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Meditation-Type Exercise for the Management of Chemotherapy Related Cognitive Impairment in Breast Cancer Patients

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MEDITATION-TYPE EXERCISE FOR THE MANAGEMENT OF CHEMOTHERAPY RELATED COGNITIVE IMPAIRMENT IN BREAST CANCER PATIENTS

by

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DEDICATION

This project is dedicated to my family, friends, co-workers, and patients. My husband, Bill Cain; you have been supportive and patient throughout this journey and without that, I could not have reached this goal in my life. I promise I will make time to go fishing. My mother, Ann Peters, a breast cancer survivor; you have demonstrated bravery, resilience, and a compassion for giving to others for as long as I can remember. Your determination in life has guided me to achieve my goals. My father, Paul Peters; you have shown me what hard work is and how to find true greatness in every day: the glass is always half full. My daughters and son-in-law, Taylor White, Andrew White, and Savanna Cain; you are my life. You are selfless and make me so proud to be your mother and friend. You have had confidence and faith in me and without your encouragement and support, I would not be obtaining this degree. My aunt, Barb Werblo; you are my rock. You encourage me to keep “pushin’ on”. You have been my lifelong inspiration. My friends (old and new); thank you for sharing this journey with me and continuously cheering me on, waiting for me, and understanding the phrase “I have homework”…it’s been a long four years. My co-workers and family at Premier Oncology/Hematology; your confidence in me has carried me through to the end of this journey. I could not have done it without your support. Thank you, Dr. Barai for your encouragement and persistence over the years to obtain this degree. Thank you, Dr. Kurra for your continuous support. My patients; I would not be here if I did not care about you all so much. I am as excited as you are for me to finish this degree and be able to spend more time doing what I love. And, last but not least, to the people we have lost to cancer; you are not forgotten.

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ABSTRACT

Chemotherapy-related cognitive impairment (CRCI), or “chemobrain”, is one of the most troublesome side effects of chemotherapy (Dijkshoorn et al., 2020). Ongoing CRCI may negatively affect relationships, confidence, sleep, fatigue, anxiety, and the ability to return to work activities leading to a decreased quality of life (Johns et al., 2016; Gokal et al., 2018). The purpose of this evidence-based practice (EBP) project was to assess the efficiency of a meditation-type exercise intervention, chair yoga, on decreasing perceived cognitive impairment (PCI) in breast cancer patients. The PICOT question for this project was: In breast cancer patients with chemotherapy related cognitive impairment (P), how does chair yoga (I) compared to standard care (C) affect perceived cognitive impairment (O) after 10 weeks (T)? Twenty-five female breast cancer patients from an oncology clinic in Northwest Indiana were screened for CRCI; defined as a score of ≤ 60 on the PCI portion of the Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog) (v3) assessment tool. A total of 10 women met eligibility criteria and agreed to participate in a 10-week, 150-minute per week, chair yoga program which included a free, 1-hour, biweekly yoga class. Participants were given a logbook to track yoga activity and provided support at scheduled appointments or by phone to promote adherence to the program. Eight participants remained in the program and completed the post-intervention FACT-Cog questionnaire. The pre-intervention and post-intervention FACT-Cog scores were analyzed for statistical significance using the Wilcoxon signed rank test. The primary outcome of this project demonstrated a nonsignificant increase in FACT-Cog scores ($Z = 1.682$, $p = .092$). Although the outcome was not statistically significant, this project emphasizes the need to manage CRCI and provides healthcare professionals with a reliable, validated tool for screening patients.

Keywords: chemotherapy-related cognitive impairment, chemobrain, meditation-type exercise, chair yoga, FACT-Cog

CHAPTER 1

INTRODUCTION

Background

Breast cancer is the most commonly diagnosed cancer worldwide (Dijkshoorn et al., 2020). Between 2011 and 2017, the 5-year survival rate for women diagnosed with localized breast cancer was 99%; regional 5-year survival was 86%; distant metastatic 5-year survival was 29% (American Cancer Society (ACS), 2022b). During that same time, 95% of men with localized breast cancer survived 5 years or more; regional 5-year survival was 83%; metastatic 5-year survival was 19% (ACS, 2022a). Depending on the stage of cancer at diagnosis, patients are often treated with chemotherapy. According to Kim et al. (2022), subjective cognitive impairment was significantly worse among patients treated with chemotherapy compared to patients' chemotherapy naïve. Although chemotherapy is an effective, life-prolonging, breast cancer treatment, approximately 75% of patients receiving chemotherapy experience chemotherapy-related cognitive impairment (CRCI), or "chemobrain" (Ren et al., 2022). CRCI is described as a decrease in memory, attention, thought processing, ability to multitask, and reasoning ability following cancer treatment (Gokal et al., 2018; Johns et al., 2016; Koevoets et al., 2022; Ren et al., 2022). During and following cancer treatment, cognitive impairment was rated as one of the most troublesome side effects by cancer survivors (Dijkshoorn et al., 2020). CRCI is most prevalent immediately following breast cancer treatment (Van der Gucht et al., 2020); however, up to 35% of patients continue to report cognitive impairment several years after receiving chemotherapy (Johns et al., 2016; Runowicz et al., 2016; Van der Gucht et al., 2020).

According to Das et al. (2020), the major cause of this phenomenon is cytokine elevation and reduction of white matter. Antimetabolites (Methotrexate and 5-Florouracil), cytotoxic antibodies (Doxorubicin), alkylating agents (Cyclophosphamide), anti-microtubule agents (Paclitaxel and Docetaxel), and monoclonal antibodies (Trastuzumab) are among some of the

most common anti-cancer therapies used to treat breast cancer. These effective cancer treatments are shown to cause neuroinflammation, oxidative stress, cerebrovascular alteration, impaired neurogenesis, white matter abnormalities, hormonal changes, and impaired ATP synthesis leading to delayed neurotransmission and cognitive impairment (Das et al., 2020; Mounier et al., 2020). Cumulative chemotherapy and other drug interactions are also thought to contribute to reduced connectivity between various regions of the brain causing decreased cognitive function (Oh, 2017; Van der Gucht et al., 2020).

Approximately 21% of patients are already cognitively impaired prior to chemotherapy due to a variety of reasons including age, stress, anxiety, depression, and medications (Das et al., 2020; Dijkshoorn et al., 2020); however, evidence indicates that chemotherapy is undeniably correlated with cognitive impairment (Das et al., 2020). Ongoing CRCI may negatively affect relationships, confidence, sleep, fatigue, anxiety, and ability to return to work activities leading to a decreased quality of life (Gokal et al., 2018; Johns et al., 2016). Due to early diagnosis, the number of breast cancer survivors continues to rise. Cancer survivorship care, including the routine assessment of subjective cognitive impairment, is needed so CRCI can be managed and breast cancer patients can improve quality of life.

Data Supporting Need for the Project

Data supporting the need for the EBP project will reflect on the number of survivors of female breast cancer. One *Healthy People 2030* objective is to continue to improve the female breast cancer survival rate, especially among high risk racial and ethnic groups (U.S. Department of Health and Human Services, n.d.). Due to the increase in breast cancer survival rates, the long-lasting side effects of chemotherapy, including cognitive impairment, have become increasingly noticeable (Joly et al., 2019; Runowicz et al., 2016). Research regarding CRCI in breast cancer survivors focuses exclusively on females, therefore, this project will center only on this population of patients.

Global Data

According to the World Health Organization (WHO) (2021), breast cancer is the most prevalent cancer globally. As of 2020, the number of female breast cancer survivors who had been diagnosed since 2015 was 7.8 million (WHO, 2021). The Global Breast Cancer Initiative objective is to decrease the number of breast cancer related deaths by 2.5% by 2040 through early diagnosis and treatment (WHO, 2021), thus increasing the number of breast cancer survivors.

National

Breast cancer is the second most diagnosed cancer in females in the United States. Since 1989, the number of deaths related to breast cancer decreased by 42% as a result of early diagnosis and treatment (ACS, 2022b). According to the American Cancer Society (2022b), the United States has more than 3.8 million female breast cancer survivors, including women still receiving treatment. This number is expected to rise to almost 5 million by 2030 (ACS, 2019). It is estimated there will be approximately 290,560 new cases of breast cancer in the United States in 2022 (ACS, 2022c). The 5-year breast cancer survival rate is 90% and 10-year survival is 84% (ACS, 2022b).

State

As of 2019, female breast cancer was the leading cause of cancer and second leading cause of cancer death in Indiana (CDC, n.d.); there were 4,971 new breast cancer diagnoses and only 847 deaths (CDC, n.d.). The American Cancer Society (2022c) estimates there will be 5,600 new female breast cancer diagnoses and 880 deaths in 2022. This signifies a rise in the number of new diagnoses, as well as an increase in the number of breast cancer survivors in Indiana.

County

The incidence rate for breast cancer in Lake County, Indiana is slightly higher than the state average: 131.4 per 100,000 compared to 130.8 per 100,000 (Indiana Cancer Consortium, 2021).

Clinical Agency Data

This EBP project was implemented in an outpatient oncology and hematology clinic, which is part of a larger healthcare organization, located in Lake County, Indiana. According to the National Institute of Health (n.d.a), the average number of female breast cancers diagnosed annually in the county in which the clinic is located is 390. The number of breast cancer patients actively seen in this clinic in the last 12 months is 552. As of July 15th, 2022, the number of breast cancer patients actively receiving intravenous chemotherapy in this clinic was 32.

To determine priority level, the EBP project was discussed with the healthcare providers and clinical manager within the clinical agency. The physicians, nurse practitioners (NPs), physician's assistant (PA), and clinical manager were all supportive of the project idea and agreed there was a need to assess and better manage CRCI in breast cancer survivors. All providers felt the intervention would be feasible and beneficial for breast cancer patients reporting impaired cognitive function as a result of chemotherapy treatment.

The organization's oncology social worker was also very supportive of the EBP project. She provided the schedule of chair yoga classes, a form for patients to complete with health history information, and a form which notifies physicians when patients have signed up for the class. This form provides physicians with the social worker's contact information should they object to patient participation. The chair yoga is led by a certified instructor and is offered every other Monday from 9:30-10:30 am on the first floor of the building in which the clinical agency is located.

Purpose of the Evidence-Based Practice Project

As a result of early diagnosis and treatment of female breast cancer, the number of survivors continues to rise. Many survivors report a decrease in quality of life related to CRCI; therefore, this EBP project was designed to provide healthcare providers, especially NPs, with a protocol for assessing and managing this problem. The resources to help patients maximize cognitive function and quality of life during and after chemotherapy treatment were needed at this

clinical site. A program for female breast cancer patients who reported CRCI was developed utilizing identified best practices. Participants were encouraged to spend 150-minutes per week engaging in a meditation-type exercise (chair yoga) by attending a biweekly in-person class combined with at home practice, logging time spent, and receiving weekly follow-up by clinicians. This project was evaluated for efficacy to determine if it is a feasible intervention for this clinic to utilize in the future.

PICOT Question

The clinical question that led to the development of this project was, “What are the most effective interventions for managing chemotherapy related cognitive impairment in breast cancer patients?” The purpose of this EBP project was to assess the efficiency of a meditation-type exercise intervention, chair yoga, on perceived chemotherapy related cognitive impairment in breast cancer patients. The PICOT question for this project was: In breast cancer patients with chemotherapy related cognitive impairment (P), how does chair yoga (I) compared to standard care (C) affect perceived cognitive impairment (O) after 10 weeks (T)?

EBP Project Description

Breast cancer patients who had received at least one chemotherapy treatment were screened for perceived cognitive impairment. A score of ≤ 60 was classified as CRCI using the 20-question perceived cognitive impairment (PCI) portion of the Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog) (v3) assessment tool (FACIT, n.d.) (See Appendix B for tool and scoring guidelines). Patients who agreed to participate in a 150-minute per week chair yoga program, were asked by the project leader, clinicians (NPs or PAs), or clinical staff to complete a demographic form and were given a folder which included information about where and when free chair yoga classes were offered, yoga safety, and project manager contact information, along with a logbook to record activities performed over a 10-week period of time. Participants were invited to attend a one-hour, in-person chair yoga class, which was conducted by a licensed yoga instructor every other week on the first floor of the facility. In

addition, they were given a list of preselected, 20-minute, YouTube yoga videos to engage in at home. Participants were assessed by the project leader and/or clinicians weekly via telephone or at their regularly scheduled appointments for needed support and adherence to the program. The comparison data included pre and post-intervention FACT-Cog scores. A Wilcoxon signed rank test was conducted for analysis.

CHAPTER 2

EBP MODEL AND REVIEW OF LITERATURE

Evidence-based Practice Model

The revised Iowa EBP model was chosen to guide this EBP project. The Iowa Model was developed by nursing staff at the University of Iowa Hospital and faculty from the University of Iowa College of Nursing in 1994 and was then revised in 2017 (Duff et al., 2020). The model combines quality improvement, interdisciplinary collaboration, and evidence-based interventions to change practice and improve patient outcomes (Melnyk & Fineout-Overholt, 2019). The process has seven steps: identify triggers or clinical problems; determine priority of the problem within the organization or setting; form a team; collect, appraise, and synthesize evidence; design and pilot change in practice; identify and sustain change in practice; and disseminate results. The model contains three feedback loops which continually identify topic priorities, support for change, and change sustainability.

In the first step, clinicians are encouraged to identify triggers or opportunities for change within an organization. A clear purpose and PICOT question is formed to help guide the EBP process and keep the healthcare team focused. In step two, problems are rated as a priority for the organization. Problems that have a greater impact on patients, staff, or administration may be given higher priority and attract the support necessary to implement EBP change. The first feedback loop is presented at this point of the model. If a problem is not identified as a priority, another trigger may be considered. Once a problem is identified as a high priority, the next step is to form a team. Team members are stakeholders who are involved in developing, evaluating, and implementing change and should include nursing and non-nursing disciplines (Brown, 2014). Fourth, the team conducts a literature search and synthesizes evidence to identify a potential intervention or solution to the problem. The research is critiqued to ensure sufficient quality evidence is available to support practice change. The second feedback loop is presented at this

step and asks if sufficient evidence is available. If there is not enough quality research available to implement practice change, then new research may be conducted or lower-level evidence such as expert opinion, case reports, scientific principles, or theory may be used to pilot change in practice (Brown, 2014; Melnyk & Fineout-Overholt, 2019). In the next step, pilot change is implemented. It is done so in a small practice area to make certain it will be feasible and increase the probability of positive outcomes. At this time, the third feedback loop is used to review the results of the pilot and determine if change is appropriate beyond the pilot. If the results do not support change, then revising the design of the pilot is needed. If the change is appropriate and successful, it may be expanded to cover a larger part of the organization. Step six includes continually evaluating for effectiveness and need for modification. In this step, it is important to engage key stakeholders so long-lasting integration of the practice is sustained. Lastly, outcomes and new knowledge learned from the pilot change are shared with healthcare professionals within, as well as outside of, the organization. This final step is critical to the promotion of evidence-based change throughout the healthcare system (Melnyk & Fineout-Overholt, 2019).

Over the years, the Iowa model has been useful for implementing evidence-based change in the oncology setting (Melnyk & Fineout-Overholt, 2019). The model was designed by nurses, is led by nurses, and promotes interdisciplinary collaboration (Duff et al., 2020). It adjusts to the needs of patients and healthcare organization priorities which allows greater support of the organization itself and more successful outcomes. The Iowa Model was chosen to guide this project for these reasons in addition to the clear and systematic process it provides. As an oncology nurse, the triggering issue, CRCI, was identified as a common complaint among breast cancer patients. An intervention to manage CRCI in breast cancer patients was supported by key stakeholders at the clinical site and the need for practice change was supported by clinical guidelines and research data. The team formed included the following: five clinicians (two physicians, two NPs, and one PA), six registered nurses (RNs), five medical assistants (MAs),

one social worker, and one office manager. Due to the smaller size of the clinic in which the project was conducted, this model was considered appropriate for this project.

Literature Search

Database Searches and Key Words

As shown in Table 2.1, a comprehensive search of Turning Evidence Into Practice (TRIP), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Joanna Briggs Institute (JBI) Evidence-based Practice Database, Medline, Nursing and Allied Health Premium, Cochrane Library, and PubMed was completed. All databases were searched using the date range limiter 2015-2022. Within TRIP, a title search included: “cognitive impairment” OR “cognitive function” AND “breast cancer”. CINAHL was searched using key words and phrases: “chemotherapy related cognitive impairment” OR “cognitive impairment”, breast cancer OR breast neoplasm, and manag* OR treat* or interven* with additional limiters of English language, peer-reviewed, and all adult. The JBI search included: “cognitive impairment” OR “cognitive function” AND chemotherapy OR cancer treatment. Medline was searched using the MeSH heading: “chemotherapy related cognitive impairment” with additional limiters of English language and peer-reviewed. An abstract search of Nursing and Allied Health Premium included: “cognitive impairment” OR “cognitive function” AND chemotherapy OR “cancer treatment” AND “breast cancer” with additional limiters English language, peer-reviewed, and the subject: breast cancer. Cochrane Library was searched for reviews using the key words and phrases: cognitive impairment OR cognitive function AND chemotherapy. Lastly, Pubmed was searched using key words and phrases: “cognitive impairment” AND chemotherapy AND “breast cancer” with additional limiters English language, RCT, meta-analysis, systematic reviews, clinical trials, and reviews. To retrieve adequate evidence, citation chasing and hand searching of various journals was also carried out. A search of each database was performed and documented (see Appendix A). The search yielded 608 results. A total of 17 pieces of evidence were then chosen using inclusion and exclusion criteria.

Inclusion and Exclusion Criteria

Additional inclusion criteria included studies which included breast cancer patients undergoing chemotherapy or post-chemotherapy with cognitive impairment, research assessing interventions aimed at improving perceived cognitive impairment in breast cancer patients, and research assessing subjective outcomes of interventions to treat cognitive impairment. No preliminary reported studies, studies that focused on pediatric populations, invasive intervention studies, or studies done on animals were included to ensure applicability and safety of interventions to the adult breast cancer population.

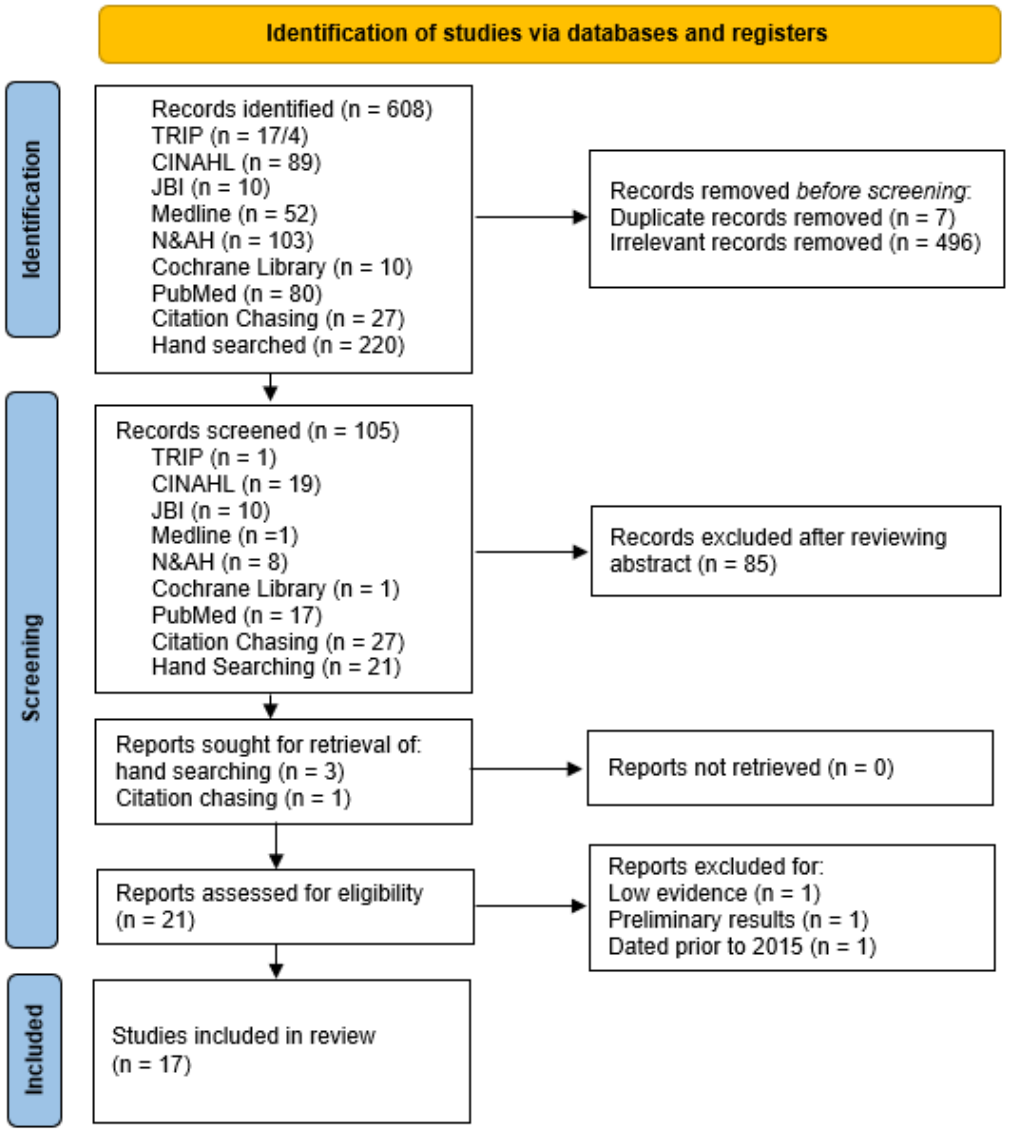
Each database was searched and titles were screened for relevance to the topic. Abstracts of relevant articles were read and if the article seemed to fit the inclusion and exclusion criteria, then the entire article was read. While reading articles, citation chasing was also performed for additional pieces of evidence. In addition, common journals were “hand searched” for additional articles which met the criteria.

The TRIP database search yielded 17 guidelines. Four of the guidelines were United States based guidelines which included one relevant for inclusion. 89 articles were yielded through the CINAHL database search. Several articles applied only to experiencing cognitive impairment or factors related to cognitive impairment. Nineteen abstracts were reviewed and four articles were chosen for inclusion. The JBI search resulted in 10 results. One evidence summary was chosen based on strong quality and relevance to the project. A Medline search yielded 52 results, however, no articles fit the criteria for inclusion. The Nursing and Allied Health Premium search yielded 103 results. Eight article abstracts were read for inclusion and four articles were chosen to use. The Cochrane Library search yielded 10 reviews. Due to the low quality of evidence and irrelevance of the reviews, none were chosen. PubMed was also searched and yielded 80 results. Seventeen article abstracts were read and three articles were chosen. Citation chasing yielded 27 articles relevant to the project topic. One article from this category was chosen. Three common journals published between 2015 and 2022 were “hand searched”

for relevant articles. Three articles were retrieved and all were chosen for inclusion. Figure 2.1 demonstrates the identification and screening of studies included in this review.

Figure 2.1

PRISMA Diagram of Literature Search



Melnyk and Fineout-Overholt

The Melnyk and Fineout-Overholt level system (Melnyk & Fineout-Overholt, 2019) was used to assign each piece of evidence a level of I-VII based on the study design. Level I is the

highest level of evidence and includes systematic reviews and meta-analysis of RCTs. Four pieces of evidence fell into this category: a breast cancer survivorship care guideline published by the American Cancer Society and American Society of Clinical Oncology; an evidence summary; and three systematic reviews. Level II is evidence resulting from well-designed RCTs. Nine pieces of evidence fell into this category. Level III evidence is attained using well-designed control trials in which randomization is not done. Three pieces of level III evidence were chosen for strong quality. Level IV evidence results from well-designed case control trials and cohort studies. Level V evidence is evidence obtained from systematic reviews in which descriptive and qualitative studies are conducted. Level VI evidence is research supported by a single descriptive or qualitative study. Level VII evidence is considered expert opinion and and/or reports created by expert committees. As identified in Table 2.1, only level I-III evidence was chosen for this project.

Analysis and Appraisal of Relevant Evidence

The evidence retrieved and selected from the literature search was critically appraised to determine quality of evidence. The Appraisal of Guidelines for Research and Evaluation (AGREE II) (Brouwers et al., 2017) tool was used to assess the quality of the level I practice guidelines published by the American Cancer Society and American Society of Clinical Oncology (Runowicz et al., 2016). This appraisal tool was developed specifically for assessing the rigor and transparency strategies used to develop guidelines. This is critical to the effectual implementation in clinical practice. The Critical Appraisal Skills Programme (CASP) checklist (2020) was used to appraise a level I evidence summary. This tool is used to determine if the results and validity of the studies included in the review are valuable. It also assesses the applicability and benefit of the results to the population under investigation. The last tool used was the Joanna Briggs Institute (JBI, n.d.) critical appraisal tool. This was used to appraise level II and III evidence. These three appraisal tools were used because they are all reliable, accessible, and easy to use. All evidence was graded as good to strong quality. See Table 2.1

for a summary of evidence level, quality, and appraisal tool used. A table of the evidence is found in Appendix A.

Table 2.1

Summary of Evidence

Author/year	Database(s)	Level of Evidence/Type	Quality/Tool
Bedillion et al. (2019)	CC	III/NRC	Good/JBI
Campbell et al. (2016)	HS	II/RCT	Good/JBI
Derry et al. (2015)	Nursing Allied Health	II/RCT	Good-Strong/JBI
Fernandes et al. (2019)	HS	I/SR	Strong/JBI
Gokal et al. (2018)	PUBMED	II/RCT	Good/JBI
Johns et al. (2016)	CINAHL	II/RCT	Strong/JBI
Koevoets et al. (2022)	PUBMED	II/RCT	Good/JBI
Leach et al. (2015)	Nursing Allied Health	III/NRC	Strong/JBI
Magtoto (2020)	JBI	I/Summary	Strong/CASP
Myers et al. (2019)	HS	II/RCT	Good/JBI
Park et al. (2017)	Nursing Allied Health	III/NRC	Strong/JBI
Ren et al. (2022)	PUBMED	I/SR	Strong/JBI
Runowicz et al. (2016)	TRIP	I/Guideline	Good/AGREE II
Vance et al. (2017)	CINAHL	I/SR	Good/JBI
Van der Gucht et al. (2020)	CINAHL	II/RCT	Good-Strong/JBI
Von Ah & Crouch (2020)	CINAHL	II/RCTs	Strong/JBI
Wei et al. (2022)	Nursing Allied Health	II/RCT	Strong/JBI

Note. HS = hand searched; *CC* = citation chased; *RCT* = randomized control trial; *SR* = systematic review; *NRC* = non-randomized control

Construction of Evidence-based Practice

Synthesis of Critically Appraised Literature

The American Cancer Society and American Society of Clinical Oncology recommend clinicians assess breast cancer survivors for signs of increased cognitive impairment, such as difficulty concentrating, poor memory, or inability to function in usual roles (Runowicz et al., 2016). Various pharmacologic and non-pharmacologic interventions were identified throughout the literature; however, the efficacy of pharmacologic therapies to treat CRCI has not been established. A notable amount of research has been conducted on non-pharmacologic therapies. After critically appraising the evidence, the following themes were selected for synthesis: assessment of cognitive function, exercise, and cognitive rehabilitation.

Assessment of Cognitive Function

Throughout the literature, various tools were utilized to measure subjective cognitive function. The most commonly used tool was the Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog) (v3) (Bedillion et al., 2019; Campbell et al., 2016; Fernandes et al., 2019; Leach et al., 2015; Myers et al., 2019; Park et al., 2017; Ren et al., 2022; Wei et al., 2022) (See Appendix B). This assessment tool is part of the Functional Assessment of Chronic Illness Therapy (FACIT, n.d.) measurement system. It has been used in clinical practice to reliably screen breast cancer patients for perceived cognitive impairment (PCI), the most clinically significant measure of CRCI (Wei et al., 2022). Researchers using the FACT-Cog PCI subscale did not consistently use cut-points for classifying PCI. However, the PCI-18 (<54), and now the PCI-20 (<60), both validly demonstrate the ability to identify CRCI (Van Dyk et al., 2020). The higher the PCI score, the lower PCI and higher the quality of life. Although there were tools used for measuring objective cognitive function, the focused outcome of this project was to measure subjective cognitive function.

Exercise

Exercise has many benefits for breast cancer survivors including improved self-reported cognitive function (Bedillion et al., 2019; Campbell et al., 2016; Gokal et al., 2018; Koevoets et al., 2022; Ren et al., 2022) and quality of life (Koevoets et al., 2022; Runowicz et al., 2016). According to Magtoto (2021), exercise may be potentially beneficial in reducing CRCI in breast cancer patients by improving daily function, attention, and thought process. Much of the literature assessed meditation-type and aerobic exercise for efficacy in treating CRCI with positive outcomes.

Meditation-type. The literature identified meditation-type exercises, such as Qigong and yoga, as effective interventions to treat impaired cognitive function in breast cancer patients (Derry et al., 2015; Johns et al., 2016; Myers et al., 2019; Vance et al.; Van der Gucht et al., 2020; Wei et al., 2022). These exercises incorporate slowed breathing, relaxation, gentle exercise, and mindfulness to control stress. They are considered affordable, accessible, and acceptable interventions for treating impaired cognitive function in breast cancer patients (Vance et al., 2017). Breast cancer patients participating in meditation-type exercise studies, were found to have improved subjective memory, balance, and stress levels, as well as quality of life and cognitive function (Vance et al., 2017). It is assumed that the gentle movement and controlled breathing associated with these interventions stimulate the brain and reduce stress which decreases neurotoxicity and allow the neuroplastic process to occur.

Johns et al. (2016), Myers et al. (2019), and Van der Gucht et al. (2020) implemented 8-week yoga and Qigong interventions. Johns et al. (2016) and Myers et al. (2019) provided weekly in-person instruction, while Van der Gucht et al. (2020) provided four in-person sessions and supplemental online support. Patients were encouraged to continue the intervention at home and to log their activity. All participants reported a decrease in perceived cognitive impairment at the end of the 8-week intervention. At the 3-month follow up (Myers et al., 2019) and 6-month follow up (Johns et al., 2016), there was continued improvement in perceived cognitive function.

Derry et al. (2015) and Wei et al. (2022) assessed patients perceived cognitive function after a 12-week meditation-type intervention. Wei et al. (2022) provided in-person Baduanjin, a common form of Qigong, prior to the start of chemotherapy, then provided an instructional video for subsequent at home use. Researchers recommended participants perform the intervention 30-minutes per day, five days per week. Perceived cognitive function, perceived cognitive ability, and quality of life were significantly improved at post-intervention. Derry et al. (2015) implemented a yoga intervention which was delivered in 90-minute sessions, twice a week. Participants were also provided a video to promote at home use and asked to log their activity. Although the intervention did not show a significant difference in perceived cognitive function immediately following the intervention at 12-weeks, there was a 23% decrease in perceived cognitive dysfunction noted at the 3-month post-intervention follow-up. Women who reportedly practiced yoga more often post-intervention had a significantly larger decreases in cognitive impairment. This suggests that breast cancer patients participating in yoga often maintain improved activity levels.

Aerobic. To prevent cognitive impairment, the American Heart Association recommends a combination of 150-minutes of moderate intensity with 75-minutes of high intensity exercise weekly (Ren et al., 2022). Exercise promotes cerebral perfusion, regulates glucose levels and inflammation, and stimulates the growth and development of the nervous system (Ren et al., 2022).

In the systematic review conducted by Ren et al. (2022), most trials were 12-weeks long and suggested 30-60-minute-long exercise sessions, two to three days per week. Of the nine trials which reviewed aerobic and/or resistance exercise, four were supervised exercise sessions at a designated location, two were home-based programs, and three were a combination of the two. Ren et al. (2022) reported improved subjective cognitive function in breast cancer survivors participating in physical exercise, especially moderate to high-intensity aerobic exercise.

A 12-week, home based, walking intervention was conducted by Gokal et al. (2018). The intervention group was instructed to increase walking duration to 30-minutes per day five times per week. Moderate levels of walking by breast cancer patients were associated with a decrease in PCI; the more physically active breast cancer patients were, the greater perceived cognitive function (Gokal et al., 2018).

A 24-week, 150-minute per week aerobic exercise program was implemented by Campbell et al. (2016). Participants were advised to exercise four times per week: two 45-minute supervised sessions and two 20-minute unsupervised sessions. A 24-week, 240-minutes per week supervised aerobic and strength training exercise program was implemented by Koevoets et al. (2022). Exercise intensity was increased over time in both studies. Although Koevoets et al. (2022) reported improved perceived cognitive function, the effect size was small in both studies.

Cognitive Rehabilitation

Vance et al. (2017) defines cognitive training as “methods for restoring cognitive function through repeated practice with cognitive exercises tapping domains such as attention, memory, speed of processing, or executive functioning” (p.E21). A considerable amount of evidence reports significant improvement in cognitive function when treated with approaches such as computer-based cognitive training, group training, and individual training (Fernandes et al., 2019; Magtoto, 2021; Park et al., 2017; Von Ah & Crouch, 2020). Cognitive rehabilitation programs lasting 4-12 weeks, which included homework assignments or telephone support, showed significant improvement in objective and subjective cognitive function; improvement in memory is reportedly most common (Fernandes et al., 2019; Von Ah & Crouch, 2020). Breast cancer patients who participate in repetitive cognitive tasks, which are challenging and require problem solving, are found to have a decrease in cognitive impairment (Runowicz et al., 2016).

The National Comprehensive Cancer Network (NCCN) and Oncology Nursing Society (ONS) recognizes cognitive rehabilitation as a likely effective intervention and optional first line treatment of cognitive impairment in cancer patients (Von Ah & Crouch, 2020). The *American*

Cancer Society/American Society of Clinical Oncology Breast Cancer Survivorship Care Guidelines (Runowicz et al., 2016) recommends referral for neurocognitive assessment and, if required, cognitive rehabilitation to restore and maintain cognitive function among breast cancer patients.

Intervention Procedures

According to Gokal et al. (2018), interventions aimed at improving cognitive function may be more appreciated by participants if initiated after chemotherapy treatments have begun. Interventions throughout the literature lasted from 6-24 weeks and all resulted in an increased perceived cognitive function; however, interventions lasting 8-12 weeks had lower attrition rates than those lasting 24-weeks.

Evidence suggests participants be instructed to log their daily activities to promote adherence to exercise programs (Derry et al., 2015; Gokal et al., 2018; Johns et al., 2016; Koevoets et al., 2022; Leach et al., 2015; Myers et al., 2019; Wei et al., 2022). Participants were also contacted by phone or mail to encourage continued intervention practice (Fernandes et al., 2019; Park et al., 2017; Van der Gucht et al., 2020).

Best Practice

According to the synthesis of evidence, exercise and cognitive rehabilitation are interventions best supported by research to be effective at treating CRCI. Although computerized cognitive rehabilitation programs can increase accessibility for patients who live in rural areas, there are obstacles to implementing this intervention (Von Ah & Crouch, 2020). This intervention often provides a limited number of cognitive exercises for free leading to incurred costs to download apps. In person cognitive rehabilitation programs often require a licensed psychiatrist which may not be covered by insurance and limits the accessibility to patients. Due to the mentioned limitations, a meditation-type exercise intervention was more accessible and feasible in this clinical setting and was the focus of this project.

A combined in-person and home-based meditation-type exercise intervention in which participants engage in chair yoga and log activity over eight to 12-weeks appropriately addresses the clinical problem (Derry et al., 2015; Johns et al., 2016; Myers et al., 2019; Van der Gucht et al., 2020; Wei et al., 2022). A baseline assessment of subjective cognitive impairment should be obtained so appropriate interventions can be initiated. Meditation-type exercise, such as chair yoga, performed for a total of 150-minutes per week is within the recommended exercise guidelines of the American Heart Association. Follow-up with patients weekly in person or by telephone helps with compliance and decreases possible attrition. Intervention activities should be logged by participants to promote accountability (Leach et al., 2015).

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

In the beginning of the planning process, the project manager met with key stakeholders and physicians, in person and via telephone, to discuss potential clinical issues. When the identified issue was agreed upon as a high priority, the clinical workflow was analyzed for how the project would be implemented. The process was discussed with the clinical manager to ensure it was feasible and would not disrupt the existing workflow. The role of the NPs and PA was discussed with them personally, and the project manager was assured they were willing and prepared to participate in the implementation of the project. A project binder was used to organize and educate key stakeholders about how participants would be screened and recruited for the project, as well as how follow-up would occur. Feedback from key stakeholders was considered and revisions were made to the planned implementation protocol and documents.

Participants and Setting

The EBP project was implemented in an outpatient oncology and hematology clinic located in Lake County, Indiana which is part is a larger healthcare organization. The key stakeholders at this clinical agency included a physician with 30+ years of experience, a physician with 15+ years of experience, an NP with 2+ years of experience, an NP with 1+ years of experience, and a PA with 1+ years of experience. Other key stakeholders included the project site facilitator who is a BSN with 35+ years of experience in oncology and hematology (17+ with the practice), an MA with 30+ years of experience with the practice, an RN with 2+ years of experience, an MA with 2+ years of experience, and four remaining RNs and MAs with less than two years of experience.

Pre-Intervention Group Characteristics

Most of the patient population was non-Hispanic white and African American adults over the age of 18. Participants who were eligible for this project included females over the age of 18,

diagnosed with stage I-IV breast cancer, who had received at least one chemotherapy treatment. The physicians, NPs, and PA made final determination as to who was excluded from participation. These exclusions included known brain metastasis and mental or substantial physical disability. Each participant was asked to complete a demographic form which collected age, race, income level, education level, and menopausal status. See Appendix C for demographics form.

Intervention

During the planning process, the project manager retrieved information regarding the free chair yoga classes offered to oncology patients by the organization. The organization's social worker provided the class schedule and the yoga program intake form which participants were required to complete. This form was part of the class registration process and was followed up with a notification of participation to the participant's physician.

The project manager created a patient instruction form which provided the chair yoga class schedule and location, online at-home yoga link suggestions, yoga safety, instructions for keeping track of time spent performing yoga, anticipated follow-up, and the project manager's contact information. The patient instruction form, demographic form, and yoga program intake form were placed in a folder and given to patients, along with a yoga logbook, upon agreeing to participate in the program.

The project manager met with the project site facilitator and key stakeholders to discuss how patients would be screened and recruited for the project. Female, breast cancer patients in active chemotherapy treatment were identified as possible participants. A list of the potential participants was provided to physicians, NPs, and PA, for review and final approval. When approved patients presented to the clinic for scheduled appointments, they were asked by the project manager or staff to complete the 20-question PCI portion of the FACT-Cog (v3) assessment tool. Licensure to use the assessment tool was applied for and obtained through *Functional Assessment of Chronic Illness Therapy* (FACIT) System on June 30, 2022 and is

valid for two years (See Appendix D). Patients scoring >60 did not qualify to participate in the project. Patients scoring ≤60 were approached by the project manager, in person or via phone, and asked to participate in a meditation-type exercise program; those agreeable to participate, were given the folder and yoga logbook by the project manager or staff. The instructions were reviewed with the participant and the yoga program intake form and demographic form were completed by the participant. The program intake form was then collected and forwarded to the organization's social worker and no further class registration was required. The participant was reminded that routine follow up would be conducted, and at the end of 10 weeks they would again be asked to complete the questionnaire.

Comparison

The comparison group were female breast cancer patients who were actively receiving intravenous chemotherapy and standard of care. Routine standard of care in this clinical setting lacked the assessment of CRCI and PCI in female, breast cancer patients. Pre-intervention comparison data, the FACT-Cog PCI score, was obtained when female breast cancer patients were screened for PCI. This score was compared with the post-intervention FACT-Cog PCI score at the conclusion of the 10-week program.

Outcomes

The primary outcome evaluated was PCI using the 20-question PCI portion of the FACT-Cog assessment tool. This questionnaire was also administered to participants at the end of the 10-week intervention and was obtained via paper at regularly scheduled appointments in the clinic. Perceived cognitive function scores were managed on an Excel spreadsheet. Pre and post-intervention data was analyzed using a Wilcoxon signed rank test.

Secondary outcomes were analyzed using the Pearson Correlation Coefficient and MANOVA. Demographics were collected from patients who agreed to participate in the project and were also managed on an Excel spreadsheet.

Time

The project manager planned rolling recruitment for the project to begin September 6, 2022 and end September 16, 2022. The recruitment date was extended to September 30th, 2022 to allow the maximum number of participants to be invited to participate in the program; a goal of 15 patients was set, and a total of 10 out of 25 participants were eligible and agreed to participate in the program. The first chair yoga class offered following Labor Day was September 19, 2022 followed by October 3, 2022. Participants enrolled on or before September 16th began the 10-week program September 19, 2022. Those participants enrolled after September 16th began the program October 3, 2022. These start dates were chosen because they coincide with the scheduled chair yoga classes and fell after the Labor Day holiday. This date also allowed ample time for the organization to review the IRB application and determine if IRB review was necessary. A 10-week program was chosen for good adherence to the timeframe and to avoid interference with the upcoming Christmas holiday. See Appendix E for implementation timeline.

Protection of Human Subjects

Research ethics training was completed by the project manager through the Collaborative Institutional Training Initiative as required by Valparaiso University on April 12, 2022 (See Appendix F). The Valparaiso University Research Determination and Review Level Screening Questionnaire was completed on July 16, 2022 and it was determined this EBP project was exempt from IRB review. An IRB application was submitted to the Director of Nursing Professional Development at the organization and it was determined this project did not meet the requirements for IRB review.

To maintain safety, participants were guided by a licensed yoga instructor and informed by the project manager to avoid overexerting or performing yoga exercises which cause pain or discomfort of any kind, and to report any occurring symptoms to their physician. Each participant's physician was notified of their involvement in the program and given the opportunity to object to their participation. Follow-up included the reinforcement of yoga safety. Each participant's initials and demographics were collected and kept on a password protected Excel

spread sheet and hard copies were locked in a designated cabinet at the clinical site. This information was only accessible to the project manager and clinicians.

CHAPTER 4

FINDINGS

The purpose of this EBP project was to provide physicians, NPs, and PAs an affordable, accessible, and effective way to screen and treat CRCI in breast cancer patients. The intervention included the screening of female breast cancer patients who had received at least one chemotherapy treatment for CRCI. A score of ≤ 60 on the FACT-Cog PCI assessment tool was used to identify patients with CRCI. If the screening indicated CRCI, then the patient was invited to participate in a 10-week chair yoga program. They were reassessed with the same tool at their 10-week follow-up appointment. The PICOT question for this project was: In breast cancer patients with chemotherapy related cognitive impairment, how does meditation-type exercise effect perceived cognitive impairment scores compared to pre-intervention perceived cognitive impairment scores over 10 weeks? The primary outcome of this project was to assess PCI sores using the FACT-Cog assessment tool. Secondary outcomes were to assess the effects of age, race, education level, and menopausal status on post-intervention scores. This chapter provides the results of the data analysis conducted on participant demographics, as well as the pre-intervention and post-intervention PCI FACT-Cog (v3) questionnaire scores.

Participants

A total of 32 female, breast cancer patients were actively receiving chemotherapy at the time of the implementation of this EBP project. A total of 25 female, breast cancer patients were screened and 10 scored ≤60 on the PCI FACT-Cog (v3) assessment tool deeming them eligible to participate; all were agreeable. The post-intervention group consisted of eight female, breast cancer patients who completed implementation of the project. One participant withdrew from the project and another participant did not complete the post-intervention questionnaire.

A chart audit of the remaining female, breast cancer patients receiving chemotherapy at the time of the EBP project implementation was conducted to collect demographic data on age,

race, and menopausal status. The age of the pre-intervention comparison group was between 40 and 85 (M = 59.28, *SD* = 11.33). The post-intervention group included women between the ages of 40 and 74 (M = 50.37, *SD* = 10.99). A single sample *t*-test comparing the mean age of the two groups indicated there was not a significant difference in age (*t* (7) = -2.291, *p* = .056).

The pre-intervention comparison group consisted of 7 (21.9%) Caucasian, 23 (71.9%) African American, 1 (3.1%) Hispanic, and 1 (3.1%) other race women while the post-intervention group consisted of 2 (25%) Caucasian and 6 (75%) African American women (Figure 4.1). A chi-square test determined there was not a significant difference between race of the pre-intervention comparison group and the post-intervention group (*p* = .157).

The education level of the post-intervention participants included 1 (12.5%) < high school education, 1 (12.5%) high school education, 1 (12.5%) some college, 4 (50%) college degree, and 1 (12.5%) trade school.

The menopausal status of the pre-intervention comparison group included nine (28.1%) pre-menopausal, one (3.1%) peri-menopausal, and 22 (68.8%) post-menopausal women. The menopausal status of the post-intervention group included four (50%) premenopausal, one (12.5%) peri-menopausal, and three (37.5%) post-menopausal women (Figure 4.2). A chi-square test determined there was not a significant difference between the pre-intervention comparison group and the post-intervention group (*p* = .417).

One NP did not participate in the implementation of the project due to absence from the clinic. Refer to Table 4.1 for pre-intervention and post-intervention demographic data. See appendix C for patient demographic form.

Table 4.1

Demographic Characteristics

Characteristic	Pre-intervention Comparison Group n = 32	Post-intervention Group N = 8	*t*	*p*
Age (mean)	59.28	50.375	-2.291	.056
Race				.157
Caucasian	21.9% (7)	25% (2)		
African American	71.9% (23)	75% (6)		
Hispanic	3.1% (1)			
Other	3.1% (1)			
Education Level				
< high school		12.5% (1)		
High school		12.5% (1)		
Some college		12.5% (1)		
College degree		50% (4)		
Trade School		12.5% (1)		
Other				
Menopausal Status				.417
Pre-menopausal	28.1% (9)	50% (4)		
Peri-menopausal	3.1% (1)	12.5% (1)		
Post-menopausal	68.8% (22)	37.5% (3)		

Figure 4.1

Race Comparison

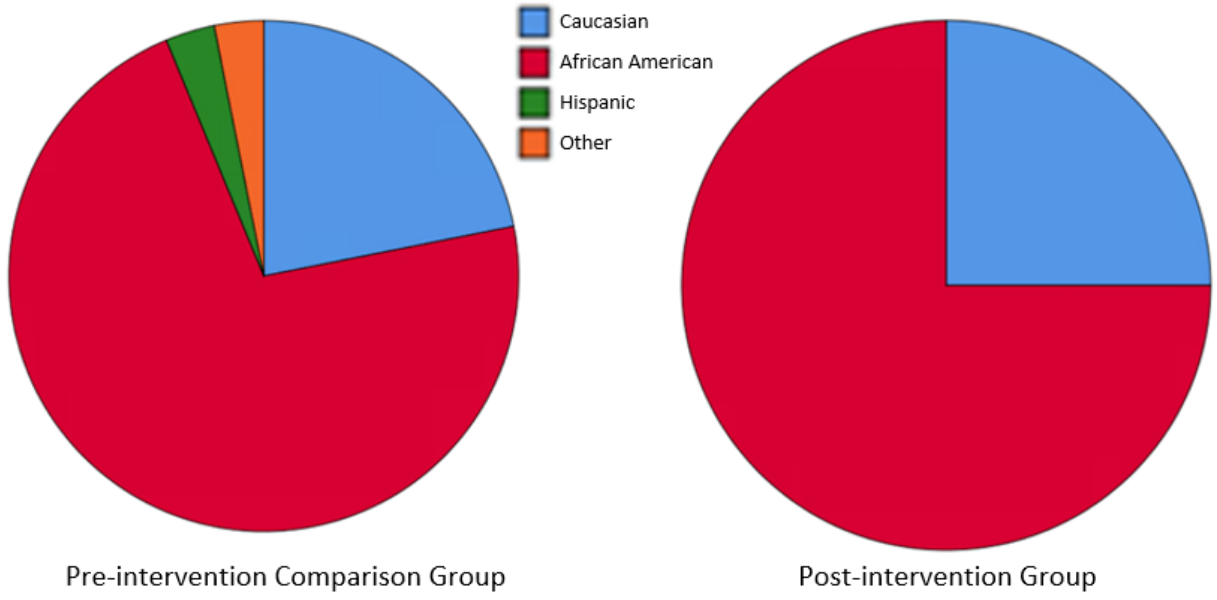
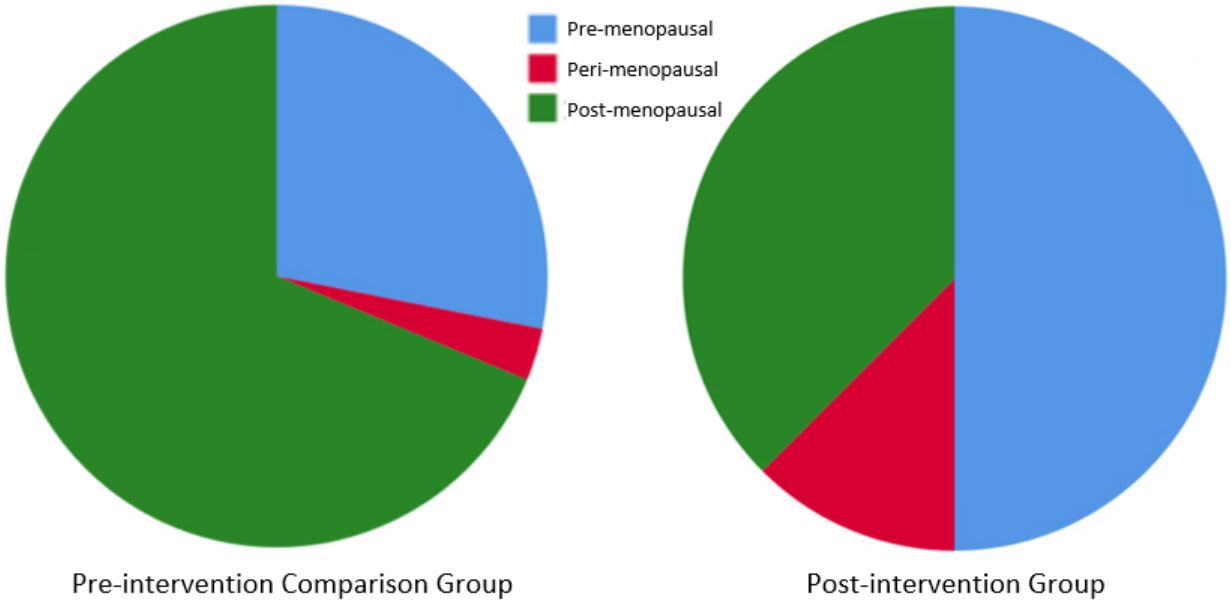


Figure 4.2

Menopausal Status Comparison



Changes in Outcomes

The primary outcome was measured using the PCI portion of the FACT-Cog (v3) assessment tool (see Appendix B). The 20-question PCI portion of the FACT-Cog (v3) assessment tool assesses PCI using a 0 (never) to 4 (several times a day) Likert scale. The questions assess a person's PCI over the previous seven days. A Wilcoxon signed-rank test was used to examine the results of pre-intervention and post-intervention scores for statistical significance.

Statistical Testing and Significance

Data were analyzed using the Wilcoxon signed rank test, single sample *t*-test, and chi-square goodness of fit test. The Wilcoxon test was an appropriate statistical test for assessing ordinal data among two related samples (Cronk, 2018). The paired sample *t*-test was an appropriate test used to assess the difference in mean scores, interval, or ratio data, between two related samples (Cronk, 2018). The chi-square was an appropriate statistical test for assessing the difference in distribution of nominal variables of race and menopausal status between two groups (Cronk, 2018). *A* Pearson's *r* and MANOVA were conducted to assess the relationship between demographics and FACT-Cog PCI scores. This was an appropriate statistical test to determine the strength of the relationship between two dichotomous variables (Cronk, 2018).

Findings

Primary Outcome

Primary outcome. A Wilcoxon signed rank test examined the FACT-Cog PCI pre-intervention and post-intervention scores (Table 4.2). The primary outcome of this project demonstrated there was not a statistically significant increase in FACT-Cog scores among female, breast cancer patients with CRCI whom had participated in a 10-week meditation type exercise program ($Z = 1.682$, $p = .092$). The mean score on the pre-intervention screening was

39.33 (*SD* = 17.44) and the mean score at the 10-week post-intervention follow up was 44.93 (*SD* = 17.87).

Table 4.2

Participant FACT-Cog Scores

	Pre-intervention (Baseline)	Post-intervention (10-Weeks)
1	60	63
2	49	33
3	40	60
4	22	42
5	4	9.5
6	44	54
7	57	58
8	30.7	40

Secondary Outcome

A Pearson Correlation Coefficient and MANOVA were conducted to determine relationships between age, race, menopausal status, education level, and post-intervention FACT-Cog PCI scores.

Post-intervention Scores. A moderate negative relationship was found between age and post-intervention test scores, but this was not statistically significant (N = 8, r = -.634, *p* = .091). A weak negative relationship between race and post-intervention test scores was also found not to be significant (N = 8, r = -.106, *p* = .803). A weak negative relationship between menopausal status and post-intervention scores was demonstrated, but was not significant, as well (N = 8, r = -279, *p* = .504). While there was a moderate positive relationship demonstrated between education level and post-intervention test scores, it was not statistically significant (N = 8, r = .419, *p* = .301).

Age. A Pearson Correlation Coefficient was calculated and determined there was a moderate negative relationship between age and post-intervention test scores which was not statistically significant (N = 8, r = -.634, *p* = .091).

Race. A weak negative relationship between race and post-intervention was not statistically significant (N = 8, r = -.106, *p* = .803). A MANOVA was computed comparing the mean post-intervention scores between participants of different races. The Caucasian group had a mean post-intervention score of 48.00 (*SD* = 8.48), and the African-American group had a mean post-intervention score of 43.91 (*SD* = 20.68). There was not a statistically significant difference demonstrated between group scores (*F* (1,6) = .068, *p* = .803).

Menopausal status. A weak negative relationship between menopausal status and post-intervention scores was not statistically significant (N = 8, r = -.279, *p* = .504). A MANOVA was computed comparing the mean post-intervention scores between participants of different menopausal status. The pre-menopausal group had a mean post-intervention score of 50.75 (*SD* = 11.47), the peri-menopausal group had a mean post-intervention score of 33.00, and the post-menopausal group had a mean post-intervention score of 41.16 (*SD* = 27.58). There was not a statistically significant difference discovered between pre-menopausal, peri-menopausal, and post-menopausal group scores (*F* (2,5) = .418, *p* = .680).

Education level. A moderate positive relationship was found between education level and post-intervention test scores, but this was not statistically significant (N = 8, r = .419, *p* = .301). A MANOVA was computed comparing the mean post-intervention scores between participants with different levels of education. The mean post-intervention score for participants with less than a high school education was 9.50, the mean score for participants with a high school diploma was 63.00, the mean score for participants with some college education was 54.00, the mean score for participants with a college degree was 48.25 (*SD* = 12.97), and the mean score for participants with a trade school degree was 40.00. There was not a significant

difference in post-intervention scores discovered between groups of participants with different levels of education (F (4,3) = 2.574, p = .232).

CHAPTER 5

DISCUSSION

This EBP project was implemented to determine the effects of a meditation-type exercise, chair yoga, on reducing PCI in female breast cancer patients with CRCI. Demographics were collected on project participants and an analysis was conducted to determine if age, race, menopausal status, and educational level had a statistically significant impact on the outcome of the intervention as well. This chapter will discuss the primary and secondary outcomes of the EBP project and identify its strengths and limitations. The relevance of the EBP model selected to guide the implementation of this project will also be addressed in addition to practice change sustainability and recommendations for future research and education.

Explanation of Findings

Primary Outcome

The primary outcome of this EBP project demonstrated there was an improvement in mean PCI FACT-Cog scores from pre-intervention (M = 39.33) to post-intervention (M = 44.93). Although this was not statistically significant (p = .09), evidence strongly supports improved perceived cognitive function following meditation-type exercise (Derry et al., 2015; Johns et al., 2016; Myers et al., 2019; Van der Gucht et al., 2020; Wei et al., 2022). The small number of participants (N = 8) may have contributed to the inability to demonstrate statistical significance in this project: 10 participants agreed to participate in the project and two were lost to attrition (20%). The number of participants in supporting evidence ranged from 10 (Campbell et al., 2016) to 317 (Bedillion et al., 2019). Campbell et al. (2016) (N = 10) and Gokal (2018) (N = 25) both failed to observe statistical significance in their studies and recognized small sample size as a potential explanation. Evidence with somewhat larger intervention group sizes such as Derry et al. (2015) (N = 100), Myers et al. (2019) (N = 50), Wei et al. (2022) (N = 35), Johns et al. (2016) (N = 35), and Koevoets et al. (2022) (N = 91) reported statistically significant improvements in PCI following mindfulness and activity-based interventions: Qigong, yoga, Baduanjin, and

physical exercise. Therefore, it is very possible statistical significance could have been demonstrated had there been a larger number of participants in this EBP project.

Another potential reasons for not achieving statistical significance in the primary outcome was participant failure to complete the expected number of minutes each week doing chair yoga. There are various explanations for non-compliance with the program. Participants explained they were busy or tired and had difficulty fitting yoga into their already busy schedules. Similarly, Myers et al. (2019) reported common reasons for failure to practice Qigong in their study included “too busy, too tired, forgot” (p. 1401). Fatigue is often exacerbated following cancer treatment and can make adherence to exercise a challenge (Myers et al. 2019). In addition, not all project participants attended the free bi-weekly yoga classes for additional reasons such as work, lack of transportation, and conflicts with other appointments. Had additional class times been available for participants to attend, there may have been greater compliance with the program.

Secondary Outcomes

An analysis was conducted to determine if the primary outcome of the intervention was affected by participant demographics. It did not identify statistically significant relationships between demographics and mean post-intervention scores. Evidence used to support this project did not conduct analysis to determine if age, race, menopausal status, and educational level had an impact on outcomes of the implemented interventions.

Age. Although a moderate negative relationship was discovered between age and mean pre-intervention and post-intervention scores, increased age did not correlate with a statistically significant decrease in post-intervention score. The age of participants ranged from 40 to 74 and post-intervention scores ranged from 63 to 9.5 respectively. However, there was not a pattern of decreasing scores to correlate with increasing age (See Table 5.1).

Table 5.1

Participant FACT-Cog Scores by Age

Age (Descending Order)	Pre-intervention (Baseline)	Post-intervention (10-Weeks)
74	4	9.5
57	44	54
52	40	60
48	22	42
45	57	58
45	30.7	40
42	49	33
40	60	63

Race. The mean scores of Caucasian and African American participants were compared which determined race did not significantly affect post-intervention scores. This could be due to the small sample size or the variation in other demographics (age, menopausal status, and education level) within each race.

Menopausal status. The mean scores of pre-menopausal, peri-menopausal, and post-menopausal women were analyzed. Although participants in the pre-menopausal group had higher mean pre-intervention and post-intervention scores, the post-menopausal group scores demonstrated a larger standard deviation. This, along with small sample size, could explain why there was no relationship found.

Education level. The mean pre-intervention and post-intervention scores for the different levels of education were analyzed. There was an increase in mean scores from pre-intervention to post-intervention in all groups of education levels. This supports that education level had no statistically significant effect on mean post-intervention scores with the implementation of this intervention.

Additional Literature Search

An additional literature search was conducted after the analysis of data to assess for new evidence. One new article was found through Medline to support physical activity for the management of CRCI and to improve quality of life (Onzi et al., 2022). Onzi et al. (2022) conducted a comprehensive review of possible interventions for managing CRCI and improving quality of life. A phase III trial implementing a 6-week exercise program for breast cancer patients during the time they were receiving chemotherapy resulted in a decrease in PCI and lower proinflammatory markers. Like previous evidence, this evidence demonstrated an increase in memory performance associated with physical exercise and supports the implementation of this project.

Strengths and Limitations of the DNP Project

Strengths

A major strength of this EBP project was the support of staff and key stakeholders. This clinical site did not have a policy in place for screening patients, nor an intervention or referral process for managing CRCI. Staff and key stakeholders were willing to assist with the screening process and implementation of the project, as well as follow up of participants. This helped to ensure participants were provided ongoing support, as well as ensuring pre-intervention and post-intervention data was collected.

Another strength was the FACT-Cog (v3) PCI questionnaire was a free, easy to use, validated, reliable, and accessible screening tool for assessing CRCI. Patients were able to complete the questionnaire while in the clinic which led to an increase communication about CRCI between patients and healthcare providers. Patients felt validated that the CRCI they were experiencing was real and were interested in hearing about effective strategies available to manage it.

Lastly, accessibility to a free chair yoga class was also a strength of this project. The organization had a preexisting biweekly class scheduled for oncology patients to attend. Participants who were eligible and agreeable to participate in the project were able to complete

the yoga program intake form while in the clinic. This form was then forwarded to the facility social worker by the project manager which registered the participant for the class. Participants were not required to do take any additional steps. The class was affordable and allowed patients to meet in a supportive environment with people who had common needs and concerns.

Limitations

One major limitation to this EBP project was participant non-compliance with the yoga program. Some participants had work or family obligations which did not allow them the time to engage in yoga as suggested. Participants also expressed a desire to do yoga with friends and family, and found it difficult to commit without their participation. The project manager provided suggestions, such as the practice of desk yoga, to help improve adherence for those participants. Participants were given a logbook to keep track of their time spent doing yoga, yet they did not consistently document their time. Myers et al. (2019) reported persistent fatigue as a cause for poor adherence to home yoga practice, as well as lack of compliance with documentation of home practice by more than 50% of participants. At times, it was difficult to reach participants over the phone to discuss the program and provide encouragement. Toward the end of the program, participants began to feel yoga was a “chore”. This may have led to inconsistency in the amount of time spent engaging in yoga and failure to complete the program. The use of smartphone apps or text messaging to motivate participants to practice and log the time spent doing yoga could be beneficial in future EBP projects.

Another limitation was the time at which the in-person yoga class was offered. It was scheduled on Monday mornings from 9:30 to 10:30 am. Patients had expressed an interest in additional classes to be offered after hours to accommodate their work schedule. A class scheduled at a more convenient time may have improved attendance for these patients as well as give those with transportation problems additional options. Myers et al. (2019) suggests a virtual yoga class to promote adherence to class attendance in their evidence. These differences

may have improved compliance and resulted in a statistically significant improvement in PCI post-intervention scores.

A third limitation is there are other potential factors which may significantly impact a patient's PCI including anxiety, depression, and insomnia (Campbell et al., 2016; Derry et al., 2015; Johns et al., 2016; Myers et al., 2019). In addition, this population of patients have the potential for infection, medication toxicities, and disease progression which can be disabling. These factors may have had a negative impact on participation and completion of the project. Derry (2015) reported patients with higher levels of fatigue and cognitive impairment were less likely to complete a 12-week, twice-weekly yoga intervention. One participant was hospitalized due to pain and disease progression during the implementation of this project.

Small sample size was a significant limitation to this project. A goal of 15 participants was set for this project and only 10 patients were eligible and agreed to participate. There was also a 20% attrition rate which resulted in only eight patients completing this project. Eliminating the cut-off used for identifying CRCI while screening patients is one way to increase the number of participants in the project. Had the cut-off been eliminated, and all patients agreed to participate, 25 pre-intervention and post-intervention scores could have been available for analysis. Wei et al. (2022) did not impose a FACT-Cog cut-off score for eligibility in a study aimed at assessing PCI scores for improvement following a Baduanjin intervention. This allowed them to recruit a total of 70 participants. Myers et al. (2019) imposed an eligibility cut-off score of <59 on the PCI FACT-Cog (v3) to recruit participants in a study assessing the effects of Qigong, gentle exercise, and support. This resulted in a total of 50 out of 60 patients being eligible to participate in their study; however, they encountered a 28% attrition rate resulting in a reduction of participant data (N=36) available to analyze at the end of the study.

Sustainability

Although statistically significant findings were not found as a result of this EBP project, future implementation of interventions to manage CRCI will be resumed in this clinical setting.

Rather than screening patients for CRCI using the FACT-Cog (v3) assessment tool, patients will continue to be asked if they are having impaired cognitive function and educated by staff and key stakeholders about the benefits of mindfulness-based interventions and exercise on reducing CRCI. This project had a clinically significant impact on patient-provider relationships and has promoted open communication about CRCI. Patients felt their concerns about PCI were validated once discussions were initiated by the project manager, key stakeholders, and staff. Prior to this project, patients were not assessed or provided treatment options for PCI in this clinic. This project provided valuable knowledge to staff, key stakeholders, and participants about a tool for identifying CRCI and resources for managing it. As a result of this project, the importance of the role of healthcare providers in providing patients with unbiased information about troublesome chemotherapy side effects including CRCI was realized by the project manager and key stakeholders. In the future, patients will continue to be referred to the biweekly yoga class by providers and staff in hopes of preventing, limiting, or reducing PCI among breast cancer patients. The organizations social worker will keep patients and staff informed of the yoga class schedule and the yoga intake form will continue to be available to patients in the clinic.

In-person yoga classes, or a virtual option, may improve compliance with future programs such as this. A change that would be helpful to future projects is the use of text messaging to provide encouragement to patients, yoga class time reminders, and can also offer links to short yoga videos to promote adherence to the intervention and increase positive outcomes.

Relevance for EBP Model

The revised Iowa EBP model combines quality improvement, interdisciplinary collaboration, and evidence-based interventions to change practice and improve patient outcomes (Melnyk & Fineout-Overholt, 2019). This model is clear and systematic and has been used in the past to implement evidence-based change in the oncology setting, therefore aligned well with this project. Step one, identifying triggers or opportunities for change, was a critical step in determining a focus for this project. The support of key stakeholders in recognizing CRCI as a

high priority, as well as the existing, bi-weekly chair yoga classes offered by the organization, helped strengthened the likelihood that this practice change was feasible. Additionally, the first feedback loop confirmed that CRCI was a priority problem and needed to be addressed in this patient population and clinical setting. Next, forming a team was easily achieved since nursing and non-nursing disciplines were already a consistent part of implementing change within this project site. A thorough literature search and synthesis of evidence was conducted and discovered best practice recommendations including screening for CRCI and management with meditation-type exercise, aerobic exercise, and cognitive rehabilitation. The second feedback loop confirmed there was substantial evidence available to support meditation-type exercise to manage CRCI before attempting to institute the intervention into practice. The change was considered appropriate and was implemented with the support and assistance of staff and key stakeholders within the project site. The model promotes continuous evaluation of the implementation process and outcomes leading to the modification of practice guidelines which promote successful outcomes. The dissemination of results was achieved by completion of this report and presenting the outcomes of the EBP project to healthcare professionals at the pilot organization and at a local research conference.

Overall, the Iowa model aligned well with this EBP project. The intervention was supported by key stakeholders and there was substantial evidence to support the implementation of practice change within this clinical site. This model provided repeated measures for ensuring feasibility and success of this project. In addition, prior use of this model to pilot change in small groups of patients or in a small clinical setting such as this have been very successful.

Recommendations for the Future

As the number of breast cancer survivors continues to rise, the need for further research, revised breast cancer survivorship guidelines, and student and healthcare provider education is vital to improving quality of life of these patients.

Research

The evidence in the literature supports the use of meditation-type exercise to manage CRCI, however future research needs to assess effects of frequency and duration of chair yoga on improving PCI in breast cancer patients. Additional research should be conducted to assess the effects of a meditation-type exercise intervention when initiated prior to the start of chemotherapy or in early stages of chemotherapy induction on limiting perceived CRCI as well.

Additional research needs to focus on incorporating convenient motivational interventions, such as text messaging and smartphone apps, to promote adherence to programs. Research should be conducted assessing the effects of group participation, as well as a virtual attendance option, on adherence to a program.

Research assessing the correlation between demographics, such as menopausal status, and PCI need to be conducted to determine if additional strategies need to be incorporated into the management of CRCI in post-menopausal women. In addition, the impact age has on CRCI needs further investigation to decipher if the same strategies are equally effective in managing CRCI in older populations of females with breast cancer. Research assessing the impact other symptoms, such as fatigue and depression, have on patients with CRCI need to be conducted to determine if these patients require different management strategies as well.

The evidence did not include male breast cancer patients with CRCI; therefore, additional research is needed to establish the incidence of CRCI in this population and strategies for assessing and managing CRCI in male breast cancer patients.

Survivorship Clinical Guidelines

Breast cancer survivorship care guidelines should be updated to include exercise interventions to manage CRCI in breast cancer patients. Although the National Comprehensive Cancer Network (NCCN) recommend management of CRCI and other symptoms with stress management, they do not provide specific strategies for doing so (Johns et al., 2016). There is ample evidence to support the use of aerobic (Campbell et al., 2016; Gokal et al., 2018; Koevoets et al., 2022; Ren et al., 2022) and meditation-type (Derry et al., 2015; Johns et al.,

2016; Myers et al., 2019; Van der Gucht et al., 2020; Wei et al., 2022) exercises to decrease PCI in this population. There is a gap in the implementation of survivorship care strategies which promote self-management of CRCI which increased quality of life in breast cancer patients.

Education

Students and healthcare professionals should be educated about the incidence and symptoms of CRCI in female breast cancer patients. They should be encouraged to ask patients about CRCI so symptoms can be validated and patients are comfortable discussing the impact it has on their quality of life. As the number of breast cancer survivors continues to increase, students and healthcare professionals should also be educated on how to screen and manage CRCI, so patients can be properly treated and have improved quality of life.

Conclusion

Chemotherapy is a very effective, life-prolonging, breast cancer treatment. The breast cancer survival rate continues to rise due to early diagnosis and treatment; however, overwhelming evidence correlates cancer treatment with troublesome consequences, including CRCI. This common side effect can last for several years following cancer treatment and often results in a deceased quality of life for many breast cancer patients (Gokal et al., 2018; Johns et al., 2016). The FACT-Cog (v3) assessment tool is a valid and reliable tool used to screen patients for PCI. This tool is available online and licensure fees are not usually implicated for researchers, students, or clinical use. Once CRCI is detected, patients should be offered effective strategies, including meditation-type exercise (Derry et al., 2015; Johns et al., 2016; Myers et al., 2019; Vance et al.; Van der Gucht et al., 2020; Wei et al., 2022) to effectively manage symptoms.

The purpose of this EBP project was to assess the efficacy of a meditation-type exercise, chair yoga, on reducing PCI in female, breast cancer patients receiving chemotherapy. Although it was not statistically significant, an increase in mean PCI scores from the time of screening to week 10 was demonstrated, indicating some degree of improved in perceived cognitive function.

This project also produced a clinically significant impact on how participants and healthcare providers communicate about CRCI. Patients voiced an appreciation for acknowledging that CRCI was real and were more comfortable discussing it with staff and healthcare providers following the screening process. Patients expressed a desire to learn about effective strategies they could use to manage CRCI.

Future EBP projects should aim to have larger numbers of participants so likelihood of statistical significance can be demonstrated. The use of different motivational techniques, virtual class options, and more class times should be used to promote better adherence to programs. Future research should also include male breast cancer patients experiencing CRCI.

Breast cancer survivorship guidelines need to be updated to include all best practice recommendations, including aerobic and meditation-type exercise and cognitive rehabilitation strategies. Screening and management strategies, should be incorporated into standard practice by nurse practitioners and other providers in the primary care and oncology settings, so the quality of life of breast cancer patients receiving chemotherapy treatments is not compromised.

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BIOGRAPHICAL MATERIAL

Christine Cain received her Bachelor of Science in Nursing from Valparaiso University in 1994. Following graduation, she worked at various hospitals in Northwest Indiana in the medical-surgical, telemetry, and float pool departments. Since 2004, she has worked for Premier Oncology and Hematology in Merrillville, Indiana as an infusion nurse and clinical research associate. This is where Mrs. Cain's love for oncology began. For several years, she spent time getting to know her patients and felt a strong desire to do more to help them. In Fall of 2019, Mrs. Cain decided it was time to follow her heart. She began pursuing her Doctor of Nursing Practice (DNP) at Valparaiso University and will graduate in May of 2023. She is a member of Sigma Theta Tau International Honor Society of Nursing, Zeta Epsilon Chapter. She submitted the abstract for her DNP project to the Midwest Nursing Research Society Conference in Iowa and presented her project in March of 2023 as a poster presentation. Christine is an active volunteer and board member for the Pink Ribbon Society, a not-for-profit breast cancer organization in Northwest Indiana. She has a special interest in working with culturally diverse and underserved populations. Following graduation, she has agreed to continue her career as a nurse practitioner at Premier Oncology and Hematology.

ACRONYM LIST

ACS: American Cancer Society

AGREE II: Appraisal of Guidelines for Research and Evaluation II

CASP: Critical Appraisal Skills Programme

CC: Citation Chased

CDC: Centers for Disease Control

CINAHL: Cumulative Index to Nursing and Allied Health Literature

CITI: Collaborative Institutional Training Initiative

CRCI: Chemotherapy Related Cognitive Impairment

FACT-Cog: Functional Assessment of Cancer Therapy—Cognitive Function

NP: Nurse Practitioner

EBP: Evidence-Based Practice

EMR: Electronic Medical Record

HS: Hand Searched

IRB: Internal Review Board

JBI: Joanna Briggs Institute

PCI: Perceived Cognitive Impairment

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RN: Registered Nurse

RTC: Randomized Control Trial

TRIP: Turning Research Into Practice

MA: Medical Assistant

NCCN: National Comprehensive Cancer Network

NRC: Non-Randomized Control

ONS: Oncology Nursing Society

SR: Systematic Review

WHO: World Health Organization

APPENDIX A

Evidence Table

Citation	Purpose/Design/Sample	Intervention	Measurement/Outcome	Results	Strengths/Limitations
Bedillion, M. F. et al. (2019)	Assess the effects physical activity has on reducing side effects of cancer treatment 317 breast cancer patients	Single survey assessing demographics, cancer treatment, depressive symptoms, physical activity, and cognitive function.	Subjective cognitive function measured using the *FACT-Cog.*	Physical activity "moderated" perceived cognitive ability in women receiving chemotherapy. Subjective cognitive ability was improved in women who were more physically active.	Strengths: Valid assessment tool. Limitations: Potential for bias due to other known adverse effects caused by chemotherapy. No comparison group.
Campbell et al. (2018)	Assess the effects of aerobic exercise on cognitive impairment in breast cancer patients Randomized control trial 19 breast cancer patients	24-week, 150-minute per week moderate to vigorous exercise: two 45-minute in-person and two 30-minute at home vs. waitlist	Subjective cognitive function measured using *FACT-Cog.*	No significant difference in subjective cognitive function between groups.	Strengths: Good adherence. Limitations: Small sample size. 3 year post treatment eligibility.
Derry et al. (2015)	Assess the effects of yoga on subjective cognitive impairment Randomized control trial	Supervised yoga program delivered for 90-minutes, twice weekly, over 12-weeks.	Subjective cognitive function measured using the *BCPT* at baseline, 12-weeks, and 3-months post intervention.	23% decrease in cognitive complaints in yoga group at 3-month follow up. No	Strengths: True randomization. Large sample size. Limitations:

	200 breast cancer survivors	Provided video for home use. Follow-up phone calls and participant logs		significant difference between groups of cognitive complaints at 12-weeks.	
Fernandes et al. (2019)	Assess the effects of cognitive rehabilitation programs on cognitive dysfunction in cancer patients Systematic review 19 studies	Four home-based cognitive training; 10 strategy training; Five combined cognitive and strategy training Telephone contacts and homework	Subjective cognitive function	67% of level I and II evidence reported improvement in subjective cognitive function compared to control. All level III evidence reported improvement in subjective cognitive function.	Strengths: Homogenous samples. Limitations: Measurement for cognitive impairment not identified.
Gokal et al. (2018)	Assess the effects of a home-based, self-managed walking intervention on CRCI in breast cancer patients Randomized control trial 50 breast cancer survivors	150-minutes per week of home-based, moderate intensity walking plus usual care vs. usual care alone over 12-weeks Exercise logs and self-managed	Subjective cognitive function measured using *CFQ* at baseline and 12-weeks Objective cognitive function measures: *Executive function:* Stroop task *Working memory and perceptual organization:* Wechsler Adult Intelligence Scale III	Moderate levels of walking may be helpful at preventing perceived cognitive impairment. Subjective cognitive function improved with increase in walking. No significant change in	Strength: True randomization. Low attrition level. Similar baseline characteristics. Limitations: Small sample size. Did not provide reminders to participants.

			Attention: Sustained Attention to Response Task	objective findings.	
Johns et al. (2016)	Analyze the effects of mindfulness-based stress reduction (MBSR) on cognitive function in breast and colorectal cancer survivors. Randomized pilot study 71 breast and colorectal cancer survivors	8-weekly 2-hour classes: mindfulness meditation vs. education and support	Subjective and objective cognitive function and mindfulness assessed at baseline, end of 8-weeks, and 6-months post intervention. Subjective cognitive function measure: *AFI*	Significant improvement in subjective and objective cognitive function in MBSR compared to education and support. Improvement in MBSR group was maintained at 6-month post-intervention assessment	Strengths: Diverse sample Limitations: Pilot study small sample size. Cognitive outcome was part of secondary analysis.
Koevoets et al. (2020)	Assess the effects of exercise on self-reported cognitive function in breast cancer patients previously treated with chemotherapy Randomized control trial 181 breast cancer patients	Supervised 4-hour/week aerobic and strength training exercise for 6-months vs. control waitlist group Exercise logs and monitoring visits for adherence to program	Subjective cognitive function measured at baseline and 6-months using *MDASI-MM*	Improvement in self-reported cognitive function and quality of life	Strengths: Large study sample. Low attrition. True randomization. Limitations: Participants did not have good baseline word recall which could show falsely improved findings.
Leach et al. (2015)	Evaluate the feasibility and effectiveness of a 12-week exercise program on psychosocial	5-7 day per week, 12-week in person resistance, aerobic, and	Subjective cognitive function measured at baseline and 12-weeks using the *FACT-Cog*	Decrease in cognitive complaints from baseline to 12-	Strengths: Program was individualized to participant. More participants were eligible making it more

	outcomes in breast cancer survivors. Non-randomized trial 80 breast cancer survivors	flexibility exercise program Bi-weekly education on exercise, nutrition, sleep, stress management, support, and cognitive impairment Weekly exercise log		weeks but was not significant.	generalizable to specific population. Limitations: Logs were not routinely assessed. No control group. Need to recruit more diverse population.
Magtoto (2021)	Assess what the evidence reports as best interventions to improve symptoms of CRCI Evidence Summary 4 Systematic reviews and 3 Randomized control trials	Computer-based cognitive training, compensatory strategy training, meditation, medication, acceptance and commitment therapy, acupuncture, and memory and attention adaptive training.	Tools for measuring subjective cognitive function not identified.	Medicinal treatments were ineffective. Cognitive training in group and individual methods as well as computer-based training resulted in moderate improvement in subjective and objective reported cognitive function. Tibetan sound meditation showed	Strengths: Comprehensive review of high level evidence. Limitations: Tools used to measure subjective cognitive function not identified.

				positive results. Brief acceptance and commitment therapy improved subjective cognitive impairment. Compensatory strategies and immediate feedback training improved perceived cognitive function and quality of life. Cognitive training and exercise should be considered when treating CRCI in breast cancer patients.	
Myers et al. (2018)	Evaluate the effects of Qigong on objective and subjective cognitive function, treatment relates side effects, and quality of life in breast cancer patients. Randomized control trial	Standard support vs. eight weekly, 60-minute Qigong vs. gentle exercise plus 15-minutes twice a day practice at home.	Subjective cognitive function measured at baseline, 8-weeks, and 4-weeks post intervention using *FACT-Cog, PROMIS, and MDASI*	Participants in the Qigong and gentle exercise groups had improved subjective cognitive function compared to	Strengths: Sample homogenous. 3-arm RCT. Limitations: Small sample size. High attrition and low adherence.

	50 breast cancer patients	Weekly logs		standard support group from baseline to 8-weeks. Standard support group had decrease in subjective cognitive function. No significant improvement noted between weeks 8 and 12.	
Park et al. (2017)	Assess the effects a program which promotes cognitive health has on preventing CRCI in breast cancer patients. Pilot study 54 breast cancer patients	12-week compensatory cognitive training vs. waitlist assessed at baseline, 12-weeks, and post intervention 6-months. 45-60 minute in-person education, homework exercises, six 20-minute phone calls biweekly, and activities log	Subjective cognitive function measured using the *FACT-Cog.*	Subjective cognitive impairment increased from baseline to 6-month post intervention in waitlist group. Scores did not significantly change in intervention group over time.	Strengths: High retention rate. Groups were homogenous. Limitations: Small sample size. Young sample group.
Ren et al. (2022)	Evaluate the effects of physical activity on subjective and objective function in breast cancer patients	6 aerobic exercise, 3 mind-body exercise, 2-combined aerobic and resistance	Subjective cognitive function measured using *EORTC and FACT-Cog.*	High-intensity aerobic exercise and combined aerobic with	Strengths: All RCT. Limitations: Some studies had heterogenous

	Meta-analysis 12 Randomized control trials	exercise, 1 resistance exercise Supervised and home-based		resistance exercise improves subjective and objective cognitive function.	samples. Did not explore duration or frequency of exercise.
Runowicz et al. (2016)	To provide evidence-based guidelines on how to manage areas of breast cancer survivorship including cognitive impairment to healthcare providers caring for breast cancer survivors. Guidelines	Screen for breast cancer recurrence or second primaries, assess and manage physical and psychological symptoms related to cancer and cancer treatment, health promotion, and care coordination.		Assess for cognitive impairment and contributing factors. Refer patients with signs of impairment for neurocognitive assessment and cognitive rehabilitation. Cognitive rehabilitation shows benefit in treatment of cognitive impairment in survivors of breast cancer.	Strengths: Suggests assessment of cognitive impairment and referral. Limitations: Does not cover all possible strategies to treat CRCI.
Vance et al. (2017)	Identify interventions to manage cognitive impairment. Systematic review 21 studies of interventions for managing cognitive	2 Cognitive training, 5 Combined cognitive training and compensatory strategies/Memory and attention adaptation training, 6 pharmacologic,	Subjective and objective cognitive function	Cognitive training: Improvement in objective cognitive function. Combined cognitive training and	Strengths: Provides table of evidence with strengths and limitations of each study. Touches on four well studied areas of research aimed at managing CRCI. Supports the need for further research.

	impairment in breast cancer patients	8 complementary and integrative medicine:		compensatory strategies: Improved objective and subjective cognitive function as well as improved quality of life Pharmacologic: Mixed results Complementary and integrative medicine: Some aspects of improved subjective cognitive function	Limitations: Measuring tools not identified
Van der Gucht et al. (2020)	Analyze the effects of mindfulness-based intervention (MBI) on chemotherapy related cognitive impairment (CRCI) Randomized control trial 33 breast cancer survivors with CRCI	Four, 3-hour, in-person and at home mindfulness-based exercise guidance (including yoga) with supplemental online support over 8-weeks vs. waitlist	Subjective and objective function was assessed at baseline, 8-weeks, and at 3-month post-intervention Subjective cognitive function measure: *Cognitive Failure Questionnaire (CFQ)*	Subjective reduction in cognitive impairment at 8-weeks and at 3-month post-intervention follow up in MBI group. No significant change in objective cognitive function.	Strength: Results support the need for future research. Study design is feasible for participation. Limitation: Small sample size. Possible selection bias and high attrition rate.

Von Ah & Crouch (2020)	Provide cognitive rehabilitation strategies for oncology nurses and APN for assessing and treating cancer and treatment related cognitive impairment. Systematic review 27 studies	16 Computerized cognitive training (CT): group and individualized 11 Cognitive behavior training (CBT): psychoeducation, relaxation, and mindfulness delivered in-person and remotely.	Standardized measures not reported.	Improvement in subjective cognitive function noted in 15/16 cognitive training studies. All CBT studies showed improvement in cognitive function, notably subjective.	Strengths: High quality evidence. Limitation: CBT studies had small sample sizes. Some studies did not have control group. Need standard measures.
Wei et al. (2022)	Analyze the effects of Baduanjin on cognitive function and QOL in breast cancer patients Randomized control trial 70 breast cancer patients	In-person Baduanjin instruction and at-home video. Recommended 30-minutes per day 5-days per week over 12-weeks. Patient recorded activity logs	Subjective cognitive function measured at baseline, 4-weeks, 8-weeks, and 12-weeks. Subjective cognitive measure: *FACT-Cog*	Greater improvement in subjective cognitive function in intervention group at all measured intervals.	Strengths: Feasible program. Good adherence. Limitations: Small sample size.

Note: AFI: Attention Function Index*;* BCPT: Breast Cancer Prevention Trial Symptom Checklist*;* CFQ: Cognitive Failure Questionnaire*;* EORTC: European Organisation for Research and Treatment of Cancer quality of life questionnaire; FACT-Cog: Functional Assessment of Cancer Therapy—Cognitive Function; PROMIS: Patient reported outcomes measurement system; MDASI: MD Anderson Cancer Symptom Inventory; MDASI-MM: MD Anderson Cancer Symptom Inventory – Multiple Myeloma;

APPENDIX B

FACT-Cognitive Function (Version 3)

FACT-Cognitive Function (Version 3)

Below is a list of statements that other people with your condition have said are important. **Please circle or mark one number per line to indicate your response as it applies to the past 7 days.**

	PERCEIVED COGNITIVE IMPAIRMENTS	Never	About once a week	Two to three times a week	Nearly every day	Several times a day
CogA1	I have had trouble forming thoughts	0	1	2	3	4
CogA3	My thinking has been slow	0	1	2	3	4
CogC7	I have had trouble concentrating	0	1	2	3	4
CogM8	I have had trouble finding my way to a familiar place	0	1	2	3	4
CogM10	I have had trouble remembering where I put things, like my keys or my wallet	0	1	2	3	4
CogM12	I have had trouble remembering new information, like phone numbers or simple instructions	0	1	2	3	4
CogV13	I have had trouble recalling the name of an object while talking to someone	0	1	2	3	4
CogV15	I have had trouble finding the right word(s) to express myself	0	1	2	3	4
CogV16	I have used the wrong word when I referred to an object	0	1	2	3	4
CogV17b	I have had trouble saying what I mean in conversations with others	0	1	2	3	4
CogF19	I have walked into a room and forgotten what I meant to get or do there	0	1	2	3	4
CogF23	I have had to work really hard to pay attention or I would make a mistake	0	1	2	3	4
CogF24	I have forgotten names of people soon after being introduced	0	1	2	3	4

FACT-Cog (Version 3)

Please circle or mark one number per line to indicate your response as it applies to the past 7 days.

		Never	About once a week	Two to three times a week	Nearly every day	Several times a day
CogP25	My reactions in everyday situations have been slow	0	1	2	3	4
CogC31	I have had to work harder than usual to keep track of what I was doing	0	1	2	3	4
CogC32	My thinking has been slower than usual	0	1	2	3	4
CogC33a	I have had to work harder than usual to express myself clearly	0	1	2	3	4
CogC33c	I have had to use written lists more often than usual so I would not forget things	0	1	2	3	4
CogMT1	I have trouble keeping track of what I am doing if I am interrupted	0	1	2	3	4
CogMT2	I have trouble shifting back and forth between different activities that require thinking	0	1	2	3	4

Please circle or mark one number per line to indicate your response as it applies to the past 7 days.

	COMMENTS FROM OTHERS	Never	About once a week	Two to three times a week	Nearly every day	Several times a day
Cog01	Other people have told me I seemed to have trouble remembering information	0	1	2	3	4
Cog02	Other people have told me I seemed to have trouble speaking clearly	0	1	2	3	4
Cog03	Other people have told me I seemed to have trouble thinking clearly	0	1	2	3	4
Cog04	Other people have told me I seemed confused	0	1	2	3	4

FACT-Cog (Version 3)

Please circle or mark one number per line to indicate your response as it applies to the past 7 days.

	PERCEIVED COGNITIVE ABILITIES	Not at all	A little bit	Some-what	Quite a bit	Very much
Cog PC1	I have been able to concentrate	0	1	2	3	4
Cog PV1	I have been able to bring to mind words that I wanted to use while talking to someone	0	1	2	3	4
Cog PM1	I have been able to remember things, like where I left my keys or wallet	0	1	2	3	4
Cog PM2	I have been able to remember to do things, like take medicine or buy something I needed	0	1	2	3	4
Cog PF1	I am able to pay attention and keep track of what I am doing without extra effort	0	1	2	3	4
Cog PCH 1	My mind is as sharp as it has always been	0	1	2	3	4
Cog PCH 2	My memory is as good as it has always been	0	1	2	3	4
Cog PMT 1	I am able to shift back and forth between two activities that require thinking	0	1	2	3	4
Cog PMT 2	I am able to keep track of what I am doing, even if I am interrupted	0	1	2	3	4

Please circle or mark one number per line to indicate your response as it applies to the past 7 days.

	IMPACT ON QUALITY OF LIFE	Not at all	A little bit	Some-what	Quite a bit	Very much
CogQ35	I have been upset about these problems	0	1	2	3	4
CogQ37	These problems have interfered with my ability to work	0	1	2	3	4
CogQ38	These problems have interfered with my ability to do things I enjoy	0	1	2	3	4
CogQ41	These problems have interfered with the quality of my life	0	1	2	3	4

FACT-Cog Scoring Guidelines (Version 3) – Page 1

Instructions:* 1. Record answers in "item response" column. If missing, mark with an X
2. Perform reversals as indicated, and sum individual items to obtain a score.
3. Multiply the sum of the item scores by the number of items in the subscale, then divide by the number of items answered. This produces the subscale score.
4. Add subscale scores to derive total scores (Not applicable to the FACT-Cog*).
5. **The higher the score, the better the QOL.**

Subscale	Item Code	Reverse item?		Item response	Item Score
PERCEIVED COGNITIVE IMPAIRMENTS (CogPCI)	CogA1	4	-		=
	CogA3	4	-	_____	=_____
	CogC7	4	-		=
	CogM9	4	-		=
Score range: 0-72	CogM10	4	-	_____	=_____
	CogM12	4	-		=
	CogV13	4	-	_____	=_____
	CogV15	4	-		=
	CogV16	4	-	_____	=_____
	CogV17b	4	-		=
	CogF19	4	-		=
	CogF23	4	-	_____	=_____
	CogF24	4	-		=
	CogF25	4	-	_____	=_____
	CogC31	4	-		=
	CogC32	4	-		=
	CogC33a	4	-	_____	=_____
	CogC33c	4	-		=
	CogMT1	NOT CURRENTLY SCORED			
	CogMT2	NOT CURRENTLY SCORED			

Sum individual item scores:
Multiply by 18:
Divide by number of items answered: _____ =**CogPCI subscale score**

Subscale	Item Code	Reverse item?		Item response	Item Score
IMPACT OF PERCEIVED COGNITIVE IMPAIRMENTS ON QUALITY OF LIFE (CogQOL)	CogQ35	4	-		=
	CogQ37	4	-	_____	=_____
	CogQ38	4	-		=
	CogQ41	4	-		=
Score range: 0-16					

Sum individual item scores: _____
Multiply by 4:
Divide by number of items answered: =**CogQOL subscale score**

Subscale	Item Code	Reverse item?		Item response	Item Score
COMMENTS FROM OTHERS (CogOth)	CogO1	4	-	_____	=_____
	CogO2	4	-		=
	CogO3	4	-		=
	CogO4	4	-	_____	=_____
Score range: 0-16					

Sum individual item scores: _____
Multiply by 4:
Divide by number of items answered: _____=**CogOth subscale score**

PERCEIVED COGNITIVE ABILITIES (CogPCA)	CogPC1	0	+		=
	CogPV1	0	+	_____	=_____
	CogPM1	0	+		=
	CogPM2	0	+		=
	CogPF1	0	+	_____	=_____
Score range: 0-28	CogPCh1	0	+		=
	CogPCh2	0	+	_____	=_____
	CogPMT1	NOT CURRENTLY SCORED			
	CogPMT2	NOT CURRENTLY SCORED			

Sum individual item scores: _____
Multiply by 7:
Divide by number of items answered: _____=**CogPCA subscale score**

*FACIT recommends that either cognitive impairments or cognitive abilities be selected as a 'primary' score (we currently recommend cognitive impairments be used).

There are two options regarding the scoring of items CogMT1, MT2, PMT1 and PMT2: (1) include the 4 items in scoring and conduct some additional analyses to confirm the items fit with the scale (range 0-80, 0-36); or (2) score the scale without the additional 4 items (range 0-72, 0-28).

While CogMT1, MT2, PMT1 and PMT2 are not currently scored, they may be included in the total score if a measure of internal consistency (eg Cronbachs alpha) and individual item-total score correlation coefficients indicate that the items fit with the scale. These extra steps would be needed because the items were added later and not included in the initial validation analyses.

Appendix C

Demographics Form

Chair Yoga for Breast Cancer Patients
Demographics Form
Valparaiso University

Please complete the following form. Information provided will be kept confidential.

Date: _____

Initials: _____

Age: _____

Race:

____ Caucasian

____ African American

____ Hispanic

____ Other

Education level:

____ < high school

____ high school diploma

____ some college

____ college degree

____ trade school

____ other

Income level:

____ Less than $25,000

____ $25,000 - $50,000

____ $50,001 - $75,000

____ > $75,000

____ other

Menopausal status:

____ pre-menopausal

____ peri-menopausal

____ post-menopausal

Appendix D

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PROVIDING A VOICE FOR PATIENTS WORLDWIDE

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Name ("Licensee"): Christine Cain

Measurement: FACT-Cog

Language(s): English

Study Title ("Study"): Meditation-Type Exercise for the Management of Chemotherapy Related Cognitive Impairment in Breast Cancer Patients

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Signature: Christine Cain
Christine Cain (Jul 31, 2022 12:04 CDT)

Email: christine.cain@valpo.edu

Appendix E

Chair Yoga for Breast Cancer Patients Program

Implementation Timeline

Pre-screening: August 24 – September 2, 2022
Review EMR for eligible patients (breast cancer diagnosis receiving chemotherapy). Provide clinicians with list of eligible patients for approval.
Rolling recruitment starting September 6 – September 30, 2022

Week 1*: If patient meets criteria for CRCI, offer 10-week meditation-type exercise program. If agreeable, provide information folder with program instructions and yoga log book to participant. Collect program intake form and demographic form.

Week 2: In-person or telephone follow up for encouragement and adherence to program

Week 3: In-person or telephone follow up for encouragement and adherence to program

Week 4: In-person or telephone follow up for encouragement and adherence to program

Week 5: In-person or telephone follow up for encouragement and adherence to program.

Week 6: In-person or telephone follow up for encouragement and adherence to program

Week 7: In-person or telephone follow up for encouragement and adherence to program

Week 8: In-person or telephone follow up for encouragement and adherence to program

Week 9: In-person or telephone follow up for encouragement and adherence to program

Week 10: Administer post-intervention FACT-Cog assessment in-person or via telephone.

* If enrolled between September 6 – September 16, 2022, participants will be asked to attend first chair yoga class and begin program September 19th. If enrolled September 19 – September 30, participants will attend chair yoga class and begin program starting October 3rd.

Appendix F

Collaborative Institutional Training Agreement Certificate

CITI PROGRAM

Completion Date 12-Apr-2022
Expiration Date N/A
Record ID 48436079

This is to certify that:

Christine Cain

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Group 1: Social Behavioral Educational Researchers
(Curriculum Group)
Group 1: Social Behavioral Educational Researchers
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Valparaiso University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w58e32dbb-7d35-4ad8-9e96-646b41ac355e-48436079