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A pilot study to compare the effect of memory training and health training interventions on affective and cognitive function with a group of cancer survivors

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Abstract

Cancer survivors over 65 years of age experience treatment-induced memory impairments. However, clinicians are often at a loss on how to intervene for these cognitive problems. This paper describes the findings from a pilot study of a memory vs. health training intervention and its adaptability for cancer survivors.

Design and Methods—A convenience sample of older adults was enrolled in a longitudinal study of a memory and health training intervention and tested on five occasions for 2 years post-intervention. The memory training was designed to reduce anxiety, decrease negative attributions, promote health, and increase self-efficacy. In this analysis we included change over time for the first four of the five data collection points. We calculated means and standard deviations on the memory measures for cancer survivors in the intervention (n=8) and comparison (n=14) groups. The analysis consisted of a mixed design ANOVA comparing the two intervention groups across 4 time periods for twelve months.

Results—The typical cancer survivor in the sample was a 74-year old Caucasian female; 14% were minorities. Because of the small sample, some of the effects were not statistically significant. Moderate to large effects were revealed in everyday and verbal memory performance scores, memory self-efficacy, strategy use, and memory complaints. There were also moderate effects for group by time interactions on the visual memory performance measure, the memory self-efficacy measure, the depression, the trait anxiety measure, and the complaints subscale. The memory intervention group tended to improve more than the health training group, although this was not always consistent. The results suggested that the participants benefited from the memory training intervention.

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The findings have been presented at the 9th National Conference on Cancer Nursing Research in 2007 in Hollywood, CA, the 4th Annual Conference of the American Psychosocial Oncology Society in 2007 in Austin, TX, and the National Academies Keck Futures Initiative. Future of the Human Healthspan: Demography, Evolution, Medicine, & Bioengineering in 2007 in Irvine, CA.

Implications—Clinicians are often at a loss on how to intervene with cancer survivors who are experiencing cognitive problems following chemotherapy treatment. Evidenced-based interventions for this aspect of symptom management are almost non-existent.

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Keywords

Cancer Survivors; Memory Performance; Instrumental Activities; Older Adults; Health Promotion Intervention; Transfer of Learning

The prevalence of cognitive deficits is estimated to be 20–30% among cancer survivors who received chemotherapy (Tannock, Ahles, Ganz, & van Dam, 2004). More than 6.8 million people in the US are considered at high-risk for memory impairments and mild cognitive impairment (MCI), both because they are cancer survivors and because they are over 65 years of age (Office of Cancer Survivorship, National Cancer Institute, 2010). Estimates from 2006 indicate that sixty percent of all cancer survivors are age 65 or older. An individual is considered to be a cancer survivor from the time of a cancer diagnosis through the balance of his or her life. Since two-thirds of adults diagnosed with cancer will be alive in 5 years, the health and life of a person with a history of cancer beyond the acute diagnosis and treatment phase has become of interest to the medical and scientific community. Decreasing cognitive and functional ability may lead to a poorer quality of life may determine which adults will remain independent and which will require care and formal services (Ahles, Saykin, Furstenberg, Cole, Mott, et al., 2002; Beer, Bland, Bussiere, Neiss, Wersinger, et al., 2006; McDougall, Becker, & Arheart, 2006). Though the risk of developing cognitive impairment is 3.5 times higher in patients treated with high-dose chemotherapy, the neuropsychological side effects of cancer treatment have not been sufficiently treated.

Cancer survivors experience high levels of depression, stress and anxiety associated with the fear that the cancer may return and uncertainty about how to interpret and appropriately handle symptoms (Caplette-Gingras, & Savard, 2008; Segar, Katch, Roth, Garcia, Portner et al, 1998). Psychological needs are the most frequently reported and discussed in the literature. Some studies have demonstrated that cancer survivors experience significantly higher levels of psychological morbidity than healthy women (Fann, Thomas-Rich, Katon, Cowley, & Pepping et al., 2008). However, while much has been written about psychological morbidity among cancer patients, there are very few publications describing interventions for helping cancer survivors, particularly older adult survivors with psychological and emotional issues (Badger, Segrin, Dorros, Meek, & Lopez, 2007; Perkins, Small, Balducci, Extermann, Robb et al., 2007).

Cognitive Impairment and Cancer Treatment

Three meta-analyses and one systematic review provide evidence for the cognitive impairments experienced by cancer survivors who received chemotherapy. Matsuda, Takayama, Tashiro, Nakamura, Ohashi, Shimosuma (2005) reviewed ten studies of mild cognitive impairment (MCI) in breast cancer patients who completed adjuvant chemotherapy. The identified cognitive symptoms included memory loss, lack of attention, and concentration difficulties. The authors concluded that while the MCI symptoms were transient, they nevertheless took several years to disappear. Jansen, Miaskowski, Dodd, Dowling, and Kramer (2005) reviewed 16 studies that included eight cognitive domains. This review included 996 patients who averaged 48 years of age ($SD = 7.54$). Most (84%) of the patients were female; 56% of the sample were breast cancer studies. Even though all

significant effect sizes were in the negative direction, consistent with previous meta-analyses, visual memory was the sole cognitive domain that had significant chemotherapy-induced impairment across all comparison types. Falletti, Sanfilippo, Maruff, Weih, and Phillips (2005) reviewed six studies that included six cognitive domains. Their conclusions were that cognitive impairment occurred in women who had undergone adjuvant chemotherapy for breast cancer but that the magnitude of this impairment depended on the study design.

Anderson-Hanley, Sherman, Riggs, Agocha, & Compas (2003) evaluated 30 studies across seven cognitive domains. The study included patients ($N = 838$) who were on average 49 years of age and 86 weeks ($SD = 124.1$) from either a diagnosis or treatment. Gender of the sample was not provided, although only 28% of the sample was composed of breast cancer studies. Large negative effects were most pronounced in the three cognitive domains executive function, verbal memory, and motor function. Executive function was an example of a cognitive deficit related to cancer treatment. If an average person who has not received any systematic cancer treatment performed at the 50th percentile, then the average individual who received treatment might fall somewhere between the 15th and 35th percentile. As a result, these individuals would have a lower performance than 65–85% of a normative sample on the cognitive domain in question. While this decrease in function may not impair an individual to the point of a disability, there be a great deal of distress over these cognitive losses in their everyday life. Within the two meta analyses reviewed there was a 44% overlap.

Other studies demonstrated the cognitive effects from chemotherapy were variable. Donovan, Small, Andrykowski, Schmitt, Munster, and Jacobsen (2004) determined that six months after the completion of breast carcinoma treated with chemotherapy plus radiotherapy ($n = 60$) or radiotherapy only ($n = 83$), there were no statistically significant differences between women ($M \text{ years} = 55.4$, $SD = 9.0$) who received chemotherapy and those who did not with regard to their average performance on tests of episodic memory, attention, complex cognition, motor performance, or language.

Wefel, Lenzi, Theriault, Davis, and Meyers (2004) followed 18 women ($M \text{ years} = 45.4$, $SD = 6.7$) with breast carcinoma for eighteen months. At six months, 61% of the women experienced a decline in one or more domains including attention, learning, and processing speed, that are consistent with frontal lobe networks. At the completion of the study, 50% of the women who had cognitive impairments demonstrated improvements, and the remaining individuals were stable. Among these women ($\text{age years } M = 50.4$, $SD = 9.1$), 35% exhibited cognitive impairment before the start of systemic therapy.

The impaired cognitive domains from breast, colorectal, and prostate cancer treatment are summarized in Table 1. This summary provides an inconclusive picture of the phenomena and the ability to determine if anticancer treatment causes cognitive impairment. Following treatments, the cancer patients scored lower on those cognitive domains reported than did the control groups. However, the impact of chemotherapy on cognitive function may be delayed and manifest at some later time period, thus implying the need for longitudinal prospective study designs. What is not known is how these cognitive impairments affect an individual's everyday function.

Remediation of Cognitive Impairment in Cancer Survivors

Two intervention studies aimed at remediating cognitive impairment have been published. McDougall (2001) tested a memory training intervention in a retirement community with a sample of 78 adults with an average age of 82 years that included eleven cancer survivors, eight females and three males. The overall sample included 58 females and 20 males with 16

years of education (McDougall, 2000). Participants were not cognitively impaired as indicated by an average MMSE score of 28. The cancer survivors however were significantly older ($p = .02$), $M=84.12$ years and scored significantly lower ($p = .03$) at the pretest on metamemory capacity ($M = 2.5$, $SD = 0.5$). There were significantly lower self-reported instrumental activities of daily living ($p=.033$) at post-test when compared to their cohort group in the retirement community. On the Rivermead Behavioural Memory test, 5 of these individuals improved after the intervention, including three females and two males. Two females and one males' memory performance decreased; one female maintained and data were missing for two individuals. The length of time since the completion of active cancer treatment was unknown.

Recently, Ferguson et al. (2007) tested whether a cognitive-behavioral intervention was effective in managing dysfunction in attention and self-reported memory problems following chemotherapy in breast cancer survivors (BCS) with Stage I or II breast cancer. In a quasiexperimental pre-post group design, 29 women participated in four in-office monthly visits (30–50 minutes each) and three contacts between visits, for seven total contacts. The participants showed significant improvements over baseline in verbal and executive function, self-reported cognitive function. Limitations of this study included lack of a control group, an all Caucasian sample, and variable cancer diagnoses.

SeniorWISE Study

This paper reports the outcomes of a memory-training intervention originally developed for community-residing older adults, with a group of self-identified cancer survivors, and proposes an adaptation of the intervention for cancer survivors. The Cognitive Behavioral Model of Everyday Memory (CBMEM), a conceptual model derived from Self-Efficacy theory, posits that mental frailty and cognitive vulnerability are influenced by modifiable risk factors such as health (physical & emotional) and self-efficacy beliefs, which influence the metamemory and memory performance relationship. The hypothesis tested in the larger study was that at-risk older adults in the CBMEM-based memory training intervention would show significantly better memory self-efficacy, metamemory, memory performance, and better function in the instrumental activities of daily living than the subjects in the health promotion comparison condition at post-class (two months after baseline), and these benefits would be maintained over the remaining four assessment points: post-classroom (two months), post-booster (six months), post-classroom follow-up (14 months), and end of study (26 months).

The intervention component of the CBMEM addresses anxiety, depression, health, metamemory, and memory self-efficacy, which are known to influence memory performance (McDougall, 1998, 1999, 2009). The memory improvement intervention, based on this model has four components: Stress inoculation, health promotion, memory self-efficacy, and memory strategy training. The intent was to transfer the learning from the classroom to everyday experience. The emphasis was on everyday memory and strategy use. In addition, participants learn skill building through modeling techniques, observing performance, developing awareness and mastery coping, handling of controlled challenges, becoming confident and realistic.

Self-Efficacy Theory

Bandura (1997) postulated four principal sources of self-efficacy information. Each component of the theory is proposed in the CBMEM intervention. First, enactive mastery experience is built into the curriculum so that the exercises increase gently from less difficult to more difficult. As people begin to feel more competent and comfortable, they were encouraged to take more risks. Principles of adult learning were used throughout the

program, so that no one was embarrassed or intimidated in front of the group, and all relevant experience was discussed. Next, vicarious experiences that alter efficacy beliefs through transmission of competencies and comparison with the attainments of others were operationalized through the group format and group sharing of the experiences. Third, verbal persuasion and allied social influences to reinforce that one possesses certain capabilities were operationalized through continual feedback on performance accomplishments and encouragement for continued progress. Finally, physiological and affective states were practiced each class with relaxation and stress inoculation. People tend to feel anxious in situations where competence is questioned. Stress inoculation taught and practiced in subsequent sessions assisted participants to deal with stressful cognitive situations in everyday life. Participants were also reminded to practice relaxation techniques such as take a few deep breaths at stressful times to alleviate memory anxiety. Specific examples of self-efficacy theory operationalized to the memory training curriculum are described.

During the 8-session classroom component of the intervention, at least 30 minutes of practice with memory strategies was allocated within each class to strengthen enactive mastery experience, the strongest component of Self-Efficacy Theory. In addition, an enabling booster session was also provided to enhance perceived self-efficacy and instrumental activities of daily living. Each Memory training session began with a twenty-minute relaxation exercise. The various topics included: Memory and health; Memory functions and mechanisms; Factors affecting memory for people of all ages; Memory beliefs and aging; Use of internal and external memory strategies. The memory training was based on self-efficacy theory, and therefore the use of the female septuagenarian role model was the intended role model for that condition and looked like the participants. She only taught the memory training classes. If she had to miss a training session, the PI taught the class. However, this never occurred. On completion of the study, all participants received a copy of the memory improvement book written for older adults entitled *Improving Your Memory* (Fogler & Stern, 1994).

Health Training

The curriculum goals for the health group were to provide a meaningful educational offering, both to fulfill the purpose of the comparison group and to hold the interest of the participants for twenty-six months, enough to guarantee their continued involvement in the project over the period of the study. Consideration was given to the need for inclusion of health topics with an emphasis on successful aging. As we progressed through the study, additional health topics were added and lectures built around them, as more topics appeared in the news and as participants expressed their interest in certain subjects. We developed lectures that included eighteen topics covering a wide range of health concerns related to successful aging. The health intervention emphasized successful aging based on focus groups. Topics included: Exercise, Spirituality and Health, Alternative Medicine, Weight Management, Getting the Most from Your Doctor Visit, Caring for the Caretaker, Healing Foods, Drug Interactions, Osteoporosis, Maintaining Relationships, Health Myths, Consumer Fraud, Nutrition, Leisure Activities, Writing Family Stories, Health Monitoring Tests for Home Use, and Buying Drugs in Foreign Countries. The comparison group received health promotion training.

The curriculum consisted of 18 different health topics, which varied by cohort group at different sites (McDougall, Becker, Acee, Vaughan, Pituch, Delville, 2010). Each health topic was delivered in PowerPoint format and received the same information on the topic across cohort groups. Handouts were also standardized so that when a group was presented the health topic they received a standard set of handouts to enhance the content. Each group

began with the 'alternative medicine' topic because of its widespread interest to a diversity of people and the media coverage of scientific trials that often appeared in the newspaper.

Booster Sessions—The four mandatory, 2-hour booster sessions, were offered weekly for one month, for both experimental and comparison subjects in Year 1, and within 3 months of the end of the initial training. They were integral to the training and provide a transitional experience between the theoretical and practical concerns of memory improvement. The goals of the booster sessions were to boost learning, to enhance retention and, to assist with transfer of memory strategies to everyday life. The emphasis of the booster sessions was on practical everyday memory strategies needed for IADLs. Individuals were given opportunities to practice strategies that can be incorporated into their everyday activities and routines.

In the booster sessions an additional 8 hours of classroom time were delivered to both the memory and health groups over the 3 months following the initial training. Four 2-hour sessions met weekly for 1 month. For the intervention group, the booster training sessions provided a transitional experience between classroom work on memory improvement and practical applications.

The booster sessions were designed to boost learning, enhance SeniorWISE Study retention, and assist with the transfer of memory strategies to everyday life. The emphasis was on practical everyday memory strategies needed for IADLs. Individuals were provided opportunities to practice strategies that could be incorporated into their everyday activities and routines in order to maintain IADLs. The health training group received training in new areas of health promotion not previously presented in their earlier 8 sessions.

A convenience sample drawn of 267 participants drawn from a metropolitan area in Central Texas were enrolled in the study over a 2-year period. Their participation lasted for 26 months and they were tested on five occasions during that period. From our health questionnaire, it appeared that 44 individuals might have been cancer survivors. To confirm this self-reported information we called each individual by phone and asked five questions related to their diagnosis, treatment, recurrence, and termination of treatment. Fifteen individuals did not have cancer and another 7 either dropped out before completing the study, or were not able to be contacted.

The final sample of confirmed cancer survivors consisted of 22 individuals. Of those individuals, five had prostate cancer, eight had breast cancer, two had uterine cancer, one had lymphoma and leukemia, one had throat, one had lung, and three had facial and/or had basal cells on the nose. Of those, 59% were female ($n=13$), 86% ($n=19$) were Caucasian and there were 2 African Americans and 1 Hispanic adult. The typical survivor had a mean age of 73.86 ($SD=4.82$) years with 16 years of education. In self-ranking their socio-economic status, four individuals (18%) said they had enough for bills and things, 1 had enough for bills and outings (5%), 11 (50%) had enough for bills, things, and outings, and 6 (27%) had enough not to worry. Length of time from active treatment was unknown.

Measures

Verbal memory was tested with the Hopkins Verbal Learning Test-Revised (HVLTR), which tests immediate recall, delayed recall, and recognition memory (Brandt, 1991; Benedict, 1997). Test/retest correlation was .66 for the Delayed Recall Subscale, which was used in these data analyses.

Visual memory was assessed with the Brief Visuospatial Memory Test-Revised (BMVTR) (Benedict, 1997; Benedict, Dobraski, & Goldstein, 1999). Test/retest correlation was .72.

The Rivermead Everyday Behavioural Memory Test (RBMT) was used to assess everyday memory performance in twelve domains (Cockburn & Smith, 1989; Wilson, Cockburn, Baddeley, & Hiorns, 1989). For each subtest, two scores are produced, a pass/fail screening score and a standardized profile score (SPS) with a range from 0–24. The analysis reported here used the SPS scores and had alpha reliabilities of .73 to .80.

The Direct Assessment of Functional Status (DAFS) is a performance-based measure that contains 85 items (Loewenstein, Amigo, Duara, Guterman, Hurwitz, Berkowitz, et al. 1989; Loewenstein, et. al., 1992). An adapted version of the DAFS was used in this study with alpha reliabilities of .79 to .84. The DAFS domains used were time orientation, communication abilities, transportation, financial skills, and shopping skills. A fifth domain, medication knowledge, was added for the study.

Anxiety was measured with the State/Trait Anxiety measure had alpha reliabilities of .85 to .92 (Spielberger, Gorsuch, & Lushene, 1970). Alpha reliabilities were .85 and .89.

The Centers for Epidemiologic Studies Depression Scale (CES-D) was used to measure depression had alpha reliabilities of .78 to .87 (Radloff & Teri, 1986). Alpha reliability in this study was .78.

The Metamemory in Adulthood Questionnaire (MIA) measures seven aspects of memory knowledge had alpha reliabilities of .84 to .87 (Dixon & Hultsch, 1983; Dixon, Hultsch & Hertzog, 1988). We used the Strategy subscale (18 items), which indicates how often someone uses both internal (elaboration, rehearsal, etc.) and external memory (lists, notes, etc.) strategies to facilitate their everyday memory function. Alpha reliabilities were .78 and .77, respectively.

Memory complaints were measured with the Change subscale of the Metamemory in Adulthood Questionnaire (MIA) (McDougall, Becker, & Arheart, 2006). The change subscale determines individuals' perception of their memory abilities as generally stable or subject to long-term decline. Alpha reliability was .91.

The Memory Self Efficacy Questionnaire (MSEQ) consists of 50 questions, 5 for each of ten everyday tasks: everyday objects, text details, shopping list, people's names, main points from story, digits, line drawings, animal names, phone numbers, and objects (Berry, West, & Dennehey, 1989). Subjects make performance predictions on self-efficacy level (Yes or No) and on strength and confidence in each performance prediction, from 10% to 100%. In this study, the text details (B), digits (F), and line drawings (G) subscales were dropped to shorten the time required for the test battery. Alpha reliabilities of the MSEQ were .95 to .96.

Findings

We examined change over time for those individuals who indicated they were cancer survivors on the background questionnaire that SeniorWISE participants completed when they entered the study. The analysis included only the first four of the five data collection points, to maximize the sample size. Data used here were collected prior to the classes, at the end of classes, at the end of the booster session, and six months later. The analysis consisted of a mixed design ANOVA comparing the two intervention groups across 4 time periods for twelve months. Means and standard deviations were calculated for survivors in the intervention (n=8) and comparison (n=14) groups across the four time points.

Table 2 shows the means and standard deviations for survivors in the intervention (n=8) and comparison (n=14) groups across the four time points. The last two columns indicate the

partial eta2 associated with change across time and the time by group interaction effects. Because of the small sample size, some of the moderate effects (i.e., partial eta2 greater than .20) were not statistically significant, yet they suggest that meaningful differences were occurring.

On performance measures, moderate effects were noted with increases in the Rivermead and HVLT memory performance scores. There were also moderate effects for group by time interactions on the BVMT memory performance measure, and there were decreases in depression and trait anxiety. At pretest there was a ceiling effect in DAFS scores in both groups.

On the memory self-report scales the findings were significant. Moderate effects were seen with increases in memory self-efficacy and the use of capacity, change, locus, use of internal, and external strategies, and a decrease in memory complaints (Figure 1). The memory intervention group was more likely to increase scores, while the performance of the comparison group was more variable across the four time periods.

Discussion

Though the main study was not designed specifically for cancer survivors, this pilot study, a secondary analysis, makes a contribution to the cancer survivor literature, and provides preliminary knowledge about two types of interventions that may assist cancer survivors to improve their cognitive and executive function. The main study was a randomized clinical trial that delivered two psychosocial interventions, memory and health training. The study provides beginning evidence, that as a targeted memory intervention, positive changes were manifested in overall cognition, everyday and verbal memory performance. In addition, the survivors showed a slight improvement in performance based instrumental activities.

The assignment to memory and health training groups was a random process, but in this analysis of the cancer survivors, these differences are of interest. Since there were multiple sites, randomization occurred separately for each site known as a Group. Each group was screened and eligible within the various sites and consisted of eleven different groups, which met at seven different sites in the community over a 3-year period. Regardless of the group assignment, memory or health, each group participated in twelve classroom experiences, or twenty hours of group training.

There were notable differences between the training groups on the performance measures of verbal and visual memory at pre-test. In previous reviews of breast, colo-rectal, and prostate cancer survivors, the four overlapping cognitive domains identified in all three cancers were executive function, memory, verbal memory, and recall (Anderson-Hanley, Sherman, Riggs, Agocha, & Compas, 2003; Jansen, Miaskowski, Dodd, Dowling, & Kramer, 2005; & Matsuda, Takayama, Tashiro, Nakamura, Ohashi, & Shimozuma, 2005). In the memory training group there were significant pre-intervention differences on visual memory at pre-test. That group scored ten points higher than the health training group. At twelve months, the memory training group was fourteen points ahead of the health training group. Visual memory as measured by the BVMT-R is sensitive to brain integrity and involves both verbal and nonverbal memory processes. Impaired performance has been documented with patients who were breast cancer survivors, Alzheimer type dementia, and vascular dementia. The memory training group also maintained its gain on verbal memory.

We observed a ceiling effect in the DAFS in our SeniorWISE sample of community-residing older adults and therefore saw no significant changes in the scores in either training condition. The DAFS measured instrumental activities that included addressing a letter, writing a check, balancing the check register, identifying and calculating money, making

change from a grocery purchase, reading a prescription label and dialing the pharmacy to order a refill, dialing a telephone number, and remembering a grocery list given orally given and reading from the book. Even though these tasks were relevant, they were not requiring full use of one's abilities and may have precluded the detection of IADL improvement over time. The DAFS was also not sensitive to the early decrements in IADLs that might signal initial cognitive impairment. With only one version of this measure, many participants learned through practice and maintained their scores over time.

In this pilot study, the cancer survivors significantly improved the subjective aspects of their cognitive function, such as increased confidence, greater capacity, reduced memory complaints, and improved their control beliefs that their memory difficulties were able to be managed. For example, on memory self-efficacy, the intervention group at pretest scored significantly lower than the health training group--an eight point difference. However at 12 months, the memory training group was ahead of the comparison group by six points. Even though this was not a significant difference, the changes over time in the memory training group were significant. This gain of 16 points represented a notable positive change in the cancer survivors confidence about their everyday memory performance.

Participants' self-reported knowledge of memory vis-à-vis the MIA subscales was a positive outcome of the intervention. The cancer survivors significantly improved the subjective aspects of their cognitive function, such as increased confidence, greater capacity, reduced memory complaints, and improved their control beliefs that their memory difficulties were able to be managed. The participants maintained these gains at fifteen months. Following the intervention, the cancer survivors reported using more memory strategies, a compensatory mechanism that facilitates the adaption of the individual to the cognitive limitations and losses. Of the two types of memory strategies, it was the internal ones that were reported being utilized significantly more often. Findings from memory research indicate that older adults do not use effective acquisition strategies and have limited repertoires of alternative memory strategies.

In previous studies, findings pertaining to the association between memory strategy use and memory performance have been equivocal (Devolder, & Pressley, 1992; Intons-Peterson MJ, & Fournier, 1986). Other cognitive aging researchers determined there were no differences in strategy use as a function of causal beliefs for recall, recognition, and appointment-keeping tasks (prospective memory). They concluded that for the older adults despite the differences in effort expenditure as a function of causal beliefs even, there were no differences in strategy use reported. They concluded that the older adults were less strategic and believed that their ability was a more important influence on their performance than was their use of strategies, which was the opposite view of the younger participants. Even though the findings were not significant, there were noticeable differences in anxiety and depression scores at fourteen months. The memory training group of cancer survivors had lower scores on both measures.

The cancer survivors who represented approximately ten percent of the sample had many cancer diagnoses. Further, the generalizability of the findings is limited due to the convenience sample recruited for the main study. Nevertheless, the memory training intervention provided participants with the confidence, knowledge, skills, and support necessary to deal with their memory problems and consequently their everyday functioning. Competing explanations for the changes may be best addressed by looking at the demographic characteristics of the two groups. We acknowledge that other differences besides their being in the intervention versus health comparison group could account for the differences in responses-which is another argument for replication with a larger sample.

In the Ferguson et al (2007) intervention, the BCS received 25% of the dose (3 vs. 12 hours) delivered in the SeniorWISE study; however the two samples were substantially divergent in age, gender, and comorbidities. When compared with McDougall's 2001 study, that study provides a more comprehensive picture of how an intervention might contribute to the cognitive difficulties experienced by cancer survivors.

Essential Components or Features Of Modified Intervention

To adapt the content of SeniorWISE for a group of cancer survivors we recommend these topics. In class one emphasize Stress and Relaxation. Discuss the effects of "chemo brain" and fatigue (i.e., symptoms) on concentration and memory, and ways to cope. Emphasis would be placed on the importance of being organized, and on the insidious nature of self criticism, such as using terms like "chemo brain." Further, a discussion of the effects of stress on the body and memory by introducing several relaxation techniques, and practice these at the beginning of each lesson to enhance learning. Next, define the parts of memory, encoding, recognition and recall, and discuss reasons for forgetting. Finally, describe how memory works, how we put information into and retrieve it from long-term memory. Provide exercises illustrating the use of cues in memory.

In Class #2 the focus would emphasize Memory and Attributions. Begin with stress inoculation and relaxation. Next, introduce false beliefs concerning memory, and discuss findings that refute these beliefs and changes in memory due to medication-impaired states. Provide instruction on how to encode information into long-term memory. Then, offer exercises illustrating the difficulty of performing divided attention chores, the ways in which people group information for encoding. Finally, discuss factors affecting memory, such as alcohol consumption, grief, medications, and stress. Introduce strategies to enhance memory function.

In Class #3 the topic would highlight Memory and "Chemo Brain. Begin with stress inoculation and relaxation. Compare the changes in memory that come with aging to those resulting from anticancer therapy, and ways to protect memory. Next, illustrate the effect of medications and chemotherapy on memory, including nutraceuticals and vitamins. Finally, illustrate factors affecting memory in greater depth, including depression and illnesses, and steps to take to forestall depression. Provide exercises on the effects of medications on memory. Discuss the seven sins of memory. Provide strategies for overcoming negative information about memory. Provide exercises that illustrate active observation.

In Class #4 focus primarily on Memory Remediation Techniques. Begin with stress inoculation and relaxation, with specific emphasis on the cognitive problems associated with anticancer treatment. Emphasize strategies such as association, elaboration, visualization, and active observation and the best ways to use these techniques in everyday situations. Next, introduce strategies for remembering more than one thing at a time. Follow with new technologies for memory training. Provide exercises to practice strategies in a controlled setting.

Conclusions

Deficits in cognitive function have been documented before and after adjuvant therapy and may be related to affect or stress as much as neurological factors. How this information will be interpreted to patients is frustrating to clinicians. An intervention may be intended to improve memory skill or capacity, memory function in day to day living, or participant perception of or efficacy for memory functions, or all of the above. The concerns about cognitive difficulties and perceived impairments in daily living related to cognitive deficits

such as diminished memory skills is a primary concern of survivors and is a component of symptom management.

Complaints of cognitive impairment following breast cancer treatment are well known and have been frequently studied, although questions still exist regarding the prevalence of genuine organic impairment versus, for example, subjective complaints that are not demonstrated on cognitive testing, sequelae of depression and/or fatigue that are not related to chemotherapy, or natural age-related deterioration. Regardless of the source of patient complaints, interventions that might improve cognitive functioning have clear potential to remediate the cognitive losses for that subset of patients affected.

Implications

In the booklet, *Life After Cancer Treatment* (National Institutes of Health, 2004; No. 04-2424), Chapter 3 (Your Mind and Your Feelings after Cancer Treatment) provides tips for improving memory and concentration and validates the experience of many cancer survivors. However, evidenced-based interventions for this aspect of symptom management are almost non-existent. Clinicians are often at a loss on how to with survivors intervene for cognitive problems experienced post treatment. Adult cancer survivors experiencing memory problems want to improve their everyday memory in specific domains that are of concern, such as remembering faces and names, dates and telephone numbers, household objects, recent and past events, meetings and appointments, information and facts, and directions. Whether cognitive stimulation or memory interventions will alleviate the cognitive difficulties experienced by cancer survivors remains unknown. Based on the inadequate sample size in this pilot study we were unable to determine if the changes noted were clinically significant. Although, the results suggest that cancer survivors can benefit from a memory training intervention, which seemed to have specific impacts on self-reported memory measures and visual memory.

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Figure 1.

Table 1

Cognitive Domains Impaired in Cancer Survivors

Impaired Function	Breast	Colorectal	Prostate
Attention	x		
Cognition	x		
Concentration	x	x	
Dementia	x		
Digit Symbol		x	
Executive Function	x	x	x
Learning	x		
Memory complaints	x		
Memory	x	x	x
Memory (verbal)	x	x	x
Memory (visual)	x		
Memory (working)	x		
Mild Cognitive Imp.	x		
Motor Function	x	x	
Processing Speed	x		
Recall	x	x	x
Spatial Ability			x

Descriptive Statistics for Cancer Group Time 1 through Time 4

Performance	N	Mean				SD				eta ²			
		T1	T2	T3	T4	T1	T2	T3	T4	Time	Time × GRP	Time × GRP	Time × GRP
MMSE Intervention	8	28.75	0.89	29.00	0.76	29.00	1.20	29.50	0.76				
MMSE Comparison	14	28.36	1.65	28.64	1.86	28.57	1.60	28.29	1.73	0.11	0.19		
SPS Intervention	8	20.25	2.43	21.25	2.19	20.88	2.23	21.63	1.41				
SPS Comparison	14	19.43	3.86	19.43	4.15	19.14	4.99	20.79	2.81	0.22	0.06		
DAFS Intervention	8	85.75	1.91	85.38	2.13	86.13	3.76	86.63	1.85				
DAFS Comparison	14	82.93	5.21	83.29	5.31	83.43	5.49	84.21	4.74	0.14	0.02		
HVLT Intervention	8	55.75	6.36	55.38	6.55	55.75	5.63	58.25	4.50				
HVLT Comparison	14	48.57	8.67	52.00	10.56	48.50	12.89	51.50	9.67	0.22	0.10		
BVMT Intervention	8	56.38	9.88	49.13	15.85	53.75	9.11	53.25	10.87				
BVMT Comparison	13	46.38	13.63	46.00	12.29	43.77	13.46	39.15	13.20	0.16	.33*		
Self-report	N	T1	T2	T3	T4	T1	T2	T3	T4	Time	Time × GRP	Time × GRP	Time × GRP
MSEQ Intervention	8	45.45	20.58	51.96	15.91	56.04	10.27	61.43	16.64				
MSEQ Comparison	14	53.57	16.90	46.80	11.23	52.49	11.56	55.41	14.25	0.42**	0.23		
COMP Intervention	8	2.70	.70	2.98	.46	3.12	.56	3.09	.62				
COMP Comparison	14	2.63	.59	2.80	.48	2.77	.64	2.55	.64	.14	.42**		
ACH Intervention	8	4.05	0.25	4.01	0.20	3.99	0.19	4.02	0.27				
ACH Comparison	14	3.86	0.48	3.90	0.38	3.82	0.39	3.75	0.51	0.09	0.08		
ANX Intervention	8	3.22	0.76	3.13	0.60	3.01	0.60	3.04	0.68				
ANX Comparison	14	3.23	0.46	3.14	0.63	3.24	0.55	3.18	0.58	0.06	0.13		
CAP Intervention	8	2.87	0.51	3.01	0.28	3.18	0.34	3.14	0.45				
CAP Comparison	14	3.00	0.38	3.01	0.37	2.88	0.44	2.84	0.40	0.07	.49***		

Performance	N	Mean				SD				eta ²			
		T1	T2	T3	T4	T1	T2	T3	T4	Time	Time × GRP	Time × GRP	Time × GRP
CHG Intervention	8	2.44	0.67	2.72	0.41	2.88	0.53	2.85	0.66				
CHG Comparison	14	2.46	0.62	2.54	0.44	2.53	0.58	2.34	0.63	0.26			.41**
LOC Intervention	8	3.75	0.43	4.13	0.56	3.94	0.41	4.11	0.41				
LOC Comparison	14	3.61	0.61	3.52	0.44	3.60	0.46	3.27	0.62	0.11			.47***
STRI Intervention	8	3.53	0.57	3.75	0.49	3.92	0.41	3.83	0.40				
STRI Comparison	14	3.52	0.58	3.61	0.55	3.67	0.60	3.49	0.57	0.31*			0.15
STRE Intervention	8	3.99	0.36	4.15	0.56	4.14	0.56	4.17	0.40				
STRE Comparison	14	3.93	0.44	4.12	0.40	4.11	0.41	4.16	0.55	0.22			0.00
TSK Intervention	8	4.01	0.35	4.17	0.45	4.16	0.31	3.99	0.49				
TSK Comparison	14	3.98	0.43	4.02	0.38	3.93	0.40	4.01	0.40	0.16			0.24
CESD Intervention	8	6.00	3.02	9.13	5.00	6.00	3.85	5.75	3.20				
CESD Comparison	14	6.64	5.34	6.43	5.97	6.21	8.24	7.93	7.77	0.17			0.28
STAIIS Intervention	8	28.25	7.69	26.00	4.66	25.00	2.78	23.88	4.12				
STAIIS Comparison	13	27.54	8.23	27.00	7.76	27.31	8.53	29.92	12.14	0.07			0.10
STAIT Intervention	8	28.25	6.48	29.38	6.89	27.88	5.59	26.00	4.04				
STAIT Comparison	14	28.36	7.46	30.93	8.05	31.29	9.03	32.07	9.46	0.08			0.21