

A Pilot Study of a Cognitive-Behavioral Intervention for Breast Cancer Survivors

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Purpose/Objectives: To test combining a group intervention to build self-efficacy for using compensatory strategies and lifestyle adjustments with brain-training practice to improve cognition.

Design: A quasiexperimental design.

Setting: Texas Oncology, a community oncology practice in Austin.

Sample: 20 women aged 35–65 years, who had finished chemotherapy at least three months before the study, were within five years of completing all treatment, and had self-reported cognitive concerns.

Methods: Six group sessions to build self-efficacy for using compensatory strategies, along with other health behaviors that affect cognitive performance, were combined with practice on a computer-based training program. Female breast cancer survivors were recruited through flyers, mailings, and personal contacts.

Main Research Variables: Cognitive performance, cognitive concerns, cognitive/memory strategies, fatigue, emotional distress, sleep disorders, and quality of life.

Findings: Participants reported that the intervention was useful in building cognitive abilities. Although scores on performance tests did not increase, ratings of cognitive concerns, fatigue, emotional distress, and sleep disturbance decreased significantly. Use of cognitive/memory strategies increased significantly.

Conclusions: This pilot study demonstrated the feasibility of combining a group intervention with brain-training practice. A larger randomized trial would afford a more rigorous test of efficacy.

Implications for Nursing: A growing body of evidence regarding potential interventions to address survivors' cognitive problems exists. Nurses should counsel breast cancer survivors about fatigue, sleep deprivation, and emotional distress, as well as the effects of cancer treatment on cognition.

A growing body of literature has linked cancer diagnosis and treatment with deficits in cognitive functioning (Ahles, Root, & Ryan, 2012; Ono et al., 2015; Von Ah, 2015). Breast cancer survivors have reported that cognitive impairment is one of the most troubling side effects of treatment, and survivors have expressed frustration that providers do not validate cognitive complaints or provide assistance for dealing with them (Boykoff, Moieni, & Subramanian, 2009; Myers, 2012; Von Ah, 2015). The most commonly reported deficits occur in attention, memory, processing speed, word finding, and executive functioning (Hutchinson, Hosking, Kichenadasse, Mattiske, & Wilson, 2012; Von Ah, 2015; Wefel, Kesler, Noll, & Schagen, 2015). The causes of these deficits are complex and continue to be investigated (Ahles et al., 2012).

Researchers have begun to explore interventions to help breast cancer survivors deal with their cognitive limitations (Cherrier et al., 2013; Ferguson et al.,

2012; Kesler et al., 2013; Von Ah et al., 2012). These studies have focused on survivors at various points in treatment, targeted different cognitive skills, and investigated various cognitive behavioral approaches. Modest gains have been observed, but effects differ, showing change over time on some neurocognitive tests but not others (Cherrier et al., 2013; Ferguson et al., 2012; Kesler et al., 2013). Participants also have reported improvement in cognitive abilities and in other symptoms that can affect cognitive functioning, such as fatigue, anxiety, and depression (Cherrier et al., 2013; Ercoli et al., 2013; Ferguson et al., 2007; Von Ah et al., 2012).

Many of these interventions focus on building cognitive skills in specific areas, such as memory or attention. However, the extent to which gains reflected in standardized performance testing in specific cognitive domains generalize to other areas of cognitive functioning, such as cognitive abilities in day-to-day activities, remains unclear. Therefore, this pilot study was designed to test a comprehensive intervention that combined computer-based skills training with group sessions addressing compensatory strategies, as well as other health conditions that may affect cognitive performance (e.g., sleep disturbance, fatigue, stress, physical inactivity). Participants were breast cancer survivors at least three months postchemotherapy but no more than five years post-treatment. Many intervention studies have been conducted at major cancer centers; few have examined the feasibility and effectiveness of an intervention for patients who receive treatment in community oncology practices, where most cancer care is delivered (Richardson & Tangka, 2007). The current authors hypothesized that (a) performance on neurocognitive tests, use of cognitive and memory strategies, and quality of life would increase and (b) self-reported cognitive concerns and related symptoms (e.g., fatigue, emotional distress, sleep disorders) would decrease among breast cancer survivors who participated in a cognitive intervention combining computer-based skills training with group sessions addressing compensatory strategies. The authors also investigated the acceptability and feasibility of delivering the intervention in a community oncology practice, as well as the relationship among measures at each time point.

Methods

The authors conducted an exploratory pilot study using a quasiexperimental design. Data were collected at three time points: four to six weeks prior to the intervention program (T1), one to two weeks prior to the program (T2), and one to two weeks after the six-week program (T3). Participants served as their own

controls. Testing at T1 and T2 enabled assessment of potential naturally occurring change over time in the outcome measures prior to exposure to the intervention and controlled for learning that could occur from being tested (Cherrier et al., 2013).

Recruitment and Screening

Following approval by the institutional review board at the University of Texas at Austin, recruitment began with posting flyers at a local community oncology practice. Clinic staff also personally contacted women they thought might be interested in the study. In addition, patient navigators from a resource center for breast cancer survivors informed women who had cognitive concerns about the study. To be included, women had to be aged from 35–65 years, have Internet access, be able to speak and write English, and be at least three months postchemotherapy but not more than five years post-treatment when they enrolled in the study. To screen for cognitive concerns, participants had to self-report that they had at least five problems “sometimes” or more often on the Perceived Deficits Questionnaire (Sullivan, Edgley, & Dehoux, 1990). Women who were taking anti-estrogen or anti-HER2 therapies were allowed to participate.

Participants and Procedure

Twenty-five women expressed interest in the study. They were screened by telephone to determine whether they met the eligibility criteria and to explain the study. Once enough women were enrolled to form a group (at least eight women), they were mailed a consent form to complete (including Health Insurance Portability and Accountability Act [HIPAA] authorization to access medical records) and the initial questionnaire packet. They were then scheduled for baseline neuropsychological testing. Two were unable to attend the classes when they were scheduled, and two others did not return their consent forms after receiving reminders. One woman was ineligible because she was still receiving chemotherapy. The final sample included 20 women.

At each data collection point, women completed the self-report measures prior to the cognitive testing so that their self-reports would not be affected by their immediate test experience. All testing was conducted by testers trained in administering and scoring neurocognitive tests, and they followed standard testing procedures. The same testers were used throughout the study.

Intervention

Twelve women attended the first set of classes, and eight were enrolled in the second set. The six classes lasted about 90 minutes each. The classes were

facilitated by a master's-prepared nurse (AH) who has worked with patients with cancer in a community oncology practice and has previous experience in facilitating group discussions with cancer survivors. The class content was adapted from an earlier program for people with multiple sclerosis, many of whom also experience cognitive limitations (Stuifbergen et al., 2012). This theory-driven program was informed by Pender's (1987) model of health promotion and Bandura's (1989) social cognitive theory. Consistent with Bandura's (1989) theory, the classes focused on building self-efficacy for compensatory strategies and lifestyle adjustments to enhance cognitive functioning. They addressed the categories of positive coping strategies identified by Von Ah (2015) and confirmed in previous research with cancer survivors (Becker, Henneghan, & Mikan, 2015). The facilitator verbally reinforced participants' attempts to engage in behaviors to improve their cognitive functioning, such as avoiding distractions or using electronic reminder functions. As participants shared what worked for them, they role-modeled use of strategies for each other. Barriers to engaging in behavioral changes, a key component of Pender's (1987) model, were also discussed. Each set of classes lasted six weeks and covered compensatory cognitive strategies and health-promotion resources for physical activity, sleep hygiene, and stress management. Work accommodation and a brief review of evidence about cognitive changes in patients with cancer were also discussed. The participants received a manual covering the intervention's content and a subscription to the BrainHQ computer-based training program. BrainHQ targets a broad range of cognitive domains and has been used in a variety of scientific studies designed to improve functioning in individuals with health conditions leading to cognitive impairments, such as heart failure and multiple sclerosis (PositScience®, 2016). Each week, participants were assigned a different set of cognitive exercises covering the domains of attention, memory, brain speed, people (recognition) skills, navigation, and intelligence. They were asked to practice the exercises for 45 minutes three to four times per week.

Feasibility parameters: Multiple measures of feasibility were collected. The facilitator downloaded data from BrainHQ about number of minutes practiced on a weekly basis and used this information to encourage participants to continue practicing as recommended. The facilitator also recorded the number of sessions each participant attended. To assess self-reported use of the types of cognitive strategies discussed in the classes, participants were asked to describe anything they were doing to improve their cognitive functioning at each data collection point.

Participant reaction to the intervention: At the end of each cohort's last session, an experienced focus group facilitator (HB) met with each group to ask about their perceptions of the study. The facilitator developed a focus group discussion guide adapted from questions that had been used to evaluate previous health-promotion interventions (Stuifbergen, Becker, Rogers, Timmerman, & Kullberg, 1999). The same questions were asked in both groups. The facilitator used written notes to identify themes about participants' perceptions of the study's effects, length of the intervention, the combination of computer homework with group discussions, and suggestions for improvement.

Instruments

Several well-researched, widely implemented cognitive function tests were used to assess cognitive functioning; some have alternative forms to reduce practice effects. The California Verbal Learning Test® (CVLT) assesses verbal learning and remembering (Delis, Kramer, Kaplan, & Ober, 2000). Scores range from 0–80, with higher scores indicating better cognitive functioning. In the test manual, a test-retest reliability coefficient of 0.82 was reported during a three-week period. The Controlled Oral Word Association Test (COWAT) is a speed test of verbal fluency and word finding (Benton, Sivan, Hamsher, Varney, & Spreen, 1994). Scores reflect the number of words produced in 180 seconds, and higher scores indicate better cognitive functioning. Ruff, Light, and Parker (1996) reported a test-retest reliability coefficient of 0.74 during a six-month period. The Symbol Digit Modalities Test (SDMT) assesses complex scanning and tracking (Smith, 1982). Scores range from 0–110, with higher scores indicating better cognitive function. A test-retest correlation coefficient of 0.76 was observed during one month. The 30-item Everyday Problems Test-Revised was used to assess the ability to reason and solve everyday problems (Willis et al., 2006). Scores range from 0–30, with higher scores indicating better cognitive function. A reliability coefficient of 0.83 has been found (Becker, Stuifbergen, & Morrison, 2012). Scores were moderately correlated with various neuropsychological tests and were sensitive to change over time following an online cognitive intervention.

The current authors also used self-report measures for assessment. Extensive testing of the Patient-Reported Outcomes Measurement Information System (PROMIS) has established reliability in multiple patient populations (Cella et al., 2007; Reeve et al., 2007), so four PROMIS scales were used in the current study (HealthMeasures, 2017). The eight-item PROMIS Cognitive Concerns scale measures

self-perceived cognitive problems. The Cronbach alpha in the current study was 0.92 at baseline. The eight-item PROMIS Emotional Distress scale measures depression. Items reflect affective rather than somatic content. The baseline alpha in the current study was 0.92. The eight-item PROMIS Sleep Disturbance scale measures self-perceived sleep quality, concerns about falling asleep, and adequacy/satisfaction with sleep. The Cronbach alpha in the current study was 0.92 at baseline. The eight-item PROMIS Fatigue scale measures the subjective sensation of fatigue and its perceived effect on daily functioning. The Cronbach alpha in this study was 0.96 at baseline. The range of scores for all PROMIS measures is 0–40, with higher scores reflecting greater cognitive problems, emotional distress, sleep disturbance, or fatigue, depending on the scale.

The 19-item Strategy subscale of the Multifactorial Memory Questionnaire (MMQ-Strategy) assesses

use of memory strategies (Troyer & Rich, 2002) and was also used for self-report. Scores range from 0–76; higher scores indicate more frequent use of memory strategies, such as use of lists or visual cues. A test-retest correlation coefficient of 0.88 was observed during a one-month period. Convergent validity is supported by strong correlations between scores on the MMQ-Strategy and other memory measures. The 24-item Compensatory Cognitive Strategies scale, developed by the first author, assesses how often respondents use technological and non-technological compensatory cognitive strategies. Scores range from 0–96, with higher scores indicating more frequent use of strategies. The Cronbach alpha coefficient among people with multiple sclerosis was 0.91; scores were sensitive to change following a cognitive intervention (Becker, Stuifbergen, Henneghan, & Morrison, 2016). The Functional Assessment of Cancer Therapy–General (FACT-G) was also used in the current study for self-report. This scale assesses quality of life in four areas: physical, social/family, emotional, and functional well-being. Scores on the FACT-G range from 0–108, with higher scores indicating higher quality of life. Its extensive development process has demonstrated reliability and validity with many patient groups, including patients with cancer (Cella et al., 1993; Ward et al., 1999).

In addition, information about participants' background characteristics and health history was collected. At each data collection point, participants were asked to describe activities they used to improve their cognitive abilities.

Permission was requested from participants to extract information about their cancer diagnosis, treatment, and other comorbid conditions. Two of the current authors, who are specialists in oncology nursing, retrieved information from the patient records using a checklist developed by the authors. The authors did not have access to records for three women, so those women were asked to self-report information about their medical diagnoses and treatments.

Data Analysis

Data entry was double-checked by having a second research staff person review the computer data file against the original surveys. All analyses were conducted with SPSS®, version 21.0. Participants with more than 20% missing data on a scale were excluded from analyses using that scale. Mean substitution with participants' average item scores was used for missing data of 20% or less. Cronbach alpha coefficients were calculated for the four eight-item PROMIS scales to assess internal consistency reliability. Because of the small sample size, Cronbach alpha coefficients could not be calculated for other summated scale

TABLE 1. Sample Characteristics (N = 20)

Characteristic	\bar{X}	SD	Range
Age (years)	53.1	8.2	36–64
Years of school completed	15.4	1.5	12–17
Months since last chemotherapy	22.1	18.4	2–64
Characteristic	n		
Marital status			
Married			12
Divorced			6
Widowed			1
Living with significant other			1
Race or ethnicity			
Non-Hispanic White			17
Black			2
Asian American			1
Employment status			
Part- or full-time or self-employed			16
Retired			3
Unemployed because of disability			1
Currently taking hormone therapy			
No			11
Yes			9
Cancer stage			
I			2
IA			3
IC			1
II			1
IIA			8
IIB			2
IIIA			1
IIIC			2
Initial diagnosis			
Invasive ductal carcinoma			13
Other			2
Missing data			5
Date of diagnosis			
Prior to 2012			6
2012–2013			9
2014			4
Missing data			1

measures. Zero-order correlations were used to examine relationships among study variables at each time point. Although means and standard deviations were computed on outcome measures at all three time points, paired t tests to assess change over time following exposure to the intervention (from T2 to T3) were performed to test study hypotheses. Because this was a pilot study, the alpha level was kept at 0.05 for each analysis and not adjusted for possible family-wise error. Two women could not be scheduled for T3 data analysis (one because of sickness and the other because of changes in her work schedule). Therefore, the data analysis for change over time is based on 18 women.

Results

Sample

The mean age of the 20 women was 53 years. Sixteen were employed at least part-time (see Table 1). Four of the women reported changes from their prediagnosis employment status, and a fifth, who was self-employed, stated that cognitive problems severely affected her work. At T1, half of the women had been diagnosed within the past two years (range = 5 months to 6 years), and half had completed chemotherapy in the past year. One woman had completed her treatment five years previously. All women had undergone surgery. One woman had not received chemotherapy, but had undergone surgery, radiation therapy, and endocrine treatment. Two participants were completing radiation therapy at T1 but were finished before the classes began. Nine women were taking endocrine therapy at T1.

Attendance and Homework Practice

Sixty-five percent of the respondents attended at least five of six sessions. According to BrainHQ records, the women practiced a mean of 33 minutes per week during the six-week period (range = 2–523 minutes total). This was considerably less than the recommended 45 minutes three to four times per week. However, participants told the facilitator that the program underreported their practice time, potentially because it did not count the time that they spent reading directions and trying to understand how to play various exercises.

Participant Feedback

In the focus groups held at the last class for each group, women referred to learning helpful new strategies, such as how to remember names, how to improve sleep hygiene, or how to be more mindful about how they carried out activities. As one woman stated, “There is so much you can’t control when you have

cancer; this is something I could do.” One woman mentioned that she had not realized that physical exercise could improve cognitive functioning, and so she had become more diligent about exercise. Some women appreciated that the groups were focused on building skills rather than being just a support group and suggested doing more skill-training exercises in the classes. A key benefit was the validation that cognitive problems were “real” and that other breast cancer survivors also experienced them. One woman stated that the intervention gave her permission to have problems; she had felt guilty about her cognitive lapses. The women generally indicated that the combination of classes and brain-training homework was good; some explicitly stated that, without the groups and the encouragement of the facilitator, they would not have persisted with the homework. Staying motivated to do homework challenged many, particularly if they perceived that they were not doing the exercises well. Because many were working, they did not think that more sessions would be feasible, and they thought that spacing out the same number of classes over more weeks might work better.

Change Over Time in Study Measures

Table 2 shows mean scores at each time point for the 18 women who completed the intervention. Consistent with other research (Von Ah, 2015; Wefel et al., 2015), scores on the neurocognitive tests generally suggested mild cognitive impairment. The scores increased on the neuropsychological tests from T1 to T2, likely because women became more familiar with the tests (i.e., a learning effect). The only statistically significant change from T2 to T3 occurred on the CVLT, where performance actually decreased, possibly because the alternate (parallel) form of the CVLT was used at T3. Scores on the Everyday Problems Test did not change significantly.

A different pattern emerged in the women’s perceptions of their functioning. There were generally small changes in women’s self-reports from T1 to T2. However, women’s ratings of their cognitive concerns, fatigue, emotional distress, and sleep disturbance decreased significantly from immediately before the classes to after the classes ended (T2 to T3). Their ratings of how often they used various memory and cognitive strategies increased significantly during the same period. The women also reported a steady increase in their perceptions of their overall quality of life across the three data collection points.

At T3, 15 of 18 respondents gave examples of cognitive strategies they were using, such as those discussed in the classes. The number of strategies listed increased from 12 at T1 to 16 at T2 and 21 at T3. These strategies included using reminder functions, getting

TABLE 2. Change Over Time in Key Outcome Measures for Breast Cancer Survivors

Measure	N	T1		T2 ^a		T3		T2–T3 t Value
		\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	
California Verbal Learning Test ^{b*}	18	58.83	11.45	64.33	11.37	55.39	8.87	5.19*
Symbol Digit Modalities Test*	18	53.11	11.85	58.5	12.68	58.5	10.47	0.00
Controlled Oral Word Association Test*	18	40.78	12.05	46	14.7	45	13.25	0.47
Everyday Problems Test–Revised	18	25	3.14	24.5	3.85	25.06	4.47	–0.99
PROMIS Cognitive Concerns	17	29.68	6.8	29.17	7.27	26.06	7.43	2.11*
PROMIS Fatigue	15	25.67	8.63	24.53	9.33	22.13	8.75	1.96*
PROMIS Emotional Distress*	15	17.53	6.16	18.93	6.57	15.2	5.32	2.64**
PROMIS Sleep Disturbance*	17	24.53	7.38	24.3	7.46	20.59	7.12	3.26**
MMQ–Strategy	16	42.08	11.96	42.25	10.96	47.99	7.54	–2.61**
Compensatory Cognitive Strategies scale*	15	39.78	15.09	43.07	15.96	49.67	13.03	–3.7**
FACT-G*	15	69.11	15.25	71.53	14.95	74.34	16.51	–1.49

* $p < 0.05$; ** $p < 0.01$

^a One woman did not complete T2 self-report measures; her T1 scores were used to compare change over time from pre- to postintervention.

^b Alternate form used for T3

FACT-G—Functional Assessment of Cancer Therapy–General; MMQ–Strategy—MultiFactorial Memory Questionnaire–Strategy subscale; PROMIS—Patient-Reported Outcomes Measurement Information System

Note. Asterisks in the Measure column indicate significant differences across all three time periods.

Note. For one-tailed t test, $p < 0.05$. All paired t tests were performed on 18 respondents.

Note. On the first four measures, a higher score indicates better cognitive performance. On the remaining seven measures, a higher score indicates more of the construct identified in the title (e.g., more of the symptom, more use of strategies, higher quality of life).

plenty of sleep, doing word games, and continuing to practice online brain-training programs.

Relationships Among Study Variables

Relationships among cognitive performance tests, self-reported cognitive concerns, symptoms, quality of life, age, time since treatment, and employment status at each time point are shown in Table 3. Moderate negative correlations were observed among cognitive concerns, fatigue or sleep disturbance, and CVLT, SDMT, or COWAT scores. Those who had completed treatment most recently tended to exhibit higher cognitive test performance and less concern about cognitive functioning. Employed women reported fewer cognitive concerns, less fatigue, less depression, and better sleep, and those correlations grew stronger following the intervention.

Discussion

This small pilot study demonstrated the feasibility of combining a group intervention focused on building self-efficacy for using compensatory strategies and lifestyle adjustments with brain-training practice. In addition, the study provided an opportunity to test the process of recruiting and delivering a cognitive intervention to breast cancer survivors in a community setting. Eighteen of the 20 women who began the study completed it, and two-thirds of the women attended

all or all but one of the classes. However, the women practiced, on average, only 33 minutes per week. In addition, recruitment took about six months, and some women who initially expressed interest were unable to attend the classes once they were scheduled. Once active treatment is completed, women have less contact with their providers, so recruitment for a survivorship study needs a comprehensive recruitment plan. Although the women's comments at the debriefing underscored the value of meeting with other women to discuss their cognitive concerns, this intervention demanded time and energy, both of which may be in short supply for cancer survivors, particularly those who are trying to continue to work. Future research should explore alternative methods of delivering a cognitive intervention. One alternative might be to combine fewer face-to-face classes with telephone or video conferencing or to explore Internet-based options. That said, feedback from the participants made it clear that interactions with the facilitator were a powerful motivator for getting them to try new cognitive strategies and engage in brain-training homework. Whatever the delivery medium, the personal contact with someone who can motivate behavior change, along with the role-modeling provided by other survivors, appears to be key and should be retained.

Although cognitive test performance did not improve following the intervention, positive changes were seen in women's self-reports of cognitive concerns

and symptoms that can affect cognitive functioning (e.g., fatigue, sleep disturbance, emotional distress). The women reported using more cognitive strategies, so the intervention may have been most effective in showing what can be done to improve cognitive abilities in daily life. This finding is consistent with previous studies in which cancer survivors participating in interventions designed to teach compensatory cognitive strategies have reported improved cognitive abilities and decreased fatigue and emotional distress (Cherrier et al., 2013; Von Ah, 2015; Wefel et al., 2015).

Most women in this study were working, but they gave numerous examples of difficulties caused by their cognitive limitations, including taking alternative job assignments. The average age was 53 years, when many women would have been at the peak of their earning potential had their careers not been affected by cancer. Consistent with previous findings (Duijts et al., 2013; Livestrong Foundation, 2013; Nelson & Suls, 2013; Von Ah, 2015), these cancer survivors showed a need for guidance on addressing cognitive limitations in the work setting, including appropriate workplace accommodations. Providers should be aware of websites, such as Cancer and Careers (www

.cancerandcareers.org/en/resource), to help survivors with work-related issues.

Unlike many previous studies, this study measured women's reports of cognitive and memory strategies before and after the intervention. On the MMQ-Strategy and the Compensatory Cognitive Strategies scale, reported strategy use increased significantly following the intervention. Cognitive test performance and self-reported improvement in cognitive functioning are key outcomes for intervention studies, but researchers might consider adding measures of behavioral changes in use of compensatory strategies.

Although correlational analyses should be interpreted cautiously because the sample was small, this study yielded relationships that merit further investigation. At T1 and T2, neurocognitive test performance tended to be more highly related (in a negative direction) to cognitive concerns, self-reported fatigue, and sleep disturbance than to emotional distress. This finding underscores the importance of addressing these symptoms with survivors. Compared with unemployed women, those who were employed reported lower cognitive concerns, fatigue, emotional distress, and sleep disturbance, and the differences between these

TABLE 3. Correlations Between Cognitive Tests and Self-Report Measures Among Breast Cancer Survivors

Measure	Fatigue	Depression	Sleep Disturbance	Cognitive Concerns	Quality of Life	Time Since Chemo	Age	Employment
Time 1 (N = 20)								
CVLT	-0.42	0.03	-0.43	-0.3	0.17	-0.23	0.42	0.01
COWAT	-0.14	0.03	-0.41	-0.03	0.07	-0.21	0.53	0.14
SDMT	-0.46	0.04	0.02	-0.32	-0.1	-0.44	-0.27	0.1
EPT-R	-0.04	0.32	-0.19	-0.47	-0.05	-0.49	0.21	-0.08
Employment	-0.38	-0.41	-0.04	0.05	0.57	-	-	-
Time 2 (N = 20)								
CVLT	-0.43	-0.24	-0.44	-0.22	0.13	-0.11	0.3	0.07
COWAT	-0.15	0.04	-0.59	0.1	0.27	-0.15	0.5	0.29
SDMT	-0.51	-0.13	0.04	-0.42	0.05	-0.57	-0.25	0.19
EPT-R	-0.28	0.14	0.12	-0.03	0.0	-0.46	0.06	0.09
Employment	-0.48	-0.2	-0.36	-0.17	0.42	-	-	-
Time 3 (N = 18)								
CVLT	-0.42	-0.38	-0.3	-0.21	0.29	-0.07	-0.04	-0.06
COWAT	-0.33	0.03	-0.35	-0.05	0.2	-0.25	0.58	0.4
SDMT	-0.27	-0.2	-0.13	-0.34	0.24	-0.49	-0.43	0.24
EPT-R	-0.27	-0.21	-0.13	-0.16	0.25	-0.51	0.11	0.15
Employment	-0.52	-0.39	-0.45	-0.46	0.53	-	-	-

chemo—chemotherapy; COWAT—Controlled Oral Word Association Test; CVLT—California Verbal Learning Test; EPT-R—Everyday Problems Test—Revised; FACT-G—Functional Assessment of Cancer Therapy—General; PROMIS—Patient-Reported Outcomes Measurement Information System; SDMT—Symbol Digit Modalities Test

Note. Quality of life was measured by the FACT-G. Time since chemo indicates months since last chemo. For employment, 1 indicates unemployed and 2 indicates employed. Fatigue, depression, sleep disturbance, and cognitive concerns were measured by PROMIS.

Note. On CVLT, COWAT, SDMT, and EPT-R, higher scores indicate higher cognitive function. Higher scores on PROMIS indicate more of the symptom being measured. Higher scores on FACT-G indicate better quality of life.

two groups tended to increase following participation in the intervention (T3). Although these correlations do not imply causality, the intervention may have helped the working women identify strategies that they could use to improve their perceived work functioning.

Unlike in previous studies (Kesler et al., 2013; Von Ah et al., 2012; Wefel et al., 2015), participants were not required to have completed treatment for at least six months. Women who had been treated most recently did not have the poorest cognitive functioning. A negative correlation was found between cognitive test performance and time since completion of chemotherapy. This relationship does not appear to have been because of age differences because age was positively related to cognitive test performance for three of four performance measures. The relationship between completion of chemotherapy and self-reported symptoms was less consistent across time points.

Although self-report measures may be subject to reporting biases, they enable participants to indicate how an intervention affects day-to-day functioning. Multiple types of self-report measures (perception scores, open-ended narrative response to a question asking women to describe what they did to improve their cognitive abilities, and debriefing comments) yielded similar findings; women's perceived cognitive abilities and activities had changed following participation in this intervention. Self-efficacy theories purport that those who believe that they have the skills to engage in a behavior are more likely to engage in that behavior, and the current findings suggest that this intervention contributed to participants' ability to use cognitive strategies.

Limitations

Interpretation of the results is limited by the small sample size and lack of a control group. The use of two pretests prior to introduction of the intervention is an improvement over the usual pre-/post-test design because it provides some control for testing effects and historic changes unrelated to the intervention. However, a randomized clinical trial with a larger group of participants would afford a more rigorous test of the intervention. A comparison group of those who also have contact with facilitators and other group members, but who do not receive the focus on building cognitive skills, would help control for the positive effects of social support on the outcomes measured in this study. In addition, the study should be replicated with a more diverse group of cancer survivors with respect to age, education, race/ethnicity, and type of cancer to explore who benefits most from this type of intervention. Focusing on a more homogeneous sample with respect to type of diagnosis and treatment also might help to clarify the results.

Knowledge Translation

- Combining facilitated group sessions to discuss cognitive strategies with brain-training homework can be a feasible intervention to decrease cognitive concerns and improve use of cognitive strategies among breast cancer survivors.
- Use of a study facilitator to personally coach and remind study participants to try new cognitive strategies and engage in brain-training exercises is an important motivator.
- Cognitive limitations do not improve with time for all breast cancer survivors.

Scores on the Everyday Problems Test–Revised, designed to assess performance of everyday cognitive tasks in older adults, showed little change over time. Most women scored relatively well on this measure, suggesting that it may not be sensitive to the subtle cognitive deficits observed in this and other studies of breast cancer survivors (Von Ah, 2015; Wefel et al., 2015). Future research should explore more sensitive measures of cognitive problems with daily activities for cancer survivors.

The current authors intend to explore ways to strengthen the intervention to increase its impact, possibly by expanding the array of cognitive strategies presented or exploring telephone follow-up to increase motivation for behavioral change. In the debriefing session, women reported problems staying motivated to keep up with the homework; none achieved the recommended 45 minutes of practice three to four times per week. Adherence to online homework may be higher when sessions are distributed across more weeks (Kesler et al., 2013). In addition, monitoring participants for a longer time period could provide a more definitive test of the program.

Implications for Nursing

Because this was an exploratory feasibility study, specific clinical practice recommendations based on study findings must be made with caution. However, the participants' comments in the debriefing session about the value of this intervention in validating their concerns about their cognitive functioning underscore the important role that providers can play in supporting survivors who struggle with cognitive problems. As Von Ah (2015) pointed out, patients' cognitive concerns should be acknowledged, and this acknowledgement alone may reduce some of the distress that they experience. In addition, the authors concur with Von Ah's (2015) assertion that nurses can play a key role in assessing patients for other symptoms that may affect cognitive functioning, such as depression or anxiety, and referring them for

neuropsychological assessments if cognitive concerns disrupt their life functioning.

Cognitive functioning remains a significant problem for many people with cancer, and nurses must be knowledgeable about the growing body of evidence regarding potential interventions to address this issue. The Oncology Nursing Society's (2017) Putting Evidence Into Practice (PEP) includes evidence-based information that providers can use to counsel their patients about dealing with cognitive impairment. To date, group-based cognitive training is the only approach that is rated as "likely to be effective"; these programs typically include repeated, structured practice of mentally challenging tasks by individuals within a group setting. Numerous other interventions have been evaluated, including individual cognitive training, meditation, exercise, and yoga; the PEP guidelines indicate that their effectiveness has yet to be established, which is important to convey to individuals who seek advice from nurses regarding activities to improve cognitive functioning. Nurses also should be aware of the National Comprehensive Cancer Network's ([NCCN's], 2016) guidelines on survivorship that include recommendations for addressing survivors' cognitive concerns. Limited evidence exists to guide practice in this area, but some evidence supports the use of enhanced organizational techniques, relaxation and stress management strategies, meditation, yoga, exercise, and limiting use of cognition-altering substances. NCCN (2016) rates their recommendations at the 2A level, meaning that "based upon lower-level evidence, there is uniform NCCN consensus that the intervention is appropriate" (p. MS-1).

Conclusion

Cognitive problems are a serious concern for many breast cancer survivors following the completion of active treatment, and they should be addressed by the nurses providing care to them. Behavioral interventions, such as the one piloted in this study, can have positive effects on survivors' self-reported cognitive abilities, fatigue, sleep disturbance, and emotional distress, as well as their use of cognitive and memory strategies. Although this intervention was well received, future studies should investigate alternative methods for building cognitive abilities among survivors who are unable or not interested in participating in group interventions.

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References

- Ahles, T.A., Root, J.C., & Ryan, E.L. (2012). Cancer- and cancer treatment-associated cognitive change: An update on the state of the science. *Journal of Clinical Oncology*, 30, 3675–3686. doi:10.1200/JCO.2012.43.0116
- Bandura, A. (1989). Regulation of cognitive processes through perceived self-efficacy. *Developmental Psychology*, 25, 729–735. doi:10.1037/0012-1649.25.5.729
- Becker, H., Henneghan, A., & Mikan, S.Q. (2015). When do I get my brain back? Breast cancer survivors' experiences of cognitive problems. *Clinical Journal of Oncology Nursing*, 19, 180–184. doi:10.1188/15.CJON.180-184
- Becker, H., Stuifbergen, A., & Morrison, J. (2012). Promising new approaches to assess cognitive functioning in people with multiple sclerosis. *International Journal of MS Care*, 14, 71–76. doi:10.7224/1537-2073-14.2.71
- Becker, H., Stuifbergen, A.K., Henneghan, A., & Morrison, J. (2016). *An initial investigation of the reliability and validity of the Compensatory Cognitive Strategies scale*. Manuscript submitted for publication.
- Benton, A.L., Sivan, A.B., Hamsher, K.deS., Varney, N.R., & Spreen, O. (1994). *Contributions to neuropsychological assessment: A clinical manual* (2nd ed.). New York, NY: Oxford University Press.
- Boykoff, N., Moieni, M., & Subramanian, S.K. (2009). Confronting chemobrain: An in-depth look at survivors' reports of impact on work, social networks, and health care response. *Journal of Cancer Survivorship*, 3, 223–232. doi:10.1007/s11764-009-0098-x
- Cella, D.F., Tulsky, D.S., Gray, G., Sarafian, B., Linn, E., Bonomi, A., . . . Brannon, J. (1993). The Functional Assessment of Cancer Therapy scale: Development and validation of the general measure. *Journal of Clinical Oncology*, 11, 570–579.
- Cella, D., Yount, S., Rothrock, N., Gershon, R., Cook, K., Reeve, B., . . . Rose, M. (2007). The Patient-Reported Outcomes Measurement Information System (PROMIS): Progress of an NIH roadmap cooperative group during its first two years. *Medical Care*, 45(Suppl. 1), S3–S11. doi:10.1097/01.mlr.0000258615.42478.55
- Cherrier, M.M., Anderson, K., David, D., Higano, C.S., Gray, H., Church, A., & Willis, S.L. (2013). A randomized trial of cognitive rehabilitation in cancer survivors. *Live Sciences*, 93, 617–622. doi:10.1016/j.lfs.2013.08.011
- Delis, D.C., Kramer, J.H., Kaplan, E., & Ober, B.A. (2000). *California Verbal Learning Test manual* (2nd ed.). San Antonio, TX: Psychological Corporation.
- Duijts, S.F., van Egmond, M.P., Spelten, E., van Muijen, P., Anema, J.R., & van der Beek, A.J. (2013). Physical and psychosocial problems in cancer survivors beyond return to work: A systematic review. *Psycho-Oncology*, 23, 481–492. doi:10.1002/pon.3467
- Ercoli, L.M., Castellon, S.A., Hunter, A.M., Kwan, L., Kahn-Mills, B.A., Cernin, P.A., . . . Ganz, P.A. (2013). Assessment of the feasibility of a rehabilitation intervention program for breast cancer survivors with cognitive complaints. *Brain Imaging and Behavior*, 7, 543–553. doi:10.1007/s11682-013-9237-0
- Ferguson, R.J., Ahles, T.A., Saykin, A.J., McDonald, B.C., Furstenberg, C.T., Cole, B.F., & Mott, L.A. (2007). Cognitive-behavioral management of chemotherapy-related cognitive change. *Psycho-Oncology*, 16, 772–777. doi:10.1002/pon.1133
- Ferguson, R.J., McDonald, B.C., Rocque, M.A., Furstenberg, C.T., Horigan, S., Ahles, T.A., & Saykin, A.J. (2012). Development of CBT for chemotherapy-related cognitive change: Results of a waitlist control trial. *Psycho-Oncology*, 21, 176–186. doi:10.1002/pon.1878
- HealthMeasures. (2017). PROMIS® (Patient-Reported Outcomes Measurement Information System). Retrieved from <http://www.nihpromis.org>
- Hutchinson, A.D., Hosking, J.R., Kichenadasse, G., Mattiske, J.K., & Wilson, C. (2012). Objective and subjective cognitive impairment following chemotherapy for cancer: A systematic review.

- Cancer Treatment Reviews*, 38, 926–934. doi:10.1016/j.ctrv.2012.05.002
- Kesler, S., Hadi Hosseini, S.M., Heckler, C., Janelins, M., Palesch, O., Mustian, K., & Morrow, G. (2013). Cognitive training for improving executive function in chemotherapy-treated breast cancer survivors. *Clinical Breast Cancer*, 13, 299–306. doi:10.1016/j.clbc.2013.02.004
- Livestrong Foundation. (2013). Employment issues. Retrieved from <http://www.livestrong.org/we-can-help/managing-your-life-during-treatment/employment-issues>
- Myers, J.S. (2012). Chemotherapy-related cognitive impairment: The breast cancer experience [Online exclusive]. *Oncology Nursing Forum*, 39, E31–E40. doi:10.1188/12.ONF.E31-E40
- National Comprehensive Cancer Network. (2016). *NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®): Survivorship* [v.1.2016]. Retrieved from https://www.nccn.org/professionals/physician_gls/pdf/survivorship.pdf
- Nelson, W.L., & Suls, J. (2013). New approaches to understand cognitive changes associated with chemotherapy for non-central nervous system tumors. *Journal of Pain and Symptom Management*, 46, 707–721. doi:10.1016/j.jpainsymman.2012.11.005
- Oncology Nursing Society. (2017). Putting Evidence Into Practice: Cognitive impairment. Retrieved from <https://www.ons.org/practice-resources/pep/cognitive-impairment>
- Ono, M., Ogilvie, J.M., Wilson, J.S., Green, H.J., Chambers, S.K., Ownsworth, T., & Shum, D.H. (2015). A meta-analysis of cognitive impairment and decline associated with adjuvant chemotherapy in women with breast cancer. *Frontiers in Oncology*, 5, 59. doi:10.3389/fonc.2015.00059
- Pender, N.J. (1987). *Health promotion in nursing practice* (2nd ed.). Norwalk, CT: Appleton and Lange.
- PositScience®. (2016). BrainHQ: Brain training that works. Retrieved from <http://www.brainhq.com>
- Reeve, B.B., Hays, R.D., Bjorner, J.B., Cook, K.F., Crane, P.K., Teresi, J.A., . . . Cella, D. (2007). Psychometric evaluation and calibration of health-related quality of life item banks: Plans for the Patient-Reported Outcomes Measurement Information System (PROMIS). *Medical Care*, 45(Suppl. 1), S22–S31.
- Richardson, L.C., & Tangka, F.K. (2007). Ambulatory care for cancer in the United States: Results from two national surveys comparing visits to physicians' offices and hospital outpatient departments. *JAMA*, 296, 1350–1358.
- Ruff, R.M., Light, R. H., & Parker, S. B. (1996). Benton Controlled Oral Word Association Test: Reliability and updated norms. *Archives of Clinical Neuropsychology*, 11, 329–338.
- Smith, A. (1982). *Symbol Digit Modalities Test*. Los Angeles, CA: Western Psychological Services.
- Stuifbergen, A., Becker, H., Rogers, S., Timmerman, G., & Kullberg, V. (1999). Promoting wellness for women with multiple sclerosis. *Journal of Neuroscience Nursing*, 31, 73–79.
- Stuifbergen, A.K., Becker, H., Perez, F., Morrison, J., Kullberg, V., & Todd, A. (2012). A randomized controlled trial of a cognitive rehabilitation intervention for persons with multiple sclerosis. *Clinical Rehabilitation*, 26, 882–893. doi:10.1177/0269215511434997
- Sullivan, M.J., Edgley, K., & Dehoux, E. (1990). A survey of multiple sclerosis: I. Perceived cognitive problems and compensatory strategy use. *Canadian Journal of Rehabilitation*, 4, 99–105.
- Troyer, A.K., & Rich, J.B. (2002). Psychometric properties of a new metamemory questionnaire for older adults. *Journals of Gerontology Series B*, 57, P19–P27.
- Von Ah, D. (2015). Cognitive changes associated with cancer and cancer treatment: State of the science. *Clinical Journal of Oncology Nursing*, 19, 47–56. doi:10.1188/15.CJON.19-01AP
- Von Ah, D., Carpenter, J.S., Saykin, A., Monahan, P., Wu, J., Yu, M., . . . Unverzagt, F. (2012). Advanced cognitive training for breast cancer survivors: A randomized controlled trial. *Breast Cancer Research and Treatment*, 135, 799–809. doi:10.1007/s10549-012-2210-6
- Ward, W.L., Hahn, E.A., Mo, F., Hernandez, L., Tulskey, D.S., & Cella, D. (1999). Reliability and validity of the Functional Assessment of Cancer Therapy–Colorectal (FACT-C) quality of life instrument. *Quality of Life Research*, 8, 181–195.
- Wefel, J.S., Kesler, S.R., Noll, K.R., & Schagen, S.B. (2015). Clinical characteristics, pathophysiology, and management of noncentral nervous system cancer-related cognitive impairment in adults. *CA: A Cancer Journal for Clinicians*, 65, 123–138. doi:10.3322/caac.21258
- Willis, S.L., Tennstedt, S.L., Marsiske, M., Ball, K., Elias, J., Koepke, K.M., . . . Wright, E. (2006). Long-term effects of cognitive training on everyday functional outcomes in older adults. *JAMA*, 296, 2805–2814. doi:10.1001/jama.296.23.2805