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What Was Lost: How Dance/Movement Therapy Can Support the Retention and Repair of Cognitive Abilities in Cancer Patients, a Literature Review

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Abstract

This literature review examines research surrounding the effects of chemotherapy on cognitive abilities alongside methods of increasing cognitive functioning throughout treatment. Cancer-related cognitive impairment (CRCI) is seen in many patients undergoing chemotherapy yet has had little attention in cancer research. However, research that has been performed shows that by increasing physical activity during chemotherapy often results in improved cognitive abilities as well as increasing individual's memory, focus, and multi-tasking abilities. With this connection between physical exercise and cognitive functioning, this author is interested in investigating the idea that dance/movement therapy can assist in the recovery and repair of residual cognitive dysfunction from chemotherapy, working with the mind-body connection to increase cognitive abilities. While there is no research available surrounding the use of dance/movement therapy to assist in cognitive functioning, this literature review will begin to discover where it would benefit an individual undergoing chemotherapy with an increase of cognitive dysfunction.

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"The initial impact wasn't terrible because I was still just trying to figure everything out. But as time went on, I realized that something certainly wasn't right and that my brain wasn't working like it had prior to chemo. I didn't know why at the time, nor did I really understand the reason behind the gaps in my memory".

-Heather Von St. James

Introduction

As if surviving cancer was not as challenging enough, patients are often faced with the residual effects from chemotherapy treatment- the most common being reports of cognitive dysfunction. This dysfunction can force individuals to relearn how to retain information or function in day-to-day life.

For survivor Christina, her struggles began after treatment ended and she returned to college. A once successful student who learned with ease, was faced with lower test scores compared to her classmates (Fernandez, 2018). She reported having to "read and reread the same paragraph, but could not grasp the information," as well as "taking twice the time to learn new concepts" (Fernandez, 2018, para. 24). Trying everything she could to combat these difficulties, including reciting her notes into a voice recorder and preparing discussion questions in advance so as not to stumble over her words, Christina was forced to learn how her "new" brain functioned (Fernandez, 2018).

Fellow survivor, Kelly, shared that she has to "have that conversation a solid three times before it even starts to slightly absorb," leaving her feeling embarrassed that others believe her not to be paying attention or caring (Fernandez, 2018, para. 62). The idea of overpreparing for all situations are not uncommon- reading books ahead of time for class, writing down notes about appointments or dates immediately. For these survivors, just getting by in daily life can be physically and mentally exhausting. And I am one of them.

In 2018, 17 million individuals globally were diagnosed with cancer, with numbers anticipated to climb continuously (American Cancer Society, n.d., para. 1). This disease is affecting a vast number of our world population. More people are living with the residual effects of treatment to cure this disease than is realized, cognitive dysfunction is an everyday struggle for millions.

As a recent cancer survivor of Stage IV Hodgkin's Lymphoma, I have personally watched my cognitive abilities shift during and after chemotherapy. Once an avid reader with high retention skills, I now struggle to concentrate, read in a straight line, or remember what the content was. I am frequently at a loss for words, stumbling over what I am trying to say, and forgetting the simplest of words mid-sentence. I jumble letters while typing and am constantly pressing the delete button to repair my mistakes. My academic work has suffered from these changes, often taking me double the amount of time to complete a task. This onset of cognitive dysfunction has completely changed how I function in my daily life. Feeling foggy or not fully present are common.

On days that I am more active, I feel more present. The physicality seems to help my neurons fire at a faster speed and provide me with more direct information. This was a slow discovery. I noticed my mood improving when I started moving again while meeting with clients

at my internship site. This movement was light, but purposeful. I felt more control over my body and experienced high levels of body autonomy. I began to carve out time for myself to move at home. Giving myself time to dance and move before settling down to accomplish schoolwork created a more centered place from which my brain could work. I continued to dance with more intensity after my treatment and could feel myself re-centering. With this noticeable difference in myself, I set out to explore how focusing on the mind-body connection could assist in my repair of cognitive dysfunction after chemotherapy.

Literature Review

Cancer-related cognitive impairment (CRCI), or chemo-brain to the lay person, has been defined as the loss of mental acuity associated with cancer and its subsequent treatment (Salerno, Rowland, Kramer, & McAuley, 2019). The American Heritage Dictionary of Medicine defines this impairment as "difficulties with memory, attention, or concentration, that results from chemotherapy." Although a broad range, it is reported that an estimated 17-75% of cancer patients experience CRCI in relation to their treatment, effecting their day to day functioning (Campbell, et al., 2017, p. 53; Myers, 2008, p. 413; Wefel, et al, 2004, p. 2293).

This notable group of effected patients are expressing concern over this largely impactful side effect to their treatment and are beginning to examine ways to combat the decline. Since CRCI has only been recently addressed on a more consistent basis in literature, it is important to understand the transformations that occur in an individual's quality of life.

Patients describe the effects of CRCI as "forgetfulness, absentmindedness, and an inability to focus when performing daily tasks (Myers, 2008, p. 413). Myers (2008) also reports that "patients have expressed concern about CRCI and their subsequent ability to resume previous profession, scholastic, and social activities" (p. 414). There is also concern over

memory and concentration that was most evident when they are asked to resume their daily work and are being given multiple tasks to perform at the simultaneously.

These self-reported side effects and concerns are clearly a detriment to everyday life for a cancer patient, creating challenges that were not previously present in their lifestyle. These changes in "memory, attention, focus, and ability to multitask has now been documented on cognitive tests as well as functional MRIs" (Love, Love, & Lindsey, 2015, Chemobrain section, para. 1). This adjustment can be discouraging and frustrating for many and requires an adjustment to their lifestyle.

Although chemotherapy has been the typical treatment method for cancer, doctors are still uncertain on how CRCI occurs. Currently, the exact cause or precise mechanisms that contribute to changes in the brain are unclear (Campbell, Zadravec, Bland, Chesley, Wolf, & Janelsin, 2020). It is only recently that this side effect is being recognized in research. With the "potential for significant impact on patients' quality of life," it is shocking that this topic is only now being taken seriously, showing that chemotherapy may damage the hippocampus which leads to cognitive impairments (Myers, 2008).

Most notably, the fornix is shown to see significant impact during chemotherapy. The fornix plays an "important role in the encoding, consolidation, and recall of declarative and episodic memory" and is the major output tract of the hippocampus (Burzynska, et al., 2017, p. 9). The hippocampus can be attributed to assisting in working memory. The fractional anisotropy (FA) values in the fornix have shown decline after chemotherapy and can be linked to the earliest sign of cognitive decline and a predictor of CRCI (Mo, et al., 2017, p. 81281). These are all vital for daily functioning for an individual.

Pace and Villani (2012) studied the effects of chemotherapy on the brain of women with breast cancer. Their study showed that white matter tracts decreased in the frontal, parietal, and occipital lobes of the brain due to the introduction of chemotherapy. The women in the study who had received chemotherapy had a lower score on attention tests, psychomotor speed tests, and memory tests than those who did not. These lower test scores were a direct reflection of the effects that chemotherapy had on the brain, primarily on the demyelination that effects cognitive abilities.

Salerno, et al. (2019, p. 1) states that "working memory, the act of holding information in one's mind and manipulating it, and processing speed, the speed at which one interprets information, have both been identified as important determinants of long-term survival in cancer survivors." Chemotherapy creates a disturbance in these functions, that are shown to be durable for some up to ten years (Tannock, et al., 2004). This dysfunction is attributed to a what is considered a standard dose of chemotherapy. As research continues to develop in this area, doctors are exploring ways to help retain and repair some cognitive abilities in cancer patients. As a natural bridge between the mind-body connection, dance/movement therapy (DMT) is an underexplored supplement to chemotherapy throughout a cancer patient's experience in assisting with the effects of CRCI.

"At its very core, dance/movement therapy emphasizes the holism of mind and body, thereby, providing a new avenue for exploring the complicated inter-relationship of factors involved in coping with cancer" (Cohen & Walco, 1999, p. 41). The integration of the mind and body can assist in internalizing and understanding of oneself, that can work to explore how the mind is affected during chemotherapy. When moving, the individual can understand more on how functioning occurs within oneself. DMT is defined as the "psychotherapeutic use of

movement to promote emotional, social, cognitive, and physical integration of the individual, for the purpose of improving health and well-being" (Welling, 2019, para. 1). DMT combines the efforts of the mind and body, working to improve health across all systems. By introducing movement into the body, the mind will also benefit, creating a cyclical effect to improve one's quality of life.

Incorporating the idea of mind, body, and spirit can enhance one's cognitive abilities, as the individual will be aware of how their body is interacting with all of its parts. Cohen and Walco (1999, p. 41) inform that "clinically, there is an expressed desire by professionals and patients for integration of mind, body, and spirit in the care of individuals with cancer." There is space for this practice and a willingness to implement DMT into the lives of those suffering from CRCI. It appeared that DMT enhanced particular domains of human function associated with their quality of life (Berrol, Ooi, and Katz, 1997).

Recently, more studies have been done in correlation with exercise to cognitive abilities in cancer patients. While these studies are giving results that support the introduction of physicality during chemotherapy, there are none that focus solely on the effects of DMT. In order to explore the gaps in knowledge regarding DMT in conjunction with the retention and repair of cognitive abilities effected by chemotherapy, the following will analyze published literature in related topics.

Over the past several years, expressive therapies, the combination of "the visual arts, movement, drama, music, writing, and other creative processes to foster deep personal growth and community development" are becoming increasingly popular and more integrated into healthcare settings (Cohen & Walco, 1999; International Expressive Arts Therapy Association, n.d., What are the Expressive Arts section, para. 1). With the physical, cognitive, and emotional

benefits becoming more recognized, expressive therapies are being seen in conjunction with other typical treatments within healthcare. While it still has a long way to go, the recognition it is receiving within recent years holds promise for therapists and patients alike. Focusing on the physical aspect primarily in many studies, this literature review is working to explore the cognitive benefits for cancer patients surrounding the use of DMT alongside their chemotherapy regiment.

The researchers in this literature review primarily focus on the effects of chemotherapy on the brain and the cognitive abilities of those receiving it. In a general sense, many of the studies focus primarily on breast cancer patients. There is little focus on other diagnoses of cancer. While focusing on one type of cancer is beneficial for the consistency of studies, it is not giving readers a full picture of how chemotherapy is a damaging agent across all types of cancer. There are many different types of chemotherapy and its side effects do not discriminate based on the cancer it is treating.

Kessler and Blayney (2016) studied the effects of chemotherapy on breast cancer patients that had specifically received chemotherapy drugs that fell under the anthracycline category. Chemotherapy regiments that include anthracycline have shown a result of greater cognitive impairment in individuals than other chemotherapy drugs. Kessler and Blayney (2016) utilized retrospective data from sixty-two breast cancer survivors that were two years post-treatment. Of these sixty-two women, twenty had been given anthracycline based-chemotherapy, nineteen had been given a different treatment besides anthracycline based chemotherapy, and twenty-three received no chemotherapy. After neurological testing and MRI's to measure and observe cognition and brain changes, it was reported that the twenty women that underwent chemotherapy with anthracycline based treatment performed significantly worse on memory

tasks and had visible changes in the brain, even two years after treatment (Kessler & Blayney, 2016). Overall, both chemotherapy exposed groups, anthracycline and non- anthracycline, performed worse than those who had not received chemotherapy. Although anthracycline demonstrates a more severe change, it is important to note that all chemotherapy drugs have a detrimental effect on an individual.

Research with CRCI

There is a lack of research done regarding the effects of DMT on assisting the retention and repair of cognitive abilities in cancer patients. Research has studied the effects of exercise or physical activity with those receiving chemotherapy to better understand the connection between the two, with results demonstrating that DMT addressed cognition on both a movement and verbal level (Berrol, Ooi, and Katz, 1997). With many positive responses to these studies and the revelation that maintaining physical activity assists in improved cognitive functioning, the next logical step would be to examine the correlation between DMT and cognitive functioning. As DMT focuses heavily on the mind-body connection, there is plenty of information to look further into.

There have been some links made between physical exercises and CRCI in the field of physical therapy. A newly published study by Campbell, Zadravec, Bland, Chesley, Wolf, & Janelsin (2020) examined the correlation between physical exercise and cognitive abilities. This was conducted with participants over eighteen years of age that were diagnosed with cancer, excluding brain cancer. These individuals participated in a variety of interventions including continuous or aerobic exercises, resistance training, or mind-body exercises. From these, self-reports, as well as neuropsychological testing, were collected surrounding their experiences. Significant findings were reported for combined aerobic- and resistance-based exercises, and

simply aerobic exercises alone, on assisting in decreasing CRCI, tested by Digit Span Forwards and Auditory Consonant Trigram. This provides limited, but "emerging evidence" that "points towards a possible impact of exercise on measure of CRCI" (Campbell, Zadravec, Bland, Chesley, Wolf, & Janelsin, 2020, p. 533).

A study focusing on women with breast cancer by Wefel, Lenzi, Theriault, Davis, and Meyers (2004) examined the cognitive dysfunction in women after receiving chemotherapy. It was reported that 33% of the women in the cohort, a total of eighteen women examined, exhibited cognitive impairment (Wefel, et al., 2004, p. 2292). Their more common complaints of "cognitive dysfunctions were related to attention, learning, and processing speed" (Wefel, et al., 2004, p. 2292). Twenty-five women took part in the study, being given comprehensive battery of cognitive tests, self-reports, and reports regarding their quality of life post-chemotherapy. From this brief assessment, the authors could determine that 61% of them saw a decline in their cognitive abilities (Wefel, et al., 2004). This shocking number, with more than half of the participants, should lead to deeper research surrounding the effects from chemotherapy on the brain.

Tannock, Ahles, Ganz, and van Dam (2004) studied cognitive impairments associated with chemotherapy on a group of breast cancer patients, acknowledging that cognitive dysfunction is an often-overlooked side effect of treatment. The authors employed the use of short-term tests to measure the patient's cognitive abilities, taking into consideration that many of these baseline tests occur during moments of high stress for an individual, soon after receiving a diagnosis (Tannock, et al., 2004). From these tests, it was revealed that cognitive functioning did decrease after the introduction of chemotherapy. The researchers noted that the cognitive dysfunction associated with chemotherapy is not contained to patients with breast cancer and can

be visible for up to ten years after completing treatment (Tannock, et al., 2004). These side effects are observed across various cancer groups receiving different regiments of treatment. This broad side effect should be addressed on a more serious level, knowing that it is not discriminatory to one specific diagnosis.

The participants involved in the study recognized the need for deeper research around this topic, requesting that studies that can reproduce the daily stressors of multi-tasking be developed, seeing how many patients notice these changes when back in a work environment with many tasks in front of them (Tannock, et al., 2004). They also expressed their wishes for this side effect to be discussed prior to treatment, so as all patients are aware of the changes that can occur while receiving treatment.

Thirty-four premenopausal female breast cancer survivors who had been exposed to chemotherapy were also studied in a longitudinal study (Deprez, et al., 2012). This group underwent testing prior to chemotherapy, and then again 3 to 4 months after finishing. All participants completed a neuropsychological test to study the domains of attention, concentration, memory, executive functioning, and cognitive/psychomotor speed. From this assessment performed prior to chemotherapy, as well as after, results showed that the chemotherapy treated group performed significantly worse than those who did not receive chemotherapy treatment. It was also reported that “significant correlations were found between increased self-reported cognitive complaints in distraction” (Deprez, et al., 2012, p. 278). Once more, this study focused primarily on breast cancer patients, limiting the results to specific chemotherapy drugs.

Exercise and CRCI

Individuals undergoing chemotherapy treatments often decrease their physical function, and "reduce their exercise levels after diagnosis and generally do not return to their pre-diagnosis activity levels once in recovery phase" (Garner & Erck, 2008, p. 200). Taking this piece out of the equation can hurt one's cognitive abilities. Research show that "thirty minutes of walking may be a better choice than sitting for at least maintaining, if not improving, important domains of cognitive functioning in breast cancer survivors" (Salerno, et al., 2019, p.8). A low impact physical activity can go a long way in assisting one's cognitive dysfunction.

With the knowledge of decreased physical activity for cancer patients, it is also seen that their feelings of fatigue from the illness and treatment actually eliminate this function and further exacerbate their feelings of fatigue (Garner & Erck, 2008, p. 200). Even once in a recovery phase, many patients never return to their previous levels of physical activity. Acknowledging this decrease in physical activity, Garner and Erck (2008) studied eleven female breast cancer patients that had admitted to a decrease in their physical activity with their diagnosis and introduction of treatment. These women were observed with various physical activities such as treadmill walking/jogging with a slight incline, elliptical use, and resistance training with weights. From this study, the positive effects of physical activity were seen as a useful adjunct form of therapy for cancer patients. While this study focuses primarily on the physical benefits of exercise for cancer patients, it is beginning to familiarize the idea of the mind-body connection that is so prevalent in DMT.

A study surrounding CRCI and exercise by Salerno, Rowland, Kramer and Mcauley (2019) examines the cognitive functioning and repair of breast cancer survivors, all of whom have reported a deficit in their functioning. Over the course of seven months, the participants,

twenty-seven total females, all took a pre- and post-test of their cognitive abilities, with a 30-minute acute exercise regime in between of walking on a treadmill. It is unknown if the participants were alone or in a group setting, but the space they were in was distraction free, so as to focus on the tasks at hand. After the participants completed their physical activity regiment of treadmill walking, they took part in a cognitive assessment. This assessment included letter comparison tasks and spatial working memory tests. With a median age of 49.11, the results revealed positive reactions to exercise. By increasing acute physical activity, such as walking on a treadmill, participants performed better on the cognitive post-test then the pre-test. It is reported that "30 minutes of walking may be a better choice than sitting for at least maintaining, if not improving, important domains of cognitive functioning in breast cancer survivors" (Salerno, et al, 2019, p. 8). While the study was deemed ultimately inconclusive due to it being the first study of its kind, it did demonstrate some improvement on cognitive functioning with the implementation of acute exercise and highlighted the importance of the mind-body connection. Salerno, Rowland, Kramer, and Mcauley (2019, p. 8) claim that "cancer-related cognitive impairment remains largely misunderstood; however, results from the present study offer preliminary evidence for the positive association between acute exercise and cognitive function in breast cancer survivors." Following up with participants, only 35% reported cognitive dysfunction in their day to day lives, as compared to the nearly 75% during treatment (Salerno, et al., 2019, p. 2). A study of this nature gives hope to the further development of that with DMT.

With a closer relation to the mind-body connection, yoga has also been used to improve both mental and physical health through a therapeutic lens (Mackenzie, et al., 2014). The idea of "mindfulness" is on the forefront of this practice, helping to bridge the gap between standard exercise and the physical activity associated with DMT. Studies show that "within exercise

settings, mindfulness builds upon associative attention by refining perceptions of exertion on a moment-by-moment basis via increased sensitivity to a host of cognitive and interoceptive cues, and concurrently limits emotional reactivity to these cues" (Mackenzie, et al., 2014, p. 131). Turning the focus on an internal lens, "the strong mind-body interaction within contemporary yoga practice adds a unique contemplative dimension to exercise that has been referred to as 'mindfulness in motion'" (Mackenzie, et al., 2014, p. 131).

While there is a lack of research done to understand how DMT can support the retention and repair of cognitive abilities related to chemotherapy, other studies that encapsulate the benefits of this type of therapy are extensive. DMT has been successful in assisting older adults with improving memory and cognition, with positive results.

DMT with Other Cognitive Dysfunctions

The degeneration of cerebral white matter (WM) is a leading cause in cognitive decline for older adults, similar to what has been seen with chemotherapy patients and the changes in their WM, often effecting processing speed (Burzynska, et al., 2017). Researchers believe that by incorporating physical, cognitive, and social engagements, patients may see an improvement in their cognitive abilities. The one activity that can fully encompass all of the previously mentioned themes is dance. By acknowledging the importance of physical and social activity through dance, the decline of the WM may decrease. "Improving WM integrity is key in preserving cognitive performance" (Burzynska, et al., 2017, p. 2). Through this study, 174 participants underwent six months of observation, participating in intervention groups such as dancing, walking, walking+nutrition, and an active control. One of the main purposes of this study was to observe the changes in fractional anisotropy (FA), measuring the levels of fiber integrity in orientation and density in the fornix (Burzynska, et al., 2017). Notably, the dance

group worked on social engagement and memorization with learning social dances over the course of one-hour weekly sessions. From this intervention, it was observed that the FA in the fornix increased over the six-month period of engagement in dance, while the other groups witnessed a decline (Burzynska, et al., 2017). An increased processing speed was also observed (Burzynska, et al., 2017).

The combination of physical and social interventions led to a more positive result, demonstrating that dance is as holistic intervention. The combination of physical and social interventions also can lead to longer-lasting effects (Burzynska, et al., 2017). With this new wealth of information, dance and movement can now be used as an intervention to assist in retention and repair of WM to better handle cognitive functioning. Research by Kattenstroth, Kalisch, Holt, Tegenthoff & Dinse (2013) also acknowledged the diverse features within treatment interventions involving dance or movement, making it a strong neuroplasticity inducing tool. An overall widespread growth encompassing both attention and cognition is demonstrated after the initiating of dance into the lives of those experiencing cognitive dysfunction.

From all of these published studies, it is understood that "combining physical, cognitive, and social engagement (dance) may help maintain or improve WM health and more physically active lifestyle associated with slower WM decline" (Burzynska, et al., 2017, p. 10). The incorporation of movement for its cognitive, physical, and social benefits for WM health is "key in preserving cognitive performance" (Burzynska, et al., 2017, p. 2). Studies have also shown that "the aging of the brain is detectable on the scale of 6-months, which highlights the urgency of finding effective interventions to slow down this process" (Burzynska, et al., 2017, p. 1).

It is important to note that the simple introduction of dance alone is not what results in the largest benefit for individuals experiencing CRCI or other forms of cognitive dysfunction. The "broad, multimodal stimulation had greater benefit for WM integrity than aerobic exercise alone" (Burzynska, et al., 2017, p. 10). Kattenstroth, et al. (2013) states that "dancing is increasingly used as an intervention because it combines many diverse features making it a promising neuroplasticity-inducing tool" (p. 1). For dancing to be a fully beneficial intervention, it must be taken from the lens of DMT to provide the most multidimensional approach.

Gaps in Research and Practice

There is a severe lack of research regarding the use of DMT as a supplemental therapy for cancer patients undergoing chemotherapy treatment. The problems of CRCI are not limited to the small samples that have been curated thus far. Tannock, et al., (2004, p. 2235) discussed that data shows "that the problem is not restricted to the patients with breast cancer and that the cognitive dysfunction is observed in various groups receiving different regimens of treatment." With majority of studies focusing around breast cancer patients, it would benefit all patients and researchers to learn more from different diagnoses. It is also suggested that "future research should be focused on the determination and development of appropriate neurocognitive testing" (Tannock, et al., 2004, p. 2238).

While it is unknown where medical professionals stand on the integration of DMT, "clinicians indicate an interest in integrating the arts in their practices" with their biggest concerns being lack of time, lack of knowledge, and professional boundaries (Quinlan, Robertson, & Fitchner, 2017, p. 14). They are seldomly utilizing expressive therapies, such as DMT, when they are with their clients (Quinlan, Robertson, & Fitchner, 2017). This "theory-to-practice" gap is hurting the implementation of these interventions and is causing the gap in

research surrounding this topic. In a poll initiated by Quinlan, Robertson, and Fitchner (2017), 90% of practitioners agreed that artistic intervention, such as pottery or clay modeling, would be beneficial for their patients, as well as about half of them reporting that drumming or expressive dance could show improvements (p. 13). Expressive therapies are "the perfect example of how a nurse can involve the whole patient using the creative arts to aid in healing" (Madden, Mowry, Gao, Cullen, & Foreman, 2010, p. 143).

Increasing access to expressive therapies, particularly DMT, to cancer patients undergoing chemotherapy would be beneficial in retaining and repairing their cognitive abilities with an increase of movement and body work. It is demonstrated that DMT has proved as a proud assistant in helping those that have experienced other forms of cognitive dysfunction.

"Physical activity is a lifestyle behavior that has been consistently associated with improved physical, cognitive, and mental health across the lifespan" (Salerno, et al., 2019). Cancer patients and cancer survivors begin to lack the time or ambition to take part in physical activity regiments. Their days are spent in treatment, in recovery, or trying to maintain a normal lifestyle. Expending any additional energy into exercise is challenging and often overlooked. By making physical activity a more accessible activity, there could be an increase in physical health, thus effecting mental health. Research has shown that by initiating "acute physical activity, or single exercise sessions" patients may find it to be "more achievable" (Salerno, et al., 2019, p. 2). DMT can provide just that. DMT can be structured to provide a lower impact form of physical activity. Working towards the mind-body connection will assist in not only the physical aspect, but also the mental aspect that is so affected by chemotherapy.

With DMT supporting the mind-body connection, it is important to remember the true idea of using both the body and the mind in recovery. Other studies have shown that "cognitive

behavioral therapy as well as meditation, yoga, and exercise can help with these symptoms" associated with chemo-brain (Love, Love, and Lindsey, 2015, Chemobrain section, para. 14). Combining "cognitive and physical interventions may also have more long-lasting effects" (Burzynska, et al., 2017, p. 9).

The mindfulness that is learned through DMT is also beneficial for deepening the mind-body connection. According to a study by Mackenzie, et al. (2014), "within exercise setting, mindfulness builds upon associative attention by refining perceptions of exertion on a moment-by-moment basis via increased sensitivity to a host of cognitive and interoceptive cues, and concurrently limits emotional reactivity to these cues" (p. 131).

DMT supports the "emotional, social, cognitive, and physical integration of the individual, for the purpose of improving health and well-being" (Welling, 2019, para. 1). This multi-tiered approach is what makes it to be a strong tool in retaining and repairing cognitive abilities in cancer patients, for those both actively receiving chemotherapy and in recovery. The benefits are clear from the research published that including exercise in a daily routine while battling cancer is effective in helping cognitive abilities, as much as they are clear from DMT supporting cognitive growth from other populations experiencing dysfunction. With this wealth of information available, DMT should be utilized in the oncology setting to work to improve the cognitive abilities of those effected by chemotherapy.

DMT in Oncology

There is research demonstrating the benefits of DMT for cancer patients, but for other areas than assisting with CRCI. Being known for encompassing "dance, movement, emotional expression, social support, and creative activity in a single intervention approach," DMT has been used as an intervention to address many problems presented associated with receiving

chemotherapy (Goodill, 2018, p. 240). Allowing for patients to explore new ways to express themselves and understand their bodies, "the body level learning that occurs in this embodied, enactive work means that newly learned patterns could be easily generalized into everyday life (Goodill, 2018, p. 240). Goals of DMT sessions for cancer patients currently include: overall quality of life, stress management, and perceived stress, pain management, reduction of anxiety, and fatigue, increases in sense of vitality, and energy, body awareness, and body image, social support, and the recognition of need for support, self-efficacy, and improved self-care, meaning making, and increases in resilience, and the installation of hope (Goodill, 2018, p. 241). DMT is also known to support more "diversified and less monotonous approach compared to conventional fitness programmes" (Sturum, Baak, Storek, Traore, & Thuss-Patience, 2014, p. 2248). Offering these diverse approaches is what helps to make DMT standout amongst other treatment approaches.

DMT, along with other creative therapies, has been recognized as a positive outlet that "allows the patients to creatively and kinesthetically process the assaults of cancer and its treatment, and thus establish a stronger sense of self and improved quality of life" (Madden, Mowry, Gao, Cullen, & Foreman, 2010, p. 133). The connections between the body and mind through creative interventions can assist in improving a patient's overall quality of life, demonstrated in both pediatric and adult patients (Madden, et al., 2010).

Quality of life is a primary focus for professionals in the oncology field. Often time, quality of life is altered by the onset of fatigue that an individual experiences during chemotherapy. This fatigue can be brought on by the combination of drugs used to treat the cancer, psychosocial factors, or the onset of depression with a diagnosis (Sturum, Baak, Storek, Traore, & Thuss-Patience, 2014). This fatigue can suppress the desire to be physically active,

which is directly affecting an individual's quality of life. DMT was utilized in a year-long study by Sturum, Baak, Storek, Traore, & Thuss-Patience (2014) to research how implementing DMT practices into cancer patient's lives could improve their overall quality of life. With forty participants involved, they were split into two groups: a walking and dance group and a control group. The walking and dance group took a six-minute walking test, as well as participated in a thirty- to sixty-minute dance class several times per week. From the time spent in activity, the researchers found that feelings of fatigue reduced up to 36%, thus increasing each individual's quality of life (Sturum, et al., 2014). The study also concluded with shown benefits for emotional and social function, as well as physical performance, all of which are positives in improving quality of life (Sturum, et al., 2014). DMT can offer focus on "the entity of body and soul, supporting coordination, creativity and activation of resources such as emotional stability in addition to building and maintaining a social network that enables mutual beneficial experiences" (Sturum, et al., 2014, p. 2248).

Suzi Tortora explored the positive effects of DMT for children hospitalized for cancer. With her idea that movement and expression through dance are natural parts of childhood, one can translate this sentiment into adulthood. When they are compromised with a life-threatening disease such as cancer, it becomes more difficult to achieve movement, leaving them feeling a "sense of disempowerment and loss of control of one's body and stress physiology when facing a threatening, traumatic life event" (Tortora, 2019, p. 14). Being able to move brings ownership and control back over the body. This somatic empowerment can help patients feel as if they can manage their illness. Intervening with a cancer diagnosis from a multi-dimensional kinesthetic approach can be called 'integrative oncology'.

Integrative oncology is defined as

> ... a patient-centered, evidence-informed field of cancer care that utilizes mind and body practices, natural products, and/or lifestyle modifications from different traditions alongside conventional cancer treatments. Integrative oncology aims to optimize health, quality of life, and clinical outcomes across the cancer care continuum, and to empower people to prevent cancer and become active participants before, during, and beyond cancer treatment. (Witt, et al., 2017, p. 3)

DMT, while still new to this field, definitely can be categorized into integrative oncology.

Using the body as a form of communication and leading non-verbal conversations is also a key in making DMT an important intervention when working with challenging situations, such as cancer. It can be difficult to verbalize and discuss all of the thoughts and emotions that live with many cancer patients. With that, "the role of creative expression becomes an especially salient component of DMT sessions" (Tortora, 2019, p. 18). DMT can benefit those struggling with finding the words to discuss their current situation by offering a non-verbal approach.

DMT utilizes alternate forms of communication to bring forth what patients are experiencing and can assist individuals to "discover and use their full movement potential" (Mendelsohn, 1999, p. 78). It encourages individuals to be active instead of passive, towards their own bodies and emotions during their treatment. Encouraging movement during treatment can assist in building physical, cognitive, and emotional capabilities.

The opportunities for DMT to be used in an oncology setting are vast, as demonstrated here, but are not limited to quality of life, expression, or physical and mental health. There are many rich benefits to movement-based interventions for those undergoing chemotherapy treatments. With DMT stressing the idea of the mind-body connection, it is hoped that research

broadens its lens to examine how DMT can support the retention and repair of cognitive abilities that are damaged during chemotherapy.

Conclusion

The information gathered has shown that the introduction of physical activity benefits the cognitive abilities of those undergoing chemotherapy treatments. Studies are demonstrating that even acute exercise has helped to retain or repair any CRCI that cancer patients are experiencing, decreasing their cognitive dysfunction. There have also been noticeable differences in the WM in the brain when physical activity is occurring. With all of the proven information, it is curious as to why physical activity is not encouraged more for patients to help overcome this side effect.

The author believes that by implementing movement into their treatment schedule, patients will see improvement in their cognitive abilities over the course of their treatment. Studies in the past have examined the link between some cognition and exercise, the population mainly being with those diagnosed with breast cancer. It is the authors hope to look forward into incorporating functional and expressive movement activities to hold on to cognitive abilities further into treatment and to assist in repairing them at a more accelerated rate.

Physical activity helps to inspire the mind-body connection, promoting activity in both areas. DMT relies on this principle to create a stronger connection. With all of the research provided surrounding DMT acting as a strong benefit for repairing cognitive dysfunction in older adults, crossing over to examine how DMT can benefit those with cognitive dysfunction due to chemotherapy would help to open more doors in research.

A neighboring practice of dance or movement, yoga, has also been highlighted as a strong contender for promoting the important mind-body connection that can help to deepen the functions of one’s cognitive abilities in day to day activities. Research with yoga has shown that

it has assisted in CRCI. Expanding to DMT would be a natural next step, as it can offer many of the same benefits, if not more. Expanding on the mind-body connection will deepen the use of DMT in the lives of those suffering from CRCI.

Another way to expand research would to be including studies on other diagnoses besides breast cancer. While this cancer accounts for a major amount of diagnoses annually, there are other cancers that should be examined that have differing chemotherapy regiments. Research to deepen the understanding of how these regiments can affect the cognitive abilities of individuals would be vital in growing the use of DMT. Understanding what is useful to differing diagnoses would ultimately change the way a DMT session could appear. The further the reach, the more beneficial it may become.

The next obstacle to tackle in the use of DMT for cognitive dysfunction is advocacy. Many doctors or nurses working in oncology do not know much about any of the expressive therapies, therefore not knowing to make recommendations for this type of therapy. If therapists can advocate and get more medical professionals on board, the more it can grow. As stated previously, many non-expressive therapists or medical professionals do not feel comfortable practicing or promoting these therapies. Although difficult, advocacy for DMT is what is needed to allow for this to be a well-utilized service.

Moving forward, I would like to further develop a study to work with cancer patients undergoing chemotherapy treatments. I would not want to limit these participants to only one diagnosis, seeing as so many studies focus mainly on breast cancer patients. I would be interested in tracking what the diagnoses are, what treatment they are receiving, and how they are responding to DMT intervention. It would be interesting to see how different treatments responded. I would also like this study to focus on males and females, seeing as many breast

cancer patients are female. CRCI is not exclusive by gender. This study could include DMT interventions to work on increasing cognitive functioning with focus on the mind-body connection.

In a DMT session focused around cognitive repair, patients can focus on meditation or other embodiment exercises, becoming mindful of their own bodies and bringing focus internally. They can utilize light stretching, similar to what is seen in yoga, and be modified to be done from a chair if energy levels are too low to be standing. Light movement around a space can be done to get the body active, while interacting and socializing with others around them. A group or an individual can work on memorizing a short movement phrase, building week to week to test their memory and retention. Movement patterns can be performed in a sequence, asking for them to be mirrored back to improve the ability to quickly recall. Not only are all of these activities focusing on getting the body moving, they are also pushing the brain to be just as active.

The research discussed in this literature review have shown altered states of grey and white cerebral matter. This visible change leads me to believe that there is more research that can be done to further understand the physiology and etiology of CRCI. The addition of movement into a patient's day to day life showed the physical changes in the brain, further proving the idea of the mind-body connection.

There are types of therapy such as DMT available to ease the transition and feelings of loss surrounding chemotherapy and CRCI. While the research performed thus far continues to leave gaps in understanding the correlation between physical movement and CRCI, and even simply the cause of CRCI, some substantial evidence has been shown that this correlation could

exist. With further research, there is hope that a more complete understanding of the implications of movement, specifically dance/movement therapy can have on those living through CRCI.

Personal Experience

I was diagnosed with Stage IV Hodgkin's Lymphoma in the Winter of 2019. I was right in the middle of completing my Masters in Clinical Mental Health Counseling with a Specialization in Dance/Movement Therapy, which is why I am so passionate about this topic. I watched my cognitive abilities suffer due to my chemotherapy treatments. I watched my physical activity be traded for days on the couch under a blanket. Without exercising my mind and my body, my brain began to suffer.

I was always a bright student and brilliant writer. I felt as if I had a strong command of words and could relay my point artistically and poignantly. Attempting to continue to do schoolwork while experiencing CRCI was difficult. Reading and comprehending became a challenge. My memory was not as deep as it used to be. Typing became difficult, as I struggled to hit the keys in the correct order. I was not longer the student I used to be. This also took a toll on my practice in being a dance/movement therapist during my internship. I was inclined to sit and act as an observer of my own sessions, allowing the individuals to follow my prompts, but never model them myself. As my strength began to grow with the chemotherapy eradicating the cancer from my body, I was able to transition from being an active observer to being able to model movements during a session.

With a newfound strength, I introduced some activity back into my day to day life. Not only was I moving with my clients at my internship site instead of being an active observer on the sidelines, I went on short walks during available time. I took the time to move for myself and tap into my creative brain to create movement phrases. While I was not nearly as active as I used

to be, my body was now up and moving. I started to notice a difference in my academic and cognitive abilities on the days I was more active. If I took the time to move and create, my words came to me at a quicker speed, I was less forgetful, and my typing was more precise. This became a small study for myself to truly discover if there is a link between my physical activity and cognitive abilities.

Throughout my experience with cancer and chemotherapy, I never had any scans done that involved my brain that would assist me in viewing my changes in the fornix or any white matter. I am able to discern from research that these changes are prominent in many cancer patients, but I do not have the ability to use myself as an example in this case.

Utilizing the knowledge I have gained from DMT, I was able to successfully connect my mind and body during this experience. I took the time to hear my body's needs, as well as those of my mind. The integration of these two working parts helped me to care for myself on a different level. With the time taken to care for my body through dance and movement, my mind benefitted as well in retaining or rediscovering my cognitive abilities. From this experience, I learned the undeniable connection between the mind and the body and the role they play in working towards healing, whatever that may be.

With these personal experiences, I am hopeful that more research can be performed to garner support in that DMT can deepen the retention and repair of these cognitive abilities in cancer patients undergoing chemotherapy. I did not have access to a dance/movement therapist while I was in treatment, but from my research I can discern that the use of these skills would be more beneficial. The undeniable mind-body connection that was experienced during my treatment demonstrated the importance of both my own physical and mental health. In order to thrive in one area, I had to tend to the other. With improved physicality, my mind functioned

properly, and any changes I had experienced were dismissed. This small act in return improved my mood and quality of life. Being able to feel like “me” was powerful. The cyclical nature of the mind-body connection is a constant. As an individual with first-hand experience in the importance of incorporating movement to improve cognitive abilities, I have witnessed the mind-body connection that DMT inhabits, establishing its cruciality to this work and understanding of how movement can impact cognition after changes due to chemotherapy.

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THESIS APPROVAL FORM

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