints. Therefore, our correlational design, although not scientifically ideal, was necessary and is informative. The problem of possible confounds was addressed in our analyses by statistically controlling for known risk factors for maladjustment.

There are several measurement issues that may threaten the validity of these study findings. One potential problem is the retrospective nature of women's reports of their diagnostic consultation. Women were asked to provide their recollections of an event that had occurred from 1 to 4 yr prior. Memory decay, alone, could produce flawed reports of women's experiences. If memory problems were widespread in this study sample, it would significantly decrease confidence in our results. However, the women who participated in this research project reported very high confidence in their memory for their cancer diagnostic consultation. This is consistent with other research involving cancer patients (e.g. Peteet *et al.*, 1991) and supports the notion of a 'flashbulb' memory phenomenon, wherein people have extraordinary recall of traumatic or highly emotional events in their lives (Brown and Kulik, 1982).

Another potential study weakness lies in its reliance upon self-report in the measurement of physician behavior during the diagnostic consultation. Clearly, it would be important to examine the relationship between more objective indices of physician behavior, such as those derived from observational data, and indices of subsequent adjustment. However, it should also be noted that what is likely critical to subsequent adjustment is a woman's *perception* of her physician's behavior and not necessarily the behavior, itself. Reliance upon subjective or objective indices of physician behavior alone is likely to yield an incomplete perspective.

In contrast, when taken together, findings from subjective and objective studies of physician behavior during the diagnostic consultation might yield important implications. For example, our study used subjective ratings and demonstrated that cancer patients who perceived their physician to be more caring during the cancer diagnostic consultation tended to have better long-term psychological adjustment. Future research involving both subjective and objective measures of physician behavior may show that patients' perceptions of physician caring and interpersonal skills are significantly impacted by actual physician behavior. Together, these findings would suggest that rates of patient psychological maladjustment following cancer might be decreased by enhancing physician behaviors that patients view as 'caring' during important communication interactions, such as the cancer diagnostic consultation.

There are probably many ways to increase the likelihood that physicians will exhibit caring behavior during diagnostic consultations. Campbell and Sanson-Fisher (1998) spelled out a detailed, five-step approach to changing physician behavior in terms of 'bad news' disclosure. They

advocated the need for: (1) the establishment of clear, professional guidelines on conducting diagnostic consultations, (2) the widespread dissemination of the guidelines, (3) provision of performance-based feedback for physicians, (4) incentives to physicians to provide best practice care, and (5) active exploration and remediation of obstacles to high quality care in the diagnostic consultation. One such obstacle to physicians conveying emotional support to patients during the diagnostic consultation could be their general skill deficits in the interpersonal and psychosocial domains. Perhaps it will be important to improve physicians' formal training in communication and interpersonal skills and in the psychosocial aspects of health and illness. For physicians in training, this could be incorporated into the medical school curriculum and residency programs. For physicians in practice, training might be done through brief courses or workshops addressing these issues. Two recent studies demonstrated the efficacy of such interventions (Fallowfield *et al.*, 1998; Hulsman *et al.*, 1997). Other methods for improving physicians' caring behavior may require change at a systems level. For example, changes in health care administration (e.g. managed care) that lead to decreased time pressures and emotional stress levels for physicians might be indicated, since these factors are likely related to physicians' capacity for displaying caring behavior toward their patients. Although this list is by no means exhaustive, it represents some of the clinical implications that may follow from continued research in the area of 'bad news' communication in cancer care.

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RUNNING HEAD: DIURNAL OFF-TREATMENT FATIGUE

Ecological Momentary Assessment of Fatigue Following Breast Cancer Treatment

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Abstract

Fatigue is a common and debilitating symptom often experienced during and following cancer treatment. An Ecological Momentary Assessment (EMA) approach was used to examine the diurnal pattern of off-treatment fatigue in breast cancer survivors. Twenty-five breast cancer (BC) survivors 6 to 26 months post-treatment and age-matched groups of healthy women (HC; n = 25) and women with benign breast problems (BBP; n = 24) completed four daily diary measures of fatigue, pain, and mood for 5 consecutive days. Type of activity engaged in at the time of the diary assessments, as well as daily pedometer activity level, and nightly sleep duration were also assessed. While BC survivors reported greater levels of fatigue relative to BBP and HC groups, no group differences in mood, activity type or level, sleep duration, or diurnal pattern of fatigue were evident. The results confirm that fatigue may continue to be experienced long after conclusion of cancer treatment while questioning its clinical significance, provide insight into potential etiological mechanisms underlying off-treatment fatigue in, and demonstrate the value of EMA approaches to the study of cancer-related fatigue.

Key words: fatigue, cancer, ecological momentary assessment, pain, mood

It is estimated that 70% to 100% of cancer patients experience significant fatigue at some time after cancer diagnosis and treatment (Irvine et al., 1991; Atkinson et al., 2000). Fatigue has been reported across the course of malignant disease; after initial diagnosis, as a side effect during adjuvant treatment, and after conclusion of adjuvant treatment (Andrykowski et al., 1998; Bower et al., 2000; Broeckel et al., 1998; Winningham et. al., 1994). Fatigue in cancer patients is thought to be different from fatigue experienced by healthy individuals in the course of everyday life. Cancer-related fatigue has been characterized as more severe, more distressing, longer lasting, and less likely to be relieved by rest than the typical fatigue experienced by a healthy person (Holley, 2000). Because of its impact upon quality of life and performance of daily activities, fatigue is often described as the most distressing symptom experienced by both cancer patients and survivors (Winningham et. al., 1994; Bower et al., 2000).

Research examining cancer-related fatigue has focused largely on fatigue associated with ongoing adjuvant cancer treatments such as chemotherapy and radiotherapy (e.g., Berger, 1998; Cella et al., 2002; Greene et al., 1994; Irvine et al., 1994; Jacobsen et al., 1999; Schwartz, 2000). Other research, however, has examined fatigue following completion of adjuvant cancer treatment (e.g; Berglund et al., 1991; Bower et al., 2000; Broeckel et al., 1998; Cella et al., 2001; Mast, 1998). In general, research suggests the prevalence and severity of fatigue increases over the course of adjuvant cancer treatment and then gradually diminishes after the conclusion of treatment. However, some disease-free patients continue to report fatigue and a decreased energy level several years or more after conclusion of adjuvant cancer treatment (Andrykowski et al., 1998; Broeckel et al., 1998; Bower et al., 2000; Cella et al., 2002; Okuyama et al., 2000).

Cancer-related fatigue is significant because of its close association with quality of life.

Fatigue in cancer patients has been associated with greater levels of depression, anxiety and mood disturbance (Andrykowski et al., 1998; Bower et al., 2000; Broeckel et al., 1998; Dimeo et al., 1999), reduced physical functioning and activity level (Dimeo et al., 1999; Mock et al., 2001; Schwartz, 2000), insomnia and other sleep problems (Bower et al., 2000; Jacobsen et al. 1999), and greater physical symptom severity (Broeckel et al., 1998; Jacobsen et al. 1999), in particular, severity of pain symptoms (Bower et al., 2000; Ferrell et al., 1998).

Most studies of cancer-related fatigue have assessed fatigue at one, or at most, a few, points in time. Furthermore, most studies of cancer-related fatigue have employed retrospective measures of fatigue. Such measures require respondents to summarize and quantify their fatigue experience over a given period of time. For example, a respondent might be asked to indicate how much fatigue they have experienced during the past day, week, or month. It is well known that such retrospective symptom reports can be subject to inaccuracies due to various recall biases (Stone & Shiffman, 1994). Furthermore, such retrospective assessments of fatigue may mistakenly suggest that cancer-related fatigue is a "chronic," essentially stable, condition with little day-to-day variation. As a result, some studies have obtained a daily rating of fatigue in order to identify the temporal trajectory of fatigue across the course of adjuvant cancer treatment (Berger, 1998; Richardson and Ream, 1996; Schwartz, 2000). However, even daily assessments of fatigue are unable to address the potentially critical issue of whether and how fatigue fluctuates throughout the course of a single day. In healthy individuals, fatigue and energy level tend to fluctuate throughout the course of a day with fatigue generally increasing toward the end of the day. However, a single, daily assessment of fatigue may obscure the possibility that for cancer patients or survivors, daily periods of profound fatigue might be

interspersed with periods of minimal fatigue or essentially "normal" energy levels. The importance of examining diurnal fatigue patterns has been emphasized for other chronic disease conditions such as chronic fatigue syndrome or rheumatoid arthritis (Stone et al. 1994; Stone et al., 1997). Specifically, it has been suggested that examination of diurnal patterns of fatigue in these conditions may yield useful insights into their etiology or may prove useful in the diagnosis of these conditions. Currently, little is known regarding the specific etiology of fatigue experienced by cancer patients and survivors and the development of techniques for the differential diagnosis of fatigue specifically related to cancer or cancer treatment is in its infancy at the present time (Cella et al., 1998; Cella et al., 2001). Thus, examination of diurnal patterns of fatigue in cancer patients and survivors would seem to be a potentially fruitful line of inquiry.

To date, only a single study has examined the diurnal pattern of cancer-related fatigue. Glaus (1993) assessed fatigue in 20 cancer patients undergoing active cancer treatment or within one year of completion of treatment. A variety of cancer diagnoses were represented. Cancer patients' responses were compared to those of two control groups: a non-cancer patient group consisting of hospital inpatients with chronic inflammatory gastrointestinal (GI) disease ($n = 12$) and a group of healthy individuals ($n = 30$). The cancer and GI problem groups completed a visual analogue scale of fatigue at four specific times during the day (7:00 am, 12:00 pm, 5:00 pm, and 9:00 pm) for seven consecutive days. The healthy comparison group completed identical measures of fatigue, but for only two consecutive days. The mean diurnal pattern of fatigue evident in each of the three study groups was determined. No significant differences were evident across the three study groups at the 7:00 AM assessment. In the Healthy control group, fatigue rose over the course of the day while the GI Disease Control group evidenced a

fairly stable level of fatigue throughout the day. The Cancer group evidenced a slightly rising level of fatigue throughout the day, with fatigue levels at the 9:00 PM assessment intermediate between those reported by the Healthy and GI Disease control groups. While noteworthy for its focus upon the diurnal pattern of fatigue evident in cancer patients and how this diurnal pattern might differ from that evident in other relevant control groups, this study possessed significant limitations. The heterogeneous mixture of cancer diagnoses and treatment status in the cancer patient group is problematic. In addition, while the GI Disease and Cancer groups provided seven sets of daily ratings, the Healthy Control group completed the fatigue assessment over only a two day period, yielding a much less stable estimate of the diurnal fatigue pattern in this latter group. Finally, while inclusion of both disease and healthy control groups was a clear strength of the research design, the control and cancer groups were not matched with regard to variables potentially related to fatigue reports, such as gender or age. This greatly limited interpretation of any observed group differences in diurnal fatigue patterns. In light of these clear limitations, the question of whether cancer patients evidence a unique diurnal pattern of fatigue is unresolved.

The present study utilized Ecological Momentary Assessment (EMA) techniques to examine the diurnal pattern of fatigue in a sample of breast cancer survivors. EMA involves sampling current, momentary levels of "state" variables, such as fatigue or mood, at multiple points in time as they are experienced in a natural setting (Stone & Shiffman, 1994; 2002). EMA has been shown to reduce the bias often associated with more commonly used retrospective self-report measures of symptom severity. In contrast to the study by Glaus (1993), the present study examined a relatively homogeneous group of breast cancer survivors, all of whom had completed adjuvant treatment and were matched with regard to age and gender with a control group of

healthy women as well as a relevant disease control group consisting of women with benign breast problems. Several primary research questions were the focus of the research including: (1) Do breast cancer survivors experience greater fatigue relative to healthy women and women with benign breast problems?; (2) Does the diurnal pattern of fatigue evidenced by breast cancer survivors differ from that evidenced by healthy women or women with benign breast problems?; (3) Do breast cancer survivors differ with regard to variability in reports of fatigue severity across multiple assessments?; (4) Do breast cancer survivors differ with regard to reports of daily activities, activity level, or sleep duration? and (5) what is the relationship between EMA-based assessments of fatigue and other related endpoints such as pain and mood? Based upon previous research utilizing retrospective measurements (de Jong et al., 2002), it was hypothesized that breast cancer survivors would report greater fatigue and decreased activity level and sleep duration relative to women in the healthy and disease control groups.

Method

Subjects

To be eligible for inclusion in the breast cancer (BC) group, a woman needed to: (a) be at least 18 years of age; (b) have an initial diagnosis of Stage 0, I, or II carcinoma of the breast (American Joint Committee on Cancer, 1988); (c) be in disease remission; (d) have received adjuvant chemotherapy and/or radiotherapy; and (e) be 6 to 30 months post-completion of adjuvant chemotherapy or radiotherapy. The final BC group consisted of 25 women a mean of 48.2 years of age (SD = 8.6, range 28-63) and a mean of 15.3 months since completion of adjuvant chemotherapy and/or radiotherapy (SD = 7.1, range 6-26). Stage of disease at initial BC

diagnosis in the BC group was: 4% Stage 0; 48% Stage I; 44% Stage II; and 4% unknown. Forty-eight percent of the BC group received chemotherapy only, 28% received radiotherapy only, and 24% received a combination of chemotherapy and radiation as adjuvant treatment.

To be eligible for inclusion in the benign breast problem (BBP) group a woman had to: (a) be at least 18 years of age; (2) have no history of cancer; (3) have a history of either a needle aspiration biopsy of the breast or an excisional breast biopsy for benign breast problems; and (4) be age-matched (within 4 years) with a member of the BC group. The final BBP group consisted of 24 women a mean age of 49.1 years (SD = 8.2; range 28-63). Median time since most recent breast was 41 months (range 4 to 312 months).

To be eligible for inclusion in the healthy comparison (HC) group a woman had to: (1) be at least 18 years of age; (2) have no history of cancer; (3) have no history of either a needle aspiration biopsy of the breast or an excisional breast biopsy for benign breast problems; and (4) be age-matched (within 4 years) with a member of the BC group. The final HC group consisted of 25 women a mean age of 48.1 years (SD = 8.6; range 30-65).

Procedure

Participants in the BC and BBP groups were recruited from the University of Kentucky Comprehensive Breast Care Center during the course of receiving routine follow-up care. Women in the HC group were recruited by asking women in the BC and BBP groups to identify an acquaintance similar to them in age and with no known history of breast cancer or benign breast problems. All participants completed an Initial and Follow-up assessment session scheduled one week apart. During the Initial assessment session (i.e., Day 1), participants were screened to verify study elegibility and provided written informed consent for study participation

per University of Kentucky Institutional Review Board guidelines. Participants then completed several subjective measures of fatigue as well as several other psychological and physical measures associated with fatigue. Finally participants were instructed in daily diary assessment procedures (see below). During the Follow-up assessment session (i.e., Day 8) participants turned in completed daily diaries and completed a subset of measures completed at the Initial assessment. Participants were paid $50.00 for study participation. The data reported here uses information collected in the daily diary assessments (i.e., Days 2-6).

Beginning the day after completion of the Initial assessment (i.e., Day 2), all participants completed daily diary assessment measures (described below) for five consecutive days (Days 2-6). A time-contingent sampling approach was used (Stone & Shiffman, 1994) with participants completing the diary measures at four specific times each day: upon rising in the morning and at 10:00 am, 2:00 pm, and 9:00 pm. These times were chosen to allow for participants' usual awakening time and to ensure a sampling of participants' status across a full day. During Days 2-6, subjects wore a digital watch programmed to sound an alarm at 10:00 am, 2:00 pm, and 9:00 pm as a reminder to complete the diary measures (cf., van Eck & Nicolson, 1994).

Daily diary assessment measures. Throughout the day, participants completed measures of current fatigue, pain, mood, and activity. Participants also recorded the actual time of completion of each diary assessment. At each of the four daily diary assessments, current fatigue (FATIGUE-D) and pain (PAIN-D) were both assessed using 10-point Likert scales with one endpoint labeled "no fatigue/pain" and the other endpoint labeled "worst possible fatigue/pain." Similarly, at each of the four daily times of assessment, current mood was assessed using the Positive and Negative Affect Scale (PANAS; Watson et al., 1988). The PANAS consists of 20

mood adjectives and subjects rated each on a 5-point Likert scale with regard to how much each adjective described them at the moment. Endpoints were labeled "very slightly or not at all" to "extremely." The PANAS yields separate subscale scores for positive and negative mood. Finally, current activity was assessed at the 10:00 am, 2:00 pm, and 9:00 pm daily diary assessments. Following Stone et al. (1994), participants recorded the type of activity they were currently engaging in with seven specific activity categories including working, relaxing, eating/drinking, socializing, housework/yardwork, exercising, or other).

Daily activity level was assessed on Days 2-6 using a pedometer measuring daily distance walked (in tenths of a mile) (Voorrips et al., 1991). The pedometer was worn at the waist and each participant attached the pedometer upon awakening and detached it at the final diary assessment period each night (i.e., 9:00 pm). Participants recorded the pedometer reading each night in their daily diary in terms of number of miles walked that day and reset the pedometer for the next day of monitoring. Finally, each day at the initial diary assessment (i.e., upon rising) on Days 2-6 participants recorded total sleep duration the previous night in hours and minutes.

Data analysis. Standard procedures were used to calculate positive and negative affect subscale scores for the PANAS. Data from the daily diary assessments were aggregated across Days 2-6 for purposes of Time x Group analyses (cf., Stone & Shiffman, 2002). Specifically, all FATIGUE-D and PAIN-D ratings, as well as PANAS positive and negative subscale scores, were summed across all five days of diary assessment for each of the four daily time periods assessed. The result was then divided by five to obtain a mean for each of the four daily assessment times over the entire five day daily diary period. Repeated measures TIME (4) x GROUP (3) analyses of variance were conducted using mean FATIGUE-D, PAIN-D, and PANAS positive and

negative subscale scores as dependent variables to examine group differences in overall symptom and mood levels (i.e., a GROUP main effect), the diurnal pattern of symptoms and mood (i.e., a TIME main effect) and group differences in diurnal symptoms and mood patterns (i.e., GROUP x TIME interaction effect). Post hoc analyses were conducted using the Least Significant Differences (LSD) test. An alpha level of .05 was used as the criterion for statistical significance.

Results

Characteristics of Daily Diary Assessments

Participants were prompted to complete diary assessments at four specific times each day during the five day EMA period. The predetermined and self-reported actual mean times of diary completion were as follows: Rising – M = 7:07am (SD = 81.4 mins), 10:00am – M = 10:05am (SD =18.32 mins), 2:00pm – M = 2:10pm (SD = 27.34 mins), and 9pm – M = 9:05pm (SD = 36.6 mins). The diary assessments resulted in very little missing data. The proportion of missing data for each of the variables assessed in the daily diary assessments (i.e., FATIGUE-D, PAIN-D, PANAS positive and negative mood, current activity) was less than 1%. Most of the participants (93%) completed the Day 1 assessment on a Tuesday, Wednesday, Thursday, or Friday and commenced the daily diary assessments the following day. Therefore, all participants' daily diary recordings included a combination of three weekdays and two weekend days.

Fatigue. A repeated measures TIME (4) x GROUP (3) analysis of variance (ANOVA) was conducted using FATIGUE-D ratings as the dependent variable (see Table 1). Results indicated significant main effects for both GROUP $F(2, 70) = 4.56$; $p < .01$ and TIME $F(3, 210) = 30.39$; $p < .001$). Post hoc analyses for the main effect for GROUP indicated the BC group

reported significantly greater fatigue than the HC group at 10:00 am, 2:00 pm, and 9:00pm. The BC group also reported greater fatigue than the BBP group at 10:00 am and 9:00pm. There were no differences in fatigue among the three study groups at the rising time period. Post hoc analyses for the main effect for TIME indicated fatigue ratings at each of the four daily assessment periods were significantly different ($p < .01$) from one another (rising mean = 3.2; 10:00 am mean = 2.3; 2:00 pm mean = 2.8; 9:00 pm mean = 3.7). There was no significant GROUP x TIME interaction effect for mean FATIGUE-D levels $F(6, 210) = 1.08$; $p = .37$ indicating no group differences in diurnal fatigue patterns. Results of this TIME x GROUP analysis for FATIGUE-D ratings are shown in Figure 1.

Pain. An identical repeated measures TIME x GROUP ANOVA was conducted using PAIN-D ratings as the dependent variable (see Table 1). Results indicated a significant GROUP main effect for PAIN-D ratings $F(2, 69) = 7.11$; $p < .01$. Post hoc analyses indicated the BC group reported greater pain than both the BBP and HC groups at each of the four daily diary assessment times. A significant main effect for TIME $F(3, 207) = 8.94$; $p < .001$ was also obtained. Post hoc analyses indicated pain ratings upon rising (mean=2.0) were significantly greater than pain ratings at both the 10:00 am (mean = 1.6) and 2:00 pm (mean = 1.6) assessments ($p < .01$). Pain ratings at 9:00 pm (mean = 1.9) were also significantly greater than mean pain levels at 10:00 am and 2:00 pm ($p < .01$). No significant GROUP x TIME interaction was obtained $F(6, 207) = .96$; $p = .46$ indicating no group differences in diurnal pain patterns. Results of this TIME x GROUP analysis for PAIN-D ratings are also shown in Figure 1.

Mood. Two similar repeated measures TIME x GROUP ANOVA's were conducted using PANAS positive and negative mood subscale scores as dependent variables (see Table 1). With

respect to positive mood, analysis of the main effect for GROUP indicated no significant differences among the three study groups F (2, 70) =.50; p =.61. However, examination of the diurnal pattern of positive mood indicated a significant main effect for TIME F (3, 210) = 63.45; $p < .001$. Post hoc analyses revealed positive mood scores at each of the four daily diary assessment times were all significantly different from each other (all p's < .01) with the exception of the 10:00 am and 2:00 pm assessment points (p = .08). Mean positive mood levels at the four assessment times (summed across the 3 study groups) were: rising mean = 20.2; 10:00 am mean = 26.7; 2:00 pm mean = 26.0; and 9:00 pm mean = 23.0. No significant GROUP x TIME interaction F(6, 210) = 1.97; p = .07 for PANAS positive mood scores was obtained indicating no group differences in the diurnal pattern of positive mood. Results of this TIME x GROUP analysis for PANAS positive mood subscale scores are shown in Figure 2.

Results of a similar GROUP x TIME repeated measures ANOVA using PANAS negative mood scores as dependent variable indicated no significant main effects for either GROUP F(2, 70) = 1.65; p = .20 or TIME F(3, 210) = 1.37; p = .25 and no significant GROUP x TIME interaction F(6, 210) = 1.55; p = .16. Results of this TIME x GROUP analysis for PANAS negative mood scores are shown in Table 1 and Figure 2.

Interrelationships among fatigue, pain, mood and sleep duration. To examine the relationships between fatigue and concurrent reports of pain and mood, Pearson Product-Moment correlations were computed for each of our three study groups for FATIGUE-D ratings and PAIN-D, PANAS-Positive, and PANAS-Negative scores at each of the four daily assessment times, collapsing across all five days of assessment. Results are shown in Table 2. In general, fatigue reports were significantly associated with concurrent reports of pain, positive mood and

negative mood in all three study groups. This pattern of significant relationships was most apparent in the BC and BBP groups, a bit less apparent in the HC group.

We also examined the time-lagged relationships between FATIGUE-D ratings and reports of pain, mood, and sleep disturbance in the BC group. The Pearson Product Moment Correlations, collapsing across all 5 days of diary assessments, for these time-lagged relationships are shown in Table 3. Sleep duration was unrelated to reports of fatigue at any of the four daily assessment times. In general, the correlation between fatigue ratings and pain and mood assessments declined with increasing lag intervals. For example, the relationship between pain and fatigue ratings was .62 upon rising, declining steadily to .16 at the 9:00 PM assessment. Similarly, the relationship between pain and fatigue ratings was .60 at the 10:00 AM assessment, declining steadily to .19 at the 9:00 PM assessment.

Mood and symptom variability. Analyses of the daily diary assessments for FATIGUE-D, PAIN-D, and the PANAS positive and negative subscales were conducted to examine variability over the five day daily diary assessment period and to identify whether variability differed across the three study groups. For each of the four daily diary measures, the standard deviation (SD) across the 20 assessment periods (4 reports per day for five days) was calculated for each participant. Four separate 3-group, one-way ANOVA's were conducted using the SD for each of the daily diary measures as the dependent variable. Results indicated no difference across the three study groups in variability of FATIGUE-D (BC mean SD = 1.7, BBP mean SD = 1.4, HC mean SD = 1.5; $F(2, 70) = .90$; $p = .41$ or PAIN-D (BC mean SD = .95, BBP mean SD = .82, HC mean SD = .62; $F(2, 70) = 1.95$; $p = .15$) ratings. Similarly, no differences were found across the three study groups with regard to variability of PANAS positive mood (BC mean SD

= 5.9, BBP mean SD = 6.4, HC mean SD = 6.7; $F(2, 70) = 1.15$; $p = .32$) or negative mood (BC mean SD = 2.4, BBP mean SD = 2.2, HC mean SD = 2.0; $F(2, 70) = .33$; $p = .72$) scores.

Daily activities, activity level, and nightly sleep duration. Potential group differences in the type of specific activities participants' engaged in at the 10:00 am, 2:00 pm, and 9:00 pm daily diary assessments were examined. For each of the seven categories of activity assessed, a proportion of the number of times the individual reported engaging in that activity divided by the total number of assessments (n=15; five days by three assessments per day) was calculated (cf., Stone et. al., 1994). A 3-group, one-way ANOVA was then conducted for each of the seven activities using this proportion as the dependent variable. Results are shown in Table 4. Results indicated no differences among the three study groups for any of the seven specific categories of activities recorded.

Differences in activity level across the three study groups and the five days of daily diary assessment were examined. Distance (in miles) walked each day, indexed by daily pedometer readings, was the dependent variable in a repeated measures TIME (5) by Group (3) ANOVA. Results indicated no significant main effects for either GROUP $F(2, 61) = 2.25$; $p = .11$ or TIME $F(4, 244) = .37$; $p = .83$, and no significant GROUP x TIME interaction $F(8, 244) = .54$; $p = .82$. Results of this analysis are portrayed in Figure 3.

Finally, differences in sleep duration across the three study groups and the five days of daily diary assessment were examined. A repeated measures TIME (5) x GROUP (3) ANOVA was conducted using daily diary reports of sleep duration (in hours) as the dependent variable. Results indicated no significant main effect for either GROUP $F(2, 69) = .22$; $p = .81$ or TIME $F(4, 276) = 1.98$; $p = .47$ and no significant GROUP x TIME interaction $F(8, 276) = .95$; $p = .47$.

Discussion

While fatigue is a prominent complaint associated with ongoing cancer treatment (Irvine et. al., 1991; Atkinson et al., 2000; Winningham et. al., 1994), understanding of the nature and course of this distressing symptom once treatment has been completed is limited. Based upon research which has utilized retrospective (i.e., non-EMA) assessments of fatigue with off-treatment cancer survivors (e.g., Andrykowski et al, 1998), we hypothesized daily reports of fatigue would be greater in our BC group relative to our two age-matched control groups. Our data provided strong support for this hypothesis by suggesting the BC group reported greater fatigue throughout the day relative to the HC and BBP groups (see Table 1 and Figure 1). As the BC group was a mean of 15 months (range 6-26 months) post-completion of adjuvant radiotherapy and/or chemotherapy, our EMA-based data are consistent with retrospective data obtained in other studies of fatigue in breast cancer survivors (e.g., Andrykowski et al., 1998; Bower et al., 2000) and suggest fatigue levels can continue to be elevated long after completion of adjuvant therapy.

While replicating this result of previous research employing retrospective assessments of fatigue, our use of an EMA approach to fatigue assessment enabled us to make at least six unique observations about fatigue in breast cancer survivors. First, no differences were observed in the diurnal pattern of fatigue evidenced by the BC group, relative to the HC and BBP control groups. All three groups in the present study evidenced an identical "U-shaped" pattern of fatigue ratings across the course of the day (see Figure 1). The BC group's "U-shaped" pattern of daily fatigue ratings was simply elevated relative to similar patterns evident in the HC and BBP groups. Using EMA and other experience-sampling techniques, similar results have been obtained in studies of fatigue in CFS patients and other healthy and disease condition control groups (Stone et. al., 1994;

Wood & Magnello, 1992; Wood et al., 1992). Second, while daily fatigue ratings were generally higher in the BC group, the BC group did not significantly differ from the HC and BBP groups at the initial daily assessment, that is, upon rising after a night's sleep. Fatigue levels diverged thereafter, however, with the BC group reporting significantly greater fatigue at each of the three subsequent daily assessments. Third, the relationship between fatigue reports and concurrent reports of pain and mood were essentially similar in all three study groups (see Table 2). Fourth, sleep duration was unrelated to daily fatigue reports in the BC group. Fifth, the variability of fatigue ratings across the five day diary period did not differ among our three study groups. In other words, there was no evidence that the experience of fatigue in BC survivors was characterized by wider or narrower fluctuations in fatigue over the course of the day, relative to fluctuations evident in the HC and BBP groups. A sixth unique observation regarded the assessment of daily activities engaged in by our three study groups. No evidence suggested the type of daily activities engaged in by BC survivors differed from the activities engaged in by women in the HC and BBP groups.

Considered together, what do these six unique observations about fatigue in BC survivors afforded by our use of an EMA approach suggest? We believe they suggest several things about the nature and etiology of fatigue in breast cancer survivors. First, our data suggest the experience of fatigue in breast cancer survivors, while quantitatively different from fatigue experienced by other generally healthy women, is not necessarily qualitatively different. More specifically, the fatigue reported by BC survivors is characterized by a diurnal pattern and level of variability that is similar, if not identical, to that reported by other generally healthy women. Furthermore, the relationships between fatigue reports and concurrent reports of mood and pain were very similar in our three study groups (Table 2). Second, contrary to earlier theoretical conceptualizations of the etiology of

cancer-related fatigue (Nail & Winningham, 1993; Winningham et al., 1994), our data suggest the elevated fatigue reported by BC survivors is likely not due to sleep deficiencies experienced by this group. This conclusion is based on the observation there were no significant differences among the three study groups with regard to fatigue reports at the initial daily diary assessment period (i.e., upon waking). In other words, it did not appear the BC group began the day less refreshed than the HC and BBP control groups. Furthermore, there were no significant differences among the three study groups with regard to nightly sleep duration across the five day study period. Finally, sleep duration was unrelated to diary fatigue ratings in the BC group. Rather, our data suggest the elevated fatigue in our BC group might be due to greater "fatigueablity." While beginning the day with a level of energy identical to the HC and BBP groups, while engaging in a profile of daily activities similar to the HC and BBP groups, and while evidencing a level of overall physical activity (as indexed by daily pedometer measurements of miles walked) similar to the HC and BBP groups, the BC group nevertheless reported a more steeply escalating level of fatigue over the day. This suggests BC survivors may simply tire more easily in response to similar types and intensity of physical activity. Of course, what might account for this greater "fatigueability" in the BC group cannot be ascertained from our data and is a significant question for future research.

Retrospective indices of depression, anxiety, and general distress are often elevated in cancer survivors and are frequently positively associated with concurrent reports of fatigue (e.g., Tross & Holland, 1990; Irvine et. al., 1991; Winningham et. al., 1994). Again, our use of an EMA approach provided a unique view of the temporal correspondence of these endpoints in a sample of BC survivors. While positive and negative mood were moderately associated with concurrent reports of fatigue in all three of our study groups (Table 2), we found no differences between the BC group

and the HC and BBP control groups with regard to the magnitude and diurnal pattern of positive and negative mood (Figure 2). Interestingly, while negative mood displayed a relatively flat diurnal pattern in all three study groups (Figure 2), positive mood displayed an "inverted-U" diurnal pattern which was essentially the inverse of the "U-shaped" diurnal pattern of fatigue evident in our study groups (Figure 1). Thus, our data suggest that fatigue reports might more closely track reports of positive mood. This is not a pattern unique to BC survivors but rather is a pattern evident in our HC and BBP groups as well. While the etiological or clinical significance of our findings regarding the diurnal relationship between fatigue and mood are unclear, our findings do suggest that fatigue can be experienced in BC survivors in the absence of psychological distress, and vice versa.

In contrast, our data suggest stronger correspondence between fatigue and pain. While some studies of fatigue after adjuvant cancer therapy have included concurrent assessments of pain or other physical symptoms (e.g., Blesch et al., 1991; Bower et al., 2000; Gaston-Johansson et al., 2000) none looked at the correspondence in diurnal patterns among these symptoms. In the present study, findings for pain reports were identical to those for fatigue reports. Specifically the BC group reported significantly more pain relative to the HC and BBP groups with no differences among the groups in the diurnal pattern of pain reports (see Figure 1). Notably, the "U-shaped" diurnal pattern of pain reports shared by our three study groups was similar to the diurnal pattern of fatigue evident in our three study groups. In addition, the correlation between concurrent reports of pain and fatigue was generally higher than for positive or negative mood (Table 2). These results dovetail with research suggesting an important link between pain and fatigue in other clinical conditions such fibromyalgia and rheumatoid arthritis (Baumstark & Buckelew, 1992; Stone et al., 1997).

Finally, our data raise a question regarding the clinical significance of cancer-related fatigue

in the "off-treatment" setting. While fatigue may be unpleasant, and thus merit clinical attention solely on this basis, fatigue in our study did not appear to be all that strongly related to reports of negative mood, at least with regard to the moment-to-moment perspective afforded by our EMA approach. As research utilizing retrospective reports of fatigue and distress have generally noted at least a moderate association between these two endpoints (e.g., Andrykowski et al., 1998; Bower et al., 2000; Broeckel et al., 1998; Dimeo et al., 1999), some reconciliation between the findings yielded by these two different methodological approaches is necessary. Furthermore, fatigue did not appear to impact performance of daily activities in the BC group. The type of activities engaged in as well as the daily general level of physical activity did not differ among our three study groups. Admittedly, however, our pedometer measure of daily physical activity was crude and our diary measure of daily activities assessed only the type, and not intensity, of activity engaged in. Future research examining the moment-to-moment relationship between fatigue and daily activity in cancer patients should include more refined assessments of both activity level (e.g., accelerometer or actigraphy) and daily activities (Masse et al., 1998; Patterson et. al., 1993.

While innovative in several respects, some limitations of the current study should be noted. While the use of two comparison groups (HC and BP) was a strength of our design, the BC group contained only 25 women, limiting statistical power and our ability to interpret null findings as a result. The heterogeneity of our BC group with regard to clinical characteristics (i.e., disease stage, treatment, time since diagnosis and treatment completion) is also a limitation. Clearly, replication with a larger sample, enabling closer analyses of how clinical characteristics might affect the fatigue experience, is warranted. In addition, we employed written diaries in which participants recorded responses at certain times of the day. While we had very little missing data, this "low-tech" EMA

approach is unable to whether participants completed diary assessments at the appropriate times. Patients may hoard assessments for completion at the end of the day or at the end of several days (Litt, Cooney, & Morse, 1998; Stone & Shiffman, 2000). Such "backfilling," if present, negates the advantage of the EMA approach – the ability to report experience in the environment and moment in which it occurs.

In conclusion, our findings provide additional evidence for the existence of elevated levels of fatigue in breast cancer survivors after completion of adjuvant chemotherapy and radiotherapy. However, while such "off treatment" fatigue has been documented in previous research utilizing retrospective fatigue reports (e.g., Andrykowski et al., 1998; Bower et al., 2000; Broeckel et al., 1998) the present study is among the first to use EMA to examine the diurnal experience of fatigue in cancer survivors. The experience of such fatigue raises interesting questions regarding the psychological, social, and biological mechanisms which might underlie this symptom as well as the overall clinical significance of this phenomenon. Our use of an EMA approach yielded some significant insights in this regard. Specifically, our findings indicate the relationship between reports of off-treatment fatigue and reports of both distress and activity type and intensity might be weaker than thought, suggesting the clinical significance of this phenomenon might be less than previously thought. In addition, our findings question the hypothesized role of sleep difficulties in the etiology of off-treatment fatigue and suggest off-treatment fatigue might stem from greater "fatigueability" in response to normal activities rather than from engaging in a different pattern of activities. Fundamentally, however, the present study suggests the EMA method is feasible for use in the assessment of cancer-related fatigue and provides unique and potentially valuable information regarding this perplexing and bothersome symptom.

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Table 1

Mean Daily Diary Measures at Each Time Period for Each of the Three Study Groups

	Rising	10:00 am	2:00 pm	9:00 pm
	M (SD)	M (SD)	M (SD)	M (SD)
FATIGUE-D				
BC Group	3.8 (2.3)	2.9 (1.8)	3.4 (1.8)	4.6 (1.7)
BBP Group	2.9 (1.2)	2.0 (.9)	2.7 (1.3)	3.5 (1.7)
HC Group	3.1 (1.5)	2.0 (1.0)	2.3 (.9)	3.1 (1.6)
PANAS-Positive Mood				
BC Group	21.4 (8.8)	26.5 (8.4)	26.1 (7.7)	24.6 (8.0)
BBP Group	20.7 (5.4)	28.0 (7.4)	26.4 (7.4)	22.2 (6.1)
HC Group	18.6 (5.0)	25.7 (6.0)	25.4 (5.4)	22.3 (4.3)
PANAS-Negative Mood				
BC Group	12.4 (4.2)	12.1 (3.1)	12.0 (2.3)	11.5 (2.2)
BBP Group	11.2 (1.1)	11.7 (2.0)	11.4 (1.7)	11.3 (1.6)
HC Group	11.3 (1.4)	11.0 (1.2)	10.8 (1.2)	11.1 (1.6)
PAIN-D				
BC Group	2.8 (2.0)	2.1 (1.8)	2.2 (1.5)	2.6 (1.6)
BBP Group	1.7 (.5)	1.4 (.5)	1.4 (.7)	1.7 (1.1)
HC Group	1.5 (.9)	1.3 (.5)	1.3 (.5)	1.9 (1.2)

Table 2

Pearson Product-moment Correlations Between FATIGUE-D Ratings and Concurrent Pain and Mood Rating at the Four Daily Diary Assessments For the Three Study Groups

	Concurrent PAIN-D	Concurrent Positive Mood	Concurrent Negative Mood
BC Group			
Rising	.62**	-.39**	.54**
10:00 am	.60**	-.19*	.39**
2:00 pm	.42**	-.28**	.33**
9:00 pm	.30**	-.29**	.27**
BBP Group			
Rising	.43* *	-.34**	.23**
10:00 am	.64**	-.36**	.18 *
2:00 pm	.33**	-.38**	.30**
9:00 pm	.53**	-.40**	.28**
HC Group			
rising	.21*	-.34*	.26**
10:00 am	.07	-.33*	.37**
2:00 pm	.45**	-.07	.31**
9:00 pm	.15	-.13	.03

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

Table 3

Time-Lagged Pearson Product-moment Correlations Between FATIGUE-D Ratings and Pain and Mood Ratings for the BC group.

	Fatigue T1	Fatigue T2	Fatigue T3	Fatigue T4
Positive Mood T1	-.39**	-.27**	-.15	-.12
Positive Mood T2		-.19*	-.09	.05
Positive Mood T3			-.28**	-.06
Positive Mood T4				-.29**
Negative Mood T1	.54**	.54**	.36**	.49**
Negative Mood T2		.39**	.23**	.08
Negative Mood T3			.33**	.17
Negative Mood T4			.	.27**
Pain T1	.62**	.52**	.30**	.16
Pain T2		.60**	.37**	.19*
Pain T3			.42**	.26**
Pain T4				.30**
Sleep Duration[a]	-.13	-.07	.07	.13

Note: T1=on rising; T2 = 10:00 AM; T3 = 2:00 PM; T4 = 9:00 PM

[a] Duration of sleep, in minutes, for previous night, recorded at T1

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

Table 4

Proportion of Daily Diary Assessments Reported for Each Activity for each of the Three Study Groups

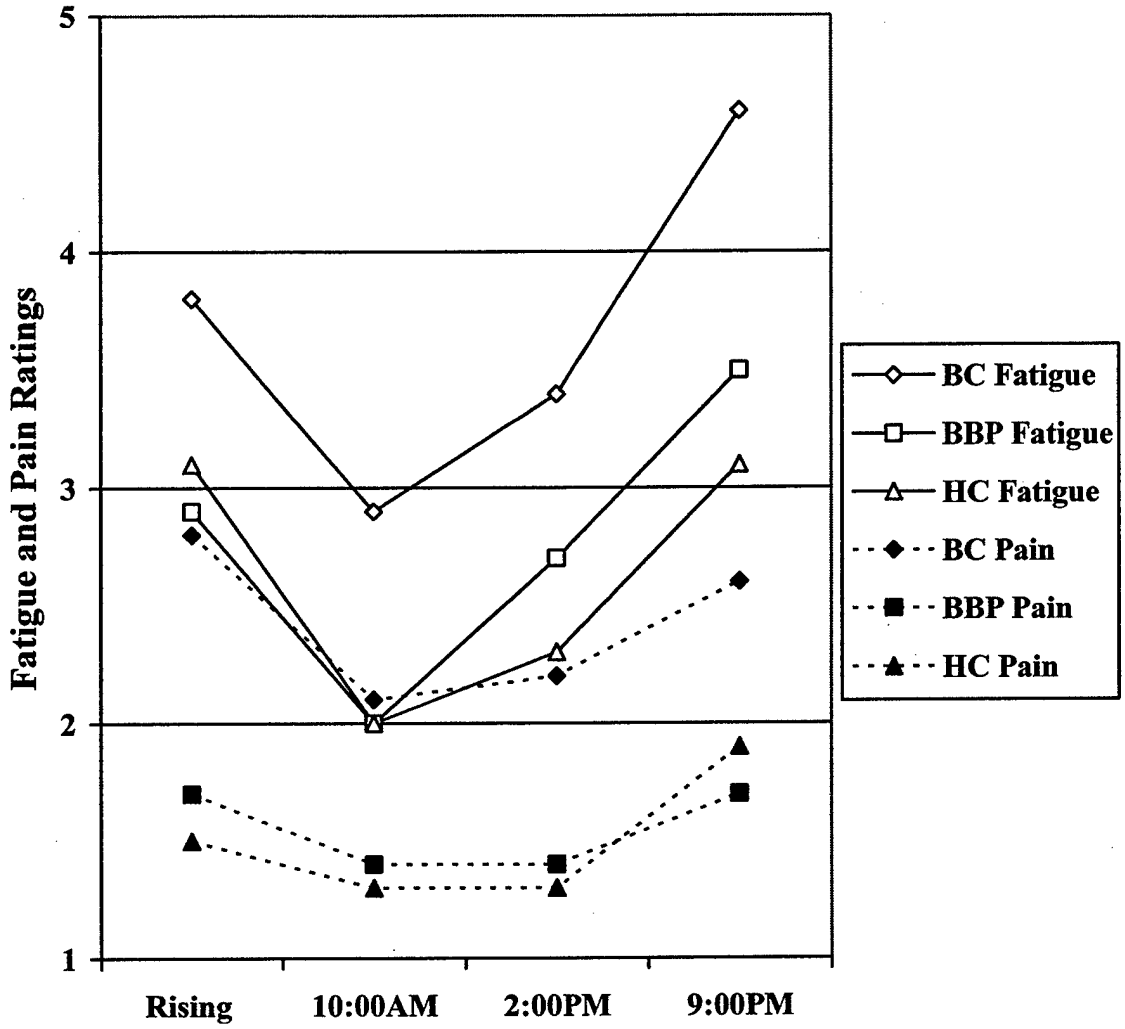
Activity	BC Group Mean (SD)	BBP Group Mean (SD)	HC Group Mean (SD)
Working	.27 (.18)	.31 (.18)	.30 (.18)
Relaxing	.29 (.17)	.29 (.16)	.21 (.12)
Eating/Drinking	.11 (.14)	.11 (.13)	.09 (.09)
Socializing	.15 (.16)	.15 (.13)	.16 (.13)
Housework/Yardwork	.11 (.14)	.12 (.11)	.16 (.17)
Exercising	.01 (.04)	.04 (.09)	.03 (.06)
Eating/Drinking	.38 (.21)	.26 (.26)	.30 (.20)

Note: One-way ANOVA analyses across 3 study groups indicated all ps>.05

Figure Captions

Figure 1. Diurnal patterns of mean fatigue (FATIGUE-D) and pain (PAIN-D) for three study groups.

Figure 2. Diurnal patterns of mean positive and negative mood levels for three study groups.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Fatigue and Pain Ratings
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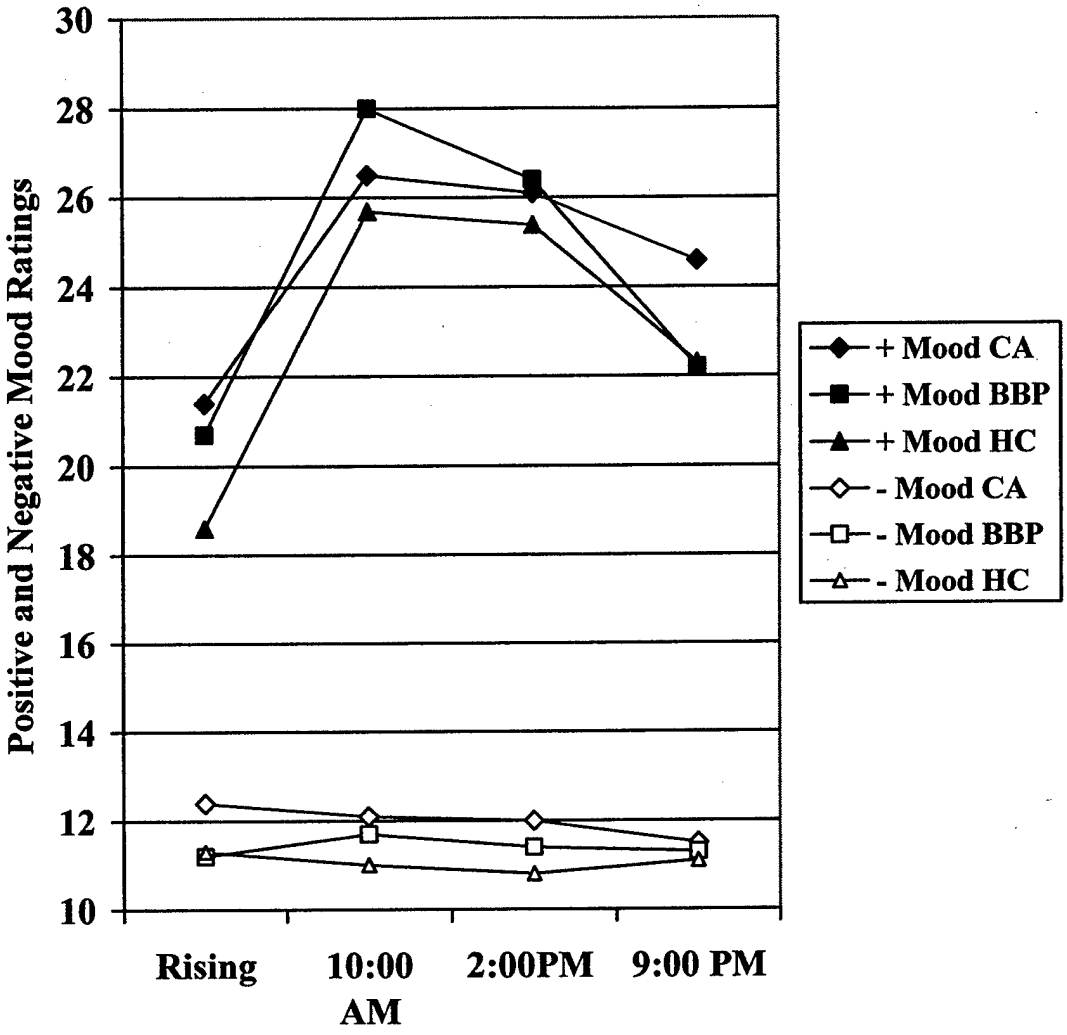
BBP Fatigue
HC Fatigue
BC Pain
BBP Pain
HC Pain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Positive and Negative Mood Ratings
Rising
10:00 AM
2:00PM
9:00 PM
+ Mood CA
+ Mood BBP
+ Mood HC
- Mood CA
- Mood BBP
- Mood HC

Running Head: BENIGN BREAST BIOPSY AND BSE

Impact of Benign Breast Biopsy Upon Breast Self-Examination

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Abstract

Current American Cancer Society guidelines recommend monthly performance of breast self examination (BSE) for women over 20 years of age. While the experience of a benign breast biopsy can result in elevated levels of distress, the impact of benign biopsy upon breast cancer (BC) screening behavior is not well known. The present study examined frequency of BSE practice in 102 women after benign breast biopsy (Biopsy Group). Telephone interviews were completed a mean of 21 days (Initial Interview) and 8 months after biopsy (Follow-Up Interview). A healthy comparison (HC) group of women (n=76) without a history of breast biopsy completed an Initial Interview only. Information regarding distress, dispositional characteristics, BC screening-related attitudes and behaviors, and subjective and objective risk for BC was collected. Results indicated the Biopsy and HC groups did not differ in typical (i.e., pre-biopsy) practice of BSE. However, practice of BSE changed after biopsy with a general trend toward a decrease in BSE frequency. Only 8% of women in the Biopsy group reported appropriate (once per month) practice of BSE at the 8 month Follow-Up while 28% reported appropriate practice at the Initial Interview. Decreases in BSE performance after biopsy were characteristic of younger women, women who lacked confidence in the ability to perform BSE correctly, and women whose biopsy was preceded by discovery of a breast lump or abnormality during BSE. Results suggest the potential value of a psychoeducational intervention after biopsy to enhance appropriate performance of BSE.

An estimated 203,500 women in the United States will be diagnosed with breast cancer (BC) annually [1]. While the causes of BC are not completely understood and the development of strategies for primary prevention is in its infancy, appropriate screening and early detection of BC have been associated with significant decreases in disease-related mortality and morbidity [2]. Currently available screening practices for BC include breast self-examination (BSE), clinical breast examination and mammography. In addition to specific recommendations for clinical breast examination and mammography, the *American Cancer Society* [1] recommends monthly BSE for all women after age 20 as a method for detecting changes in the breast over time.

Support for the efficacy of BSE in reducing BC-related mortality and morbidity has been equivocal [3]. Earlier studies suggested that BSE could result in earlier detection of BC and thus might contribute to more favorable mortality and morbidity outcomes [4,5]. More recent studies have suggested little impact of BSE practice upon mortality and morbidity outcomes [6,7]. Notwithstanding these conflicting results, there is evidence that a substantial proportion (71%) of breast cancers may be initially detected during BSE [8]. Such detections often occur among younger women who may not routinely attend mammography or CBE screening. In light of this, the authors recommended adherence to recommended BSE practice guidelines should be emphasized.

Unfortunately, it is estimated only 20-40% of women perform BSE at its recommended frequency (i.e., monthly) [9,10]. The majority of women perform BSE infrequently or not at all [11]. Factors linked to frequency of BSE performance include knowledge about BSE and confidence in performing BSE [9,12,13]. Additionally, Brain et al. [14] found that greater BC-related worry was associated with increased frequency of BSE practice while both perceived risk for BC and generalized anxiety were unrelated to frequency of BSE practice.

Some evidence suggests women at elevated risk for BC may tend to perform BSE less than recommended. Epstein, et al. [15] examined BSE among first degree relatives (FDR's) of newly diagnosed BC patients. Study participants were divided into one of three BSE categories based upon self-reported BSE practice over the previous 90-day period: 1) "under" screeners – less than recommended frequency (i.e., < once per month); 2) "appropriate" screeners (i.e., once per month); and 3) "over" screeners – greater than recommended frequency (> once per month). About one third of women were categorized as "under" screeners and another third as "over" screeners. Interestingly, about one-fourth of these "over" screeners (8% of the total sample) were identified as "excessive" in their practice of BSE, practicing more than 90 times over the preceding three month period (i.e., ≥ once per day). Excessive screeners reported higher perceived risk of BC and more frequent thoughts about BC. The authors suggested that frequent, intrusive thoughts about BC along with low confidence in performing BSE may underlie the excessive BSE practice.

Occasionally, BC screening can yield suspicious or abnormal findings in women without a breast malignancy. It is estimated that about 20% of routine mammograms are deemed "abnormal" [16]. Fortunately, the majority of such abnormal results are "false positives" (i.e., do not represent a malignancy). Appropriate clinical follow-up of these abnormal results may require performance of a diagnostic procedure, however, such as fine needle aspiration (FNA), core needle biopsy, or excisional breast biopsy, in order to make a definitive judgment regarding the presence or absence of malignant disease. The proportion of breast lesions diagnosed as malignant after surgical biopsy typically ranges from 10-40% [17,18].

Research has shown that women who undergo breast biopsy may experience psychological distress following the procedure which may persist over time [16,19, 20]. Significantly, a history of

breast biopsy with benign findings is associated with a higher objective lifetime risk of BC [21,22]. As a result, it is particularly important that women adhere to recommended BC screening guidelines following a benign breast biopsy. Paradoxically, however, distress related to the breast biopsy experience may negatively impact subsequent screening behavior [16]. For example, Andrykowski et al. [23] compared women who either did or did not adhere to clinical follow-up recommendations for mammography and/or clinical breast exam after benign breast biopsy. Factors predictive of nonadherence with follow-up recommendations included greater age, greater confidence in ability to perform BSE, and greater BC-related distress and perceived BC risk.

Additional findings suggest a woman's performance of BSE may be affected by the benign biopsy experience. For example, among women who had undergone benign breast biopsy, subsequent BSE performance differed as a function of whether or not a lump or abnormality was initially discovered through BSE [24]. Women who discovered a breast lump or abnormality via BSE were twice as likely to report reduced BSE frequency after a biopsy procedure relative to women whose lump or abnormality was not discovered during the practice of BSE. In another study, BSE frequency after breast biopsy was inversely related to pre-biopsy performance of BSE [25]. Women who had performed BSE at or above the recommended frequency (i.e., once per month) prior to breast biopsy tended to reduce BSE practice to below recommended frequency after biopsy. Conversely, women who performed BSE at less than recommended frequency prior to biopsy tended to increase BSE practice after biopsy. Reasons cited for decreasing or stopping the practice of BSE included feeling uncomfortable performing BSE, lack of confidence in performing BSE and perceptions that clinical exams are sufficient to detect breast abnormalities [25].

In summary, frequency of BSE performance is less than optimal in a majority of women.

Furthermore, research suggests the experience of benign breast biopsy can alter a woman's pattern of BSE performance. However, the specific impact of biopsy upon BSE performance remains to be clarified and factors related to change in BSE performance after biopsy have not been adequately identified. Thus, the purpose of the present study is twofold: (1) examine the specific impact of benign breast biopsy upon BSE performance; and (2) identify demographic, clinical and psychological variables associated with change in BSE performance following benign breast biopsy.

Method

Procedures

Potential participants in the Benign Breast Biopsy (Biopsy) group were identified from the roster of patients at the University of Kentucky Comprehensive Breast Care Center. Eligibility criteria for the Biopsy group included: (a) $\geq$ 18 years of age; (b) scheduled to undergo a breast biopsy or FNA for diagnostic purposes; (c) no prior history of BC, breast biopsy or FNA; (d) able to read and understand English; (e) telephone in the home; and (f) written informed consent.

Eligibility criteria for the HC group were: (a) $\geq$ 18 years of age; (b) no history of BC, biopsy or FNA; (c) able to read and understand English; (d) telephone in the home and (e) written informed consent for participation.

Biopsy group participants were identified from the patient roster of the Comprehensive Breast Care Center. Prior to biopsy, eligible women were introduced to the study by her physician. Women were given an explanation of the study by a research staff member and informed consent for study participation was obtained. After notification of biopsy results, women with benign findings were telephoned by a research staff member and an Initial Interview scheduled. The Initial Interview was conducted via telephone and was completed a mean of 21.3 days (SD=9.6; range=2 to 47) after

biopsy. All women in the Biopsy group also completed a Follow-Up telephone interview 8 months after biopsy. This was completed a mean of 246 days (SD=10.7; range=224-290) after biopsy.

Participants in the HC group were recruited through a variety of community print media. Advertisements solicited women interested in participating in a study of women's health. Interested women telephoned the project office and were screened for study eligibility. Eligible women were then scheduled for an Initial Interview conducted by telephone. All women in the HC group were paid $15.00 for completion of the study interview.

Assessment protocol and measures

At the Initial Interview, the Biopsy and HC groups completed measures of: (a) demographic and BC risk variables; (b) dispositional variables; (c) general distress; (d) BC-specific distress; (e) BC screening-related beliefs and behavior, and (f) perceived BC risk. At the 8 month Follow-Up the Biopsy group completed only sections "c," "d," "e," and "f" of the assessment protocol from the Initial Interview. The HC group did not participate in an 8 month Follow-Up Interview.

Demographic and BC Risk Variables. Information obtained included age, race, marital status, education, and annual household income. Information for estimating relative [26] and lifetime risk for BC [21] was also obtained including age at menarche, parity, history of benign breast biopsy, and number of first degree relatives (FDR's) with breast cancer.

Dispositional Variables. These included the Miller Behavioral Styles Scale-Short Form (MBSS-SF; [27]) and the Life Orientation Test (LOT; [28]). The MBSS-SF measures informational coping style and yields subscale scores for Monitoring and Blunting styles. The Monitoring subscale was used in the present research and had a coefficient alpha of .55. The LOT is a measure of dispositional optimism. Coefficient alpha was .80.

General Distress. Women completed the 37-item Profile of Mood States - Short form (POMS-SF; [29]. The 6-item Tension-Anxiety subscale of this measure was used as an indicator of general anxiety during the past week. The coefficient alpha for this subscale was .88.

BC-Specific Distress. Women completed the 15-item Impact of Events Scale (IES; [30]) a measure of avoidant and intrusive ideation regarding a specified stressor – in this case "the possibility that you will develop BC in your lifetime." Thus, the IES can be seen as a measure of BC-specific distress. The IES yields a Total score and Avoidance and Intrusion subscale scores. Coefficient alpha was .93, .87, and .90 for IES-Total, Avoidance, and Intrusion scores, respectively.

BC Screening-Related Beliefs and Behavior. Women were queried regarding confidence in their ability to practice BSE correctly. Four response options ranging from "not at all" to "definitely" were given [23]. Women were also asked if they were interested in additional training in how to perform BSE correctly. Response options were "yes," "no," and "unsure."

BSE performance was assessed via self report. To assess "typical" practice of BSE, women in the Biopsy group were asked at the Initial Interview "Prior to your biopsy or FNA, how often did you perform a breast self-examination?" Response options included "never," "< once a year," "1-2 time per year," "3-6 times per year," "once a month," "2-3 times per month," and "4 or more times per month." At the Initial Interview, women in the HC group were asked "How often do you perform a breast self examination?" Response options were identical to those for the Biopsy group. At the 8 month Follow-Up Interview women in the Biopsy group were asked "During the previous 3 months how often have you performed breast self examination?" Response options included "never," "once," "twice," "once a month," "2-3 times per month," and "4 or more times per month."

For the Biopsy group, lifetime frequency of clinical breast exam and mammography was

assessed via self-report at the Initial Interview. Women were asked how often they had undergone a clinical breast exam by a health care specialist. Response options included "never," "once," "once every 3 years or more," "once every two years," "yearly," "2 times per year," and "more than 2 times per year." Women were also asked how often they underwent mammography screening. Response options were identical to those for the clinical breast exam frequency question.

Perceived BC Risk. A subjective estimate of lifetime risk for BC was obtained. As in previous research [19,23,31,32], women estimated their personal lifetime risk for BC by providing a percentage between 0-100% in response to the question "What are the chances that you will develop breast cancer during your lifetime?" (Personal BC Risk).

Medical Record Review

Upon completion of the study, medical records of women in the BBB group were reviewed. Specifically, information regarding the type of surgical procedure performed and the circumstances leading to performance of the biopsy procedure was recorded. In particular, whether or not a woman reported discovering a suspicious breast lump or abnormality during BSE was noted.

Data preparation and analysis.

Women in the Biopsy and HC groups were categorized with regard to BSE performance based on responses to the question assessing BSE performance included in both the Initial (Biopsy and HC groups) and 8 month Follow-up Interviews (Biopsy group only). Categorization of BSE practice paralleled that employed by Epstein et al. [15] and was based upon *American Cancer Society* recommendations for monthly practice of BSE [1]. Three BSE practice groups were identified: (1) "Under practice," defined as women reporting BSE practice less than once per month; (2) "Appropriate practice," defined as women reporting BSE practice once per month; and

(3) "Over practice," defined as women reporting BSE practice more than once per month. BSE practice for women in the Biopsy group was categorized separately for both the Initial and Follow-up interviews while BSE practice in the HC group was categorized only for the Initial Interview.

Standard procedures were used to compute scale and subscale scores for the MBSS-SF, LOT, POMS-SF, and IES. An alpha level of .05 was used as the criterion for statistical significance.

Results

Sample Characteristics

A total 143 women were identified as study eligible for the Biopsy Group and 129 (90%) provided consent for study participation. Of the 14 women declining participation, most cited being "too busy" or "too stressed." Fifteen women who provided consent were later deemed ineligible for the study. These included 7 women subsequently diagnosed with BC, 3 women who did not complete the Initial Interview, and 5 women who did not complete the Initial Interview within 50 days of their biopsy. Of the remaining 114 women, 12 never completed an 8 month Follow-up Interview and were omitted from all analyses (i.e., dropouts). The Biopsy group thus consisted of 102 women who completed both the Initial and 8 month Follow-up Interviews. A total of 76 women from the community were recruited to form the Healthy Comparison (HC) group. Demographic characteristics of the Biopsy and HC groups are presented in Table 1.

Initial Analyses

Biopsy and HC groups. The majority of the Biopsy group (62%) underwent a breast biopsy while the remainder underwent an FNA (31%) or both biopsy and FNA procedures (7%). Twenty women in the Biopsy group (20%) had at least one FDR with a history of BC (17 with one FDR; 3 with 2 FDR's). Mean relative risk for BC [26] in the Biopsy group was 3.0 (SD=1.4; range=1.4 to

10.1) while mean lifetime risk for BC [21] was 10.4% (SD=5.0%; range=2.7% to 34.2%). Among the women in the HC group, nine (12%) had one FDR with a history of BC. Mean relative risk for BC in the HC group was 2.7 (SD=0.9; range=1.3 to 5.8) while mean lifetime risk for BC was 7.7% (SD=3.3%; range=1.0 to 17.1%). Demographic characteristics for each group are shown in Table 1.

Comparison of the 102 women in the Biopsy group with the 12 women who failed to complete the 8 month Follow-Up Interview and who were excluded from all study analyses revealed no significant differences with regard to age, education, # of FDR's with BC, relative or lifetime risk for BC, lifetime history of mammography or clinical breast exam, practice of BSE prior to biopsy, or IES scores at the Initial Interview (all p's > .10). The two groups did differ with regard to race and perceptions of personal BC risk (both p's < .05). Study dropouts were more likely to be African American or another ethnic minority (58% vs. 11%) and to have higher perceptions of personal lifetime risk for BC (mean of 54% vs. 30%) than women in the Biopsy group.

The Biopsy and HC groups did not differ with regard to age, number of FDR's with BC, perceptions of personal lifetime BC risk, or typical frequency of practice of BSE (all p's > .05). However the HC group was significantly more educated than the Biopsy group (15.3 vs. 13.8 years; p < .01) and included a lower proportion of racial minorities (3% vs. 11%). While the groups did not differ with regard to relative risk for BC [26], the two groups did differ with regard to lifetime BC risk [21]. The Biopsy group had a higher lifetime risk for BC than the HC group (10.4% vs. 7.7%; p<.01). This was not surprising given a history of Biopsy increases lifetime BC risk [21].

Performance of BSE at the Initial and 8 Month Follow-up Interviews. The proportion of women in the Biopsy group falling in the "under", appropriate" and "over" practice of BSE groups at baseline was 57%, 28% and 15%, respectively. The corresponding proportions for women in the

HC group were 66%, 22% and 12%, respectively. Differences in the distribution of women in the Biopsy and HC groups across these three BSE practice categories at the Initial Interview were examined using chi-square analysis. No significant differences between the Biopsy and HC groups were found (χ^2 (2, N = 178) = 1.456, p = n.s.).

In the Biopsy group, frequency of BSE practice at the 8 Month Follow-up Interview was compared to frequency of BSE practice at the Initial Interview. As shown in Table 2, 40% (n=41) of women in the Biopsy group evidenced a change in BSE practice category between the Initial and 8 Month Follow-up Interviews. For about 1/3 of these women (i.e., 13/41) this change represented an increase in frequency of BSE practice. Of these 13 women, 10 changed from the "under" or "appropriate" practice of BSE categories at the Initial Interview to the "over" practice BSE category at the 8 Month Follow-up Interview. Conversely, for about 2/3 of the women (i.e., 28/41), a change in BSE practice category represented a decrease in BSE practice. Of these 28 women, 26 changed from the "over" or "appropriate" practice of BSE categories at the Initial Interview to the "under" practice of BSE category at the Follow-up. A McNemar test was used to evaluate the significance of change in BSE practice between the Initial and 8 Month Follow-up Interviews. Results indicated a significant change in BSE practice category between these two assessments ($p \leq .05$).

Whether or not discovery of a breast lump or abnormality while practicing BSE prior to biopsy was associated with change in BSE practice following biopsy was examined. As shown in Table 3, 37% (37/102) of women in the Biopsy group had discovered a breast lump or abnormality during practice of BSE immediately prior to biopsy. Of these 37 women, 21 (56%) evidenced no change in BSE practice category following biopsy. Of the remaining 16 women discovering a lump or abnormality during BSE, 9 women (24%) evidenced a decrease in BSE practice following biopsy

while 7 women (20%) evidenced an increase in BSE practice following biopsy. Among the 62 women in the Biopsy group who did not discover a breast lump or abnormality during their practice of BSE, 61% evidenced no change in BSE practice category following biopsy, 7% decreased their BSE practice and 32% increased their frequency of BSE practice after biopsy. Chi-square analysis of change in BSE performance following biopsy indicated a significant difference with regard to whether or not a woman detected a breast lump or abnormality during practice of BSE (χ^2 (2, N = 99) = 7.228, $p < .05$). Women who did not discover a lump during BSE practice were more likely to increase their practice of BSE compared to women who did discover a lump during BSE practice.

Multivariate prediction of change in BSE practice after biopsy. Multiple regression analysis was used to identify predictors of change in frequency of BSE practice between the Initial and 8 month Follow-up Interviews. The dependent variable in this analysis, change in BSE practice frequency, was the difference between BSE practice frequency reported at the Initial and 8 month Follow-up Interviews. Numerical values were assigned to each response option for the question assessing frequency of BSE practice ranging from 0 to 6 (Initial Interview) and 0 to 6 (8 month Follow-up Interview) with lower values indicating a lower frequency of BSE practice. A single index, change in BSE frequency, was then calculated for each women by subtracting her score at the Initial Interview from her score at the 8 month Follow-Up Interview. Higher scores for this variable then represented an increase in BSE frequency. A set of 12 independent variables was entered into the regression analysis in one step. These included demographic variables (age, years of education), abnormal BSE prior to biopsy (Yes/No), objective lifetime risk for BC [21] and number of FDR's with BC), dispositional variables (MBSS-SF Monitor and LOT scores), BC screening-related beliefs and behavior variables (BSE confidence and perceived personal BC risk), General Distress (POMS

Anxiety subscale score) and BC-specific distress (IES Intrusion and Avoidance subscale scores). Results are shown in Table 4. The complete 12 variable regression model accounted for 24.5% of the variance in change in BSE frequency (Multiple $R = 0.495$; $F\,(12, 84) = 2.276$; $p = .015$). Significant individual predictors of change in BSE frequency included BSE confidence (β=.227; $p<.05$) and whether a woman had an abnormal BSE prior to biopsy (β= -.259; $p<.05$). Women reporting more confidence in their ability to perform BSE correctly were more likely to increase practice of BSE, whereas women reporting discovering a breast lump or abnormality during practice of BSE were more likely to decrease practice of BSE after biopsy.

To determine the "best fit" regression model using the set of 12 predictor variables, individual variables were removed from the regression model in stepwise fashion. The criterion for removal of a variable from the model was set at the $p\leq .05$ level. The dependent variable was again change in BSE frequency as described above. The final "best fit" model contained three variables: Age at baseline interview (β= .227; $p<.05$), confidence in performing BSE (β=.222; $p<.05$) and an abnormal BSE finding at baseline (β= -.231; $p<.05$). Specifically, women who <u>increased</u> their practice of BSE following biopsy were more likely to be older, profess more confidence in their ability to perform BSE correctly, and to not have discovered a breast lump or abnormality during practice of BSE. These three variables accounted for 17.3% of the variance in change in frequency of BSE practice following biopsy. (Multiple R = .418; $F\,(3, 93) = 2.417$; $p<.05$).

Discussion

Study findings confirm and extend previous research examining the impact of benign breast biopsy on subsequent performance of BSE. Specifically, our results confirm previous findings that the experience of benign breast biopsy can alter the frequency of BSE practice [24,25] as only 60%

of women in our Biopsy group remained in the same BSE practice frequency category prior to and after biopsy (see Table 2). The remaining 40% of the Biopsy group reported a change in BSE practice frequency, with the majority of these women (68%) reporting a decrease in the frequency of BSE practiced in the aftermath of breast biopsy. Change in BSE practice frequency could be positive if the biopsy experience triggers change in the direction of greater compliance with recommended BSE practice (i.e., once per month). However, our data indicate that reported change in frequency of BSE practice was generally not in the direction of more appropriate practice of BSE. Rather, our data suggest after biopsy women became less compliant with recommended BSE practice guidelines. At the Initial Interview 28% of the Biopsy group reported appropriate practice of BSE (i.e., once per month) prior to their biopsy procedure. At the 8 month-Follow-Up Interview, however, only 8% of the Biopsy group reported appropriate practice of BSE during the preceding three months. Thus, while the proportion of women that practiced BSE consistent with recommended guidelines prior to biopsy fell within the 20-40% range found in previous research with the general population [9,10], the proportion of women that practiced BSE consistent with recommended guidelines after biopsy dropped dramatically. Another way to look at our data regarding change in BSE practice is to look at the number of women who were either under or over practitioners of BSE prior to biopsy but who became appropriate practitioners of BSE after biopsy. Of 73 women who were either under or over practitioners of BSE prior to biopsy, only 5 (7%) moved into the appropriate BSE practice category at the 8 month Follow-Up. In short, our data strongly suggest the biopsy experience can significantly alter the practice of BSE and, in general, these changes are not in the direction of enhanced compliance with BSE practice guidelines.

While the general trend in our data was toward a decrease in reported BSE practice after biopsy, increases in BSE practice were also reported. As indicated above, these increases and decreases generally did not result in more appropriate practice of BSE following biopsy. Rather, the most common trend among the 41 women reporting change in BSE practice following their biopsy was to shift from appropriate practice of BSE prior to the biopsy to under practice of BSE afterwards. Twenty-one of 41 women (51%) reporting change in BSE practice exhibited this pattern. An additional five women (12%) made the rather remarkable transition from over practice of BSE prior to biopsy to under practice of BSE afterwards. Conversely, 10 women (25%) increased practice of BSE and became over practitioners of BSE.

Documentation of significant change in BSE practice after biopsy raises the question of what factors might account for differences among women in the direction and magnitude of change evidenced. A range of demographic, psychological, dispositional, attitudinal, and subjective and objective risk variables were examined. Decreases in BSE practice after biopsy were characteristic of younger women, low levels of confidence in the ability to perform BSE properly, and discovery of a lump or abnormality during BSE prior to the biopsy (Tables 3 and 4). While the latter finding is consistent with prior research by Janz et al. [24] and Haefner et al. [25], why discovery of a lump or abnormality during BSE should lead to decreased BSE performance is unclear. BSE might be avoided due to fear that discovery of another lump could result in a malignant diagnosis or initiate another distressing experience with benign breast biopsy. Indeed, some prior research has suggested anxiety may deter women from performance of BSE [16,33,34]. However, in the present study, neither general anxiety nor cancer-specific distress assessed at the Initial Interview were significant predictors of change in BSE practice (Table 4). Thus, while the mechanism linking discovery of a

lump or abnormality during BSE to decreased BSE performance cannot be determined from our data, the clinical implications of this finding are clear: if maintenance of BSE practice at recommended levels is a goal of post-biopsy clinical care, women who discover their lump or abnormality during BSE should be monitored closely for inappropriate decreases in BSE practice.

Not surprisingly, we found low confidence in the ability to perform BSE properly was associated with decreased BSE practice after biopsy. This lack of confidence likely translates into a lack of confidence in the "results" of BSE, making the practice of BSE consequently less informative if not more anxiety-provoking. What was surprising, however, was the lack of interest evidenced in learning how to better perform BSE. Of the women who expressed low levels of confidence in their ability to perform BSE correctly (i.e., "Not at all" or "A Little") at the 8-month Follow-up, only about one third (37.5%) expressed a desire to be taught how to better perform BSE. While additional training in BSE might be useful for some women following a biopsy, such training does not ensure appropriate practice of BSE. It is sobering to note that Lindberg and Wellisch [35] found even after extensive training and education in the practice of BSE, women reported they still did not consistently perform BSE. While the sample did not include women who had just experienced a biopsy, this study nevertheless suggests maintenance or establishment of appropriate rates of BSE practice in the aftermath of benign biopsy may not be achieved simply by appropriate skill training.

A sizable minority of woman at both the Initial and Follow-up Interviews were characterized by over practice of BSE relative to recommended guidelines. Specifically, 15% of women at the Initial interview and 18% of women at the Follow-up Interview reported practicing BSE more than once per month. This compares to the 18% prevalence of over practitioners of BSE reported by

Brain et al [14] in women with a family history of cancer, the 33% prevalence of over practitioners reported by Epstein et al. [15] in women with family members newly diagnosed with BC, and 12% prevalence of over practitioners found in the HC group in the present study. Thus, while some women become over practitioners of BSE after biopsy, it does not appear that the biopsy experience necessarily spawns legions of over practitioners of BSE. This, of course, is consistent with the general trend in our data toward a decrease in BSE practice after biopsy.

Interestingly, of women reporting over practice of BSE, the vast majority reported feeling "fairly" or "definitely" confident in their ability to perform BSE properly (80% and 94% at Initial and Follow-up interviews, respectively). Thus, excessive practice of BSE does not appear to be driven by lack of confidence in BSE performance. Although confidence in BSE performance was positively related to an increase in BSE practice after the biopsy, neither confidence in BSE performance nor general or BC-specific anxiety were associated with absolute levels of BSE practice at either of our two points of assessment. This suggests that anxiety, either general or BC-specific, plays less of a role in over practice of BSE than previously thought [14,35].

The limitations of the present study should be acknowledged. Clearly, use of a true prospective research design, including assessment of BSE performance prior to biopsy, would have strengthened the study. However, it is significant to note that reports of typical BSE performance obtained at the Initial interview did not significantly differ between the Biopsy and HC groups. This suggests reports of "typical" practice of BSE in the Biopsy group were not necessarily biased by the fact they were obtained after the biopsy procedure. A related, limitation was our reliance upon self-report assessments of BSE performance. The accuracy of self-reports of health behaviors, including cancer screening, can vary widely [36]. Due to its private nature, assessment of BSE is

difficult and the self-report procedures we employed typify those used in the vast majority of BSE-related research. Granted, the use of diary or more ecological methods of assessment may yield more accurate assessments of BSE performance [37]. Finally, BSE performance in the HC group was assessed at only a single time point. Inclusion of a follow-up assessment with the HC group might have provided a useful context for evaluating change in BSE performance in the Biopsy group as well as for examining possible causal mechanisms in any observed changes.

In summary, this study adds to existing knowledge regarding the psychological and behavioral impact of benign breast biopsy specifically [19,23] and of cancer screening activities more generally [38]. If one assumes that practice of BSE consistent with current guidelines is an important goal in the post-biopsy setting, this study suggests a brief psychoeducational intervention aimed at enhancing appropriate BSE performance may be warranted. Additionally, attention might be paid to enhancing proficiency of BSE performance [9,11] particularly since women with a history of breast biopsy might have breast densities that make it particularly difficult to detect changes in the breast. Given our findings regarding a link between low confidence in BSE performance and subsequent decreases in BSE, interventions targeting enhances self-efficacy and confidence in adequately performing BSE might be effective in ensuring that frequency of BSE after benign biopsy reflects current guidelines.

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Author Notes

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Table 1.

Demographic Characteristics of the Biopsy and Healthy Comparison (HC) groups.

	Biopsy Group (n=102)	Healthy Comparison Group (n=76)
Age [M (SD)]	44.7 (13.8)	45.3 (14.2)
Education* [years; M (SD)]	13.8 (3.0)	15.3 (2.5)
Ethnicity		
Caucasian	89%	97%
African American	8%	--
Other	3%	3%
Marital Status		
Married/Cohabitating	71%	69%
Single	12%	12%
Divorced/Separated	17%	17%
Other	--	2%
Annual Household Income		
Less than $20,000	34%	28%
$20,000-$40,000	20%	22%
$40,000-$60,000	17%	21%
Over $60,000	25%	28%

Note: * $p < .01$

Table 2

Proportion of Women in the Biopsy Group in BSE Practice Categories at Initial and 8 Month Follow-up Interviews

	BSE at 8 Month Follow-up		
	Under % (n)	Appropriate % (n)	Over % (n)
BSE at Initial Interview			
Under 57% (n=58)	86.3 (50)	5.1 (3)	8.6 (5)
Appropriate 28.4% (n=29)	72.4 (21)	10.3 (3)	17.3 (5)
Over 14.7% (n=15)	33.3 (5)	13.3 (2)	53.4 (8)
Totals (N=102)	74.5 (76)	7.9 (8)	17.6 (18)

Note. "Under"= < once per month; "Appropriate"= once per month; "Over"= more than once per month

Table 3

Change in BSE Practice at 8 Month Follow-up by Abnormal BSE Finding Prior to Benign Breast Biopsy

	BSE Practice Change at 8 Month Follow-up		
	Decrease % (n)	No Change % (n)	Increase % (n)
Abnormal BSE Finding			
Yes 37.4% (n=37)	24.3 (9)	56.1 (21)	19.6 (7)
No 62.6% (n=62)	6.4 (4)	61.3 (38)	32.3 (20)
Totals (N=99)	13.1 (13)	59.6 (59)	27.3 (27)

Table 4

Standardized Beta Weights for Multiple Regression Analysis of Change in BSE Frequency After Benign Breast Biopsy.

	Change in BSE Frequency	
	Complete model	"Best fit" model
Demographic variables:		
Age	.273	.227*
Education	- .201	--
Discovery of abnormality:		
Abnormal BSE? [a]	-.259*	- .231*
Cancer risk:		
# of FDR's with BC	.018	--
Lifetime cancer risk [b]	.075	--
Dispositional variables:		
Optimism	.073	--
Monitor	.145	--
BC-Related Attitudes & beliefs:		
BSE confidence [c]	.227*	.222*
Perrsonal BC risk [d]	-.074	--
General and BC specific anxiety:		
Poms-Anxiety	-.103	
IES-Intrusion	-.159	--
IES-Avoidance	.078	--
Total Model		
R^2	.245	.148
F Total	2.276*	6.571***

Note. *p <.05, **p <.01, ***p <.001
High scores on Change in BSE Frequency represent increases in BSE frequency between Initial & 8 month Follow-up Interviews.
[a] 0 = No; 1 = Yes. [b] from Benichou (1993) [c] 0 = "Not at all" or "a little" Confident; = "fairly" or "Definitely" Confident. [d] 0 – 100%

Paper Session #33 11:15 a.m.–11:30 a.m.

POSITIVE PSYCHOSOCIAL AND PHYSICAL HEALTH BEHAVIOR CHANGE AFTER CANCER DIAGNOSIS AND TREATMENT

Felicity Harper*, John Schmidt, Abbie Beacham, John Salsman, Alyssa Averill, Laura Boerner, Kristi Graves and Michael Andrykowski, University of Kentucky

While research has examined positive physical and psychosocial behavior changes in cancer survivors, rarely have they been examined in the same study and their relationship to dispositional (optimism, social desirability) and psychosocial variables (perceptions of cancer as a traumatic stressor, cancer-related intrusions, social support) is largely unknown. 216 off-treatment cancer survivors, 6-120 months post-dx, completed an online survey. Reports of change since dx in 2 physical (eating a healthy diet, engaging in physical exercise) and 4 psychosocial (reflecting on priorities, quality time with family/friends, engaging in volunteer work, devoting time to spiritual/religious activities) behaviors were obtained along with information on demographic, clinical, dispositional, and psychosocial variables. Whether cancer dx and treatment met DSM-IV criteria for a traumatic stressor was also assessed. Extent of post-dx positive behavior change ranged from 26% (regular exercise) to 79% (reordering priorities) with a mean of 0.7 physical, and 1.8 positive behavior changes reported. Positive physical and psychosocial behavior changes were only modestly correlated (r=.31) and cancer dx and treatment met DSM-IV criteria for a traumatic stressor for 54% of respondents. Multiple regression analyses using number of positive behavior changes as dependent variable indicated demographic (age, sex, education), clinical (time since dx, disease stage), and dispositional (social desirability) variables, were not associated with positive behavior change. However, reports of more positive behavior change were significantly related to greater cancer-related intrusions and social support (p's<.05) and greater dispositional optimism (p< .01). While positive behavior change was unrelated to whether cancer met DSM-IV criteria as a traumatic stressor, viewing cancer as a threat to life or physical integrity was marginally associated with more positive behavior change (p<.10). Results are interpreted in light of current theories of adaptation to trauma, in general, and cancer diagnosis and treatment, in particular.

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Citation Paper
Paper Session #21 2:00 p.m.–2:15 p.m.

CHANGE IN EXERCISE AND FATIGUE-RELATED DISABILITY DURING ADJUVANT THERAPY FOR BREAST CANCER

Abbie Beacham, Ph.D.1, Paul Jacobsen, Ph.D.2 and Michael Andrykowski, Ph.D.3

1University of Louisville; 2University of South Florida; and 3University of Kentucky

Fatigue is a common occurrence during cancer treatment. Exercise during treatment has been shown to attenuate this debilitating symptom. Exercise's impact on perceptions of fatigue-related disability may facilitate more adaptive progression through cancer treatment and recovery. Participants were women receiving adjuvant chemotherapy (CT: n=156) and radiation therapy (RT: n=149) for stage 0, I or II breast cancer. Participants completed the Godin Leisure-Time Exercise Inventory and Fatigue Severity Inventory at Baseline (T1), mid-treatment (T2) and treatment completion (T3). Multivariate analyses (controlling for T1 exercise levels) indicated the CT and RT groups differed in levels of exercise (frequency X intensity) ($F(1, 302)=7.35$, $p<.01$) at T2 and T3. While the RT group's level of exercise remained largely stable from T1 to T3, the CT group's level of exercise initially decreased (T1-T2), then rebounded (T2-T3), trending toward baseline levels ($p<.001$). Fatigue disability change scores were calculated to evaluate fluctuations among fatigue and exercise variables. Approximately 70% of the CT group evidenced stable ratings of fatigue-related disability (within +/–1.0 sd) throughout adjuvant treatment. Partial correlations (controlling for T1 exercise levels) indicated as treatment progressed for the CT group, ratings of average and peak daily fatigue and fatigue-related disability were inversely related to exercise levels at T2 and T3 (all p's<.05). Results suggest increases in exercise levels over the course of CT are accompanied by decreased fatigue and fatigue-related disability. CT patients may desire a return to normal activity which may occur with concurrent fluctuations in perceptions of fatigue and related disability.

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Meritorious Student Paper
Paper Session #21 2:15 p.m.–2:30 p.m.

FATIGUE COURSE DURING RADIOTHERAPY FOR BREAST CANCER: WHAT INFLUENCES FATIGUE RECOVERY?

John E. Schmidt, Paul B. Jacobsen, and Michael A. Andrykowski, University of Kentucky and University of South Florida

Fatigue is a critical symptom during cancer treatment, and adversely affects quality of life. Understanding the prevalence, severity, and correlates of cancer-related fatigue has become a major research focus. Women (n=106) undergoing radiation therapy (RT) for stage 0-II breast cancer were assessed 3 times: (1) pre-RT; (2) post-RT; and (3) 4-months post-RT. Patients completed measures of fatigue severity (FSI), quality of life (MOS-36-SF), depression (CES-D), and symptom awareness (MSAS) at each assessment. There was a main effect for time on FSI average fatigue ratings ($p<.01$). Fatigue was higher at post-RT assessment (mean=3.3; SD=2.5) relative to pre-RT assessment (mean=2.2; SD=1.9) with fatigue returning to baseline at 4-month follow-up (mean=1.9; SD=1.9). Fatigue recovery was defined as > .5 SD increase in fatigue post-RT and return to < .25 SD increase at 4 months post-RT. At 4-months post-RT, 30% of women evidenced fatigue recovery (FR Group), 24% reported no fatigue recovery (NR Group), while no significant fatigue was reported by 45% of the sample during or following RT (NF Group). Patients in the NR group were more fatigued pre-RT ($p<.01$), reported more illness-related symptoms at post-RT, ($p<.01$), and reported poorer overall physical health 4 months post-RT ($p<.01$). There were no differences among the 3 groups on illness-related symptoms, depression, and overall mental or physical health assessed pre-RT (all p's>.05). Results suggest a significant proportion of RT recipients (24%) continue to report fatigue 4 months post-RT and suggest more aggressive management of RT-related side effects may be beneficial for patients with significant pre-RT fatigue. Results also suggest careful assessment of pre-RT fatigue may help identify patients susceptible to poor long-term fatigue recovery.

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VIII-1

Psychosocial and Physical Health Behavior Change After Cancer Diagnosis and Treatment

Andrykowski MA, Schmidt JE, Beacham A, Salsman J, Averill A, Graves KD, Harper FWK
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Cancer diagnosis (dx) and treatment can trigger change in physical lifestyle and psychosocial behaviors. While research has examined both physical and psychosocial behavior change in cancer survivors, rarely have they been examined in the same study. Additionally, the relationship of such behavior change to important dispositional (optimism, social desirability) and psychological variables (perceptions of cancer as a traumatic stressor, cancer-related intrusions, social support) is largely unknown. 216 off-treatment cancer survivors, 6-120 months post-diagnosis (mean = 37), completed an online survey. Reports of change since diagnosis in 2 physical (regularly eating a healthy diet, regularly engaging in physical exercise) and 4 psychosocial (reflecting on priorities, spending quality time with family/friends, engaging in charity or volunteer work, devoting time to spiritual/religious activities) behaviors were obtained along with information on demographic, clinical, dispositional, and psychosocial variables. Whether cancer dx and treatment met DSM-IV criteria for a traumatic stressor was also assessed. Results indicated extent of post-dx positive behavior change ranged from 26% (regular exercise) to 79% (reordering priorities) with a mean of 0.7 physical, 1.8 psychosocial, and 2.5 total positive behavior changes reported. (Reports of negative change in these 6 behaviors ranged from 1% (reordering priorities) to 47% (regular exercise) with a mean of 0.6 physical, 0.5 psychosocial, and 1.1 total negative behavior changes reported.) Reports of physical and psychosocial behavior changes were only modestly correlated ($r = .31$) and cancer dx and treatment met DSM-IV criteria for a traumatic stressor for 54% of respondents. Multiple regression analyses using total number of positive behavior changes as dependent variable indicated demographic (age, sex, education), clinical (time since dx, disease stage), and dispositional (social desirability) variables, were not significantly associated with reports of positive behavior change. Rather, reports of more positive behavior change were significantly related to greater cancer-related intrusions (beta = .27; $p < .01$) and greater social support (beta = .18; $p < .05$). Importantly, greater dispositional optimism was negatively related to reports of positive behavior change (beta = −.26; $p < .01$). While whether cancer met DSM-IV criteria as a traumatic stressor was unrelated to reports of positive behavior change, whether an individual viewed cancer as a threat to life or physical integrity was marginally associated

with more positive behavior change (beta = .13; $p < .10$). Results are interpreted in light of current theories of adaptation to trauma, in general, and cancer diagnosis and treatment, in particular.

P19-1

The Role of Social Support and Positive Mood in Cancer-Related Distress in Breast and Lung Cancer Patients

Harper FWK, Graves KD, Schmidt JE, Beacham A, Salsman J, Averill A, Boerner L, Andrykowski MA

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PURPOSE: The life-threatening nature of cancer diagnosis and treatment can lead to cancer-related PTSD symptoms including intrusive thoughts and avoidance behavior. Social support and mood are important determinants of adjustment, and consistent with other research on trauma, may be associated with cancer-related PTSD symptoms. Although similar in some respects, the differential experiences of breast and lung cancer patients may lead to unique outcomes and adjustment. This study explores both inter- and intra-group predictors of cancer-related distress among breast and lung cancer patients. METHOD: Breast (n = 93) and lung (n = 60) cancer patients responded to a Web-based survey, completing the PANAS, Duke Social Support Questionnaire, Social Constraints Scale, Impact of Events Scale, and a demographic questionnaire. Participants were primarily female (86.3%), Caucasian (95.4%), and married (75.7%). Mean age was 53.62 years ($SD = 10.32$; range: 24-85). Most patients had been diagnosed with local (43.1%) or regional (45.1%) disease, and approximately 23% (n = 36) were still receiving treatment. Mean time since diagnosis was 3.66 years ($SD = 4.07$; range: 0.27–22.35 years). RESULTS: Multiple regression analyses were used to test positive mood as a mediator between social support and cancer-related avoidance behavior. In the combined sample, social support predicted cancer-related avoidance ($B = -.20$, $p = .03$) after controlling for demographic (age, gender, marital status, ethnicity, income, education), clinical variables (time since diagnosis, cancer stage, current treatment status), and social constraints. Social support, however, was no longer a significant predictor ($B = -.06$, $p = .57$) after entering

positive mood into the model (F [12,127]=4.07, $B=-.34$, $p=.000$, $R^2=.30$), suggesting that support influences cancer-related avoidance through its impact on mood. For cancer-related intrusions in the combined sample, neither social support ($p=.32$) nor positive mood ($p=.07$) had a significant effect after controlling for demographics, clinical variables, and social constraints; cancer-related intrusions were better predicted by patient age ($B=-.39$, $p=.000$) and education level ($B=-.21$, $p=.02$). Predictors of cancer-related avoidance and intrusions were examined by diagnostic subgroups, and differences were found among breast and lung patients. For breast cancer patients, cancer-related avoidance was significantly predicted by social support and patient age but not positive mood, and intrusions were predicted by age with a trend for social support ($p=.06$). For lung patients, cancer-related avoidance was predicted by positive mood and ethnicity, and cancer-related intrusions were predicted by patient age but not social support or positive mood (p-values $<.05$). CONCLUSIONS: Findings point to potential risk factors for cancer-related avoidance and intrusions in the general cancer population. Most importantly, the data also suggest that risk factors may differ by cancer diagnosis and that psychological outcomes may best be studied within (rather than across) diagnostic categories.

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Utility of a case definition approach for studying the incidence, prevalence, and predictors of cancer-related fatigue

Andrykowski M, Beacham A, Jacobsen P
University of Kentucky College of Medicine, Lexington, Kentucky, USA

PURPOSE: Fatigue is a common and debilitating symptom reported by cancer patients during and after (i.e., "off-treatment" fatigue) cancer treatment. Scientific understanding of the epidemiology, etiology, and management of cancer-related fatigue (CRF) is hampered by lack of consensual definition of this syndrome.
METHODS: The utility of a 15-item fatigue diagnostic interview (FDI) for studying CRF was examined in a prospective, longitudinal cohort of 190 women undergoing treatment for Stage 0-II breast cancer. Participants were assessed 3 times: (1) before initiation of adjuvant radiation (n = 89) or chemotherapy and radiation (n = 101) (Baseline); (2) end of adjuvant treatment (Post-Tx); and (4) 6 months after conclusion of adjuvant treatment (Follow-Up). At each assessment the FDI and a modified version of the SCID was administered by trained interviewer. Respondents also completed the Fatigue Catastrophizing scale.
SUMMARY OF RESULTS: Using the FDI, prevalence of CRF "cases" was 14%, 15%, and 6% at the Baseline, Post-Tx, and Follow-Up assessments, respectively. The corresponding prevalence of "subsyndromal" CRF, defined as reporting a recent 2-week period of significant fatigue without meeting remaining CRF criteria, was 24%, 29%, and 20%. The proportion of CRF "cases" identified as incident cases at Post-Tx and Follow-Up was 81% (n = 17) and 60% (n = 3), respectively. Univariate analyses of clinical and psychosocial data indicated incident "cases" of CRF at the Post-Tx assessment were characterized by higher fatigue catastrophizing ($p < .05$) and

greater likelihood of SCID depressive disorder at Baseline ($p < .05$).
CONCLUSIONS: We conclude use of the FDI to identify "cases" of CRF is critical to scientific understanding of CRF. Data suggest the prevalence of CRF, particularly "off treatment" CRF, may be overestimated in studies not employing a case definition approach to CRF.

C-21

EFFECT OF NEO PERSONALITY TRAITS AND TREATMENT TYPE ON PHYSICAL AND MENTAL HEALTH OUTCOMES AFTER BREAST CANCER

Debra Huss, M.A., Michael Andrykowski, Ph.D., Abbie Beacham, Ph.D., University of Kentucky; and Paul Jacobsen, Ph.D., University of South Florida

Due to the increasing interest in the inclusion of psychological traits in health psychology research, this study examined the impact of the "Big Five" personality traits (neuroticism, extraversion, openness, agreeableness and conscientiousness) and type of treatment (chemotherapy plus radiation (CT+RT; N=33) or radiation alone (RT; N=47)) on physical and mental health outcomes in a prospective, longitudinal cohort of breast cancer patients (mean age=55 years). Participants completed a measure of current physical and mental health function (MOS -36) at four time points: Prior to start of treatment, at conclusion of initial treatment and at 2 and 6 months after conclusion of treatment. Participants completed the neo-FFI at the 6-month follow-up. A series of repeated measures ANOVA's (time x treatment x personality) were performed using each of the 5 neo personality traits as independent variables, the physical and mental health MOS scores as dependent variables and age as a covariate. Reports of poorer physical health were associated with high neuroticism and low extraversion (p's$<.02$). Morover, for mental health a significant time x treatment x extraversion interaction was obtained ($p<.05$). This interaction suggested that mental health increased more in high extraverts over time relative to low extraverts and this effect was most pronounced in women receiving CT + RT. These findings suggest that extraverts may be better able to engage socially supportive resources in their environment, particularly when undergoing more aversive form of therapy, and this accounts for their better mental health scores.

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C-26

THE ROLE OF SOCIAL AND DISPOSITIONAL VARIABLES ASSOCIATED WITH EMOTIONAL PROCESSING IN ADJUSTMENT TO BREAST CANCER: AN INTERNET BASED STUDY

John Schmidt, M.S. and Michael Andrykowski, Ph.D., University of Kentucky

Recent theories suggest that cognitive and emotional processing is critical to successful adjustment to traumatic experiences. In turn, cognitive and emotional processing can be facilitated by both dispositional and social-environmental factors. Conceptualizing breast cancer (BC) as a potentially traumatic experience, this study investigated the relationship between several dispositional (emotional intelligence (EI)) and social-environmental (social support (SS), social constraints (SC)) characteristics theoretically linked to cognitive and emotional processing and current psychological adjustment in 240 BC survivors (mean age=48.3 yrs; mean time post-dx= 29.3 mos). Participants were recruited via postings to internet-based BC support groups. After logging into the study web-site, respondents completed measures of SS, SC, EI, intrusive ideation and avoidance (Impact of Events Scale; IES), and anxiety and depression (Hospital Anxiety and Depression Scale; HADS). Hierarchical regression analyses indicated that both high social constraints and low EI were associated with greater distress as measured by HADS and IES indices (all p's<.001). In addition, the EI x SC interaction was a significant predictor of IES avoidance and intrusion scores (p's<.05) while the EI x SS interaction was a significant predictor of HADS depression scores (p<.05). The interaction results suggest that high EI could buffer against the negative impact of an otherwise toxic social environment (i.e., high SC or low SS). Additional hierarchical regression analyses indicated that the Mood Repair component of the EI construct was most strongly associated with better psychological adjustment. Overall, results demonstrate the utility of the internet as a platform for behavioral research, support a social-cognitive processing model of adaptation to BC, and suggest that consideration of EI may broaden this model.

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C-36

FATIGUE-RELATED DISABILITY IN EXERCISERS VERSUS NONEXERCISERS DURING BREAST CANCER (BC) TREATMENT

Abbie Beacham, Ph.D.*, Michael Andrykowski, Ph.D., Uzma Malik, M.D., University of Kentucky College of Medicine; and Paul Jacobsen, Ph.D. University of South Florida

The relationship between fatigue-related symptoms and reduced quality-of-life among cancer patients is well established. Efforts to manage these symptoms have been employed with increasing frequency. Intervention studies support mild-to-moderate physical exercise for the management of fatigue-related symptoms during and after adjuvant cancer treatment. This study examined ratings of fatigue severity and disability among women (N=159) diagnosed with Stage 0-II BC receiving adjuvant treatment [chemotherapy (CT; n=82) or radiation (RT; n=77)]. Women completed the Godin Leisure-Time Exercise Questionnaire (LTEQ) to assess exercise frequency, duration and intensity (vigorous/moderate/mild) and the Fatigue Symptom Inventory (FSI) prior to beginning treatment (Baseline) and at treatment completion. Women rated perceived impact of fatigue on cognitive, affective and behavioral symptoms on a 7-item FSI composite disability scale. Most women (64%) reported some form of mild, moderate or vigorous exercise during the six months prior to BC diagnosis and at the end of treatment (62%). Repeated measures ANOVA results indicated that women who exercised during treatment reported lower levels of fatigue disability [$F(1,155)=4.05$; $p<.05$] and peak fatigue severity [$F(1,155)=3.58$; $p=.06$] than non-exercisers. No differences by treatment group were observed. Women exercisers receiving RT were older (MageRT=57.6 vs. MageCT=49.2, $p<.05$) but groups did not differ in fatigue ratings, physical symptoms or depression at treatment completion. Levels of perceived fatigue disability did not seem to be related to frequency, duration or intensity of exercise but to participation in some exercise versus none. Therefore, the inclusion of even lifestyle-based activity during cancer treatment may positively impact fatigue-related disability.

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C-37

ACCURACY OF PERCEIVED EXERTION RATINGS DURING TREATMENT FOR BREAST CANCER (BC)

Abbie Beacham, Ph.D.*, Michael Andrykowski, Ph.D., Uzma Malik, M.D., University of Kentucky College of Medicine, and Paul Jacobsen, Ph.D., University of South Florida

Intervention studies support mild-to-moderate physical exercise during and after cancer treatment. Exercise is being prescribed for cancer patients with increased frequency. Subjective Ratings of Perceived Exertion (RPE) of exercise intensity has been used successfully in clinical populations. This study examined RPE accuracy among women (N=169) diagnosed with Stage 0-II breast cancer receiving adjuvant treatment [chemotherapy (CT; n=88) or radiation (RT; n=81)]. Women completed the Godin Leisure-Time Exercise Questionnaire (LTEQ) to assess exercise intensity (Vigorous/Moderate/Mild) and RPE at prior to (baseline) and at treatment completion. Most women (64%) reported some form of exercise during the six months prior to BC diagnosis and at the end of treatment (62%). Women receiving RT were older ($p<.05$) but groups did not differ in fatigue ratings, physical symptoms or depression at treatment completion. Predicted RPE (RPEpred) was defined using metabolic equivalents for Vigorous/Moderate/Mild exercise assessed by the LTEQ. Actual RPE ratings were largely inaccurate and deviated from RPEpred (greater than +/–1 point). Accuracy rates were similar at baseline (Vigorous-13%; Moderate-55%; Mild-50%) and treatment completion (Vigorous-10%; Moderate-51%; Mild-46%). Predictors of rating inaccuracy differed by exercise intensity. Higher peak fatigue ($p<.001$) and physical symptoms predicted RPE inaccuracy in mild and moderate exercise (pís $<.05$). Baseline inaccuracy predicted subsequent inaccuracy at treatment completion across exercise intensities (p's $<.05$). Subjective RPE in cancer patients may be influenced by fatigue and other physical sensations at different levels of exercise intensity. Exercise recommendations should be accompanied by instructions aimed at more accurately interpreting physical exertion and sensations when RPE is utilized.

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Paper Session #20 2:45 p.m.–3:00 p.m.

UTILITY OF A CASE DEFINITION APPROACH FOR STUDYING THE INCIDENCE, PREVALENCE AND PREDICTORS OF CANCER-RELATED FATIGUE

Michael Andrykowski, Ph.D., Abbie Beacham, Ph.D., University of Kentucky; and Paul Jacobsen, Ph.D., University of South Florida

Fatigue is a common and debilitating symptom reported by cancer patients during and after (i.e., "off-treatment" fatigue) cancer treatment. Scientific understanding of the epidemiology, etiology, and management of cancer-related fatigue (CRF) is hampered by lack of consensual definition of this syndrome. The utility of a 15-item fatigue diagnostic interview (FDI) for studying CRF was examined in a prospective, longitudinal cohort of 190 women undergoing treatment for Stage 0-II breast cancer. Participants were assessed 3 times: (1) before initiation of adjuvant radiation (n=89) or chemotherapy and radiation (n=101) (Baseline) (2) end of adjuvant treatment (Post-Tx) and (4) 6 months after conclusion of adjuvant treatment (Follow-Up). At each assessment the FDI and a modified version of the SCID was administered by trained interviewer. Respondents also completed the Fatigue Catastrophizing scale. Using the FDI, prevalence of CRF "cases" was 14%, 15%, and 6% at the Baseline, Post-Tx, and Follow-Up assessments, respectively. The corresponding prevalence of "subsyndromal" CRF, defined as reporting a recent 2-week period of significant fatigue w/o meeting remaining CRF criteria, was 24%, 29%, and 20%. The proportion of CRF "cases" identified as incident cases at Post-Tx and Follow-Up was 81% (n=17) and 60% (n=3), respectively. Univariate analyses of clinical and psychosocial data indicated incident "cases" of CRF at Post-Tx assessment were characterized by higher fatigue catastrophizing ($p < .05$) and greater likelihood of SCID depressive disorder at Baseline ($p < .05$). We conclude use of the FDI to identify "cases" of CRF is critical to scientific understanding of CRF. Data suggest the prevalence of CRF, particularly "off treatment" CRF, may be overestimated in studies not employing a case definition approach to CRF.

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Poster Session E

E-50

PSYCHOSOCIAL CONCERNS AND CLINICAL PROGRAM INTERESTS OF WOMEN AT A COMPREHENSIVE BREAST CARE CENTER

Alyssa Averill, B.A., Abbie Beacham, Ph.D., and Michael Andrykowski, Ph.D., University of Kentucky College of Medicine

National Comprehensive Cancer Network (NCCN) Guidelines propose that breast cancer (BC) patients' distress is most effectively managed when patients' concerns are carefully evaluated and clinical programs are targeted to patients' preferences. A questionnaire, based on NCCN standards and assessing patients' past and current concerns and interest in psychosocial programs, was completed by 173 women (77% response rate) at a comprehensive BC treatment facility. The questionnaire also assessed demographic and clinical information. Respondents (M = 51.06 years; range =18-84) were presenting for BC diagnostic procedures (39%), post-surgical follow-up (14%), adjuvant therapy (21%), or other (23%) appointments. Regarding current psychosocial concerns, 73% of respondents reported >1 types of Emotional Distress ("Worry" most frequent), 37% reported >1 types of Family Difficulties ("Concerns About Partner" most frequent), and 30% reported >1 Spiritual/Religious Concerns ("Difficulty Relating to God" most frequent). Regarding past concerns, women reported >1 concerns in the areas of Emotional Distress (31%), Family Difficulties (26%), and Spirituality/Religion (9%). Over half (58%) cited interest in >1 programs. Women were 2.5 times more likely to prefer individual rather than group format ($p < .05$). Clinical programs generating the most interest were: 1) cancer risk information (47%), 2) nutrition education (44%), 3) supportive counseling (37%), 4) relaxation (36%) and 5) wellness (35%). There were no differences in program interests by age or reason for appointment ($p's > .05$). Results provide valuable information that can be used to develop clinical and behavioral programs that take into account women's concerns and preferences throughout care and treatment for BC.

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E-54

LONGITUDINAL ANALYSIS OF EXERCISE PATTERNS IN WOMEN RECEIVING ADJUVANT TREATMENT FOR BREAST CANCER

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Physical exercise has been regarded as beneficial during and after adjuvant treatment for breast cancer (BC). This study examined exercise patterns prospectively among women (N=114; M age=52.8; range=21-78) diagnosed with Stage 0, I or II BC. Women were undergoing adjuvant treatment [chemotherapy/radiation (CT+RT; n=54), radiation (RT; n=51) or chemotherapy (CT; n=8) alone]. Women completed the Godin Leisure Time Exercise Questionnaire (LTEQ) a measure of exercise frequency, duration and intensity (Strenuous/Moderate/Mild), at baseline (prior to adjuvant treatment), during adjuvant treatment, and 2-month post-treatment follow-up. Most women (64%) reported engaging regularly in some form of exercise during the 6-months prior to BC diagnosis (PreDx). Over half (62%) of PreDx "exercisers" and an additional seven PreDx "non-exercisers" reported engaging in exercise during adjuvant treatment. Frequency and duration of exercise did not differ by treatment group at baseline, completion of initial treatment (CT or RT), or 2-month follow-up. Differences were apparent for exercise intensity, however. Among women in the CT+RT group, t-test analyses indicated PreDx "exercisers" engaged in Mild ($p < .05$) or Moderate ($p < .05$) exercise more frequently during chemotherapy than PreDx "non-exercisers". PreDx "exercisers" receiving CT+RT, engaged in Moderate Intensity exercise for longer duration (minutes/session) than "non-exercisers" ($p < .05$). Differences between PreDx "exercisers" and "non-exercisers" were also evident at 2-month follow-up in Frequency ($p < .05$) and Duration ($p < .05$) of Strenuous exercise in the CT+RT group. Consistent with adherence-based models of exercise participation, exercise history is a strong predictor of maintenance or adoption of exercise activity during adjuvant treatment for BC.

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E-38

EVALUATION OF THE DIAGNOSTIC INTERVIEW FOR CANCER-RELATED FATIGUE (DICRF) IN WOMEN WITH BREAST CANCER

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Fatigue is recognized as a major symptom of cancer and cancer treatment, and has been shown to adversely affect quality of life. However, understanding of this symptom has been hampered by a lack of consensus regarding what constitutes cancer-related fatigue (CRF). The utility of a proposed Diagnostic Interview for a syndrome of CRF (DICRF) was assessed in 81 breast cancer (BC) patients. Women (mean age = 55.3; range 33-94) were interviewed after finishing their initial course of adjuvant therapy (chemotherapy (n=42) or radiotherapy (n=39)) for stage 0-II BC. Patients completed the DICRF and measures of fatigue (POMS, Fatigue Symptom Inventory (FSI)), depression (CES-D), fatigue catastrophizing (FCS), and a modified version of the SCID. Using the DICRF, 17% (n=19) met criteria for CRF. T-test analyses indicated that the CRF group reported symptoms of poorer sleep (84%), loss of interest in activities (79%), feeling more frustrated (58%), and struggling to accomplish tasks (95%) than women without CRF. The CRF group reported significantly more fatigue (POMS; $p<.01$), fatigue-related catastrophizing (FCS; $p<.01$), and on the FSI reported more current fatigue, higher average fatigue, more number of days and higher percent of day fatigued, more life interference from fatigue ($p's<.01$). Additionally, women in the CRF group reported more psychological distress (CES-D; $p<.01$), and were more likely to receive a diagnosis of current depression (SCID; $p<.05$). Results suggest the validity of the DICRF for identifying patients with CRF. Use of the DICRF to define "cases" of CRF has great potential to enhance research and clinical management related to CRF.

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Paper Session #31 10:30 a.m.–10:45 a.m.

EXERCISE ATTENUATES FATIGUE SEVERITY RATINGS IN WOMEN RECEIVING CHEMOTHERAPY FOR BREAST CANCER

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Exercise during and after adjuvant cancer treatment is thought to attenuate symptoms of fatigue. This study examines fatigue and exercise patterns prospectively in women receiving adjuvant treatment (chemotherapy–CT and/or radiation–RT) for Stage 0, I or II breast cancer (BC). Women (n=105, M age=53; range=21-78) completed measures of pre-diagnosis (PreDx) and current exercise (Godin Leisure Time Exercise Questionnaire; LTEQ) and peak fatigue severity (PFS) rating (scale 0-10) at baseline (pre-adjuvant treatment), completion of initial and final courses of adjuvant treatment, and 2-month post-treatment follow-up. At each assessment, women engaging in some exercise (Strenuous/Moderate/Mild) on the LTEQ were classified as "exercisers" versus "non-exercisers." T-test analyses showed that women who had engaged in regular exercise during 6-month PreDx period rated baseline PFS lower than those not engaging in PreDx exercise (M=3.07 versus 4.26; $p<.05$). Among women receiving CT+RT and CT only, exercisers reported lower PFS than non-exercisers during the week prior to conclusion of CT (M=5.13 versus 7.14; $p< .05$). Conversely, among women who received RT after CT completion, exercisers rated PFS higher than non-exercisers (M= 4.78 versus 2.5; $p<.05$) at completion of RT. Of women receiving RT only, PFS did not differ between exercisers and non-exercisers. Results suggest that during adjuvant CT, differences in PFS are reflected in comparisons of engaging in some exercise versus none. However, this trend was reversed as women receiving CT+RT approached RT completion. These differences did not emerge in items assessing average fatigue levels. This underscores the utility of multiple fatigue indices.

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A-8

LONGITUDINAL STUDY OF FATIGUE AFTER ADJUVANT TREATMENT FOR BREAST CANCER

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While fatigue is a prominent symptom during and following treatment for breast cancer (BC), most research has been cross-sectional. This longitudinal study followed women with early stage BC through an initial course of adjuvant radiation (RT) (n = 36) or chemotherapy (CT) (n = 39). Depressive symptoms (CESD), quality of life (QOL) (MOS-36), and fatigue (Fatigue Symptom Inventory (FSI)) were assessed before adjuvant treatment (baseline) and at completion of either RT or CT adjuvant therapy. Repeated measures TIME x GROUP ANOVAs revealed main effects for TIME for MOS-36 vitality and social and role functioning dimensions (ps < .05), and several FSI indices, including the disability subscale (ps < .05). Poorer QOL and more fatigue were evident at completion of treatment than at baseline. Main effects for GROUP were evident for depressive symptoms (CESD), MOS-36 pain and role and social functioning dimensions, and FSI indices of peak fatigue and number of days fatigued (ps < .05). More depression and fatigue and poorer QOL were evident in the CT group. Finally, significant GROUP X TIME interactions were obtained for MOS-36 dimensions of physical functioning and general health (ps < .05). While no group differences existed at baseline, the CT group evidenced poorer status at the end of adjuvant treatment. Results suggest that while both RT and CT negatively impact indices of QOL, depression, and fatigue, CT may have a greater negative impact upon physical functioning and perceptions of general health relative to RT.

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B-77

EMOTIONAL EXPRESSION IN WOMEN WITH BREAST CANCER: A COMPARATIVE STUDY

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This study investigated differences in emotional expression (EE) between women with breast cancer (BC) and women in a healthy comparison (HC) group. Women in the HC group (n = 25) were matched to those in the BC group (n = 25) on the basis of age (M = 57.36) and education (M = 15.02 years). Participants completed the Emotional Expressiveness Questionnaire, the Spielberger Rationality/Emotional Defensiveness Questionnaire, the Courtald Emotional Control Scale, and the CESD. Participants were randomly assigned to discuss either a traumatic or joyful event in their past, and this disclosure task was videotaped and later coded by trained raters on several EE dimensions. Lastly, participants evaluated the disclosure task. Analyses revealed that women with BC displayed greater intensity of emotion in the disclosure task than healthy women ($p = .03$). Women with BC also expressed more negativity in the disclosure task overall ($p = .08$). However, there were no differences between the women regarding dispositional measures of EE or levels of current adjustment. Furthermore, the women disclosed stories that were equally personal and coherent, and evaluated the disclosure task similarly, except women with BC reported previously discussing their topics more than healthy women ($p = .05$). These findings contrast with the notion of the Type C personality, which would predict that women with BC would be less emotionally expressive than healthy women. While inhibited EE might yet serve as a risk factor for BC, BC might alter women's EE tendencies and behavior.

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E-63

DEVELOPMENT OF A BEHAVIORAL APPROACH TO ASSESSING EMOTIONAL EXPRESSION

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Emotional Expression (EE) is critical to trauma adjustment and is viewed as a risk factor for certain diseases. Standard techniques for assessing EE rely on self-report. This study tests a behavioral approach to assessing EE. Fifty women (mean age=60) were randomly assigned to talk about an emotionally positive or negative event in their past. Subjects talked for 20 minutes while being videotaped. The transcribed videotapes were scored using 2 methods: Pennebaker's Linguistic Inquiry and Word Count (LIWC) system and emotional intensity ratings provided by trained raters. Subjects completed measures of EE (EEQ), alexythymia (TAS), and mental health (CESD, MOS-36 subscale) prior to the behavioral task. Results indicated EEQ ($r=.42$; $p<.01$) and TAS scores ($r=-.43$; $p<.01$) were significantly related to emotional intensity ratings in the total sample. Both EEQ ($r=.18$; $p>.05$) and TAS ($r=-.23$; $p>.05$) scores were unrelated to LIWC Affect scores. Emotional intensity ratings and LIWC Affect scores were not significantly associated with CESD or MOS-36 Mental Health scores suggesting current mental health did not influence performance. Post-task ratings indicated S's found the behavioral task slightly difficult (mean=2.9 on 7-point scale) and highly revealing emotionally (mean=5.7). T-tests indicated S's in the positive condition found the task to be more uplifting and less stressful than S's in the negative condition (all p's < .05). Transcripts of S's in the negative condition were rated as more coherent which may stem from a greater tendency to ruminate about negative events. It is concluded that this behavioral approach to EE assessment is acceptable to S's and captures EE tendencies.

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