Becoming One with Nature: A Nature Intervention for Individuals Living with Cancer Participating in a Ten-week Group Exercise and Wellness Program.

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Abstract

Intro/Background. Nature encompasses green or blue, earthy-textured environments comprised of biological entities. Positive outcomes associated with psychological and physiological well-being have resulted from exposure to nature. However, there is limited evidence for nature-based interventions and their effect on specific populations, such as individuals living with cancer. **Purpose of Study.** The purpose of this mixed-method study was to determine if incorporating the One Nature Challenge (ONC) into a ten-week group exercise program (WE-Can) for individuals living with cancer can offer psychological and/or physiological benefits in addition to those previously observed by WE-Can participants. Other research motives investigated seasonal variation between experimental groups and nature-based health measures change over time. **Methods.** For this study, two separate ONCs were implemented throughout two distinct seasons (i.e. summer and winter). Previous graduates of WE-Can were formulated as a control group (n=160; 59±11yrs). Psychological and physiological assessments for 18 participants (60±12yrs) were evaluated throughout two WE-Can sessions. In addition, nature relatedness (NR; ie. the relationship one has with nature) and spirituality were measured at the beginning, middle, and end of WE-Can. Following five weeks, the ONC began and participants tracked the number of days they experienced nature for a minimum of thirty-minutes (24±6 days), for a thirty-day period. For each intervention, the ONC finished concurrently with the WE-Can so that post-evaluations and a focus group could be administered immediately following. **Results.** No additional gain in overall improvement was found for both cancer-related psychological and physiological health between groups. However, a significant difference did exist for aerobic fitness and fatigue, indicating an additional improvement caused by ONC. This was supported by frequent active pursuits engaged in throughout the ONC and conveyed restoration of the mind due to a shift in perception while in nature. Spirituality significantly improved, while controversially, NR did not improve over time. **Conclusion.** In conclusion, the lack of statistical significance observed could be attributed to the small sample size and/or the high level of NR portrayed prior to ONC, indicating participants were already 'one with nature.' Although this exploratory study indicated nature to have a strong association with aerobic fitness, fatigue, and spirituality further investigation on the cancer population is warranted.

Key Words: nature-based therapy, cancer, psychology, physiology, natural environment

Table of Contents

1.0 Introduction

1.1 The Disconnect from Nature

Modern society has experienced an increasing trend of disconnection from nature (Baxter, & Pelletier, 2019). The transition from natural landscapes, consisting of green space and agricultural lands, to urbanized metropolitan areas has significantly increased by 157% from 1971 to 2011 (Statistics Canada, 2016). Along with the emergence of industrialization, technology-dependent lifestyles have contributed to this increased disconnect (Fletcher, 2017). Use of electronic gadgets such as smartphones and laptops amongst younger cohorts has been inversely associated with time spent playing outside (Bassett, John, Conger, Fitzhugh, & Coe, 2015; Paudel, Jancey, Subedi, & Leavy, 2017). In a five-year longitudinal study, significant declines in time spent outside for both boys and girls were observed (Cleland et al., 2010). This can suggest that individual and social factors, along with activity preferences (e.g. video games) for children growing up in the new millennium can influence their increasing disconnect with nature (Cleland et al., 2010). Large institutions, such as schools, play a crucial role in this change. Thousands of dollars have been invested into educational technology, deterring the opportunity to be educated in natural environments, such as the outdoors (Louv, 2012). National parks have also been impacted by this disconnect. Visits per capita to nature-based parks have dropped 19% from 1997 to 2010 (Stevens, More, & Markowski-Lindsay, 2014). In Canada, national park visitations have decreased from 16.83 million to 15.9 million people from 2017/18 to 2018/19 (Lock, 2019).

Declining trends in outdoor activities have also been noted in older cohorts. From 1986 to 2015, activities (excluding use of technology) performed by women aged sixty-five and older, have decreased from 77% to 69% (Arriagada, 2018). In addition, time spent performing activities

has decreased by 35 and 40 minutes for men and women, respectively (Arriagada, 2018). Although activity can occur indoors or outdoors, declines specifically associated with physical activity performed outside have been found for the older cohort (Eronen et al, 2014; Fujita, Fujiwara, Chaves, Motohashi, & Shinkai, 2006). This declining trend in activities pursued in nature has been highly associated with increased physical disability related to the aging process (Eronen et al., 2014; Fujita et al., 2006). Statistics Canada stated that 42.5% of Canadians over the age of 75 years-old reported a disability (2012). By 2031, there will be approximately 9.6 million seniors (aged over 65 years-old) in Canada, representing about 23% of the population (Arriagada, 2018). As the demographic shifts towards an elderly population it can be suggested that physical disability will increase as well, causing an even greater deficit of time spent outside for Canadians. Studying interventions that can promote engagement in outdoor activity may offer preventative measures towards age-related increases in physical and cognitive disability (Fujita et al., 2006; Ottosson & Grahn, 2005).

1.2 Concepts of Interest

1.2.1 Nature. Depriving humans from nature may have negative consequences (Kahn, Severson, & Ruckert, 2009), however, it is important to classify what nature is and where it can be found. Although there are many interchangeable terms used for nature, they can all be defined as processes of non-human origin (Hartig, Mitchell, de Vries, & Frumkin, 2014). Based on its Latin derivative *natura*, it resembles the "course of things; natural character, constitution, and quality" (Nature, n.d.). Nature can usually be found in an out-of-doors setting comprised of green or blue space with minimal man-made landscapes (David Suzuki Foundation [DSF], 2020). In recent years, virtual nature (e.g. video or photographs) has commonly been referred to as a natural experience (Hartig et al, 2014). For the purpose of this thesis, a combination of

definitions will be used to describe nature. Experiencing nature will be defined as the observation of or immersion in an outdoor green or blue setting comprised of non-human components such as trees or other living creatures.

1.2.2 Nature Relatedness. A human's connection to nature can be represented by the amount of nature relatedness that individual possesses (Nisbet, Zelenski, & Murphy, 2009). Nature relatedness measures how one situates themselves in the living world, both physically and cognitively (Nisbet, Zelenski, & Murphy, 2011). It involves pleasant experiences, allowing the individual to feel at ease with their surrounding environment, as well as act to conserve and protect it (Baxter, & Pelletier, 2019).

1.2.3 One Nature Challenge. Formerly known as the 30X30 Challenge, the David Suzuki's One Nature Challenge (ONC) improved nature relatedness for thousands of Canadians (Nisbet, 2015). The challenge was created by the David Suzuki Foundation to promote time in nature by encouraging individuals to spend a minimum of thirty-minutes for thirty consecutive days (DSF, 2020).

1.2.4 **Nature Contact.** Time spent in nature is considered nature contact (Baxter, & Pelletier, 2019). Contact with nature can be direct (e.g. hiking in the woods) or indirect (e.g. virtual or looking out a window) (Brooks, Ottley, Arbuthnott, & Sevigny, 2017). Although how one experiences nature can be subjective to the individual, the amount of time they spend in nature can be objectively determined (Hartig et al., 2014).

1.2.5 Quality of Life. The World Health Organization (WHO) defines quality of life as not just the absence of disease, but the overall perceived well-being of an individual. It embodies a satisfaction of life comprised of culture and value systems regarding relationship to their environment, physical health, personal beliefs, and psychological and social states (WHO, 2020).

For vulnerable populations such as individuals living with cancer, interdisciplinary care consists of improving on functional, psychological, social, and spiritual wellness in order to enhance quality of life (Hewitt et al., 2006). For this thesis, the evaluation of quality of life involved the same wellness components defined by Hewitt and colleagues. More specifically for psychological well-being, measurements comprised of fatigue, sense of coherence, and subjective physical, mental, and functional health.

1.3 Problem of Interest

Declining trends in nature contact suggest that each generation is experiencing a shift away from the true benefits that connecting to nature can offer (Kahn et al., 2009). As a result, individuals are deprived of experiences that could optimize human well-being (Baxter, & Pelletier, 2019; Gullone, 2000). Overall, nature can have a substantial impact on population health by combatting the increased prevalence of health issues associated with aging (Ottosson, & Grahn, 2005) and urbanization (Moore, Gould, & Keary, 2003). Determining an optimal dosage (e.g. 30 minutes a day) for nature may offer an effective solution for confronting these health-related problems experienced in modern society (Rogerson et al., 2020; Shanahan et al., 2016).

Associated with an aging demographic, increased prevalence of chronic diseases such as cancer contribute to the population's debilitating health (Canadian Cancer Society, 2015). Although exposure to nature has been correlated with improvements in health and well-being (Hartig et al., 2014), there is limited literature on the effects of nature for individuals living with cancer (Ray & Jakubec, 2014).

WE-Can is a wellness and exercise program for individuals living with cancer, offered by Thunder Bay Regional Health Sciences Centre (TBRHSC) and supporting community partners

in Northwestern Ontario. The program offers individuals who are in active cancer treatment or up to five-years post-cancer treatment, an opportunity to participate in two hours of a group-based exercise per week, for ten-weeks. Although psychological and physiological benefits have been observed in previous data collected throughout the program (Larocque, Gillis, Newhouse, & Paterson, 2016), the spirituality dimension of the psycho-oncological care of individuals with cancer (Hewitt, Greenfield, & Stovall, 2006) has yet to be evaluated in the WE-Can program. Nature-based therapy has been found to increase spiritual well-being and other health-related outcomes for individuals living with cancer (Nakau et al., 2013). Thus, for the cancer population, improvements in psychological, physiological, and social health have been evident for both an exercise program (Larocque et al., 2016) and nature intervention (Hartig et al., 2014). It would bring great value to individuals in the program if a nature-based experience could enhance spirituality and other health-related outcomes. If successful, this could be implemented before, during, or after WE-Can. In addition to the exercise portion of the program, nature's ubiquity may optimize cancer survivors' quality of life by improving and/or managing their current state of health (Barton, & Pretty, 2010).

1.4 Purpose Statement and Research Questions

The purpose of this exploratory study is to determine if there is any additional gain in health-related outcomes when incorporating a nature intervention into a ten-week group exercise and wellness program for individuals living with cancer.

Additional questions will be addressed specifically for the experimental group to elucidate how the detected changes for the participants, such as spiritual well-being, were attributed by the nature intervention. The following questions will be explored:

- Is there any change in nature relatedness and/or spirituality following the completion of the ONC when the first six weeks of WE-Can is controlled for?
- Is there any variation in nature contact between the different seasons (weather conditions) in which the nature intervention is implemented and how is that related to the amount of health-related outcomes detected?
- How did experiences in nature differ for participants completing the ONC? How did they perceive to benefit from nature compared to the WE-Can program?

1.5 Hypotheses

It was hypothesized that there would be a positive relationship between nature contact and nature relatedness. Also, nature relatedness would improve during the latter half of WE-Can, when the ONC was implemented. Nisbet (2015) discovered that nature relatedness was positively correlated to time spent experiencing nature. Similar to nature relatedness, spirituality fosters a desire to interact with the natural world and enhances one's gratification with life (Kellert, 1993). It was hypothesized that spirituality for participants partaking in the ONC would increase after completing the challenge as well.

A connection with nature was also found to improve psychological well-being (Nisbet, Zelenski, & Murphy, 2011) and encourage engagement in exercising outdoors (Flowers, Freeman, & Gladwell, 2016; Pyky et al., 2019). Through this rationale, it was hypothesized that greater improvements in health-related outcomes would be detected amongst individuals participating in the WE-Can program and ONC compared to individuals who only participated in the WE-Can program.

According to Kimura and colleagues, when administering a nature intervention at different times throughout a calendar year, longer daylight hours evident throughout the summer season

increased engagement with the outdoor environment and overall time spent outside (Kimura, Kobayashi, Nakayama, & Kakihana, 2015). Through qualitative inquiry, it was hypothesized that nature experiences would differ between the individuals who completed the ONC in the summer compared to the winter months. Ultimately, individuals who completed the ONC in the summer would attain higher nature contact and perceive a greater benefit from nature compared to the individuals who completed the ONC in the winter.

Finally, due to the abundance of empirical studies on the psychological enhancements gained from a nature experience (i.e. Hurly, & Walker, 2019), it was hypothesized that participants would perceive a greater psychological benefit from the ONC in addition to the physiological and psychosocial gain from the WE-Can program.

1.6 Theoretical Framework

The guiding frameworks to determine the effects of nature are the biophilia hypothesis and attention restoration theory. In 1984, Edward Wilson conceptualized that ingrained in the roots of our biology, humans have an intrinsic response to focus on life and life-like processes. More specifically, humans could instinctually extract and process living biota detected within the environment (Kellert, 1993; Wilson, 1984). It is not "strictly the love of living nature, but more accurately the whole range of innately channeled human responses to living nature" (Soulé, 1993, p. 441). And through this relationship, the natural world can encourage emotional, intellectual, aesthetic, and spiritual development (Kellert, 1993).

The attention restoration theory reinforces the inherent biophilic responses. It posits that a decrease in attentional strain brought about by the soft fascination (i.e. interest-driven) is affiliated with a nature-based experience (Kaplan, & Kaplan, 1989). This autonomic response can be better explained through attentional fascination (Kaplan, & Kaplan, 1989). Kaplan and

Kaplan (1989) state that there are two types of attention: directed attention that is used in executive functions, when fixated on a specific task; and involuntary attention that is effortlessly demanding. Increased risk of fatigue can result when directed attention is stimulated, especially when a stress-factor is involved (Kaplan, 1995). Experiencing nature calls on involuntary attention, ultimately mitigating stress and fatigue when engaged in the natural world (Kaplan, & Kaplan, 1989).

1.7 Importance of the Study

As the population shifts towards an older demographic, it is important that chronic disease prevention and management tactics are considered (Ottosson & Grahn, 2005). A large array of literature has indicated that nature interventions are widely accessible and cost-effective for improving human well-being (McEwan, Richardson, Sheffield, Ferguson, & Brindley, 2019). Although a group-based exercise program (i.e. WE-Can) successfully improved physical, psychological, and social health (Larocque et al., 2016), a nature intervention may enhance spirituality (Nakau et al., 2013; Wang, 2013) as well as additionally increase the psychological, physical, and social (Hartig et al., 2014) gains experienced in the WE-Can program. Living with a chronic disease such as cancer is life-altering (Hewitt et al., 2006). With increasing occurrence in society (Canadian Cancer Society, 2015), and the lack of nature interventions explored in healthcare settings (Korszun et al., 2014), a nature challenge may optimize health and well-being for individuals living with cancer. In addition, experiencing nature could be transferable, allowing individuals to adhere to increased nature contact and continue to benefit from its exposure to manage and prevent other health-related issues prevalent with age. The study's purpose has yet to be explored to the researcher's knowledge, allowing this exploratory investigation to provide future directions for research.

2.0 Review of the Literature

For this study health-related outcomes to assess quality of life were explored when a nature intervention was administered in conjunction with an exercise and wellness program for individuals living with cancer. There is evidence of nature's impact on health and well-being (Hartig et al., 2014), however, gaps regarding nature's impact on cancer in the literature have been found.

2.1 Nature in Research

Humans are a product of nature and their reaction to nature; both positive and negative responses are derived in part by genetic predisposition (Ulrich, 1993). In the world of academia, challenges defining 'nature' have arisen due to the large expansion of literature and the varying context in which it has been used (Hartig et al., 2014). Nature can be considered artificial or natural; many terms such as urban environment, natural environment, and greenspace are involved in its wide variety of references (Hartig et al., 2014). Vague terms are often used to capture the context of nature, for example, interacting with the natural worlds, being exposed to virtual nature (e.g. photographs), and/or enjoying natural elements in an indoor environment (e.g. indoor plants) (Capaldi, Passmore, Nisbet, Zelenski, & Dopko, 2015). Nature is ubiquitous according to the David Suzuki Foundation (2020). Time spent in nature can involve experiencing the outdoors or interacting with living things (DSF, 2020). Engagement in activities such as going for a walk in a local park (direct) (Kuo, 2015; Nisbet, 2015) or spending time watching the birds out of a window (indirect) (Ulrich,1984) can qualify as experiencing nature. As previously stated, for the scope of this study, experiencing nature will be defined as interacting either directly or indirectly, with a green or blue, earthy, textured environment comprised of biological entities.

2.2 Fundamental Theories of Natural Environments

The modern human has only existed for approximately two-hundred thousand years, with civilization emerging around six thousand years ago and industrialization around two-hundred years ago (Howell, 2015). It is apparent that the "brain evolved in a biocentric world, not a machine-regulated world" (Ulrich, 1993, p.32). Dating back to ancestral behaviours, hunters and gatherers relied on crucial elements from the environment such as food, water, and shelter for survival (Heerwagen, & Orians, 1993). This has been and continues to be an instrumental part of how modern humans experience the environment (Wilson, 1984). When analyzing the aesthetics of a tree, people were more drawn to trees with a wider canopy and trees that were flowering (Heerwagen, & Orians, 1993). The wider canopy offers more shelter, while the flowering is a nutrient-rich plant that can be consumed as food (Heerwagen, & Orians, 1993). The responses to aesthetically pleasing trees are products of evolution; biological relics that helped ancestral humans survive and proliferate (Ulrich, 1993). Proponents such as these findings would view it as essential for humans to naturally respond in a positive manner to the benefits offered by nature.

In addition, biophilic connections exist regardless of the diversity of landscapes (Rosley, Lamit, & Rahman, 2013). Whether based on intrinsic human desires to interact for pleasure, or necessity to survive, exposure to natural environments elicited similar responses in attentional restoration (Rosley et al., 2013). These responses can improve performance through enhancement of cognitive and emotional well-being in a demanding occupation (Gill, Packer, & Ballantyne, 2018). Even when partaking in pleasurable activities such as a nature walk, restoration was apparent as self-reported attentiveness decreased substantially in both natural and urban environments (Hartig, Evans, Jamner, Davis, & Garling, 2003). However, through use of

electromyography, stimulation of attentional processing was significantly less in more natural environments compared to urban (Laumann, Garling, & Stormark, 2003; Ulrich et al., 1991). More specifically, immersion in an environment enriched with biophilic qualities was more restoratively appealing for individuals who had a stronger connection to nature (Berto, Barbiero, Barbiero, & Senes, 2018). Nature can decrease physiological mobilization (e.g. blood pressure and stress hormones) and sympathetic nervous system activity, enhancing cognitive performance and well-being (Ulrich, 1993). Because of this partial genetic-derivative from a biocentric world, it holds great certainty that positive responses may result from contact with nature.

2.3 Nature Relatedness and Nature Contact

It is important to understand the connection one has with the environment when analyzing the physiological and psychological effects of exposure to nature (Tam, 2013). As mentioned, nature relatedness refers to the understanding of the interconnectedness that exists between humans and the natural world (Nisbet, et al., 2009). It involves a deep admiration for all aspects of nature, not just for its aesthetic appeal (Nisbet et al., 2009). Ultimately, it encapsulates the relationship one has with nature (Baxter, & Pelletier, 2019). Nature relatedness is comprised of the affective, cognitive, and physical aspects in which a relationship with nature can flourish (Nisbet et al., 2009; Nisbet et al., 2011). Hurly and Walker (2019) proposed that compelling evidence for nature relatedness and quality of life suggest that nature relatedness should be considered a basic psychological need for humans. When analyzed in an urban setting, individuals that had a high nature relatedness reported greater mental health, social cohesion, and physical behaviour (Cox, Shanahan, Hudson, Fuller, & Gaston, 2018). A strong connection with nature has been highly correlated with positive affect such as, vitality, autonomy, personal growth, purpose in life, happiness and psychological well-being (Dean et al., 2018; Nisbet et al.,

2011; Zelenski, & Nisbet, 2014). It has also been associated with decreased ill health and increases in pro-environmental behaviours (e.g. environmental sustainability) (Nisbet, & Zelenski, 2013; Richardson, Cormack, McRobert, & Underhill, 2016). For children living in rural Northwestern Ontario, their definitions and perspectives on nature were comprised of more than just its materialistic elements (Tillmann, Button, Coen, & Gilliand, 2019). Instead, they defined nature as not just one favoured place, but a whole community that can accessibly utilize nature to improve health for all (Tillmann et al., 2019). Individuals who frequently visit areas of greenspace for longer durations of time are more likely to embody a greater nature relatedness (Cox et al., 2018).

Nature contact is simply the time spent experiencing nature (Baxter, & Pelletier, 2019). This involvement can successfully elicit the feeling of being connected to a natural environment (Baxter, & Pelletier, 2019; Nisbet et al., 2009). In a study conducted by Nisbet (2015), frequent nature contact was directly correlated with increased nature relatedness. In congruence with nature relatedness, repetitive contact with nature can reinforce feelings of security, sense of belonging for individuals, and environmentally sustainable actions to preserve the frequently visited green space (Baxter, & Pelletier, 2019). Houge, Mackenzie, and Hodge (2020) conceptualized that nature contact independently contributed to subjective well-being in outdoor recreation. Eudemonic well-being (i.e. essence of functioning well; interchangeably known as autonomy and vitality) significantly predicted time spent in nature after completing a nature intervention (Tarrant, & Turnbull, 2019). Furthermore, common socio-demographic traits associated with increased nature contact comprised of females, older adults, retirees, and empty nesters (i.e. individuals that did not live with children) (Dean et al., 2018). Considering retired individuals have greater probability of experiencing nature, nature relatedness and nature contact

can provide a potential framework to improve the known cognitive deficits that occur with the aging process (Baxter, & Pelletier, 2019). For the purpose of this thesis and its exploratory nature, it is imperative that nature relatedness and nature contact are considered.

2.4 Psychological Benefits of Nature

The various biological entities found in urban and natural environments can strongly influence the amount of nature contact, and when frequent, can optimize psychological health (Cox et al., 2018; Jiang, Larsen, & Sullivan, 2014). Findings from a systematic review of literature confirmed that visits to greenspace were strongly associated with mental well-being, such as hedonic well-being (Houlden, Weich, de Alburquerque, Jarvis, & Rees, 2018). Hedonic well-being is also interchangeably known as emotional well-being, happiness, subjective well-being, and positive affect (Sirgy, 2012). Positive affect was measured in a group of students that were asked to perform as many nature-related activities as they could in a period of two weeks (Passmore, & Howell, 2014). When compared to students in a control group, larger increases in hedonic and eudemonic well-being resulted for the students in the nature group (Passmore, & Howell, 2014). Even when individuals were asked to walk outside for a minimum of 15 minutes in an environment with a density of approximately 40% green coverage, fewer negative emotions such as anxiety were reported (Han, 2017). Decreased depression has also been correlated with increased nature contact (Korpela, Stengard, & Jussila, 2016).

These findings are evident in older adults (Cox et al., 2018). When time spent outdoors was objectively measured, time in nature was directly correlated with fewer symptoms of depression (Harada et al., 2017). In a similar study, increased nature contact had fewer incidences of fear of falling, depressive symptoms, and increased autonomy for the elderly (Kerr et al, 2012). For older adults, exercise equipment located in green spaces encouraged social

cohesion and improved moods (Chow, 2013). From these findings, it is evident that engaging in simple nature activities close to home for thirty minutes or less may elicit positive psychological responses for aging individuals (Cox et al., 2018; Han, 2017; Korpela et al., 2016).

Although it is clear that nature can improve psychological health, well-being is comprised of several components (Hewitt et al., 2006). These include: spirituality; quality of life; sense of coherence; fatigue (emotional and cognitive); and subjective health and well-being (Hewitt et al., 2006). These components capture the goals established within medical care, offering treatment to preserve or improve bodily functioning (Ware, & Sherbourne, 1992). Nature's empirical benefits for psychological health, may optimize the goals of medical practice by acting as an adjunct or alternative therapy (Barton, & Pretty, 2010).

2.4.1 Spirituality. Therapies comprised of spiritual practices in the natural environment can foster inner peace (Schulz, 2019). Humans strive to find a purpose in life; spirituality uses faith to hold greater value to this world (Canadian Cancer Society, 2019). Religion is a term often used interchangeably with spirituality, however is distinctly different (Canadian Cancer Society, 2019; Taylor, 2001). Religion is institutionalized and generalizable whereas spirituality represents one's deepest moral values (Taylor, 2001). Nature-based spirituality renders one's sensed connections, embeddedness, and purpose for the living world (Taylor, 2001). Intrinsic values and spiritual beliefs hold significant importance for individuals that frequently interact with nature (Winter, 2007). Biophilia states that the innate tendency to interact with natural environments involves a human desire for spiritual meaning and satisfaction with life (Kellert, 1993). In a systematic review, four qualitative studies investigating spirituality, disability, and natural environments were analyzed (Saitta, Devan, Boland, & Perry, 2019). Empowerment, new perspective, invigoration and renewal were spiritually derived elements perceived by individuals

with disabilities who regularly immersed themselves in local parks (Saitta et al., 2019). In another study evaluating individuals with disabilities, nature-based recreation permitted leisure-spiritual coping to alleviate stress (Heintzman, 2014). Whether it be disability, disease, or a traumatic life experience, exploring nature away from home can help individuals cope with adverse health complications and stressful events that may be experienced (van den Berg, Maas, Verheij, & Groenewegan, 2010). Both engaging in religious or nonreligious rituals when seeking natural spaces, patients in palliative care used their spiritual intentions to connect with something greater and remain resilient to consequences experienced with their current state of health (Warmenhoven et al., 2016). Furthermore, patients in an Australian hospital that had views of the natural world felt a greater sense of belonging and desire to return (Gardner, Tan, & Rumbold, 2020). An intimate relationship with the living earth reinforces a spiritual comradeship and transformative power to help foster self-realization and faith in one's abilities (Taylor, 2001).

2.4.2 Quality of Life and Sense of Coherence. Challenging the process of understanding the natural world, Antonovsky (1987) expressed that sense of coherence is a vital essence for enhancing quality of life. Sense of coherence encapsulates how an individual can utilize their capacities to overcome adversity and manage and improve on their health (Antonovsky, 1987). When a traumatic health-related incident is endured, nature can offer support in overcoming these adverse experiences (Ulrich, 1984). Improving the quality of life for an individual is not solely looked at as physiological development; both emotional and cognitive factors take precedence as well (Foo, 2016). The characteristics of the natural environment can directly and indirectly influence well-being, including a sense of coherence (Weimann, Bjork, & Hakansson, 2019). Similar to the definition of nature for children living in Northwestern Ontario (Tillmann et al., 2018), Weimann and colleagues also identified that experiencing nature created

a sense of life and interconnectedness within the environment. As a result, individuals with stronger connections to nature portrayed higher sense of coherence (Weimann et al., 2019). Active repeated engagement in external resources such as visits to neighbourhood parks can strengthen the sense of coherence and strongly impact internal reflection of life satisfaction (Maass, Lindstrom, & Lillefjell, 2017).

Time spent in the natural environment can lead to a "promising path to flourishing in life," emphasizing the impact nature can have on determining how an individual perceives their quality of life (Capaldi et al., 2015, p.9). Beginning with the early years of development, larger masses of green space with a greater number of forests in urban neighbourhoods was positively associated with quality of life in Hispanic children (Kim, Lee, & Sohn, 2016). Throughout the life-course, enhanced quality of life was also evident for older adults who were frequently immersed in nature (Cox et al., 2018). Physical activity was not identified as a mediating factor for the increased psychological well-being of older adults (Rantakokko, Keskinen, Kokko & Portegijs, 2018). Instead, green infrastructure and diversity of natural elements had a larger influence on pleasure and well-being (Rantakokko et al., 2018). Frequent engagement in highly diversified nature was associated with enhanced quality of life, but not with depression, when physical activity, chronic conditions and cognitive functioning were controlled for (Rantakokko et al., 2018). Nature's attributes influence attachment to a place and as a result, foster a greater connection to nature and quality of life (Basu, Hashimoto, & Dasgupta, 2020). It is apparent that engagement with the natural environment may improve one of the major constructs for psychological health.

2.4.3 Fatigue. Another major construct of psychological health is emotional and cognitive fatigue (Hewitt et al., 2006). A conceptualized outcome for the attention restoration

theory, fatigue can result from stress- or pleasure-related attentional demands, impacting psychological health (Kaplan, & Kaplan, 1989). In a study where stress was provoked and controlled for in a laboratory setting, exposure to virtual nature elicited immediate stress-recovery responses following exposure (Jiang et al., 2014). Levels of stress can be improved, as anxiety and exhaustion were found to be less prevalent after being immersed in nature (Kaplan & Kaplan, 1989; Korpela et al., 2016). When looking at the effect of nature on somatic trait anxiety and autonomy in regular exercisers, a stronger connection to nature was found to predict lower levels of anxiety and increased autonomy (Lawton, Byrmer, Clough, & Denovan, 2017). Physical activity has also been found to reduce fatigue for individuals living with various types of cancer (Kangas, Bovbjerg, & Montgomery, 2008; McMillan, & Newhouse, 2011). Cancer-related fatigue is a common symptom from a cancer diagnosis where physical, psychological, and social health are negatively affected (Holley, 2000). Along with decreased cancer-related fatigue associated with exercise (Kangas et al., 2008; McMillan, & Newhouse, 2011), engaging in activities over twelve weeks in a natural environment resulted in significantly less cancer-related fatigue for individuals as well (Nakau et al., 2013).

Connections with nature can also be measured in individuals with anxiety disorders. Poulsen, Stigsdotter, Djernis, and Sidenius (2016) observed six male veterans with post-traumatic stress disorder in a nature therapy garden for ten-weeks and discovered that the garden improved social cohesion and restoration for the veterans. It was suggested that reduced stress was linked to increased autonomic responses in nature, ultimately decreasing attentional fatigue (Poulsen et al., 2016). Nature was also found to boost autonomy for performing nature-based activities and continued to be used by veterans to relieve symptoms of their disorder once the therapy program had ceased (Poulsen et al., 2016). Even for individuals who suffered from post-

concussion syndrome, eight weeks of nature-based therapy significantly reduced their mental fatigue (Corazon, Olsen, & Sidenius, 2019). These results were congruent with a study that revealed people with high levels of stress preferred resting in outdoor environments, surrounded by 'species-rich' nature, such as a therapy garden (Poulsen et al., 2016; Stigsdotter, & Grahn, 2011). For individuals living with dementia, by making available a window that looks out onto natural landscapes, autonomic multisensory stimulation decreased fatigue and allowed individuals to restore their cognitive functioning (Bossen, 2010). Regardless of disease or disorder, it is obvious that nature can have a substantial impact when used as an intervention for improving mental health (Barton, & Pretty, 2010).

2.4.4 Subjective Health and Well-Being. An individual's predicted status of general health can inform one's perceived psychological well-being (Ware, & Sherbourne, 1992). When administering a clinical intervention, the patient is generally the best judge of determining whether the predicted outcomes have been achieved (Ware, & Sherbourne, 1992). Time spent outside, outdoor activities, environmentally driven social and cultural events, sense of place, and trust in environmental governance were stakeholder-identified indicators for perceptions of well-being in a community (Biedenweg, Scott, & Scott, 2017). These factors are indicative that accessible nature in an environment can optimize general health for community dwellers (Biedenweg et al., 2017; Moore et al., 2003).

In today's society, virtual applications can also be used to encourage engagement with nature. A smartphone app developed to promote recognition of urban nature improved well-being for adults with and without mental difficulties after a one-month follow-up (McEwan et al., 2019). Six outdoor exercise study interventions were also investigated with a range of participants that were characterized by mental health disorders or multiple challenges associated

with everyday life (Rogerson et al., 2020). Using a meta-analysis approach, well-being statistically improved for all interventions with a moderate effect size, however, a dose-response curve indicated that any longer than a twelve-week intervention may maintain, but not necessarily improve well-being (Rogerson et al., 2020). Furthermore, although significance was not met, the oldest age category (i.e. over 70 years old) was observed to have the greatest improvement on well-being (Rogerson et al., 2020).

For older adults, nature contact is an everyday communal experience (Finlay, Franke, McKay, & Sims-Gould, 2015). In a qualitative inquiry involving older adults, various landscapes consisting of green and blue spaces enhanced their perceived health and well-being (Finlay et al., 2015). In a systematic review conducted by Houlden et al. (2018), subjective well-being and affiliations with nature were evaluated. Among three cross-sectional studies, a higher rating of quality or perceived greenness around their home was directly associated with better mental health (Houlden et al., 2018). In another cross-sectional study, slightly higher scores for vitality were found for women who frequently associated with biologically-rich natural environments (Houlden et al., 2018). Finally, type of environment (urban versus natural) resulted in literature comprised of mixed findings for perceived general health (Houlden et al., 2018). Although results seem to be contradictory, some confidence can be held that increased diversity within a green environment might improve subjective well-being, however, sounder methodological approaches are warranted (Houlden et al., 2018).

2.5 Physiological Benefits of Nature

Although a plethora of evidence can be found for nature and psychological benefits, physiological benefits exist as well (Shanahan et al., 2016). Attributed to healthy immune functioning, airborne microbiota is largely produced in natural landscapes (Rook, 2013).

Evidence of decreasing biodiversity (thus, lack of airborne microbiota) (Rook, 2013) due to built-up land could be linked to increasing prevalence of chronic diseases identified in developed countries (von Hertzen, Hanski, & Haahtela, 2011). Stress is also a chronic condition (Kondo, Jacoby, & South, 2018). To fully alleviate stress-related experiences in natural environments, physiological stress must be considered (Kondo et al., 2018). Numerous empirical studies reported improved stress-related outcomes through reductions of cortisol concentrations detected immediately following immersion in nature (Gidlow et al., 2016; Park, Tsunetsugu, Kasetani, Kagawa, & Miyazaki, 2009; Ochiai et al., 2015; Rodiek, 2002; van den Berg, & Custers, 2011). Moreover, walking in nature elicited greater effect than viewing nature for cortisol reduction (Olafsdottir et al., 2020).

Sleep quality is another physiological stress factor (Morita, Imai, Okawa, Miyaura, & Miyazaki, 2011). It was discovered that preceding an experimental exposure to forests, use of a wrist actigraph measured improvements in sleep time, depth, and quality for participants (Morita et al., 2011). Mixed findings for heart rate exist, however, some studies conveyed significant reductions in heart rate following exposure to nature (Kondo et al., 2018). Along with reduction of stress, physical activity is also attributed to nature. Natural environments can increase physical activity levels due to lower levels of perceived exertion while out in nature (Gladwell, Brown, Wood, Sandercock, & Barton, 2013).

There is a strong linear association between physical activity and status of health (Warburton, Nicol, & Bredin, 2006). Natural environments can not only be used in regulation of stress, but also a prevention tactic for several chronic diseases (Barton, & Pretty, 2010). For older adults prone to chronic illnesses, increased physical activity can contribute to functional fitness and independence for daily living activities (Jones, & Rikili, 2002). More specifically,

aerobic capacity, strength, and upper and lower limb mobility contribute to functional fitness (Jones, & Rikili, 2002). In addition, hardening of arterial walls with age can increase risk of atherosclerosis and underlying issues with blood pressure regulation, contributing to various diseases such as cardiovascular health (McGill, & Strong, 1968).

2.5.1 Aerobic Fitness. Natural environments have been found to encourage physical activity (Gladwell et al., 2013). Improvements in health outcomes such as cardiovascular fitness detected for indoor exercise was similar to outcomes found in green exercise (Glover, & Polley, 2019). Green exercise is commonly expressed as exercise that takes place in a natural environment (Flowers, Freeman, & Gladwell, 2018). Calogiuri and Elliott (2017) reported that opportunity to experience the natural world was the second highest motivational factor for engagement in outdoor physical activity for Norwegian adults. Other predictors such as perception of green space and connection with nature have also been reported motives for frequent engagement in green exercise (Flowers et al., 2016; Pyky et al., 2019). Matthew, Browning and Olvera (2020) also predicted that activities such as gardening could have positive affect on cardiovascular health.

It is obvious that engaging in outdoor activities is appealing, but evidence for aerobic gain in natural versus synthetic environments is contradictory (Han, 2017). Studies investigating the effects of running in a natural environment have failed to achieve significant difference of results when compared to indoor environments (Han, 2017; Turner, & Stevinson, 2017). However, conflicting findings are attributed to poor methodology and heterogeneity of outcome measures, warranting well-designed research that uses suitable participants and repeated measures (Coon, Boddy, Stein, Whear, Barton, & Depledge, 2011). Instead, it has been recognized that walking in nature posits several physiological benefits (Rapp, Mikolaizak,

Rothenbacher, Denkinger & Klenk, 2018). Exercising outdoors improved aerobic fitness such as cardiovascular endurance (Johnson, Ivarsson, Parker, Andersen, & Svetoft, 2019). Following a six-week outdoor resistance training program, number of steps per day increased by 4% and time to exhaustion increased by 3.58% for middle-aged adults (Johnson et al., 2019). For older adults, time spent outdoors was also associated with number of steps taken (i.e. walking duration) (Rapp et al., 2018). Similar to Karmin, Beyer, and Lang's (2016) results, the longer duration of time spent outside of the house for older individuals (over 80 years-old) did not predict increased physical activity due to potential accessibility and mobility limitations experienced with age. However, for participants who were younger than 80 years-old, more time out of home was directly associated with increased walking duration, more specifically less than 100 minutes of time spent outside was seen to be the greatest predictor for engagement in walking-related activities (Rapp et al., 2018). Number of steps per day increased in the summer, when more daylight exposure occurred compared to winter months with less daylight exposure (Kimura et al., 2015). Along with walking duration, body fat percentage decreased significantly during the summer months compared to winter months (Kimura et al., 2015). Weather was also indicated a reason for adherence to green exercise in recreational, competitive, and outdoor adventure sport populations (Fraser, Munoz, & MacRury, 2019). In a mixed-methods study, extreme weather conditions were conveyed to impact how the environment was perceived to limit their physical activity levels and also how they felt while engaging in activities outdoors (Fraser et al., 2019).

However, there is a gap in literature measuring green exercise and sub-maximal oxygen uptake (Coon et al., 2011). With increased sub-maximal aerobic fitness and weight-loss significantly detected in administered walking programs (Murphy, Nevill, Mutagh, & Holder, 2007), walking outside should elicit similar results. However, future research is warranted to

further quantify acute bouts of aerobic fitness following exposure to nature (Coon et al., 2011; Rogerson et al., 2020).

2.5.2 Upper and Lower Body Strength. In concurrence with findings for aerobic fitness, limited research has investigated the effects of green exercise on muscular strength. Muscular strength is a component of functional fitness, addressing the ability to independently perform personal care as individuals age (Jones, & Rikili, 2002). In addition, the amount of strength an individual has can be a valuable indicator of mortality and hospitalization with age (Legrand et al., 2016). In a study exploring the effects of surrounding green space, positive relationships between diversified vegetation, good lower limb extremity function, and engagement in physical activity was measured for elderly men (Gong, Gallacher, Palmer, & Fone, 2014). When considering nature exposure is associated with frequent engagement in physical activity, such as walking (Gladwell et al., 2013; Shanahan et al., 2016; Rapp et al., 2018), regular walking endeavours improved strength and muscle mass of the lower limbs in older adults (Kubo et al., 2008). Based on these findings, confidence can be held that increased walking duration in natural environments can be linked to increased lower limb strength and endurance. Upper limb strength also improved after engagement in nature. Maximum row increased by 15.33% for middle-aged individuals who partook in an outdoor resistance training program (Johnson et al., 2019).

Age-related decline for upper limb strength is more apparent in the elderly (Milanovic et al., 2014). Over a twenty-eight-year study, decline in handgrip strength was significantly less for individuals who lived in closer proximity to a natural environment (de Keijzer et al., 2019). Notably, although significance was found with the case analysis, further repetition of measures should be conducted to ensure reliability of the finding (de Keizer et al., 2019). Warmer weather

can also be attributed to increased handgrip strength (Kimura et al., 2015). In another longitudinal study looking at seasonal variation and physiological health, handgrip strength and steps per day were greater in warmer weather compared to colder temperatures (Kimura et al., 2015). Even a low-moderate activity such as gardening was found to significantly improve hand grip strength (Park, Shoemaker, & Haub, 2009), bicep curls (Han, Park, & Ahn, 2018), and activation in both upper and lower extremity muscles (Park et al., 2014). With an aging population, it is imperative that preventative measures towards age-related decline in muscular strength be explored (Legrand et al., 2016).

2.5.3 Upper and Lower Limb Mobility. Changes in autonomy are experienced with age-related declines of functional flexibility and mobility in the elderly (Sebastien, Despres, & Ramadier, 2011; Thapa, Gideon, Fought, Kormicki, & Ray, 1994). The surrounding environment and its infrastructure have a significant impact on the adaptations to changes in agility (Sebastien et al., 2011). Although cadence was found to increase and stride-length decrease in colder climates (Kimura et al., 2015) some positive experiences with white, snowy environments were conveyed by elderly Minessotans (Finlay, 2018). However, mobility limitations and safety concerns were still evident in winter months due to age-related decline in function (Finlay, 2018).

Increased strength can contribute to maintaining or even improving lower limb flexibility in older adults (Goncalves, Gurjao, & Gobbi, 2007). Along with lower limb flexibility, regular engagement in physical activity has also been found to increase upper limb functioning in cancer survivors (Mirandola et al., 2018). More specifically, engaging in nature-based activities such as gardening has influenced upper limb mobility. A ten-week horticultural therapy program for elders with mental health problems showed significant effects in upper and lower limb

flexibility, along with other functional abilities (Han et al., 2018). Although findings are limited, significant associations between interactions with nature and functionality warrant further investigation.

2.5.4 Blood Pressure. Continued research regarding nature's impact on physiological indicators in preventative medicine will optimize the health of today's society (Jo, Song, & Miyazaki, 2019). The aging process triggers physiological changes that increase the risk of chronic diseases associated with factors such as increased blood pressure (McGill, & Strong, 1968). Direct and indirect exposure to natural environments can influence responses in blood pressure. Diastolic blood pressure decreased for individuals when sitting in a room with a window looking out onto vegetation, while it increased for individuals sitting in a room without a view (Hartig et al., 2003). While running on a treadmill, individuals exposed to pleasant rural and urban photographs had a greater affect than pictures of unpleasant environments (Pretty, Peacock, Sellens, & Griffin, 2005). The individuals who viewed the pleasant rural photographs had the greatest mean arterial blood pressure reduction post-exercise when compared to the other groups (Pretty et al., 2005). These findings suggest that blood pressure can be positively influenced through visual sensation and complete multisensorial experiences are not always warranted to receive physiological benefits (Pretty et al., 2005). However, quantifiable changes in blood pressure after direct interactions with natural environments have been reported in literature.

Forest bathing is a therapeutic activity performed in the forests of Japan to relax and improve one's state of mind (Park, Tsunetsugu, Kasetani, Kagawa, & Miyazaki, 2010). Commonly known as *Shinrin-yoku*, a systematic literature review has presented significant findings for physiological effects of forest bathing (Park et al., 2010). The two studies that

investigated blood pressure observed significant reductions in systolic and diastolic arterial flow for both walking and viewing conditions of forest environments compared to urban (Park et al., 2010).

Kondo, Jacoby, and South (2018) conducted a meta-analysis on real-time stress responses to outdoor settings. Out of the forty-three studies reviewed, twenty-two had investigated nature's effect on blood pressure. Fourteen studies conveyed significant reductions, six found no statistical difference and two did not report differences for blood pressure variation following exposure to a green environment. Along with heart rate and self-report measures, literature that investigated blood pressure delivered the most convincing support for the effect of nature on decreased stress and improved health (Kondo et al.).

A recent study evaluating sensitivity of noise in three types of environments (urban park, urban woodland, and city centre) for middle-aged women observed that blood pressure measures were inconsistent, and no significant conclusions could be made (Ojala, Korpela, Tyrvainen, Tittanen, & Lanki, 2019). However, greater green space coverage in metropolitan areas was strongly associated with reduced risk of cardiovascular disease such as acute myocardial infraction (Seo, Choi, Kim, Kim, & Park, 2019). The literature's controversial findings for urban, however promising for rural, merit further investigation for physiological responses to nature (Ojala et al., 2019; Seo et al., 2019).

2.6 Nature Relatedness, Spiritually, and Nature

A strong relationship with nature can increase the probability of meeting weekly requirements for physical activity and visiting local green spaces (Flowers et al., 2016; Shanahan et al., 2016). The Wildlife Trusts in the UK found positive correlations between connection with nature, time spent in nature, health and happiness (Richardson et al., 2016). Individuals who

perceive greater beauty and fascination within natural environments are more likely to engage in prosocial behaviours (Zhang, Piff, Iyer, Koleva, & Keltner, 2014). Feelings of connectedness and built relationships with others are installed in our beliefs (Fox, Webster, & Casper, 2018). Spirituality can reinforce our positive emotional states (Fox et al., 2018), analogous to the effect of nature relatedness on well-being and happiness (Baxter, & Pelletier, 2018; Capaldi et al., 2015; Dean et al., 2018; Richardson et al., 2016; Zelenski, & Nisbet, 2014). Empirical findings convey that ecologically sustainable behaviours take precedence for individuals with a strong connection to nature (Obery, & Bangert, 2017; Restall, & Conrad, 2015). After increasing nature contact for one month, increases in pro-environmental behaviours were observed (Nisbet, 2015; Richardson et al., 2016). In one qualitative study reviewed, spirituality was determined a tentative moderator for engagement in environmental enhancement and conservation activities (Husk, Lovell, Cooper, Stahl-Timmins, & Garside, 2016). Holistic and spiritual wellness was represented by some aspects of the nature relatedness measure; however, a more in-depth approach on how relationships with nature enable spiritual well-being is warranted (Reese, Lewis, Myers, Wahesh, & Iverson, 2014). In addition, nature relatedness and nature contact can have substantial impact on clinical interventions, opening the door for new lines of therapy that can relieve cognitive fatigue, negative emotions and physiological stress (Barton, & Pretty, 2010; Baxter, & Pelletier, 2019). For aging individuals, understanding how connecting with nature promotes engagement in outdoor activities will inform policy makers and other stakeholders about the barriers and drivers associated with engagement in healthy lifestyles (Bammann, Drell, Lubs, & Stalling, 2018). Ultimately, alleviating healthcare costs through design parameters for such installations (Kershaw, McIntosh, Marques, & Cornwall, 2017).

2.7 Oncological Care and Nature

With an aging population, chronic diseases such as cancer will become more prevalent (Canadian Cancer Society, 2015). Globally, cancer is the second leading cause of death (WHO, 2018). Canada is ranked eleventh in the world for the age-standardised rate of cancer, having 334 per 100 000 people living with cancer (WCRF, 2018). By 2028 to 2032, the number of cancer cases will increase by approximately 79% compared to 2003 to 2007 (Canadian Cancer Society, 2015). When considering these facts, it is important to recognize the urgency for increased availability of healthcare services and programs (Denton, & Spencer, 2010). Offering individuals living with cancer a program or service to combat psychosocial and physiological factors such as distress, depression, and fatigue is warranted for future research implications (Korszun et al., 2014).

2.7.1 Psychological Benefits for Individuals Living with Cancer. One of the most fundamental discoveries involving the effect of nature on health that continues to be implemented in the design of healthcare institutions, is the use of scenic views in the patients' rooms (Ulrich, 1984). Patients who were situated in a room with a window that had a picturesque view, had shorter postoperative stays, took fewer analgesics and had more positive feedback from nurses compared to patients who had a window that looked out onto a brick wall (Ulrich, 1984). In a hospital setting, horticultural therapy was found to improve mood state for cardiac rehab patients (Wichrowski, Whiteson, Haas, Mola, & Rey, 2005). For terminal cancer patients, frequent employment of horticultural activities allowed individuals to improve life satisfaction and uplift their spirits (Wang, 2013). As well, individuals living with cancer that frequently visited an urban garden had elicited a sense of tranquility and ease and encouraged social cohesion (Spees, Joseph, Darragh, Lyons, & Wolf, 2015). Peer-group interactions encouraged by

a hiking program for individuals with cancer allowed them to grow and accept their current state of health (Harmon, 2019).

Hospitals that implemented healing gardens such as the Leichtag Family Healing Garden at Children's Hospital and Health Center in San Diego, have reported promising results such as improved clinical outcomes and staff satisfaction (Ulrich, 2002; Whitehouse et al., 2001). Nature also posed to be a hospitable support structure, offering individuals living with cancer a context that was safe, comforting and accessible (Blashke, O'Callaghan, Schofield & Salander, 2017). For adolescents, adventure therapy programs have been used to determine how exposure to natural environments can impact the health-related quality of life when living with cancer (Stevens et al., 2004). Similar to the nature-based therapy program applied to veterans with post-traumatic stress disorder (Poulsen et al., 2016), the adventure therapy program caused children with cancer to feel included and have more self-esteem when performing activities (Stevens et al., 2004).

In the Eastern world, forest therapy for individuals living with cancer also comprised of nature-based activities such as learning about trees and forest animals (Kim, & Lee, 2019). However, no significant improvement for anxiety and depression was detected in gastrointestinal tract cancer patients following a six-day pilot-study. This was attributed to a small sample size (Kim, & Lee, 2019). For older adults living with breast or lung cancer, cancer-related fatigue measures decreased, and spirituality increased after partaking in a twelve-week integrated medical approach consisting of: forest therapy; horticultural therapy; yoga meditation; and supportive group therapy (Nakau et al., 2013). Spirituality also increased in women living with breast cancer participating in dragon boat racing (Ray, & Verhoef, 2013). Improved health-related quality of life and decreased cancer-related fatigue were detected as well (Ray, &

Verhoef, 2013). Through these findings, it is obvious that interaction with natural environments can elicit a positive effect on quality of life, emotional well-being, fatigue, and spirituality (Kuo, 2015). However, further efforts need to be taken to expand upon the alternative therapies and support for those living with cancer (Harmon, 2019).

2.7.2 Physiological Benefits for Individuals Living with Cancer. There is limited quantifiable and qualitative evidence for the physiological effects of nature for individuals living with cancer. However, the few studies conducted endorse positive outcomes for improved physical health (Kuo, 2015). After four years of training in dragon boat racing, breast cancer survivors had enhanced myocardial function (Stefani, Galanti, Di Tante, Klika, & Maffulli, 2015). More specifically, the women had significantly improved their diastolic responses to physical activity (Stefani et al., 2015). Individuals living with cancer expressed that frequent horticultural activities in an urban garden improved their physical health and functionality (Spees et al., 2015). Horticultural therapy has even been found to distract individuals living with cancer, reducing the amount of physiological pain felt (Min, & Pok-Ja, 2011). If aerobic fitness, mobility, and reductions in blood pressure have been observed with healthy individuals engaging in nature-based activities such as gardening, assumptions can be made that similar physiological responses will occur for individuals living with cancer (Han et al., 2010; Park et al., 2009). Analogously, improvements in physical health can also be assumed based on populations with similar negative effects associated with cancer treatment. Coronary artery patients that walked in an urban park for thirty-minutes for seven consecutive days had a significant improvement in hemodynamic parameters such as heart rate recovery, indicating improved cardiovascular fitness (Grazuleviciene et al., 2015). Although these participants did not have cancer, increased risk of coronary artery disease is associated with several forms of cancer treatment (Yeh, & Bickford,

2009), supporting similar outcomes for the cancer population. Nature-based activities can contribute to discourse in psycho-oncology (Blashke, 2017). Experience with nature provided individuals living with cancer an accessible space to effectively relieve their clinical and personal consequences of cancer (Blashke, 2017). Although promising outcomes exist, research is limited to investigation of certain types of cancer and lack of quantified data, emphasizing the need for future investigation of nature's effect on individuals living with cancer (Ray & Jakubec, 2014).

2.7.3 Adherence Issues for Interventions. Literature for nature interventions suggest similar positive effects, as found in the general population, may exist for the morbid population, such as cancer. However, there is always a chance that the physiological and psychological changes detected immediately post-intervention may not be maintained. Spark, Reeves, Fjeldsoe, and Eakin (2013) performed a systematic review on literature regarding the maintenance outcomes for breast cancer survivors after partaking in an activity and/or dietary intervention. Out of the ten trials assessed, only four trials (40%) discovered that changed behaviour was maintained for at least 50% of the detected outcomes (Spark et al., 2013). The other six trials were not able to find any significance for maintained behaviours of breast cancer survivors (Spark et al., 2013). Another study found that maintenance was still apparent after a 12-month follow-up from an exercise intervention for cancer survivors (Stacey, Lubans, Chapman, Bisquera, & James, 2017). However, results should be interpreted with caution as only 48% (n=29) of the initial sample participated in the follow-up and measures consisted of a self-worn pedometer and self-reported surveys (Stacey et al., 2017). Although continued commitment is promising for individuals living with cancer after partaking in an exercise intervention, it may not be feasible to maintain (Spark et al., 2013; Stacey et al., 2017). Alternative therapies such as

exposure to nature may not be as life-altering, offering feasibility to maintain, or when administered in conjunction with an exercise program, may enhance the likeliness of continuing to perform healthy lifestyle behaviours learned from the intervention.

2.8 WE-Can Wellness and Exercise Program for Individuals Living with Cancer

Group-based interventions such as community exercise programs for individuals living with cancer were found to be as equally effective, if not have greater influence, than a personal training intervention on quality of life (Leach et al., 2019). Using a cancer population such as those eligible to partake in a group exercise and wellness program (i.e. WE-Can), may offer an opportunity to discover the outcomes of nature exposure in an oncological rehabilitation and prevention setting. To be eligible to partake in the program, participants must be referred by their oncologist or primary care provider, as well as cleared by program staff after physical assessments are performed (TBRHSC, 2019). The exercise program runs for a total of ten weeks, three times per year. WE-Can has a maximum of twelve participants each time the program is run, annually totalling thirty-six eligible participants (TBRHSC, 2019).

The research initiative started back in 2010 and over time, increases in psychological and physiological well-being have consistently been detected amongst all individuals regardless of age, gender, type of cancer and continuum of care (Larocque et al., 2016). When six years of collected data were analyzed, significant increases for functional fitness was observed for the WE-Can participants. Improvements in functional fitness were detected in all of the physiological measures administered consisting of: chair sit and reach; backscratch; arm curl; chair stand; six-minute walk; and handgrip strength. All of the psychological measures administered were also significantly improved over the six-year period. Reductions in fatigue (both acute and chronic), bodily pain and increases in self-reported physical functioning, vitality,

general health, social functioning, and mental health, were all statistically significant (Larocque et al.).

Further quantification of existing data for the WE-Can program could offer a respectable perspective on general trends expected for both physiological and psychological changes detected in individuals living with cancer. Considering the empirical evidence established with nature interventions in healthcare applications (Korszun et al., 2014) and the need to specifically focus on the effectiveness of care for individuals living with cancer (Ray, & Jakubec, 2014), incorporating a nature component into the existing WE-Can program may offer additional benefits.

2.9 One Nature Challenge and WE-Can

As stated previously, the nature intervention of interest was originally initiated as a national campaign by the David Suzuki Foundation (DSF; 2020) and is called the One Nature Challenge (ONC; previously known as the 30X30 Challenge). The ONC encourages individuals to get outside for a minimum of thirty-minutes, for thirty-days in a row (DSF, 2020). Participants are asked to track how many days they were exposed to nature within the thirty-day period (DSF, 2020). This challenge was determined to be the most effective tool for two reasons: 1) it's flexible structure will encourage adherence to the nature intervention in conjunction with the WE-Can program as participants can perform the criteria for the nature task on their own time; and 2) for the purpose of being an exploratory study, the independence encouraged by the ONC will advise participants' feelings regarding likes and dislikes towards the nature task. If successful, this will help develop an effective nature intervention as an adjunct therapy for the WE-Can program. As previously mentioned, experiencing nature could involve being immersed in the natural environment or viewing the outdoors through a window. This definition of nature

will be used for the ONC. To our knowledge, this nature challenge has yet to be used on a cancer population. When assessed on healthy individuals, participants reported increased nature relatedness, environmental concern, mood, and vitality after completing the thirty-day challenge (Nisbet, 2015; Richardson et al., 2016). If the ONC is effective on a healthy population, similar expectations can exist for the WE-Can participants.

3.0 Methods

3.1 Participants

A sample of eighteen participants were recruited from two sessions of the WE-Can program that took place in May 2019 (n_1=10) and October 2019 (n_2=8) after gaining ethical approval from the Thunder Bay Regional Health Sciences Research Ethics Board. The control group consisted of secondary data representing 160 previously graduated WE-Can participants. Due to the purposive sampling technique employed, inclusion criteria for participants of this intervention aligned with that of the WE-Can program. This involved individuals who were either presently in active cancer treatment or within five years post-active treatment and were referred to the program by their oncologist or primary healthcare practitioner. Participants were excluded if any contraindications to exercise (i.e. lack of mobility, abnormal responses such as increased blood pressure and heart rate) were detected by the WE-Can program staff during the initial assessment and/or at any time throughout the program, or if inclusion criteria were not met.

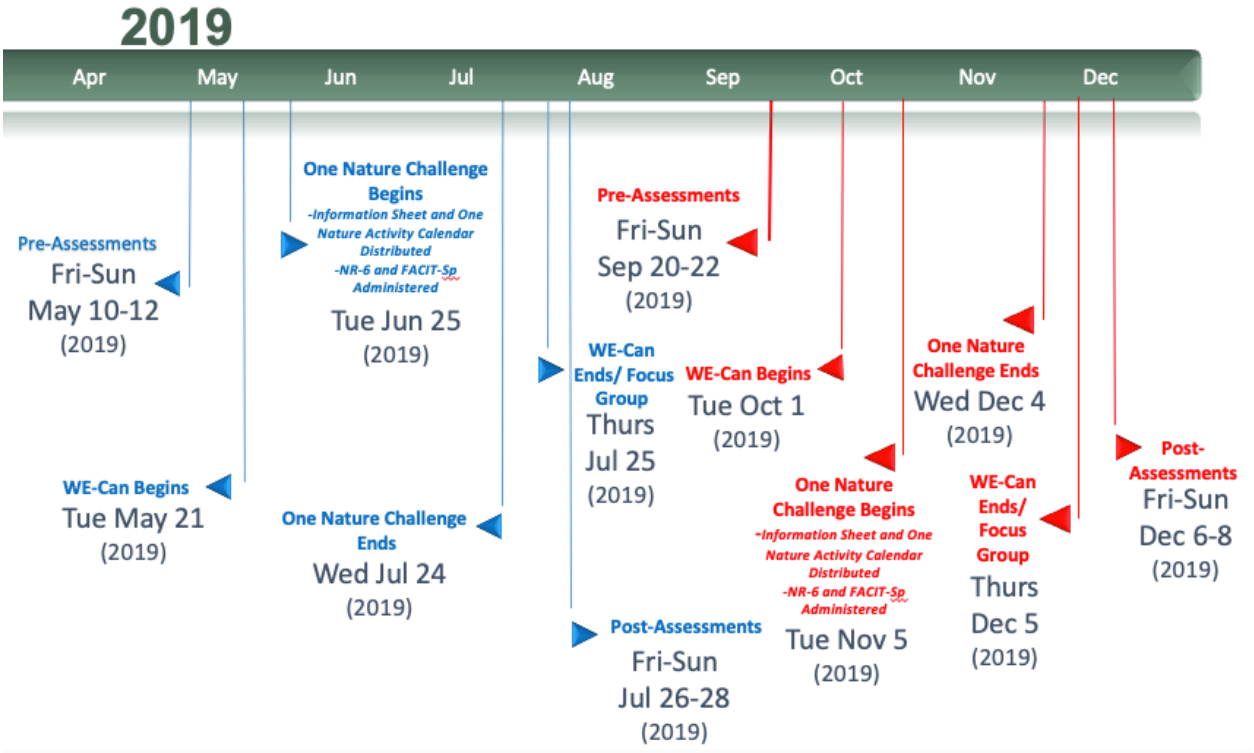
Considering the WE-Can program is already a research study of its own, the student researcher asked participants at the beginning of the program whether they would like to participate in an additional research study. A participant letter and consent form were distributed to interested participants during the introductory meeting held at the Canada Games Complex in Thunder Bay, Ontario (refer to Appendix A and Appendix B, respectively). The student researcher explained that this additional study was optional and that they could withdraw from participating in the ONC at any time throughout.

3.2 Design of the Study and One Nature Challenge Procedure

Due to ONC's lack of structure and the purposive sampling technique employed, this study took on a quasi-experimental mixed-methods design. More specifically, the mixed-methods design used was sequential explanatory, where quantitative data (pre- and post-measures: *phase one*) were prioritized first, followed by the qualitative data collection and results (interviews: *phase two*) (Creswell, Plano Clark, Gutmann, & Hanson, 2003). During this interpretation, the quantitative data was prioritized, and the qualitative results were used to complement the quantified product (Creswell et al., 2003). The integration of the two methods was investigated simultaneously in a final examination (Creswell et al., 2003).

Figure 1

Annual Timeline for Study



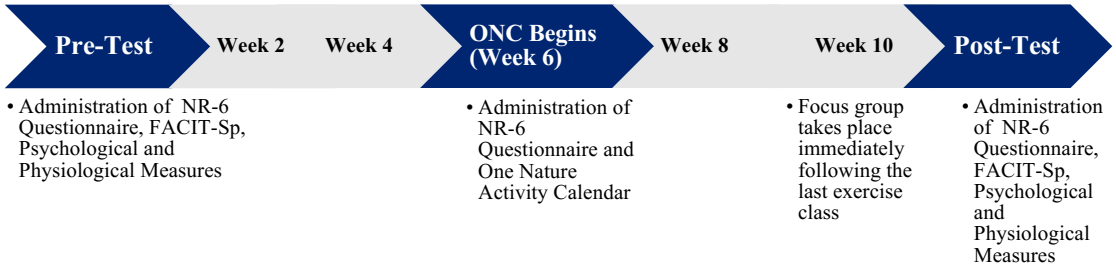
Timing was also important for the implementation of the ONC. Each WE-Can session began with an introductory meeting before pre-program assessments took place. As mentioned,

both meetings were held at the Canada Games Complex where questionnaires were administered for the WE-Can research program. Following the introduction to WE-Can, the student researcher introduced her research project in attempt to recruit participants. The student researcher collected the administered questionnaires (refer to *3.3.1.1 Psychological Measures*) and consent forms at each participants' pre-assessment. Throughout the participants' pre-assessments, the student researcher helped conduct the fitness tests (refer to *3.3.1.2 Physiological measures*) already employed by the primary researcher in the WE-Can research program. For the first group (n_1), pre-assessments took place May10-12th, 2019 and the WE-Can program began on May 21st, 2019. Pre-assessments for the second group (n_2) took place September 21-22nd, 2019 and the exercise classes began on October 1st, 2019 (refer to Figure 1).

The level of intensity for the exercises administered in WE-Can increased as the program progressed (TBRHCS, 2019). The ONC was implemented into the final four weeks of WE-Can to ensure that the participants had built up enough physical strength and confidence to take on and successfully complete the additional challenge (refer to Figure 2). As well, the challenge was applied towards the latter half of WE-Can, closer to when the qualitative inquiry could occur. This allowed for individuals to recall experiences that transpired throughout the challenge.

Figure 2

Procedure for Implementation of One Nature Challenge



As illustrated in Figure 2, during the sixth week of the WE-Can program, a nature information sheet ('Discover Nature in Thunder Bay') (see Appendix C) and the second set of questionnaires were distributed to the ONC participants during their scheduled exercise class at the Canada Games Complex. The information sheet explained how nature can be experienced in Thunder Bay and its surrounding region. The student researcher answered any questions or concerns the participants had and encouraged them to continue to ask questions throughout their time completing the ONC.

In addition to the nature information sheet, a One Nature Activity Calendar was given to each of the participants and a demonstration was provided by the student researcher. The demonstration explained how to properly fill out the form (refer to *3.3.1.3 Additional measure for One Nature Challenge*) and how to keep it from getting damaged, as they were asked to keep their calendar with them for thirty-days. Participants were also informed to be as honest as possible when completing the One Nature Activity Calendar and that they could refrain from filling it out and/or drop out of the challenge if it became too onerous.

The challenge began during the sixth week of WE-Can on Tuesday June 25th, 2019 for the first group (n_1) and Tuesday November 5th, 2019 for the second group (n_2). The challenge began after the exercise class to ensure all the participants were starting and completing the challenge on the same day. Throughout the thirty-days, participants were asked to get outside or view the outdoors through a window for at least thirty-minutes each day. Based on the pre-determined definition of nature, experiencing the outdoors could consist of relaxed (i.e. reading a book while sitting on a park bench) or active (i.e. taking the dog for a walk) activities.

The ONC ended on Wednesday July 24th, 2019 for the first group (n_1) and Wednesday December 4th, 2019 for the second group (n_2). Participants handed in their One Nature Activity

Calendar the following day at their last exercise class for the WE-Can program and completed their final set of questionnaires administered. Following the exercise class, the focus group took place at the Canada Games Complex for both the first session (n_1; July 25th, 2019) and the second session (n_2; December 5th, 2019). Post-assessments took place within a couple days of completing the program (refer to Figure 1).

3.3 WE-Can and One Nature Challenge Instrumentation

For each session of WE-Can, a series of medical information and sociodemographic forms, questionnaires, and physical assessments were distributed to participants. These were used to measure physiological and psychosocial well-being and health outcomes. In addition, measures associated with the ONC such as nature relatedness, spirituality and nature contact were administered.

3.3.1 Phase One: Quantitative Data Collection. Excluding the medical information and sociodemographic forms, each assessment tool was administered at the beginning (pre-test) and end (post-test) of the WE-Can program and ONC. Instrumentation used specifically for the ONC was administered during the initial assessment for WE-Can, prior to commencement of the ONC (i.e. week six of WE-Can) and following completion of the nature challenge and WE-Can program.

3.3.1.1 Psychological measures. Most of the instruments used to analyze psychological well-being were the exact same instrumentation used for the control group. The battery for psychological indicators assessed consisted of: Short Form Health Survey Version 2 (SF-36V2: your health and well-being), Patient-Specific Functional Scale, Functional Assessment of Chronic Illness Therapy-Fatigue Scale (FACIT-F), Brief Fatigue Inventory, and Orientation to Life questionnaire. In addition, ONC measures included: Nature Relatedness 6-Item Scale (NR-

6) and the additional concerns section of the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp12).

The SF-36V2 (Your Health and Well-Being) evaluates several concepts of an individual's perceived general health (see Appendix D). It considers eight health-related factors that are associated with one's well-being: physical functioning, role limitations, social functioning, bodily pain, general mental health, role limitations due to emotional problems, vitality and general health perceptions (Ware & Sherbourne, 1992). These are summarized into components representing perceived physical well-being and mental well-being (Ware, & Sherbourne, 1992). Strong correlations were detected across these domains except for functional capacity in individuals that were severely ill (Ware & Sherbourne, 1992). When evaluating its usages across diverse patient groups, vulnerable individuals such as the elderly, had lower item-completion scores (McHorney, Ware, Lu & Sherbourne, 1994). Although the measure has high reliability coefficients, it is important to consider that its use may not be effective at determining its factors such as functional capacity of the severely ill (McHorney et al., 1994; Ware & Sherbourne, 1992). For individuals living with cancer, additional instruments should be used to quantify a general knowledge on functional fitness.

The Patient-Specific Functional Scale (See Appendix E) is used to determine functional ability for individuals who have various concerns, such as knee dysfunction, cervical radiculopathy, acute low back pain, mechanical low back pain, and neck dysfunction through self-reported rankings for specified tasks of daily living (Horn et al., 2012; Stratford, 1995). Musculoskeletal complications such as these, have been evident in the cancer population as a result from treatment such as radiation (Stubblefield, 2011). This measure aims to determine a perspective on how well individuals are able to manage their musculoskeletal and/or

neurological condition by successfully performing activities of daily living (Stratford, 1995). Reliability has been reported moderate to excellent, depending on the musculoskeletal condition assessed and construct validity was also confirmed in numerous reports evaluating various conditions (Horn et al., 2012).

The FACIT-F (see Appendix F) has been used to assess the level of illness-related fatigue for individuals living with cancer, and other various chronic conditions such as stroke or HIV (Butt et al., 2013). A direct association between severity of psychological and physical symptoms, as well as fatigue has been reported with this questionnaire (Yennurajalingam, Palmer, Zhang, Poulter, & Bruera, 2008). Along with the general inquiry (physical and psychological outcomes), the FACIT-F has 13 items (Cella, 1997). Test-retest reliability has ranged from 0.84 to 0.90 for the FACIT-F subscale (Cella, 1997) with a strong internal consistency found for the scale in its entirety (α = 0.93-0.94) (Cella et al., 1993).

Mendoza and colleagues (1999) investigated the internal reliability (α = 0.96) for the Brief Fatigue Inventory (see Appendix G). Unlike the FACIT-F, the questionnaire is used to measure fatigue acutely, within the past twenty-four-hours. The brief fatigue inventory was found to effectively measure fatigue and the severity of fatigue experienced by cancer patients. The constructs used to measure an individual's level of fatigue consist of physical and psychological outcomes (Mendoza et al., 1999).

The last questionnaire provided to participants of the WE-Can program for psychological outcomes was the Orientation to Life Questionnaire (see Appendix H). This instrument was administered to measure the sense of coherence and its implications towards well-being (von Humboldt & Leal, 2015). It was found to successfully measure sense of coherence for older adults (von Humboldt, & Leal, 2015) and the general population (Feldt, & Rasku, 1998). Out of

the 29-items involved, it effectively measures the three sub-factors that encompass sense of coherence: meaningfulness (8-items), comprehensibility (11-items), and manageability (10-items), to fully conceptualize how one orients themselves to the meaning assigned to their life (Feldt & Rasku, 1998). Reliability of the questionnaire was high ($\alpha = 0.93$) and construct and criterion validity were confirmed when a cross-national perspective was evaluated for older adults (von Humboldt, & Leal, 2015).

The NR 6-Item Scale (see Appendix I) is a modified version of the original 21-Item Scale and was used to assess the relationship an individual has with nature (Nisbet et al., 2009; Nisbet & Zelenski, 2013). Previously created by Nisbet and colleagues, the NR-6 was found to strongly correlate ($r = 0.89$-0.91) with the original scale and test-retest reliability was consistent over time when three subpopulations were tested (Nisbet & Zelenski, 2013). The original questionnaire is comprised of three components: NR-Self, NR-Experience, and NR-Perspective (Nisbet et al, 2009), however the six-item measure does not encompass NR-perspective (Nisbet & Zelenski, 2013; Zelenski & Nisbet, 2014). This scale not only considers frequency of exposure to the natural environment, but how one sees their self as a biological component of nature. More specifically, the NR-6 measures how one perceives nature in its entirety, including both the positive and negative aspects associated with the interaction of nature (Nisbet et al., 2009). Considering NR-6 is a shorter version, the statistical reliability of the scale was minimally compromised, however, still able to effectively predict positive affect and environmental concern (Nisbet & Zelenski, 2013). This scale was used to differentiate whether the increased gain was allocated to the ONC. In a previous study with healthy adults, individuals who had a high nature relatedness before the thirty-day challenge began, did not receive as much benefit completing the challenge as those with lower levels of nature relatedness, indicating a potential ceiling effect

(Nisbet, 2015). When compared to wellness measures, a significant relationship was found (Reese et al., 2014). More specifically, NR-experience was found to associate with the holistic component of physical self, offering potential for its use in holistic wellness interventions (Reese et al., 2014).

The FACIT-Sp12 is another form of functional assessment for illness therapy; it is a widely used questionnaire for individuals living with cancer (see Appendix J). The measure has recently changed, adding a third component associated with spirituality (Murphy et al., 2010). The three constructs measured to assess spirituality were meaning, peace, and faith (Murphy et al., 2010). When compared to the two-factor assessment using a nation-wide sample, the root mean square error of approximation values were significantly lower, indicating a better fit of evaluation for spirituality (Murphy et al., 2010). Thus, FACIT-Sp12 is a suitable measurement when assessing a diversified population (Murphy et al., 2010). Because FACIT-F is already administered in this battery, this questionnaire only comprised of the additional concerns section, where spirituality was measured. This questionnaire helped with assessing 1) whether there is a spirituality component already inherently embedded within the WE-Can program; and 2) whether the addition of the ONC can impart a spirituality dimension to the WE-Can program if this component is missing.

3.3.1.2 Physiological measures. Physiological measures were used to evaluate functional fitness. The functional fitness battery was developed to assess the physiological parameters associated with independent function for older adults (Rikli, & Jones, 1999). These parameters are known to decline with age (Rikli, & Jones, 1999), while increased risk of high blood pressure simultaneously occurs with age (McGill, & Strong, 1968). Cancer and/or cancer treatment has a substantial impact on aging by accelerating its process (Hurria, Jones, & Muss, 2016). Therefore,

along with blood pressure and the handgrip strength test, it is appropriate to use the senior fitness test to evaluate functionality for individuals living with cancer.

An assessment by a physiotherapist and medical history forms were used to determine any precautionary measures that should be addressed for each participant before the intervention commenced. They were also used to report current medication intake for the blood pressure analysis. Gauging blood pressure was a precautionary measure taken before each exercise class for WE-Can to determine whether a participant was healthy enough to exercise. Exercise has commonly been known to elevate blood pressure (Schultz, & Sharman, 2014). If an individual had high blood pressure and engaged in exercise, increased propensity of target organ damage can result (Shultz, & Sherman, 2014). High blood pressure has been associated with increased risk of mortality for individuals living with cancer (Khaw, & Barrett-Connor, 1984). Thus, it is important to monitor these underlying physiological conditions to ensure they do not manifest into undesirable outcomes such as mortality (Khaw, & Barrett-Connor, 1984).

The handgrip strength test is a strong predictor for functional and psychological health in older adults (Taekema, Gussekloo, Maier, Westendorp, & de Craen, 2010). Poor grip strength has been associated with higher levels of dependency for daily living activities and cognitive decline (Taekema et al., 2010). Although not included in the senior fitness test, due to cancer's impact on accelerated aging (Taekema et al., 2010), a hand grip strength test was useful in assessing functional fitness for individuals living with cancer.

The backscratch test incorporates abduction, adduction, internal and external rotation of the shoulders (Rikli, & Jones, 1999). Distance between middle fingers for each hand or how much they overlap, was measured when one hand reached over one shoulder and the opposite hand reached behind the back. Shoulder flexibility is necessary to perform activities of daily

living such as combing one's hair, removing an item from a back pocket, and fastening a bra. The test was determined to be significantly reliable regardless of age cohorts and activity levels (Rikli, & Jones, 1999).

The chair sit and reach test assessed lower limb flexibility, primarily flexibility of the hamstring muscles group (Rikli, & Jones, 1999). The subject sat on the edge of the chair with one leg straightened and the other leg bent. The subject was then required to reach forward with both hands towards the straightened leg's foot. The distance from the tips of the fingers to the toes was measured. Hamstring flexibility impacts daily living activities. It is a strong predictor for restricted gait, low back pain, and risk of falling for the elderly. A strong correlation was found for both men ($r = 0.76$) and women ($r = 0.81$) when the test was compared to the original goniometer measures for the gold standard sit and reach test (Rikli, & Jones, 1999).

The arm curl test measured how many times a full-range bicep curl (i.e. full extension of elbow to full flexion of elbow, back down to full extension) could be performed with a five-pound (for females) or eight-pound (for males) weight in thirty seconds (Rikli, & Jones, 1999). This test is an indicator for performing daily living activities such as personal care and lifting items onto an overhead shelf. When arm curls were compared to three upper body one-rep max tests, both men ($r = 0.81$) and women ($r = 0.78$) were significantly correlated. This indicates that the test can be a strong predictor for bicep strength and overall upper body strength. The test was significantly reliable, discriminating across age cohorts and activity levels (Rikli, & Jones, 1999).

The chair stand test requires individuals to place their arms crossed against their chest and without use of their arms, push themselves up to a full stand and then back down to a seated position (Rikli, & Jones, 1999). The amount of times an individual could fully stand and sit back

down in thirty-seconds was measured (Rikli, & Jones, 1999). Lower limb strength is associated with mobility (Goncalves et al., 2007) and declines in strength have predicted the decline for a number of functional variables such as gait, stair climbing, and balance (Bassey et al., 1992). Validation was met when the test was compared to a maximal leg strength test and high correlations were found for both men (r = 0.78) and women (r = 0.71) (Rikli, & Jones, 1999). Construct validity for the chair stand test was confirmed through analysis of age cohorts and activity levels; chair stand test was significantly less in the older old and less active individuals (Rikli, & Jones, 1999).

The six-minute walk test measured the distance an individual could walk in a period of six minutes (Rikli, & Jones, 1999). Compared to long distance walk tests, the timed test lowered the difficulty factor, suiting a wide variation of aerobic abilities in older adults (Rikli, & Jones, 1999). Aerobic endurance is critical for performance of daily living activities such as walking and running errands (i.e. shopping, going to the bank) (Shepard, 1993). Correlations ranged from 0.71 to 0.82, indicating moderately good support for the criterion validity (Rikli, & Jones, 1999). As well, discrimination across age cohorts and activity levels supported construct validity for the test (Rikli, & Jones, 1999). When considering, cancer's impact on accelerated aging and the functional decline associated with the aging process (Taekema et al., 2010), the seniors battery tests validated use for older adults (Rikli, & Jones, 1999) could be as effective for individuals living with cancer.

3.3.1.3 Additional measure for One Nature Challenge. To evaluate the amount of nature contact that the participants achieved over the thirty-day period, an instrument needed to be developed to do so. In previous studies that evaluated the effects of nature exposure over a thirty-day period, time spent in nature was not objectively measured (Nisbet, 2015; Richardson et al.,

2016). However, self-report activity calendars have been found useful for tracking participants' success (Tudor-Locke, Lind, Reis, Ainsworth & Macera, 2004). Through use of a pedometer, participants used a self-report calendar to record how many steps they had taken that day. Out of the 375 participants, 209 participants successfully completed and returned their calendar with the required data (Tudor-Locke et al., 2004). This can suggest that the use of an activity calendar to self-report data is feasible and encourages participants' adherence to the study (Tudor-Locke et al., 2004).

A One Nature Activity Calendar was developed to track nature contact throughout the ONC (see Appendix K). The calendar had a simple design, only requiring two items to be circled each day (see Appendix L). This was constructed to alleviate any potential burden experienced by engaging in both the WE-Can program and ONC simultaneously. For example, if the participant was able to complete their thirty minutes of nature exposure for that day, they would circle the 'YES' answer located on the calendar and its corresponding day (see Appendix L). The participants were then prompted to circle the second question regarding the type of activity they performed while spending time outside (i.e. resting or active). If the participant answered 'NO' to experiencing nature for the thirty minutes, they were only required to circle that answer for the day. Acquiring the participants' type of activity helped infer the physiological outcomes of the ONC in conjunction with WE-Can, as increased activity could contribute to physiological improvements such as maintained or improved functional fitness (Milanovic et al., 2014). A blank calendar was printed on the back of the One Nature Activity Calendar as an optional way to keep track of activities engaged in throughout their challenge.

3.3.2 Phase two: Qualitative Data Collection. For the second phase of the mixed-methods study, qualitative inquiry was used to complement quantified data (Creswell et al.,

2003). Further investigation was required to infer what transpired from the ONC because the One Nature Activity Calendar only indicated nature contact and type of activity. Unique perspectives offered by individuals living with cancer can add significant meaning to psychological effects experienced within the cancer care setting (MacCormack et al., 2001). In a nature context, a strong connection to nature can impact three categories of health and well-being: physiological stress reduction and immunization, psychological well-being, and cognitive/attentional restoration (Baxter, & Pelletier, 2019). Further exploration of these categories for health, well-being, and nature can be further elucidated through personal perspectives; a cancer diagnosis is considered exclusive despite commonalities that can be observed, warranting qualitative inquiry to effectively decipher these experiences (Foley et al., 2006).

3.3.2.1 Focus group. Inductive and deductive techniques were used to employ focus groups for the two ONC interventions for 16 participants (missing; n = 2), immediately following their last exercise class. Deductive methods use a philosophical framework where expectations can be pre-derived without observation, based on logical rules and patterns expressed as known information (Fereday, & Muir-Cochrane, 2006). For each focus group, the concept of phenomenology was used to discover the participants' lived experiences during the ONC. Phenomenology embodies a state of wonder and is a less deterministic method for exploring the "meaning of a prereflective experience" (van Manen, 2016, p.15). Phenomenology does not only focus on events but what may cause these events to occur using interpretive and descriptive reasons (van Manen, 2016). More specifically, the phenomenon of interest for this thesis were experience in nature, and how it compared to WE-Can for individuals living with cancer.

Before the group discussions commenced, the student researcher reviewed the purpose of the focus group and reiterated that the participants' involvement was optional. Dialogs were recorded on the student researcher's iPhone and each focus group lasted for approximately 25 to 30-minutes. Through a phenomenological concept, semi-structured questions led conversations regarding individual experiences of the ONC and how they differed from the WE-Can program (refer to Appendix M for interview guide). Questions were discoursed to address the positive and negative aspects associated with completing the ONC and living with cancer. More specifically, questions asked provided more depth to the results for the One Nature Activity Calendar data to determine what they did while resting or being active during their thirty-minutes of nature exposure. Audio recordings were transcribed, and the information was preliminarily coded based on the phenomenological concepts of nature, WE-Can, and living with cancer.

3.4 Data Analysis

Quantitative and qualitative data were analyzed in separate phases and subsequently followed by a third analysis, merging the two datasets. The first phase analysis consisted of WE-Can and ONC data and was then complemented by a second phase of analyzed transcriptions for the qualitative findings. The final analysis transformed the two findings into a joint displays method to illustrate the effects of nature on individuals living with cancer.

3.4.1 Phase One Analysis. The first phase analysis was conducted using Statistical Package for Social Sciences 25 (SPSS v25). The compilation of secondary data retrieved from nine years of past WE-Can participants represented the control group for this study. This data acted as a baseline for general trends, such as improvements in fatigue, quality of life, well-being, sense of coherence, and functional capacity for past WE-Can participants (Larocque et al., 2016).

Descriptives and frequency distributions were generated to determine participant characteristics and normality of data. Using a descriptive analysis, normality was tested using a z-test for skewness and kurtosis values. Skewness and kurtosis statistics were divided by their corresponding standard errors for each variable. If the computed value was greater than 3.29, the hypothesis was rejected, indicating a violation in the normality of data for that variable (Kim, 2013). Multiple bivariate correlation analyses were used to detect shared variation between the psychological variables and physiological variables, respectively. This was done to address the primary research concern on evaluating general health-related outcomes for individuals with cancer when exposed to nature. Through significant associations, the reduction of variables can help minimize violations in multicollinearity and positively influence the interpretability of data (Draper, & Smith, 1981).

Percentage of change scores have been used to normalize data when looking at additional gains experienced across different sample groups (Rogerson et al., 2020). This protocol was employed as the primary research question aimed to investigate an additional gain caused by the nature intervention. An index on the percentage of change was calculated for both groups (i.e. control and experimental) by subtracting the pre-test from the post-test data and dividing it by the absolute value, multiplied by 100 (refer to Appendix N for the complete set of equations used to compute the index for each variable; Rogerson et al., 2020). To adjust for the functional capacity of the sample population, the maximum score for each fitness assessment was used as the absolute value for the index calculations. For measures such as blood pressure and brief fatigue inventory where a reduction indicated an improvement, the index measures were inversely scored by multiplying them by -1. By standardizing and inversing scores when required, this ensured that a positive numeric value actually represented an increased gain for

each variable and the removal of units of measurement allowed for effective comparison between variables.

For the statistical analyses conducted to answer the primary research question, a Bonferroni correction was used to control for type-one error (Westfall, Young, & Lin, 1998). Eight independent-samples t-tests were conducted to assess differences between groups on changes in physiological well-being. Statistical significance was met for each test if $p < 0.00625$ (two-tailed significance) when the Bonferroni correction was enforced (0.05 / 8). Six independent-samples t-tests were computed to evaluate if a significant difference between groups on changes in psychological well-being were observed. For this evaluation, significance was achieved for each test if $p < 0.0083$ (two-tailed significance) when the Bonferroni correction was applied (0.05 / 6) (Westfall et al., 1998).

Further statistical analyses focused solely on the experimental group to determine how increased nature contact influenced the participants after completion of the ONC. First, a descriptive analysis was conducted on ONC attendance (i.e. # days / 30) to ensure that nature contact between each subgroup (i.e. summer and winter) was similar for comparison. To determine if spirituality and nature relatedness was affected by the nature challenge, two repeated-measures ANOVAs were used to observe significant change for each variable over time. If sphericity was not assumed, the Greenhouse-Geisser technique was applied to determine the within-subjects effects. Furthermore, if results were statistically meaningful, least significant difference (LSD) pairwise comparisons were computed to detect if a significant change occurred between the first five-weeks of WE-Can (i.e. baseline) compared to the last five-weeks, when the ONC was implemented. Three time points were measured to ensure that the change in spirituality and nature relatedness was not influenced by the WE-Can program and instead,

imparted by the ONC. Finally, to elucidate the difference between seasons in which the ONC was implemented, descriptive analyses were used to investigate average change scores for cancer-based health-related outcomes between each experimental subgroup.

3.4.2 Phase Two Analysis. To assess the shared experiences between 16 participants who completed the ONC, the phenomenon of interest was thematically analyzed. Data was decoded through the process of listening, reading, and summarizing (Fereday, & Muir-Cochrane, 2006). Key themes were extracted using inductive and deductive techniques to provide more clarity regarding how the participants engaged with nature and how it differed from their WE-Can experiences. These findings supported inferences made from the quantitative analysis.

Qualitative findings were speculated from notes written on the One Nature Activity Calendar and dialogs transcribed from the two focus groups. To begin, data was familiarized through an active search of meaning and patterns embedded within the text (Nowell, Norris, White, & Moules, 2017). Through this process, generation of initial codes and important concepts were highlighted based on the phenomenon of interest and research questions. Over-arching themes then transpired from the preconceived ideas based on theory (deductive) and directly from the initial sequencing of codes (inductive) (Fereday, & Muir-Cochrane, 2006). Therefore, based on the biophilia and attention restoration conceptualizations, major themes generated were associated with improved well-being and innate tendencies with the natural world (Kaplan, & Kaplan, 1989; Wilson, 1984). Simultaneously, the major themes were refined into sub-themes using direct quotes from participants and inferred codes initially generated.

Although the study is looking at the phenomenon of experiencing nature, WE-Can and living with cancer, when conducting qualitative research, it must be speculated that the experience of the phenomena will differ for everyone. Merriam and Tisdell (2016) conveyed that

through various perspectives, it is hard to capture an objective reality, thus credibility was used to justify inferences using triangulation. Triangulation was met as multiple methods of data collection were employed, specifically quantitative and qualitative. In addition, adequate engagement in the data collection process was used to enforce credibility of the qualitative findings. The student researcher was able to immerse herself by playing an instrumental part assisting the WE-Can program, interacting with her participants on a weekly basis. As well, the researcher had already performed the ONC on her own so that she could relate to her participants' experiences. This helped with the preconception of themes that were identified within the transcriptions and allowed the researcher to elaborate on their shared experiences.

When inferences are made from data collected qualitatively, they must be consistent (Merriam, & Tisdell, 2016). To ensure consistency was achieved, use of multiple theories helped confirm that the major themes detected align with what has been expected in past literature (Merriam, & Tisdell, 2016).

Although experiences are diversified, generalization of the major themes detected within the data can be transferred and related by other individuals or research studies (Merriam, & Tisdell, 2016). Thick, rich descriptions of the major themes found were used to ensure findings were transferable. Thick, rich descriptions consisting of descriptive writing, where the setting was described in great detail and adequate quotes supported experiences of the studied phenomenon (Merriam, & Tisdell, 2016).

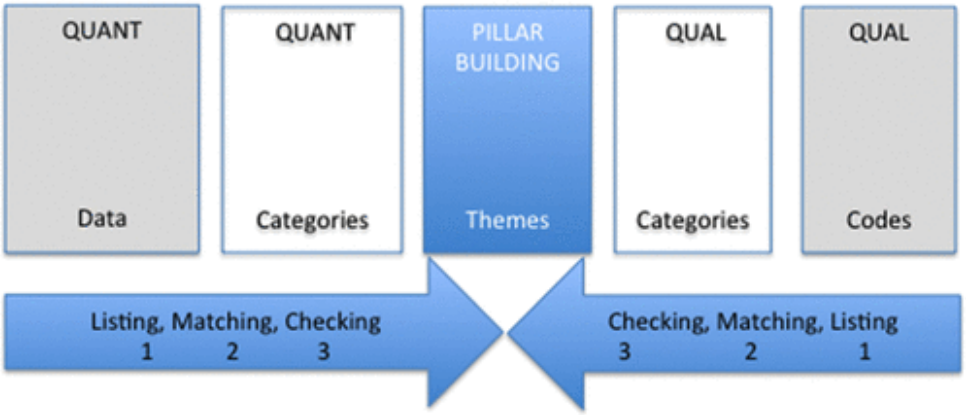
Finally, trustworthiness of the results was met through intellectual rigor (Merriam, & Tisdell, 2016). The researcher conducted the interview in a professional demeanour, where the participants' responses were treated with the utmost respect and confidentiality was kept. The student researcher conveyed that they did not have to respond to any questions that they did not

feel comfortable with and could refrain from participating at any time throughout the discussion. As well, a supervisor was present to intervene if any problems transpired from the questions asked. By ensuring credibility, consistency, transferability, and trustworthiness, sound results for the qualitative phase of this research study could be confidently applied to the final analysis.

3.4.3 Phase Three Analysis. The final analysis was conducted to combine the transcribed codes from the second analysis with the statistical products computed from the first analysis. To do this, the Pillar Integration Process (PIP) was the mixed-methods technique employed. Johnson, Grove, and Clarke (2017) developed the PIP to demonstrate a rigorous technique that transparently integrated qualitative and quantitative evidence in a joint display method. Merging data through a joint display has been commonly used in mixed-method studies (Creswell, Klassen, Plano Clark, & Smith, 2011), however, current literature does not discuss detailed replicable techniques for research in health science, warranting a procedure like PIP to do so (Johnson et al., 2017). Figure 3 illustrates the protocol for PIP utilized for the final phase analysis.

Figure 3

Overview of Protocol for PIP Using A Generic Diagrammatic Representation



As depicted in Figure 3, four stages were conducted using the PIP technique to integrate the findings. For the purpose of this study, four PIP displays were created to demonstrate

findings for the following variables of interest: cancer-related physiological well-being; cancer-related psychological well-being; nature relatedness; and spirituality. The following steps for the generation of one PIP display will be discoursed. To begin, quantified data that were relevant to the hypotheses of the study were listed on the left side (i.e. quantitative data and categories) of the joint display. The data selected could be widespread or discerning, depending on the aim of the integrative approach (Johnson et al., 2017). In this case, quantified data was selected to demonstrate the difference in improvement scores between groups and/or over time. Matching of data was then employed where qualitative codes and categories that reflected the left column (i.e. quantified findings) were added horizontally to the right side of the display in their corresponding columns. The horizontal depiction helped organize the findings so that patterns and parallels could be easily identified (Johnson et al., 2017). Findings for each column were then cross-checked to ensure that the data was properly matched. This allowed time to reflect if emerging patterns, or lack thereof, were represented in order to improve the overall quality of the integration technique (Johnson et al., 2017). Finally, the verified findings in the PIP display were compared and contrasted. The final column (i.e. pillar column) was then computed, where the inferred integration of themes, patterns, and insights were summarized by the student researcher. This last step enabled the researcher to merge a common narrative for each variable of interest (Johnson et al., 2017).

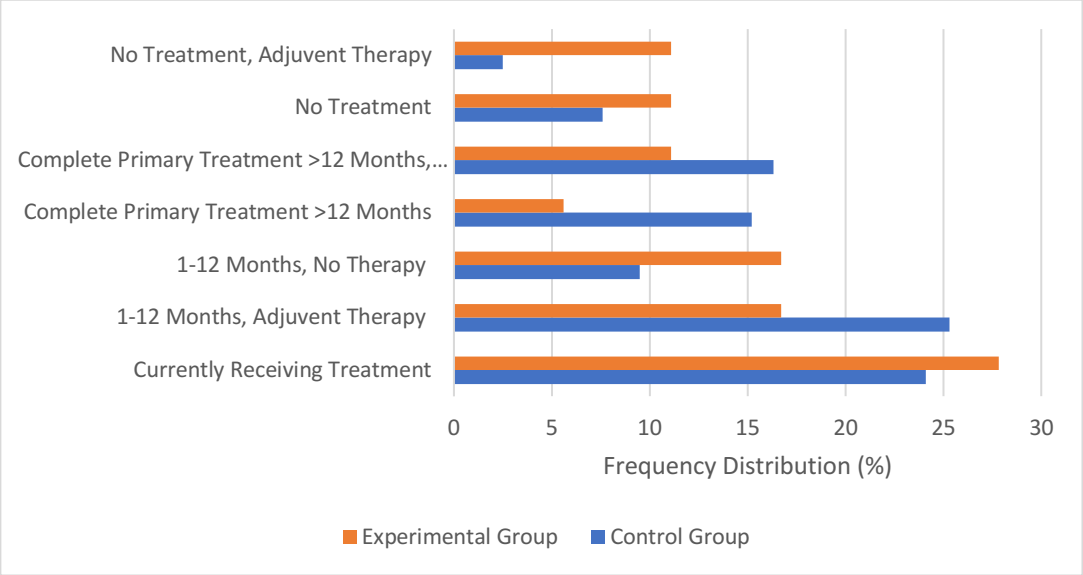
4.0 Results

4.1 Sample Characteristics

The control group consisted of 160 past graduate participants of the WE-Can program. The average age for this group (M = 58.95; SD = 10.879) was similar to the 18 participants recruited for the experimental group (M = 60.33; SD = 11.971). Similarly, the mean number of WE-Can classes attended for the control group was 16.48 (SD = 2.766) and the experimental group was 16.83 (SD = 2.455). Females made up the majority of both the experimental (72.2%) and control (85%) groups. However, greater variation was observed for cancer types amongst both groups. The control group comprised mostly of individuals diagnosed with breast cancer (60%), with lymphoma (8.23%) and lung cancer (3.8%) having the next two highest frequencies. For the ONC group, 55.5% of the sample was comprised of various types of cancer (excluding lung, lymphoma and breast), with the second highest representation being individuals diagnosed with breast cancer (38.9%). Regardless of cancer type, treatment status of participants provided a better indicator for their potential limitations to both an exercise class and the ONC.

Figure 4

Frequency Distributions for Cancer Treatment Status



As Figure 4 depicts, the majority of participants in the control and experimental groups were either currently receiving cancer treatment or within one-year-post treatment (58.9% and 61.2%, respectively). The number of individuals that did not require treatment for their cancer was higher for the experimental group (22.2%) compared to control group (10.1%), however this could be attributed to the small sample size (n = 18).

4.2 Data Consolidation

Prior to the consolidation of data through correlation coefficients, data was cleaned and checked for normality. Table 1 and 2 provide z-tests scores calculated to check assumptions of psychological and physiological health.

Table 1

Normality Test Using Skewness and Kurtosis for Physical Health

Statistic Std. Error **Ratio**	Skewness	Kurtosis
Diastolic BP	.043 .269 **0.15**	1.482 .532 **2.78**
Systolic BP	.010 .269 **0.04**	.074 .532 **0.14**
Handgrip	2.024 .184 **5.79***	3.404 .365 **9.33***
Strength	.251 .183 **1.37**	.671 .363 **1.85**
Flexibility	.781 .185 **4.22**	.443 .367 **1.21**
Aerobic	.189 .187 **1.01**	.552 .371 **1.49**

*Note: * indicates violation on assumption of normality, null hypothesis is rejected.*

Table 2

Normality Test Using Skewness and Kurtosis for Psychological Health

Statistic Std. Error **Ratio**	Skewness	Kurtosis
Patient Function Scale	.621 .195 **3.18**	.982 .387 **2.54**
Sense of Coherence	1.280 .269 **4.76***	2.159 .532 **4.06***
Physical Component	.553 .190 **2.91**	.882 .377 **2.34**
Mental Component	.217 .190 **1.14**	1.144 .378 **3.03**
Chronic Fatigue	.515 .186 **2.77**	.080 .370 **0.22**
Acute Fatigue	.403 .184 **2.19**	.938 .365 **2.57**

*Note: * indicates violation on assumption of normality, null hypothesis is rejected.*

When analyzing physical well-being, z-test scores indicated that distributions for blood pressure, strength, flexibility, and aerobic fitness were not violated. However, as indicated by Table 1, handgrip strength normality was defied for both skewness ($z = 5.79$) and kurtosis ($z = 9.33$), as ratios exceeded 3.29. Sense of coherence's normality was also violated when evaluating psychological well-being (refer to Table 2). Z-test scores of 4.76 (skewness) and 4.06 (kurtosis) indicated that normality of data cannot be assumed for statistical analyses. Patient functional scores, physical well-being, mental well-being, and both types of fatigue significantly met the normality criteria.

Following the review of data, bivariate correlations were conducted for physical well-being indicators and their corresponding results can be referred to in Appendix O. The mean scores for upper limb and lower limb mobility (measured in centimeters) were computed into a newly formed variable indicating flexibility, as participant scores for backscratch and chair sit

and reach were deemed significantly correlated (r = .360, p = 0.00, n = 176). The number of bicep curls and chair squats (measured in # / 30s) performed by participants were also significantly associated (r = .652, p = 0.00, n = 175). As a result, the average values for both tests were consolidated into a new variable representing participants' strength. To ensure these newly computed variables were independent of other physical health measures, bivariate correlations were investigated once again.

Table 3

Bivariate Correlations for Physiological Well-Being

		Systolic BP (Inverse Score)	Diastolic BP (Inverse Score)	Aerobic Fitness	Flexibility	Strength	Overall Strength
Systolic BP (Inverse Score)	Pearson	1	**.316****	-.061	-.081	.057	-.130
	Sig.		**.004**	.590	.474	.615	.250
	N	80	80	80	80	80	80
Diastolic BP (Inverse Score)	Pearson	**.316****	1	.135	-.096	-.068	.008
	Sig.	**.004**		.233	.396	.548	.945
	N	80	80	80	80	80	80
Aerobic Fitness	Pearson	-.061	.135	1	**.230****	**.235***	**.215****
	Sig.	.590	.233		**.003**	**.002**	**.005**
	N	80	80	169	169	169	167
Flexibility	Pearson	-.081	-.096	**.233****	1	**.329****	**.153***
	Sig.	.474	.396	**.002**		**.000**	**.046**
	N	80	80	169	177	177	175
Strength	Pearson	.057	-.068	**.235****	**.329****	1	**.303****
	Sig.	.615	.548	**.002**	**.000**		**.000**
	N	80	80	169	177	178	175
Overall Strength	Pearson	-.130	.008	**.215****	**.153***	**.303****	1
	Sig.	.250	.945	**.005**	**.046**	**.000**	
	N	80	80	167	175	175	175

Note: * indicates significance when $p < 0.05$ using a two-tailed test and ** indicates significance when $p < 0.01$ using a two-tailed test

Table 3 presents moderately low relationships between all the indicators of physical health. Although two-tailed significance was observed, it was only detected for samples greater than 80 participants. These samples differed due to premeditated procedures conducted in past WE-Can sessions. These shared variances indicated by the correlation coefficients could be

influenced by sample size and a potential limitation to the interpretation of the statistical analyses. When a bivariate analysis was conducted on psychological indicators, limitations were also detected for sense of coherence. The variable sense of coherence significantly correlated with mental well-being, physical well-being, and fatigue ($p < 0.01$, n = 73-79).

4.3 Differences Between Groups on Cancer-Based Health Outcomes

Cancer-based health-related outcomes such as physical and psychosocial well-being were investigated between the control and experimental groups. Scores for each variable were standardized and computed into percent change scores to determine if additional benefits were associated with the ONC group. Sample sizes for the control group (n = 160) were substantially less when sense of coherence (50%, n = 80) and blood pressure (48.75%, n = 78) were evaluated due to premeditated application in the WE-Can program. However, samples were sufficient enough to represent appropriate trend scores for both psychological and physiological health.

4.3.1 Physiological Well-Being. To examine measures of physiological well-being between secondary data and the experimental group, a series of independent-samples t-tests were employed. The ONC group's aerobic fitness significantly differed [$t(167) = -3.117$, $p < .00625$] based on the Bonferroni correction. More specifically, the experimental group exemplified a greater average improvement (14.86%) compared to the baseline (9.22%).

Table 4

Summary of Independent-Samples T-Tests Comparing Groups on Physical Health Indicators

		t	df	Sig.	Mean Difference (% Change)	Std. Error Difference	95% CI of the Difference	
							Lower	Upper
Aerobic Fitness		-3.117*	167	.002	-5.63926	1.80927	-9.25515	-2.06727
Flexibility		-0.419	175	.676	-3.06644	7.31670	-17.50676	11.37388
Strength		-0.594	175	.553	-1.34581	2.26381	-5.81369	3.12208
Handgrip		-0.376~	18.07	.711	-0.86232	2.29235	-5.67713	3.95249
Systolic BP	**Total**	-0.212	78	.832	-0.43011	2.02586	-4.46329	3.60307
	Control	0.039	49	.969	0.09596	2.46607	-4.85979	5.05171
Diastolic BP	**Total**	-0.628	78	.532	-1.01180	1.61045	-4.21796	2.19436
	Control	-0.924	49	.360	-2.03835	2.20637	-6.472222	2.39552

Note: ~ indicates that 'equal variances not assumed' was employed for statistical analysis. * indicates significance when $p < 0.00625$ using a two-tailed test.

As portrayed in Table 4, blood pressure was evaluated under two conditions. The control condition only evaluated participants' blood pressure if they were not taking medication to regulate their blood pressure, whereas the total condition evaluated all participants. Regardless, there were no significant differences for mean percent changes between the control and experimental group on the remainder of physical health indicators ($p > .00625$). However, the trend in average difference in change scores were greater for the ONC group on flexibility (3.06%), strength (1.35%), handgrip (0.86%), and systolic (0.43%) and diastolic (1.01%) blood pressure compared to the control.

4.3.2 Psychological Well-Being. Once again, significant differences on psychological health between control and experimental groups were determined by a series of independent-samples t-tests. Based on the Bonferroni correction applied, a statistically significant difference was determined at the $p < .0083$ level (two-tailed).

Table 5

Summary of Independent-Samples T-Tests Comparing Groups on Psychosocial Health Indicators

		t	df	Sig.	Mean Difference (% Change)	Std. Error Difference	95% CI of the Difference	
							Lower	Upper
Mental Component		-1.197	161	.233	-2.75212	2.29829	-7.29079	1.78656
Physical Component		0.067	162	.946	0.13117	1.94800	-3.71558	3.97791
Patient Functional Scale		0.734	153	.464	0.65726	0.89582	-1.11252	2.42704
Sense of Coherence		0.072~	78	.943	0.15926	2.22315	-4.26668	4.58520
Fatigue	**Acute**	-1.133	173	.259	-6.45964	5.70368	-17.7174	4.7981
	Chronic	-0.899	168	.370	-7.71933	8.58794	-24.67352	9.23486

The summary of results depicted in Table 5 present no significant differences between the control and experimental groups on a statistical level ($p > .0083$). However, the experimental group had a greater trend in difference of average change scores for mental health (2.75%), acute fatigue (6.46%) and chronic fatigue (7.72%) when compared to baseline measures. Perceived physical well-being, functionality, and sense of coherence scores did not exemplify any trend in difference between the two groups as the average difference in change scores were less than 1% (refer to mean difference in Table 5).

4.4 Impacts of the One Nature Challenge on the Experimental Group

To further decipher the outcomes of the ONC and its potential effect on the additional change scores detected between groups, a series of analyses were conducted. Participants experienced nature for a total of 438 days out of the anticipated 540 days (18 participants x 30 days), indicating an overall completion rate of 81%. Out of these 438 days, 86.76% of nature contact was physical activity and 13.24% of nature contact was spent resting. On average, the participants spent approximately 24 days ($SD = 5.605$) experiencing nature during the thirty-day challenge. However, the mean exposure to nature for participants that engaged in the ONC in the summer ($M = 23.90$; $SD = 6.008$; $n_1 = 10$) was comparable to those who experienced nature in

the winter (M = 24.88; SD = 5.410; n_2 = 8). Based on similarities, measures on spirituality and nature relatedness were conducted using one sample (n = 18).

4.4.1 Nature Relatedness and Spirituality. Repeated-measures ANOVAs were used to determine change of nature relatedness and spirituality over time. Nature relatedness and spirituality was measured at three time points. Time 1 to time 2 indicated the change measured from the beginning of WE-Can to before the ONC began (i.e. week 5 of WE-Can) and acted as a baseline to compare the latter measures. Time 2 and time 3 measured the change in nature relatedness and spirituality throughout the ONC while simultaneously partaking in the WE-Can program. Table 6 presents a summary of findings from the two ANOVAs conducted.

Table 6

Summary of Repeated-Measures ANOVA for Nature Relatedness and Spirituality Over Time

	Multivariate Tests		Test of Sphericity		Within-Subjects Effects				
	Hypothesis df	Error df	Approx. Chi-Square	Sig.	df	F	Sig.	Partial Eta Squared	Observed Power
Nature Relatedness	2	16	.499	.779	2	2.080	.140	.109	.398
Spirituality	2	16	22.892	.000	1.14	5.808*	.023	.255	.662

Note: * indicates significance when $p < 0.05$ using a two-tailed test.

Table 6 depicts that for nature relatedness, statistical significance was not obtained over time (p>.05). Average scores did slightly increase from time 1 (M = 4.05; SD = 0.653) to time 3 (M = 4.22; SD = 0.726) for nature relatedness, however mean scores were relatively high to begin. Sphericity was not assumed for spirituality [$X^2(2, 16) = 22.892$, $p = 0.00$], therefore the Greenhouse-Geisser technique was applied to correct the violation. The total score for spirituality significantly differed over time [$F(1.14) = 5.808$, $p = .023$, $\eta = 0.255$]. LSD pairwise comparisons helped detect between which time points the significant differences occurred and are illustrated in Table 7.

Table 7

LSD Pairwise Comparisons for Total Spirituality

Time	Time	Mean Difference	Std. Error	Sig.
1	2	-2.093	1.118	.079
	3	-4.684*	1.881	.023
2	1	2.093	1.118	.079
	3	-2.591*	.949	.014
3	1	4.684*	1.881	.023
	2	2.591*	.949	.014

Note: * indicates significance when $p < 0.05$ using a two-tailed test.

When LSD contrasts were computed for spirituality, meaningful findings were discovered. Spirituality significantly improved from time 2 to time 3 ($p = 0.014$), however did not change from time 1 to time 2 ($p = 0.079$). Statistical significance was also identified from time 1 to time 3, indicating an increase over time, especially towards the latter. However, the interpretation of these findings is limited, as no previous data was available for comparison.

4.4.2 Differences Between Seasons. To compare the seasons in which nature was experienced, average change scores were computed for each subgroup to decipher differences in cancer-based health outcomes. This analysis was executed to better comprehend if one group portrayed greater overall improvements compared to the other. Inferences were made through Figures 5 and 6, depicting changes in cancer-related physiological and psychological health, respectively.

Figure 5

Comparison of Average Change Scores for Physical Health Between Seasons

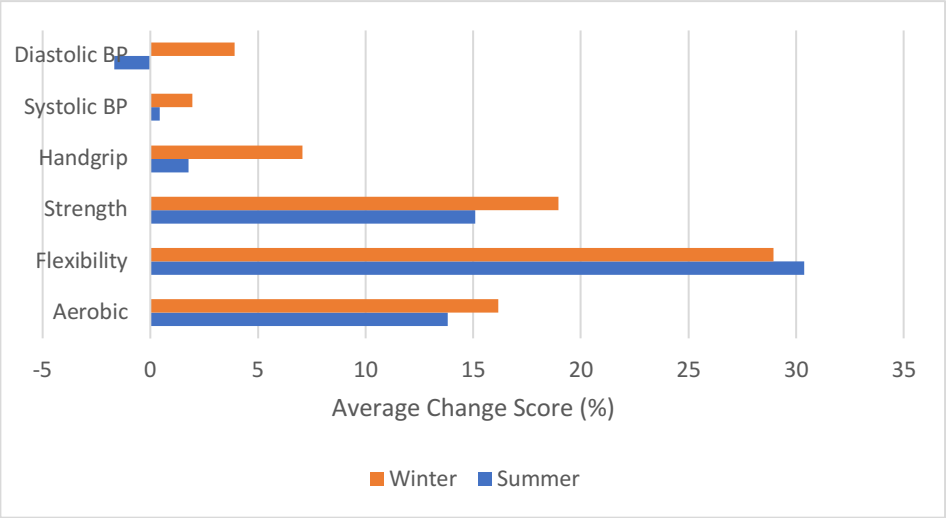
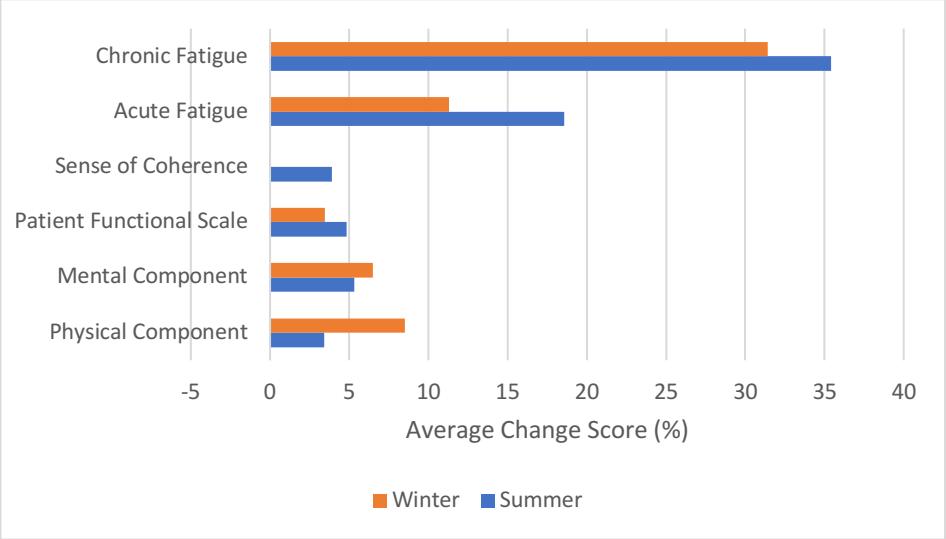


Figure 6

Comparison of Average Change Scores for Psychological Health Between Seasons



Greater change scores for blood pressure, handgrip, strength, and aerobic fitness were exemplified by individuals that partook in the ONC during the winter season (refer to Figure 5). Although change scores for flexibility were slightly greater for the ONC participants in the summer, overall average change in physical health was greater for participants in the winter (12.83%, n = 8) compared to the summer (9.96%, n = 11). Figure 6 depicts the opposite. The

overall average change in psychological health was slightly larger for the summer subgroup (11.90%, n = 11) compared to the winter subgroup (10.18%, n = 8). More specifically, those who completed the ONC in the summer had greater improvements in sense of coherence, chronic fatigue, and acute fatigue.

4.5 Qualitative Responses

Data collected for the ONC was limited to reduce burden on participants partaking in two research studies simultaneously. Therefore, qualitative inquiry helped reinforce quantified findings. Through use of inductive and deductive techniques, patterns within the transcripts and One Nature Activity Calendars were identified as themes that represented the concept of experiencing nature, contrasts of WE-Can and living with cancer. Common codes detected within the data represented overarching themes and their corresponding sub-themes A summary of findings is projected in Table 8.

Table 8

On Overview of Overarching and Corresponding Sub-Themes

Overarching Themes	Sub-Themes		
Strong Nature Relatedness	Concern for living beings and the environment (NR-experience)	Accessibility to natural landscapes (NR-self)	Experiencing nature was nothing new, but still breath-taking
The Challenges of a Cancer Experience	Lack of support from cancer centre on coping with diagnosis and impact of WE-Can	Altered perspective and support from WE-Can	Functional limitations enhanced by weather conditions
Facilitation of Nature in Confronting Cancer	Experiencing nature enables a shift of the mind	Perceived effort in the nature experience	Nature offers a social context

4.5.1 Strong Nature Relatedness. Participants' comments and characteristics exemplified components associated with having a high level of nature relatedness. As mentioned,

it is not just understanding nature and how it can be experienced but accepting how one can live in the natural world (Nisbet et al., 2009). Therefore, nature relatedness-experience, and -self, were identified as sub-themes that embodied participants' strong nature relatedness.

4.5.1.1 Concern for living. The nature relatedness-experience was exemplified by participants' concern for other living beings and their environment. More specifically, 64.7% of participants involved in the focus group mentioned some sort of concern for their environment and its entities. Participants expressed apprehensions towards the endangerment of species, fewer reported sightings of species, and the noticeable change in the environment detected over time.

> "Um, you were talking about Clearwater. A week ago, we went to hike to Sleeping Giant, to Sea Lion. I never was there. I was many times with my kids. Back then water was different colour than normal Lake Superior because you could see every rock." – *P1, Summer Session*

> "I looked after the gardens a little bit better. I started a butterfly garden for the monarch butterflies, I spend lots of time on it… I count them every day. I count the caterpillars…I seen something on tv, there's not much place left for these little guys." – *P2, Summer Session*

> "We're outside a bunch of times during the day. And the only thing I've noticed around is there are not many birds around anymore." – *P3, Winter Session*

Physical changes in the environment was noticed by participants that had been situated or living in a certain area over the years. For the winter session, when one participant mentioned the reduced bird sightings, the majority of participants also expressed concern for this as they discussed what the cause of this reduced sighting may be. In the summer session, a male participant created a garden for butterflies in an attempt to counteract their increasing endangerment. These concerns were not just for animals, but for the destruction of ecosystems in which a noticeable change such as the colour of the water, was detected over time. These apprehensions for their environment were made aware due to consistent interaction with nature.

4.5.1.2 Accessibility to nature. Nature relatedness-self was represented by the accessible and various environments in which participants lived in or near. More specifically, approximately 70.6% of the participants in the focus group mentioned that nature was readily available to them. Participants expressed their desire to be closer to more naturally derived elements of the environment. This was emphasized through expressions of pleasure and pride for being situated in biophilic-rich areas. Participants expressed that nature was everywhere in Northwestern Ontario; natural environments that could be experienced were right outside their backdoors.

> "I go to camp, and that is very nice. But, up in our area, there is a woods, up at Kamview, and there is a woods across the street that's an old trail. So I walk in there and uh, so I get right off the road, the busy twenty side road, whatever it is, and climb the trail." – *P4, Summer Session*

> "I mean like I love, like I live in a beautiful, beautiful area!" – *P5, Winter Session*

> "Because we are so close, to, not the marsh, but the, you know the rivers…" – *P6, Winter Session*

Due to the accessibility and ease of accessing natural landscapes, one participant expressed that she sought out unpaved paths in nature compared to those that were paved. Many participants reported that they generally had a place in nature they liked to go, however, they were not limited due to availability of surrounding landscapes. Regardless if they were at their camps or at home, they were surrounded by aesthetically pleasing settings. A couple participants indicated that their own backyard was where they spent a majority of time experiencing nature throughout the challenge. Although consistently experienced and readily available, participants still conveyed a respect for the natural world they lived in.

4.5.1.3 Nature was nothing new. A perspective on nature was embodied when considering that no matter how many times a nature setting was experienced, it still provoked a

sense of fascination and awe for participants. Furthermore, the majority of participants (76.5%) reported that the ONC was not a new experience for them. Instead, the challenge reinforced how much time participants actually spent in nature. Several participants commented that their lifestyles consistently involved contact with nature, however, they still took time to acknowledge their surroundings.

> "The challenge wasn't so difficult, because I'm so busy, it was naturally more than half an hour every day – *P1, Summer Session*

> "I'm always aware of the trees and um, you know, the changes, beautiful snow. And some places, there's a beautiful place where you're up a little higher, and your can see the view. And it always makes you pause and say, 'this is so beautiful here'" – *P7, Winter Session*

> "Yeah, talk about the beauty in the water… the freshness of the water." – *P8, Summer Session*

One participant accredited the beauty of winter, even though she had expressed her fear of ice from a previous fall. The participant was able to acknowledge dangers that transpired from natures' entities but convey it in a way that demonstrated respect and acceptance for its being. Similar discussions were had by others, where a deep admiration and fascination using specific vocabulary, such *P8's* comment "the freshness of the water," emphasizing it was more than just an aesthetic appeal, but a necessity. In the eyes of the participants, experiencing natural environments was not superficially enforced when completing the ONC, but embedded in their lifestyles, indicating a strong connection to nature already exists.

4.5.2 The Challenges of a Cancer Experience. Although a strong nature relatedness was characterized by the participants who engaged in the ONC, it did not make them resilient to the consequences derived from a cancer diagnosis. Throughout their shared experiences of what it was like to complete the challenge, participants often stressed the contests they endured on a daily basis when living with cancer. Lack of guidance following their diagnosis had a large

impact on how they engaged in daily activities and how grateful they were to have the WE-Can program.

4.5.2.1 Insufficient support from cancer centre. When first diagnosed, a lot of the participants felt lost and helpless and relayed that there was a lack of support and education from their healthcare providers on how to manage their illness. Those who were avid exercisers prior to their diagnosis did not continue to exercise based on a fear of worsening their state of health. A majority of participants were grateful that WE-Can was recommended to them by a healthcare practitioner and encouraged safe engagement in physical activity and activities of daily living.

> "I mean for me, I mean I worked out all my life. After all this, I felt really insecure about it, I didn't, I didn't know what to do, I didn't want to do it on my own. In case I hurt myself." – *P5, Winter Session*

> "Because they, I don't know how you feel, you know, I mean four days after, it was just, 'kay, bye, see you.' And there was no follow-ups, other than every six months you get your PET scan, your blood work, but I think there's a missing component… My paraphrase is the excellent job here of treating cancer, but they're not doing an excellent job here of treating the person." – *P9, Winter Session*

A strong sense of anger and disappointment was expressed by many on how their cancer diagnoses were lived and how they were supported by the healthcare institution. They conveyed gratitude towards the WE-Can program as it helped educate them on how they could safely continue daily activities engaged in prior to their diagnosis. One participant even acknowledged that their ignorance on living with cancer also limited the activities performed outside. The WE-Can program help reinforce awareness on how daily living activities could still be employed despite of their state of health. Participants expressed that their cancer diagnosis was stressful and almost instilled a constant fear on how their body was going to manage the disease.

4.5.2.2 Altered outlook on life. Throughout their cancer experience, participants explained that they were more aware of how their body responded and how they felt in everyday

activities. Most were appreciative of the WE-Can program to improve on their confidence. More specifically, approximately 70.6% of participants mentioned confidence was enhanced throughout the exercise program. The education they received enabled them to maintain or start to engage in healthy practices of daily living. Similar to ignorance expressed by participants, several also mentioned how they adapted new perspectives on life after living through a cancer experience.

> "A totally different perspective on what a gift it is just to breathe." – *P5, Winter Session*

> "You do gain confidence because you go, 'oh well, can I do this? Should I do this?." – *P6, Winter Session*

> "And I wanted to come and get comfortable working out and pushing myself. This has done it within a week." – *P4, Summer Session*

The gratification to breathe and importance of taking the time to better oneself were identified through the groups' discussions. Participants mostly recognized the exercise program for doing this. However, one participant expressed a spiritual gratification towards the fact that she had defied her diagnosis and would not take the rest of her life for granted. Ultimately, the majority of participants gained a new perspective on the importance of engaging in healthier behaviours, partially learned from WE-Can and their cancer experience.

4.5.2.3 Functional limitations of the cancer experience. Although the WE-Can program was perceived to benefit participants, it was identified that it could not resolve all the negative outcomes associated with a cancer diagnosis and treatment. Throughout the exercise classes, many participants expressed that their functionality had declined due to side effects of treatment. Although types of treatment differed amongst the participants, 41.2% of the participants in the focus groups mentioned that weather conditions influenced their daily living activities and nature contact.

> "But I do go for careful, I do go for careful walks but not that long, it's just too cold." – *P5, Winter Session*

> "I find the sun, well with my condition, right, the heat will make it hotter." – *P6, Summer Session*

The limitations expressed by some of the participants were justified based on consequences of cancer therapy. For one participant, a fear of walking outdoors was caused by a fainting spell experienced just before her diagnosis. For a participant that partook in the ONC in the summer, she explained that the sun could irritate her radiated skin and she had to take extra precautions when going outside such as wearing a hat and sunscreen. It was rare that the participants mentioned that they did not achieve their nature contact, however when they did not, legitimate reasons based on their lived cancer experience were conveyed. Although there was a uniqueness to the cancer experiences discoursed, similarities on perspectives and appreciation for having a program such as WE-Can or visits to their favourite spot in nature was apparent.

4.5.3 Facilitation of Nature in Confronting Cancer. Analogous to the WE-Can program, participants perceived to benefit from the ONC. Commonly emerged themes were extracted from perspectives on positive experiences elicited throughout the nature challenge.

4.5.3.1 A shift of the mind. Approximately 64.7% of participants in the focus groups mentioned that nature contact elicited a shift in the mind or change in mood. The majority of these responses were comprised of participants who engaged in the ONC in the summer. Based on participants' answers throughout the discussions, it was made obvious that participants sought out a place in nature to help cope with their feelings through self-reflection. Either as a distraction from managing their illness or time to engage in healthier behaviours, a nature experience was perceived as a psychological benefit; eliciting a calmness and sense of peace and tranquility for most participants.

> "Quiet time. Just to clear my mind, enjoy the weather, the sun." – *P6, Summer Session*

> "There's always a shift for me, if things aren't so great one day and I go outside, I'm energized. I find my, I call it a mind shift, keep me going, 'awe, there's so much to do here in the house, blah, blah, blah, there's laundry,' and I go outside and hear the birds, and the shift in my mind, it puts me in a really peaceful and quiet place. That I really like." – *P4, Summer Session*

Even for one participant that experienced nature contact by sitting on her deck and reading a book, she felt more energized. A majority of participants acknowledged that time in nature was able to relieve their emotional and mental stresses experienced in everyday life. Even when having a bad day, a participant explained that going outside made her forget about all the responsibilities and tasks that still needed to get done. Similar to the mind shift, participants also felt this shift was a result from lack of effort perceived when enjoying nature.

4.5.3.2 Perceived effort in nature. Compared to the exertion experienced during exercise classes mentioned earlier, participants exclaimed that exercising outdoors was more effortless. More specifically, over half of the participants (58.8%) involved in the focus groups conveyed that exercising in nature was painless. For one participant, walking was not perceived as exercise, but more a calming experience to cope with the adversities of her cancer diagnosis.

> "And I don't push myself. It's not about exercise, it is about getting on the lake and sitting, really. And enjoying the paddle." - *P4, Summer Session*

> "So I love my walk and uh, for me it's almost like meditating." – *P5, Winter Session*

Even when kayaking on the lake, a participant explained that it was not hard work when asked how it compared to the WE-Can program. Additionally, she explained that she kayaked for more pleasure opposed to improving fitness such as increasing muscle mass. One male explained that maintaining the yard was hard work, however enjoyment of being outside made it easy to do even after his cancer diagnosis. Through these perceptions, it is obvious that the intentions to engage in nature was not always for physiological benefit, but more mental.

4.5.3.3 Support as a social context. Participants reported to interact with nature by themselves or with others depending on their intents. One participant explained that sometimes she would walk in the woods with her son, but other days she preferred to walk alone, seeking out the natural environment for emotional support. Another participant expressed that she liked to go hiking with her kids as a means to motivate her and get her out of the house throughout her cancer experience. Regardless of the context, nature contact was found to be a hospitable support structure, encouraging an interaction to others or the living environment for most participants.

> "I did, yeah [walk]. And like I said going to it everyday, going through chemo, I found it really helpful. Like, partly to learn how I felt. Especially because it always, always makes me feel better." - *P7, Winter Session*

> "…a few days ago, what brings me all this clear, I love… like I almost want to take out all the worry and yell" – *P1, Summer Session*

Through participants' perspectives it was identified that socialization did not have to always be with other humans, but other living creatures and the environments' entities could relate as well. This was expressed through participant encounters of walking the dog or sitting by in a park and listening to the birds. One woman explained that being outside enabled her to feel she had a safe context, in which she could yell out and express all her worry regarding her diagnosis. Through these qualitative findings, experiencing nature was found to alleviate the hardships such as consequences of therapy, fear instilled by a diagnosis, and psychological and physical stress and anxiety, endured when living with cancer.

4.6 Mixed-Methods Results

To strengthen the quality of these mixed-methods findings, data was merged in a joint display so meta inferences could be determined (Creswell et al., 2011). More specifically, the PIP technique was employed to conceptualize the emergence of themes between the quantitative and qualitative data (Johnson et al, 2017). To investigate the quantified data for cancer-related

physiological well-being, psychological well-being, nature relatedness and spirituality, four PIP displays were created, contrasting and emerging the qualitative findings for each variable.

4.6.1 Cancer-Related Physiological Well-Being. To illustrate differences observed between the experimental and control group on cancer-related physiological health, this analysis contrasted quantitative and qualitative findings. As a result, the PIP display was created, and the finalized product is shown in Table 9.

Table 9

Mixed-Methods Analysis for Improvements in Physiological Well-Being Using PIP Technique

Mean Difference Percentage (ONC - Control) 95% CI of Difference	Quantitative Categories	Pillar Conclusion	Qualitative Categories	Qualitative Findings for Nature	Qualitative Findings for WE-Can
	→		←	←	←
↑ 5.64** (-9.26; -2.07)	A significant difference was detected for Aerobic Fitness ONC > control	**Increased aerobic fitness aligned with the frequent activity conveyed.**	For ONC, majority of activities engaged in were physically active. Participants expressed that they were outside on an almost regular basis being physically active. For WE-Can, participants felt like they were able to achieve endurance goals and gain strength.	I spend lots of time gardening and hiking and is it different then before? No (F, Summer) I go to camp, and that is very nice… and there is a woods across the street that's an old trail. So I walk in there…and climb the trail (F, Summer) Yeah, backyard with my dog… we're outside a bunch of times during the day (M, Winter) I spent more time outside. Yard work… I looked after the gardens a little bit better (M, Summer)	Well I never thought I was going to make 10 minutes on that bike (F, Summer) Like oh my god, look at that [points to newly formed biceps] (F, Winter) This is way better than any pill they will give you (M, Winter) And you either push yourself or you don't push yourself. So it's up to you. But here, you push here, and it's good (F, Winter)
↑ 3.07 (-17.51; 11.37)	No significant difference was detected for Flexibility ONC > control	**Although perceived to benefit from WE-Can, additional gain is plausible based on daily engagement in various exercise-driven activities performed outdoors. This can also explain other increases that were observed but did not significantly differ from the control group.**			
↑ 1.35 (-5.81; 3.12)	No significant difference was detected for Strength ONC> control				
↑ 0.86 (-5.68; 3.95)	No significant difference was detected for Handgrip ONC > control				
↓ 0.10 (-4.86; 5.05)	No significant difference was detected for Systolic BP ONC < control				
↑ 2.04 (-6.47; 2.40)	No significant difference was detected for Diastolic BP ONC > control				
Stats for Focus Groups (n = 16)		**Extreme weather mostly mentioned in winter conditions could have limited nature contact compared to summer group.**	Some limitations on weather conditions were expressed. Participants expressed greater intensity for WE-Can.	But I do go for careful, I do go for careful walks but not that long, it's just too cold (F, Winter)	
41.2% mentioned weather impacted nature experience 76.5% reported that they walked 70.6% mentioned that they felt stronger from WE-Can					

Note: ** indicates significance when $p<0.00625$ using a two-tailed test.

To begin, computed results from the series of independent-samples t-tests were added to the left of the table, along with a few relative statistics computed from the focus group. As seen in Table 9, an explanation for each tests' outcomes were provided. Qualitative data that matched the significant improvement between groups on aerobic fitness, as well as the observed differences between the other indicators of physical health, were added to the right of the display. More specifically, the qualitative data was divided into codes for the ONC and codes for WE-Can program to better decipher what may have caused the increased improvements observed for the experimental group. The findings were cross-validated and organized so that they were displayed in a parallel fashion. To conclude this analysis, the middle column expressed the emergence of findings from the two methods employed. For physiological well-being, the significant improvements in aerobic fitness were supported by the various engagements pursued during the ONC, making it quite probable that this additional gain was caused by the nature intervention. Although not statistically significant, the greater changes observed by the ONC group also demonstrate plausibility that the active pursuits experienced when in nature had some effect, however this could have been limited based on weather conditions experienced between subgroups (i.e. summer and winter).

4.6.2 Cancer-Related Psychological Well-Being. To illustrate differences observed between the experimental and control group on cancer-related psychological health, once again, this analysis contrasted quantitative and qualitative findings. The formulated PIP display is illustrated in Table 10.

Table 10

Mixed-Methods Analysis for Improvements in Psychological Well-Being Using PIP Technique

Mean Difference Percentage (ONC - Control) 95% CI of Difference	Quantitative Categories	Pillar Conclusion	Qualitative Categories	Qualitative Findings for Nature	Qualitative Findings for WE-Can
↑ 2.75 (-7.29; 1.79)	No significant difference was detected for Mental Health ONC > control	**Happiness and social interaction mentioned by WE-Can experience, which as a result pushed them more physically.**	WE-Can participants felt more comfortable performing physical activity.	And some places, there's a beautiful place where you're up a little higher, and you can see the view. And it always makes you pause and say, 'this is so beautiful here.' (F, Winter)	I think I missed two classes …I stood at the door, what was that? … And everyone's faces were different, totally different. Happy, talking, laughing, everything (F, Summer)
↓ 0.13 (-3.72; 3.98)	No significant difference was detected for Physical Health ONC < control			I did, yeah [walk]. And like I said going to it everyday, going through chemo, I found it really helpful…. a whole new appreciation for most everything in my life (F, Winter)	I'm not as depressed as I was. I was pretty depressed. I was pretty pissed off at everything. And I never thought I was going to make it through the whole ten weeks (F, Winter)
↓ 0.66 (-1.11; 2.43)	No significant difference was detected for Functional Scale ONC < control	**Participants of ONC mentioned nature acted as support for overcoming adversity.**	New appreciation indicates overcoming adversity of cancer experience		
↓ 0.16 (-4.27; 4.59)	No significant difference was detected for Sense of Coherence ONC < control			Quiet time. Just to clear my mind, enjoy the weather, the sun (F, Summer)	And, I wanted to come and get comfortable working out and pushing myself. And uh, this has done it within a week (F, Summer)
↑ 6.46 (-17.72; 4.80)	No significant difference was detected for Acute Fatigue ONC > control	**Although no significant differences between groups, the ONC experience aligned with the attention restoration theory findings, supporting the increased improvement in fatigue.**	ONC expressed an ease and rejuvenation when in nature. A mind shift can be energizing and improve fatigue.	If things aren't so great one day and I go outside, I'm energized. I find my, I call it a mind shift, keep me going…it puts me in a really peaceful and quiet place (F, Summer)	
↑ 7.72 (-24.67; 9.23)	No significant difference was detected for Chronic Fatigue ONC > control		It felt natural for them to experience nature.		People, positive people. And, that's what made me come here. (F, Winter)
Stats for Focus Groups (n = 16)		**Mind shift was mostly mentioned by summer group.**	Participants gained confidence from the exercise and others that were in WE-Can	The challenge wasn't very difficult, because I'm so busy, it was naturally more than half an hour every day (F, Summer)	You do gain confidence because you go, 'oh well, can I do this? Should I do this (F, Winter)
64.7% mentioned a mind shift or change in mood 58.8% mentioned that nature was effortless 70.6 % mentioned they gained confidence from WE-Can		**Gain in confidence and camaraderie in We-Can could attribute to mental health.**			

Again, computed results from the series of independent-samples t-tests were added to the left of the table, along with a few relative statistics calculated from the focus group. As depicted in Table 10, an explanation for each tests' outcomes were provided, explaining that no significance was met for each test. Qualitative data that matched the observed differences between groups on psychological health indicators were added to the right of the display. Again, the qualitative data was divided into codes for the ONC and codes for WE-Can program to better decipher what may have caused the increased improvements, or lack thereof, observed for the experimental group. The findings were cross-validated and organized so that they were displayed in a parallel fashion. To conclude this analysis, the middle column expressed the emergence of findings from the two methods employed. For psychological well-being, observed improvements for the ONC group on fatigue was supported by participant experiences regarding decreased attentional demand when experiencing nature, especially for the summer group. It is plausible that the improvements detected for mental health were supported by both the nature challenge and WE-Can program. Furthermore, the participants expressed that they become stronger from due to exercising in the WE-Can program and this is reflected by the lack of change observed between both groups on perceived physical health and functionality.

4.6.3 Nature Relatedness. To conceptualize how nature relatedness was subjectively and objectively determined for the ONC group, a PIP analysis was conducted. The joint display was created to determine how participants connected to nature and how it impacted their experience throughout the ONC when it was implemented in the summer versus the winter. The summary of this analysis is presented in Table 11.

Table 11

Mixed-Methods Analysis for Nature Relatedness Using PIP Technique

Mean Difference Between Time 2-1	Mean Difference Between Time 3-2	Quantitative Categories	Pillar Conclusion	Qualitative Categories	Qualitative Findings for Nature
Total ↑ 0.16 *Summer* ↑ 0.15 *Winter* ↑ 0.18 **Stats for Focus Groups** (n = 16)	*Total* ↑ 0.01 *Summer* 0.00 *Winter* ↑ 0.02	No significant difference was detected for Nature Relatedness Time 2 > 1 Time 3 > 2 Change in Winter was larger than Summer Group	**Participants were identified to portray strong traits that support the physical, cognitive and affective relationship one has with nature.** **Statistically the summer group demonstrated a smaller change. It is plausible the weather or just the participants themselves embody a stronger NR and that is why it did not change over time.**	NR- Self was identified through participant findings as they conveyed that they interacted with nature to feel better. They situate or live in areas that are richly diverse with nature and away from urbanization. NR-Perspective identified through the language in which they describe nature. Even in winter, they can bring light to the beauty of the changes and snow. NR- Experience was identified through the physical interaction with nature and their reactions to the endangerment of living species.	I mean like I love, like I live in a beautiful, beautiful area (F, Winter) Because we are close to, not the marsh, but the, you know the rivers (F, Winter) I'm always aware of the trees and um, you know the changes, beautiful snow (F, Winter) Yeah, talk about the beauty in the water… the freshness of the water (F, Summer) Back then water was different colour than normal Lake Superior because you could see every rock (F, Summer) We're outside a bunch of times during the day. And the only thing I noticed around is there are not many birds around anymore (M, Winter) I started a garden for the monarch butterflies, I spend lots of time on it… I count them everyday… I seen something on tv, there's not much place for these little guys (M, Summer)
64.7 % mentioned a concern for other living beings and entities 70.6% mentioned nature being accessible 76.5% mentioned ONC was not a new experience for them		Nature was convenient and experienced on a regular basis.			

Data quantified from the repeated-measures ANOVA for nature relatedness was inputted to the left of the display. More specifically, data was divided into average changes detected between the three time points (i.e. time 1 to 2 represented no ONC and time 2 to 3 represented ONC), indicating a positive change over time. The change scores were also portrayed for just the

summer group and winter group, respectively (refer to Table 11). Furthermore, statistics relative to nature relatedness computed from focus groups were added as well. Explanations were provided for the corresponding findings. The codes that represented nature relatedness for the qualitative data were then added to the right of the display. The codes represented the three traits for nature relatedness, previously identified in the qualitative analysis. The emergence of data displayed in the middle column conceptualizes that the combination of strong nature relatedness traits and lack of significant changes detected over time make it probable that nature contact was already an integral part of the participants' lives. This was especially prevalent for the summer group, indicating probable influence on seasonal variation experienced in Northwestern Ontario and how it can foster the connection one has with nature.

4.6.4 Spirituality. To conceptualize how the emergence of both qualitative and quantitative findings represented spirituality within the ONC group, the PIP analysis was employed. The joint display was created to determine how participants improved their spiritual well-being and how it impacted their experience throughout the ONC when it was implemented in the summer versus the winter. The PIP display for this analysis is shown in Table 12.

Table 12

Mixed-Methods Analysis for Spirituality Using PIP Technique

Mean Difference Between Time 2-1	Mean Difference Between Time 3-2	Quantitative Categories	Pillar Conclusion	Qualitative Categories	Qualitative Findings for Nature
Total ↑ 2.09 *Summer* ↑ 2.01 *Winter* ↑ 2.19 **Stats for Focus Groups** (n = 16) 52.9% expressed having a new outlook on life	*Total* ** ↑ 2.59 *Summer* ↑ 3.40 *Winter* ↑ 1.58	A significant difference was detected for Total Spirituality Time 2 > 1 Time 3 > 2 Change in Summer was larger than Winter Group	**Statistically, spirituality increased towards the latter of the intervention. It is plausible that nature had an impact on this, however findings are limited.** **The summer group demonstrated a greater change compared to winter. Winter group demonstrated more spiritual traits, indicating could have been a more spiritual group.** **Participants were identified to portray traits that support meaning, peace and faith.**	Meaning and Peace identified through the feeling of ease experienced and a time of self-reflection elicited while being in nature. Participants expressed that it motivated them and made them feel better. Faith identified through a new perspective on life and appreciation for health and wellness.	And you don't think meditation or breathing is important. But you realize, I realize now, yes it is (F, Winter) A few days ago, what brings me all this clear, I love… like I almost want to take out all the worry and yell (F, Summer) Yep, that's why why I go out, just have like own time (F, Summer) So I love my walk and uh, for me it's almost meditating (F, Winter) Like partly to learn how I felt. Especially because it always made me feel better (F, Winter) A totally different perspective on what a gift it is just to breathe (F, Winter)

Note: ** indicates significance when $p < 0.05$ using a two-tailed test.

Once again, data quantified from the repeated-measures ANOVA was inputted to the left of the display. More specifically, data was divided into average changes detected between the three time points (i.e. time 1 to 2 represented no ONC and time 2 to 3 represented ONC) on spirituality. As seen in Table 12, a significant change occurred throughout the implementation of the ONC. The increased change scores were also portrayed for just the summer group and winter

group, respectively (refer to Table 12). Furthermore, a statistic relative to spirituality computed from focus groups was added as well. Although limited, qualitative codes that best represented traits conveyed by participants on spirituality were added to the right of the display. The emergence of the two findings represented in the middle column, indicate that spirituality increased towards the latter of WE-Can when the ONC was implemented. This could largely be due to chance, as differences between subgroups were detected. The winter group expressed more spiritually derived traits, and less improvement, indicating that they could be more spiritual to begin, or the nature challenge did not improve spirituality. Controversially, the summer group experienced a greater change in spirituality over time, making probable that nature had some influence, however they did not discuss spiritually-related concepts and more information is required to make a firm assumption on these results.

5.0 Discussion

The ONC was successfully completed by participants who were already partaking in a group-based exercise program for individuals living with cancer. Although the ONC has been investigated in a study by Nisbet (2015) on the general population, this was to the researcher's knowledge, the first time investigated on the cancer population.

5.1 Quantitative Findings

The study found that there was no overall improvement on physiological health outcomes for the experimental group when compared to control. However, statistical significance was still observed for aerobic fitness. More specifically, the experimental group rendered a greater average change than the control group, indicating the additional improvement was associated with the nature intervention. This finding was congruent with other literature that measured improvements in aerobic fitness from outdoor activity on healthy middle-aged (Johnson et al., 2019), elderly (Rapp et al., 2018), and cardiac cohorts (Grazuleviciene et al., 2015). A resistance training program prescribed twice a week, for six-weeks, enhanced aerobic fitness by exhibiting improved time to exhaustion on a modified Bruce Treadmill Test, and number of steps taken per day based on a self-worn tracking device (Johnson et al., 2019). Comparable to the One Nature Activity Calendar data, the self-report instrument helped reinforce autonomous motivation, improving adherence and overall impact of the nature intervention (Johnson et al., 2019). For average changes in flexibility, strength, and handgrip strength, no significant differences were detected between groups, however, greater average changes were observed by the experimental group for each outcome. Controversially, a ten-week horticultural therapy program significantly improved upper and lower limb flexibility and number of bicep curls for seniors with mental health problems (Han et al., 2018). Other gardening interventions were also found to

significantly enhance handgrip strength (Park et al., 2009) and muscle activation (Park et al., 2014) in older adults. These lack of statistical significance for flexibility, strength and handgrip strength, indicate that the small sample of participants that partook in the ONC in the summer, or their limited engagement in activities such as gardening, could have acted as a limitation to this study's results. Finally, average change in both systolic and diastolic blood pressure did not significantly differ between groups. This is congruent with recent findings concluding inconsistent results for systolic and diastolic responses following exposure to various environments for middle-aged women (Ojala et al., 2019) However, systolic blood pressure was observed to be slightly less, and the diastolic blood pressure was observed to be greater for the experimental group compared to the control group. These findings are somewhat similar to results for individuals that were assigned to walking or viewing conditions in the forest, as both systolic and diastolic responses significantly improved (Park et al. 2010). Again, a small sample size in addition to the confounds of medication and treatment for cancer on blood pressure may have limited these statistically insignificant outcomes.

Similar to physiological health, the study found that there was no significant difference between the experimental and control group on overall improvement for psychological well-being and health outcomes. However, the experimental group had noticeably larger improvement change scores for both acute and chronic fatigue when compared to control. Although not statistically significant, these findings are consistent with empirical evidence for the attention restoration theory regarding nature's effect on reduced attentional demands (Hartig et al, 2003; Jiang et al., 2014; Kaplan, & Kaplan, 1989; Korpela et al., 2016; Laumann et al., 2003; Rosley et al., 2013; Ulrich et al., 1991), and reduced fatigue specific to the cancer population (Kangas et al., 2008; Nakau et al., 2013; Ray, & Verhoef, 2013). A larger improvement in perceived mental

well-being was also observed for the experimental group, but again, statistical significance was not met. This is contradictory to evidence on improved well-being associated with virtual nature (McEwan et al., 2019), perceived greenness around the home (Houlden et al., 2018), and horticultural therapy for cancer patients (Wichrowski et al., 2005). Finally, no significance was found between groups on perceived physical well-being, perceived functional capacity, and sense of coherence. Again, these findings lack consistency as increased nature contact was found to improve autonomy, depressive symptoms and mitigate fear of falling for the elderly (Kerr et al., 2012). The controversial evidence for these psychological outcomes can indicate that the self-selected process of participants may have limited statistical findings for this study, as only participants willing to partake in a nature intervention were observed.

When evaluating the experimental group, nature relatedness did not significantly improve over time, however, incremental increases were still observed. Although the connection one has to nature has been found to increase following a thirty-day challenge in the UK (Richardson et al, 2016) and Canada (Nisbet, 2015), greater improvement was more evident for individuals that had lower scores to begin. Therefore, it is probable that based on the small sample investigated, a ceiling effect could have resulted for most participants. On the contrary, spirituality increased over time. More specifically, a significant difference was found during the latter of WE-Can when the ONC was employed. This aligns with similar literature that determined nature exposure significantly improved spiritual well-being for breast (Nakau et al., 2015; Ray, & Verhoef, 2013) and lung cancer patients (Nakau et al., 2015). However, similar to Ray and Verhoef's limitations to studying dragon boat racing for breast cancer survivors, group-based interaction can influence one's spirituality (Thauvoye et al., 2018), making it more plausible that the significant

improvement in spirituality was imparted by both the WE-Can program and the ONC. These findings must be cautiously inferred due to the lack of control group comparison available.

When looking at the experimental group, the study also found that there was an observed difference between the seasons in which the ONC was administered on cancer-related health outcomes. The participants that partook in the ONC in the winter depicted greater change scores on physiological health indicators than participants in the summer. Although not statistically supported, this finding contradicts evidence that snow and icy conditions significantly impact physical activity performed outdoors for older adults (Kimura et al., 2015; Rapp et al., 2018). More specifically, an increase in 10 degrees Celsius increased walking duration by approximately 8-minutes for the older cohort (Rapp et al., 2018).

5.2 Qualitative Findings

It was evident that participants had a strong connection to nature. Participants enjoyed partaking in the challenge and discussed common themes that embodied the three traits that represents nature relatedness. Participants talked frequently about a species that they did or did not see out in nature. It was apparent that a lot of them had some sort of passion for sustaining the environment, as they often negatively emphasized a perceived change in the environment due to the recent development of the land. For some participants, they even engaged in behaviours to support their environment by making a garden for endangered species or biking and/or walking to destinations instead of driving. Similarly, a self-reported study administered across the UK also found that individuals with higher nature relatedness conveyed to have greater social cohesion and more frequently pursue activities in the natural environment (Cox, et al., 2018). Participants also expressed that nature was easily accessible based on where they lived. Most had access to paved or unpaved trails and for some, their backyard was their own nature-rich oasis.

Participants conveyed that they would actively pursue a nature experience to improve their current mental state and well-being. They generally provided no rationale for this, just knew by experiencing nature that they would feel better. This aligns with the innate tendencies to interact and thrive in the natural world expressed by biophilia (Wilson, 1984), and through familiarization, the environment in which they frequently experience reinforces this satisfaction (Basu et al., 2020). Participants also expressed that the ONC was nothing new and that experiencing nature was already embedded in their daily lives. Even in the winter months, participants explained that experiencing nature was easily attainable and natural. Their perspectives on snow and ice were still portrayed as beautiful, regardless of the harm it could inflict. Relatedly, cooperation with the environment has been expressed through a deep fascination with nature (Zhang, et al., 2014). For most participants, their fascination was identified as greater than just the superficial elements nature can portray (Nisbet, et al., 2009), fostering a high nature relatedness.

However, although the ONC was effortlessly completed, participants still emphasized the daily struggles experienced when living with cancer. When first diagnosed, participants explained that the support and services provided to them did not help them manage their disease. The resources were specific to cancer, but not the individual. Participants conveyed that they were unaware on what they could or could not do and were scared to worsen their current state of health. Other literature has stated that there is an urgency for therapeutic support for cancer as not enough resources are readily available based on the increasing prevalence of the disease (Denton, & Spencer, 2010). Participants expressed that they were thankful for being involved in the WE-Can program as they gained a newfound confidence to once again engage in activities that were part of their daily lives prior to their diagnosis. We-Can enabled participants to learn

how to safely engage in healthy behaviours such as exercise and as a result, participants perceived to gain more strength from the program. Congruently, individuals living with cancer have to combat outcomes of treatment such as distress and fatigue (Korszun, et al., 2014) These were symptoms participants often experienced when they came to their weekly exercise classes. For some participants, depression was an everyday battle. Participants expressed that both engaging in the exercise class and visiting a place in nature helped manage these symptoms. However, consequences of treatment often limited them to engaging in pursuits such as experiencing nature. Participants expressed that extreme weather could worsen their state of health. Notably, even in healthy populations, participants relayed that severe weather conditions limited their time spent in nature and negatively impacted how they felt while experiencing nature (Fraser et al., 2019). In contradiction, elderly Minnesotans discussed positive experiences in white conditions classified as snow, however, extra precautionary measures still had to be considered (Finlay, 2018). For most participants, dealing with a cancer diagnosis was an everyday struggle, however, became what was considered a new normal for them.

Nature helped facilitate the cancer experience by relieving hardships such as treatment symptoms endured. Participants expressed that being out in nature alleviated stress and fatigue. Participants felt more energized and this generally was caused by a perceived shift of the mind. This mentally restorative response is coherent with the attention restoration theory. The theory conceptualizes a shift of the mind based on the increased soft fascination and reduced attentional burden when experiencing a natural environment (Kaplan, & Kaplan, 1989). In addition, nature exposure reduced physiological mobilization such as stress hormones, eliciting a positive response (Kaplan, & Kaplan, 1989). Furthermore, individuals living with cancer that were frequent gardeners also expressed a sense of ease and tranquility (Spees et al., 2015). For people

with post-traumatic stress disorder (Poulsen et al., 2016) or dementia (Bossen, 2010) time in nature was conveyed therapeutic. This was similar to participants' experiences, as for one, something as laborious as kayaking was perceived to be effortless and healing. Through these positive interactions, nature was identified as a hospitable support structure for the participants. Whether alone or with others, participants used the natural environment to enhance their well-being. Similarly, children living with cancer felt supported by the environment after immersed in an adventure therapy program in the woods (Stevens et al., 2014). The children felt included and useful when they connected with the natural environment (Stevens, et al., 2014). Congruent to the safe context in which nature provided for terminally ill patients (Blashke et al., 2017), participants felt empowered and protected, voicing that nature allowed them to express emotion or pain without any apprehension. Analogously to these findings, nature was identified to provide a retreat and enhance a sense of coherence for life satisfaction (Weimann et al., 2019). Therefore, the power of nature was emphasized through participants' experiences, as it no longer was conveyed as just a piece of land, but an escape from the chaos that transpires from a cancer diagnosis.

5.3 Mixed-Methods Findings

Both the quantitative and qualitative processes employed in this study played integral roles on deciphering how experiencing nature can affect individuals living with cancer. The pillar conclusions established through the emergence of the two methods helped confirm and deny the study's hypotheses.

The study findings did not support the hypothesis that the ONC would cause an additional gain for physiological well-being when compared to baseline. Instead, the additional gain in aerobic fitness detected was supported by the participants' reported active pursuits

engaged in while completing the ONC. Therefore, the nature intervention encouraged additional activity, especially for those who completed the ONC in the summer, supporting its impact on significantly improving aerobic fitness for participants. It is plausible other additional increases observed by participants can be influenced by the ONC, however, it is more probable these improvements in strength and flexibility were caused by the WE-Can program.

Similarly, the study findings did not support the hypothesis that the ONC would cause an additional gain for psychological well-being when compared to baseline. However, a strong inference can be made that the ONC elicited additional improvements for both acute and chronic fatigue, especially for those who completed the ONC in the summer. This indicates that nature interventions can have a positive effect on mitigating cancer-related fatigue, however, repeated measures and a larger sample size are necessary to reinforce if these findings could be statistically significant.

The study findings did not support the hypothesis that nature relatedness would improve after completing the ONC. Instead the lack of significant change was supported by the inference that nature relatedness was already practiced by the majority of participants. It is plausible that the season in which the ONC was completed influenced these findings, as a ceiling effect was more prevalent in the summer group. Regardless, this high nature relatedness exemplified by the participants can help support the primary findings regarding improvements in overall psychological or physiological health, as benefits from nature could have already been known and experienced by participants.

The study findings did support the hypothesis that spirituality would improve after completing the ONC. However, these findings have to be taken with caution as controversial results between the subgroups make it more probable that both the WE-Can program and ONC

influenced spiritual well-being. Regardless, repeated measures are necessary so that the data can be compared and can confidently determine whether experiencing nature or group-based exercise had the greatest effect.

The study findings did not support the hypothesis that participants who completed the ONC in the summer would attain more nature contact than those who completed it in the winter. Similar nature contact was calculated for both groups. However, the study findings somewhat supported the hypothesis that participants would perceive greater benefit from nature. More specifically, the summer group conveyed greater benefits for psychological health than the winter group and were observed to have much larger improvement scores for both acute and chronic fatigue as a result.

The study findings did support the hypothesis that participants perceived to gain more physiological benefit from the WE-Can program and psychological benefit from the ONC. However, these results must be interpreted with caution as the participants still perceived to gain confidence and social cohesion from the WE-Can program. These findings support other inferences made throughout the study; although further investigation is warranted.

5.4 Limitations

Limitations exist based on the study being exploratory and employing a unique methodological approach. To the researcher's knowledge, no study has been conducted using the same instrumentations and protocol. Although the study purposively targeted participants in the WE-Can program, it was optional as to whether they would like to partake in the additional nature challenge in conjunction with their exercise program. The self-selected choice to participate only recruited individuals who were avid nature lovers and willing to go outside. In addition, these findings cannot be generalized to all individuals living with cancer as desire to

experience nature may not be congruent within the cancer cohort. Another drawback was the underrepresented experimental sample and its comparison to a much larger control sample. Based on the Bonferroni correction employed throughout most of the analyses, the results are at risk for type II error. Sample characteristics also varied between groups. The control group comprised of secondary data from previous years. It is probable that participants could have been actively interacting with nature while they were partaking in WE-Can, as no objective measure was applied to this group. Furthermore, the inclusivity of the WE-Can program allowed for individuals with various types of cancer, stages of cancer, age, gender, and treatment status. Refinement by selecting a cohort within the cancer population may allow for findings to be more comparable to other literature, such as a specific type of cancer examined.

Although the nature intervention was strengthened by qualitative inquiry, its lack of structure and self-reporting still limit inferences made. Self-reporting has been known to increase participant bias based on subjective measurement. In this study, the amount of time spent experiencing nature was not objectively evaluated. It may have been that participants were experiencing nature for much longer or shorter duration than the targeted thirty-minutes, making these findings hard to replicate. Although being physically active was the most commonly reported type of activity engaged in while experiencing nature, the type, duration, and intensity were not reported. Other studies have measured energy expenditure while experiencing nature to convey a potential dose-response effect. This was not prioritized by the researchers but could have strengthened the assumptions made for this study.

Several confounding factors that were not conveyed by participants during the group discussions could have influenced the way nature was experienced. The lack of statistical significance detected between the ONC and control groups could have been caused by weather

conditions. More specifically, extreme weather conditions such as ice, snow, rain, or extreme heat could have limited the amount of nature contact achieved by participants. Furthermore, symptoms of cancer treatments could have restricted time spent experiencing nature.

As mentioned, the qualitative findings complemented quantified data to improve inferences made. However, the approach on this could have been more rigorous. The large group setting around a boardroom table could have been intimidating and prevented participants from speaking up. This could have caused a lack of consistent contribution by each participant. Participants may have provided more input if asked questions during individual interviews.

5.5 Recommendations for Future Research

The study findings provide a general overview on how nature can benefit and be experienced by individuals living with cancer. Further investigation using both qualitative and quantitative techniques on cancer patients need to be considered to better refine how nature can be applied as an additional therapy in the cancer care context. Although the spirituality and aerobic fitness (i.e. physical) dimensions of the psycho-oncological care model were the only well-being components statistically improved by experiencing nature, enhancement of other dimensions in the model, as proven by other literature, are still plausible. To begin, a more structured nature intervention such as one that mimics the WE-Can protocol in an outdoor setting can increase strength in comparability between the two interventions. In addition, more objective measures such as energy expenditure and actual time spent experiencing nature could elicit a greater dose-response effect. This will further support the efficacy of a nature-based therapy program as a continuum of care for cancer.

When considering the aging population, it is also critical to evaluate nature exposure's effect within cohorts. Experiencing nature may be more feasible and enjoyable compared to an

exercise program for older cohorts within the cancer population, supporting the value of a nature-therapy program. Furthermore, the study should be conducted in multiple geographical locations to better decipher the potential effects on climate and availability of natural landscapes. Although this study was conducted in a semi-urbanized area in Northwestern Ontario, perspectives on experiencing nature and benefits gained may differ between rural and urban, warranting further investigation.

6.0 Conclusion

This was the first study to examine the ONC in a rehabilitation setting, specifically an exercise oncology program. The use of a mixed-methods approach rendered a large depth of data that can help translate into alternative therapies in exercise oncology or other chronic disease contexts. The study's participants did not find it difficult to complete the additional nature intervention in conjunction with a group-based exercise program. Findings did not support that the nature challenge elicited an overall greater improvement on psychological, physiological, and social health amongst individuals living with cancer. However, the participants who completed the ONC demonstrated greater improvements on aerobic fitness and fatigue compared to individuals who only partook in the exercise program. It is plausible that the additional intervention motivated participants to be more physically active throughout their time completing the WE-Can program. Qualitative inquiry also added to these findings. Most themes that emerged from the group discussions were associated with psychological factors such as reduced fatigue and perceived well-being. Similar to other literature evaluating vulnerable populations, experiencing nature provided the participants with a safe place to self-reflect and cope with negative outcomes derived from living with a chronic disease such as cancer. The increase in spirituality found may be indicative of the camaraderie gained from the group-based exercise classes and the support received from the environment in which nature was experienced. The lack of improvements in nature relatedness detected can support the assumption that participants were already experiencing nature on a daily basis and receiving benefits prior to completing the ONC. Although it was anticipated that the nature challenge would enable individuals living with cancer to become one with nature, perhaps these individuals had already

done so. To conclude, the study was able to direct future implications for research on nature-based interventions in healthcare applications for aging populations.

7.0 References

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8.0 Appendices

Appendix A- Participant Letter for One Nature Challenge

WE-Can
A Wellness and Exercise Program for Individuals with Cancer

Dear Potential Participant,

In addition to the WE-Can Wellness and Exercise program for individuals living with Cancer, we are excited to offer you the opportunity to participate in the David Suzuki One Nature Challenge. This challenge started as a campaign for the David Suzuki Foundation, encouraging people to get outside and since then, has been successfully completed by individuals on a global level.

Empirical data from previous research has shown that nature can offer a multitude of benefits including physical, spiritual, and psychological. Evidence of benefits from nature has also been directly associated with individuals living with cancer. When the nature challenge was completed by a group of healthy Canadians, they reported increases in environmental concern, vitality and happiness. Other documentation suggests improvements in walking duration, spirituality, overall well-being, and decreased fatigue after being exposed to nature.

The One Nature Challenge will be completed on participants' own time, based on their convenience. This will help you receive the greatest benefits possible to you, without the added pressure of commitment.

We look forward to supporting you with the completion of the One Nature Challenge and providing guidance and education on outdoor environments whenever necessary. We hope you enjoy partaking in this nature challenge, please do not hesitate to contact the researcher at (647)920-0676 or the WE-Can Team at (807)684-7221 or at wecan@tbh.net if any questions or concerns arise.

Yours Sincerely,

The WE-Can Team

Appendix B- Consent Form for One Nature Challenge Research Study

Consent of Participation in the One Nature Challenge

In addition to the information provided by WE-Can, the incorporation of the One Nature Challenge will now be addressed.

I, the undersigned, hereby acknowledge:

My Consent to Complete the Survey Questionnaires:

In addition to WE-Can, the following questionnaires are included in the participant home information package. This is to be completed before the WE-Can initial assessment, before the One Nature Challenge begins and finally, at the end of the 10-week exercise program and One Nature Challenge:

- Nature Relatedness Scale (6-item) - This nature relatedness questionnaire will be used to evaluate the connection you have with nature. This will require approximately 5 minutes of your time to answer six questions. You will be asked to rank how much you agree or disagree with the statement. You may, at any time, choose not to answer some or all of the questions.

- Functional Assessment of Chronic Illness Therapy - Spirituality Scale (FACIT-Sp-12) - This questionnaire has commonly be used to assess spirituality amongst individuals living with cancer. This will require approximately 5-10 minutes of your time to answer twelve questions. You will be asked to circle the response that has applied to you in the past seven days. You may, at any time, choose not to answer some or all of the questions.

My Consent to Participate in a One Nature Challenge:

- Activity Calendar - You will be encouraged to engage in outdoor activity and/or sit by a window and view an outdoor environment for at least 30 minutes, for 30 consecutive days. The 30 minutes of environmental exposure can be undertaken at any point throughout the day, based on your convenience. The engagement with nature does not have to be active, it can also involve resting in nature (e.g. sitting on a park bench). The activity calendar will be distributed to you before the One Nature Challenge begins. You will be asked to, with the best of your ability, complete the calendar daily. If you achieved

your 30 minutes, you will be asked to circle 'Yes' on the activity calendar, as well as circle if you performed an 'Activity' (e.g. walking) or 'Rest' (e.g. sitting). If you did not complete the 30 minutes for that day, you will be asked to circle 'No' on your calendar. On the back of the activity calendar, an additional section that can be completed daily is available for you to write notes or make comments as you complete the challenge. The additional comment section is solely for you and optional, it will not be involved in the data collection and analysis process.

You will be able to refrain from filling out the calendar on any given day, or all together. Participation in the One Nature Challenge can be successfully performed without the completion of the activity calendar. This calendar will be collected during the post-assessments following the One Nature Challenge and WE-Can program. If any questions or concerns arise throughout the One Nature Challenge, the researcher's contact information will be provided on the activity calendar.

- Nature Information Sheet - This information sheet will be used to assist you with your completion of the One Nature Challenge. The information sheet will be distributed to you after your consent to complete the One Nature Challenge. The information sheet will present participants with potential activities and/or places that can be enjoyed outside in Thunder Bay. It is important to note that these are merely suggestions and participants are free to engage in whatever activity they feel comfortable with. The information sheet will also inform proper clothing attire for the outdoors, based on the various seasons.

I also hereby acknowledge:

My understanding that there are modest potential risks with participation in this One Nature Challenge, however, the risks are no greater than any other engagement with the outdoors that I would do on my own;

My understanding that it is my obligation to immediately inform the researcher and/or WE-Can team of any pain, discomfort, fatigue, or any other symptoms experienced while spending time in nature;

My understanding that I may stop or delay any further time spent in nature or participation in the One Nature Challenge if I so desire;

My understanding that I may ask questions or request further explanation about the procedures at any time before, during, and after the One Nature Challenge;

WE-Can
A Wellness and Exercise Program for Individuals with Cancer

My consent for the researchers to access my medical history and discuss with each other, any medical information that has been provided through the WE-Can process. This will be done in order to provide the best care possible for myself.

With full knowledge of all foregoing, I agree, of my own free will, to participate in the One Nature Challenge and research project

Client Name	Signature
Date	Witness

WE-Can®
A Wellness and Exercise Program for Individuals with Cancer

Appendix C- Nature Information Sheet: Discover Nature in Thunder Bay

Discover Nature in Thunder Bay

CONSERVATION AREAS

What are they?

The Lakehead Region has over 2500 hectares of land used to help conserve habitat protection and water management. These areas also promote outdoor recreation and conservation education. Lakehead Region has 8 conservation areas available to the public.

What can I do there?

There are over 28 kilometers of combined hiking trails throughout the conservation areas. They consist of forested areas, where many different wildlife and plants can be observed. These areas also include bird watching sites, scenic waterfalls, rivers and lakeside settings. Activities offered in some of the conservation areas include fishing, canoeing, kayaking, and more.

Visit: https://lakeheadca.com/conservation/conservation-areas for more information on conservation areas.

Visit: www.tbfn.net/nature-guide-to-thunder-bay-area for checklists of wildlife found in Thunder Bay

PROVINCIAL PARKS

Where can I find them?

There are 5 Provincial parks located less than 2 hours from the city of Thunder Bay. These parks include:

- Kakabeka Falls Provincial Park – approx. 25 minutes away
- Pigeon River Provincial Park – approx. 45 minutes away
- Sleeping Giant Provincial Park – approx. 60 minutes away
- Quimet Canyon Provincial Park – approx. 60 minutes away
- Quetico Provincial Park – approx. 90 minutes away

What can I do there?

These parks offer hundreds of kilometers of regulated hiking trails. Scenic landscapes such as waterfalls and canyons can be viewed at these locations, along with a variety of various plants and wildlife. Activities such as snowshoeing, fishing, camping, kayaking, and canoeing can be enjoyed by individuals of all ages.

Visit: https://www.ontarioparks.com for more information on these parks and many more.

DRESS FOR SUCCESS

Layering for colder weather conditions:

The First Layer: Worn tight to the skin to help protect it from exposure. The best materials include polyester, polypropylene, merino wool and silk. These materials aid to wick moisture and dry quickly. In moderate weather, a lightweight t-shirt will suffice.

The Mid Layer: Long-sleeve shirts, button-ups or zip-ups to allow for easy removal.

The Insulating Area: The last layer to put on, this helps to conserve all the heat emitted from your body. The best materials include wool, fleece, or a down vest or down jacket.

Winter hats, gloves, face masks, and boots are also important for keeping your extremities warm. Visit: https://www.sierra.com/lp2/head-to-toe-winter-dressing-guide/ for more information on winter wear.

Layering for warmer weather conditions:

Not as many layers are involved in warmer weather, however, it is important to consider layering when walking or performing an activity near an open body of water or in the Spring/Fall seasons (when temperatures are below 20°C). Base layers should involve materials such as polypropylene or polyester to allow for proper ventilation when sweating occurs. Additional layers should include mid-lightweight jackets or wind-breakers that can be easily removed if the body becomes overheated. Hats such as baseball caps or sun visors, as well as sunglasses should also be worn for protection from the sun. Sunscreen is also recommended on sunny or cloudy days to prevent sunburn.

LOCAL PARKS IN THUNDER BAY

Park Name	Location	Swimming Area?	Picnic Area?	Washroom?	Walking Trails?	Additional Features
Boulevard Lake	400 Lyon Blvd. W.	Yes (seasonal)	Yes (seasonal)	Yes (seasonal)	Yes	-18-hole disc golf course -Concession (seasonal) -Mini-putt (seasonal) -Boat rentals (seasonal)
Centennial Park	751 Centennial Park Rd.	No	Yes (indoor)	Yes	Yes	-1910 Logging Museum -Farm animals
Chippewa Park	2465 City Rd.	Yes (seasonal)	Yes	Yes	Yes	-Concession (seasonal)
Hillcrest Park	High St.	No	Yes	Yes	Yes	-War Memorial -Sunken Gardens
Kaministiqua River Park	May St. S.	No	Benches only	No	Yes	-James Whalen Tugboat
Marina Park	Sleeping Giant Pkwy	Splash Pad	Yes	Yes	Yes	-Marina (seasonal) -Skating rink (seasonal) -City Events
Friendship Gardens	102 Legion Track Dr.	No	Yes	No	Yes	-Skating rink (seasonal) -Shade trees -2 ponds
Waverly Park	Waverly St.	No	Yes	No	Yes (historical)	-Hogarth Memorial Fountain -WWI Cenotaph

Check out the Centennial Botanical Conservatory located at 1601 Dease St. It is open Monday and Tuesday from 10am-4pm and Wednesday-Sunday from 12pm-8pm. Individuals can view live bee hives, a wishing pond, flowering plants, exotic trees and shrubs from around the world at the conservatory. A community and children's garden is also available for use to the public. Benches are located throughout.

Visit: https://www.thunderbay.ca/en/recreation/conservatory.aspx for more information

ADDITIONAL ACTIVITIES

SUMMER

- Golf (7 courses located right in Thunder Bay)
- Putt-Putt Mini Golf (located at Boulevard Park)
- Summer in the Park – Every Wednesday in the summer months at Marina Park
- Boat rentals for Canoeing, Kayaking, Paddle Boating, etc.
- Fly fishing, and Urban Angling Fishing
- Hiking, Running, and Walking
- Beaches (Chippewa Park & Boulevard Lake) –Supervised & Unsupervised
- Cycling and Mountain Biking
- Motor Boating

WINTER

- Dog Sledding
- Fat Biking
- Ice Climbing
- Ice Fishing
- Ice Skating
- Downhill Skiing and Snowboards
- Cross-Country Skiing
- Snowshoeing (rentals available from Chaltrek, Loch Lomond, Fresh Air, and Lakehead University)

Visit: https://www.visitthunderbay.com/en/outdoor-adventre/outdoor-adventure.aspx for more information regarding outdoor activities in Thunder Bay.

A special thank you to Thunder Bay Field Naturalists for their help with creating this information sheet. Visit www.tbfn.ca to discover more about this non-profit organization.

Appendix D- SF-36v2: Your Health and Well-Being Questionnaire

Your Health and Well-Being

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. ***Thank you for completing this survey!***

For each of the following questions, please mark an ☒ in the one box that best describes your answer.

1. In general, would you say your health is:

Excellent	Very good	Good	Fair	Poor
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

2. <u>Compared to one year ago</u>, how would you rate your health in general <u>now</u>?

Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

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3. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	☐ 1	☐ 2	☐ 3
b. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐ 1	☐ 2	☐ 3
c. Lifting or carrying groceries	☐ 1	☐ 2	☐ 3
d. Climbing several flights of stairs	☐ 1	☐ 2	☐ 3
e. Climbing one flight of stairs	☐ 1	☐ 2	☐ 3
f. Bending, kneeling, or stooping	☐ 1	☐ 2	☐ 3
g. Walking more than a mile	☐ 1	☐ 2	☐ 3
h. Walking several hundred yards	☐ 1	☐ 2	☐ 3
i. Walking one hundred yards	☐ 1	☐ 2	☐ 3
j. Bathing or dressing yourself	☐ 1	☐ 2	☐ 3

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4. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b. Accomplished less than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c. Were limited in the kind of work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d. Had difficulty performing the work or other activities (for example, it took extra effort)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

5. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the amount of time you spent on work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b. Accomplished less than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c. Did work or other activities less carefully than usual	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

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6. **During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?**

Not at all	Slightly	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

7. **How much bodily pain have you had during the past 4 weeks?**

None	Very mild	Mild	Moderate	Severe	Very severe
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

8. **During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?**

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

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9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks…

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Did you feel full of life?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b. Have you been very nervous?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c. Have you felt so down in the dumps that nothing could cheer you up?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d. Have you felt calm and peaceful?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
e. Did you have a lot of energy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
f. Have you felt downhearted and depressed?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
g. Did you feel worn out?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
h. Have you been happy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
i. Did you feel tired?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

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11. How TRUE or FALSE is <u>each</u> of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
a. I seem to get sick a little easier than other people	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b. I am as healthy as anybody I know	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c. I expect my health to get worse	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d. My health is excellent	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing these questions!

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Appendix E- Patient-Specific Functional Scale

The Patient-Specific Functional Scale

This useful questionnaire can be used to quantify activity limitation and measure functional outcome for patients with any orthopaedic condition.

Clinician to read and fill in below: Complete at the end of the history and prior to physical examination.

Initial Assessment:

I am going to ask you to identify up to three important activities that you are unable to do or are having difficulty with as a result of your _____ problem. Today, are there any activities that you are unable to do or having difficulty with because of your _____ problem? (Clinician: show scale to patient and have the patient rate each activity).

Follow-up Assessments:

When I assessed you on (state previous assessment date), you told me that you had difficulty with (read all activities from list at a time). Today, do you still have difficulty with: (read and have patient score each item in the list)?

Patient-specific activity scoring scheme (Point to one number):

0 1 2 3 4 5 6 7 8 9 10

Unable to perform activity

Able to perform activity at the same level as before injury or problem

(Date and Score)

Activity	Initial					
1.						
2.						
3.						
4.						
5.						
Additional						
Additional						

Total score = sum of the activity scores/number of activities
Minimum detectable change (90%CI) for average score = 2 points
Minimum detectable change (90%CI) for single activity score = 3 points

PSFS developed by: Stratford, P., Gill, C., Westaway, M., & Binkley, J. (1995). Assessing disability and change on individual patients: a report of a patient specific measure. Physiotherapy Canada, 47, 258-263.

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Appendix F- Functional Assessment of Chronic Illness Therapy- Fatigue Scale

FACIT-F (Version 4)

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

	PHYSICAL WELL-BEING	Not at all	A little bit	Some-what	Quite a bit	Very much
GP1	I have a lack of energy	0	1	2	3	4
GP2	I have nausea	0	1	2	3	4
GP3	Because of my physical condition, I have trouble meeting the needs of my family	0	1	2	3	4
GP4	I have pain	0	1	2	3	4
GP5	I am bothered by side effects of treatment	0	1	2	3	4
GP6	I feel ill	0	1	2	3	4
GP7	I am forced to spend time in bed	0	1	2	3	4

	SOCIAL/FAMILY WELL-BEING	Not at all	A little bit	Some-what	Quite a bit	Very much
GS1	I feel close to my friends	0	1	2	3	4
GS2	I get emotional support from my family	0	1	2	3	4
GS3	I get support from my friends	0	1	2	3	4
GS4	My family has accepted my illness	0	1	2	3	4
GS5	I am satisfied with family communication about my illness	0	1	2	3	4
GS6	I feel close to my partner (or the person who is my main support)	0	1	2	3	4
Q1	*Regardless of your current level of sexual activity, please answer the following question. If you prefer not to answer it, please mark this box* ☐ *and go to the next section.*					
GS7	I am satisfied with my sex life	0	1	2	3	4

FACIT-F (Version 4)

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

	EMOTIONAL WELL-BEING	Not at all	A little bit	Some-what	Quite a bit	Very much
GB1	I feel sad	0	1	2	3	4
GB2	I am satisfied with how I am coping with my illness	0	1	2	3	4
GB3	I am losing hope in the fight against my illness	0	1	2	3	4
GB4	I feel nervous	0	1	2	3	4
GB5	I worry about dying	0	1	2	3	4
GB6	I worry that my condition will get worse	0	1	2	3	4

	FUNCTIONAL WELL-BEING	Not at all	A little bit	Some-what	Quite a bit	Very much
GP1	I am able to work (include work at home)	0	1	2	3	4
GP2	My work (include work at home) is fulfilling	0	1	2	3	4
GP3	I am able to enjoy life	0	1	2	3	4
GP4	I have accepted my illness	0	1	2	3	4
GP5	I am sleeping well	0	1	2	3	4
GP6	I am enjoying the things I usually do for fun	0	1	2	3	4
GP7	I am content with the quality of my life right now	0	1	2	3	4

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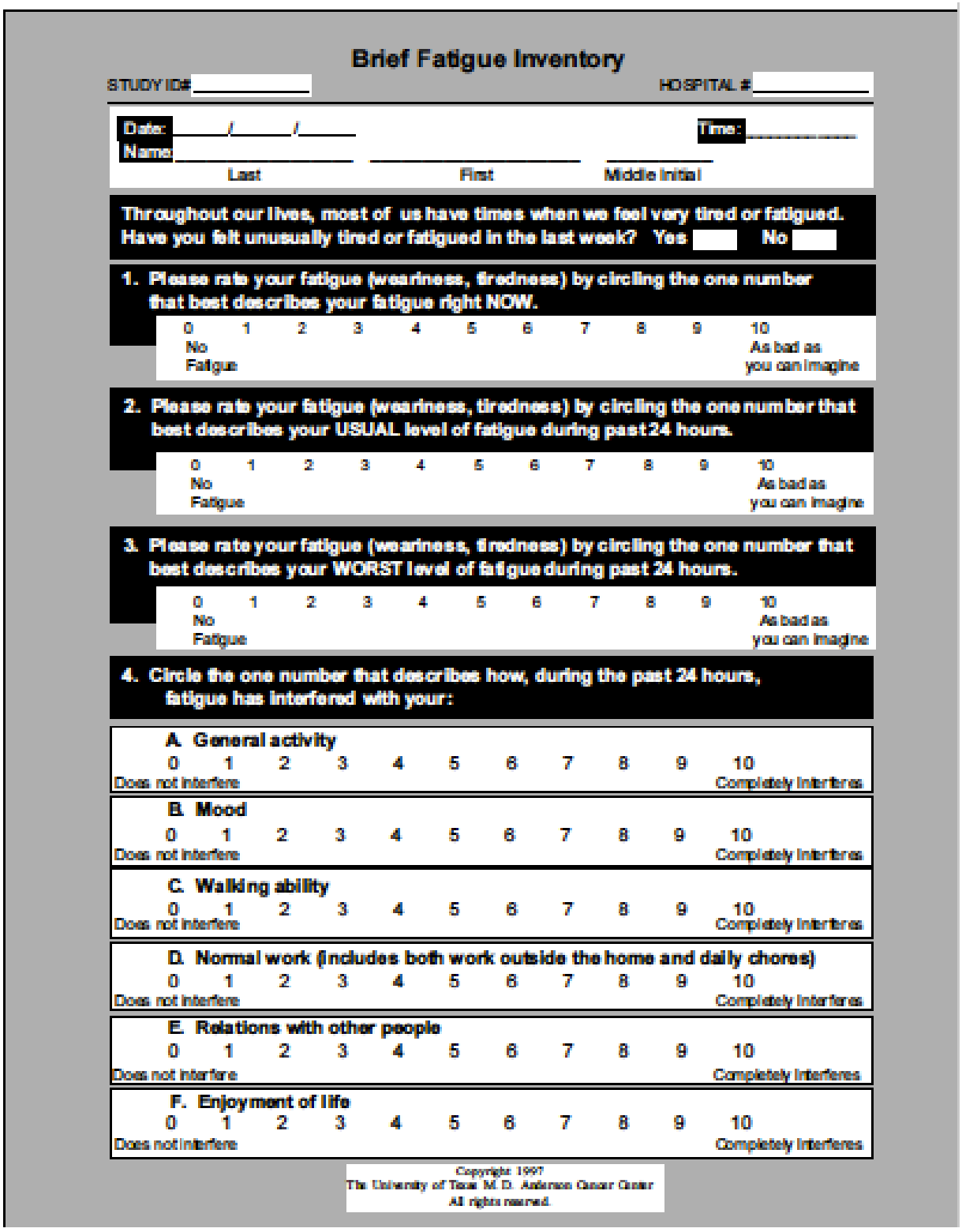
FACIT-F (Version 4)

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

	ADDITIONAL CONCERNS	Not at all	A little bit	Some-what	Quite a bit	Very much
H23	I feel fatigued	0	1	2	3	4
H12	I feel weak all over	0	1	2	3	4
An1	I feel listless ("washed out")	0	1	2	3	4
An2	I feel tired	0	1	2	3	4
An3	I have trouble starting things because I am tired	0	1	2	3	4
An4	I have trouble finishing things because I am tired	0	1	2	3	4
An5	I have energy	0	1	2	3	4
An7	I am able to do my usual activities	0	1	2	3	4
An8	I need to sleep during the day	0	1	2	3	4
An12	I am too tired to eat	0	1	2	3	4
An14	I need help doing my usual activities	0	1	2	3	4
An15	I am frustrated by being too tired to do the things I want to do	0	1	2	3	4
An16	I have to limit my social activity because I am tired	0	1	2	3	4

Appendix G- Brief Fatigue Inventory



Brief Fatigue Inventory

STUDY ID#_____ HOSPITAL #_____

Date: ____/____/____ Time: _____

Name: _____ _____ _____

Last First Middle Initial

Throughout our lives, most of us have times when we feel very tired or fatigued. Have you felt unusually tired or fatigued in the last week? Yes ☐ No ☐

1. Please rate your fatigue (weariness, tiredness) by circling the one number that best describes your fatigue right NOW.

0 1 2 3 4 5 6 7 8 9 10
No Fatigue — As bad as you can imagine

2. Please rate your fatigue (weariness, tiredness) by circling the one number that best describes your USUAL level of fatigue during past 24 hours.

0 1 2 3 4 5 6 7 8 9 10
No Fatigue — As bad as you can imagine

3. Please rate your fatigue (weariness, tiredness) by circling the one number that best describes your WORST level of fatigue during past 24 hours.

0 1 2 3 4 5 6 7 8 9 10
No Fatigue — As bad as you can imagine

4. Circle the one number that describes how, during the past 24 hours, fatigue has interfered with your:

A. General activity
0 1 2 3 4 5 6 7 8 9 10
Does not interfere — Completely interferes

B. Mood
0 1 2 3 4 5 6 7 8 9 10
Does not interfere — Completely interferes

C. Walking ability
0 1 2 3 4 5 6 7 8 9 10
Does not interfere — Completely interferes

D. Normal work (includes both work outside the home and daily chores)
0 1 2 3 4 5 6 7 8 9 10
Does not interfere — Completely interferes

E. Relations with other people
0 1 2 3 4 5 6 7 8 9 10
Does not interfere — Completely interferes

F. Enjoyment of life
0 1 2 3 4 5 6 7 8 9 10
Does not interfere — Completely interferes

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Appendix H- Orientation to Life Questionnaire

Code Identifier _____ Date _____

Orientation to Life Questionnaire

Here are a series of questions relating to various aspects of our lives. Each question has seven possible answers. Please mark the number which expresses your answer, with numbers 1 and 7 being the extreme answers. If the words under 1 are right for you, circle 1; if the words under 7 are right for you, circle 7. If you feel differently, circle the number which best expresses your feeling. Please give only one answer to each question.

1. When you talk to people, do you have the feeling that they don't understand you?

1	2	3	4	5	6	7
never have this feeling						always have this feeling

2. In the past, when you had to do something which depended upon cooperation with others, did you have the feeling that it:

1	2	3	4	5	6	7
surely wouldn't get done						surely would get done

3. Think of the people with whom you come into contact daily, aside from the ones to whom you feel closest. How well do you know most of them?

1	2	3	4	5	6	7
you feel that they're strangers						you know them very well

4. Do you have the feeling that you don't really care about what goes on around you?

1	2	3	4	5	6	7
very seldom or never						very often

5. Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?

1	2	3	4	5	6	7
never happened						always happened

6. Has it happened that people whom you counted on disappointed you?

1	2	3	4	5	6	7
never happened						always happened

7. Life is:

1	2	3	4	5	6	7
full of interest						completely routine

8. Until now your life has had:

1	2	3	4	5	6	7
no clear goals or purpose at all						very clear goals and purpose

9. Do you have the feeling that you're being treated unfairly?

1	2	3	4	5	6	7
very often						very seldom or never

10. In the past 10 years your life has been:

1	2	3	4	5	6	7
full of changes without your knowing what will happen next						completely consistent and clear

11. Most of the things you do in the future will probably be:

1	2	3	4	5	6	7
completely fascinating						deadly boring

12. Do you have the feeling that you are in an unfamiliar situation and don't know what to do?

1	2	3	4	5	6	7
very often						very seldom or never

13. What best describes how you see life:

1	2	3	4	5	6	7
one can always find a solution to painful things in life						there is no solution to painful things in life

14. When you think about your life, you very often:

1	2	3	4	5	6	7
feel how good it is to be alive						ask yourself why you exist at all

15. When you face a difficult problem, the choice of a solution is:

1	2	3	4	5	6	7
always confusing and hard to find						always completely clear

16. Doing the things you do every day is:

1	2	3	4	5	6	7
a source of deep pleasure and satisfaction						a source of pain and boredom

17. Your life in the future will probably be:

1	2	3	4	5	6	7
full of changes without your knowing what will happen next						completely consistent and clear

18. When something unpleasant happened in the past your tendency was:

1	2	3	4	5	6	7
"to eat yourself up" about it						to say "ok, that's that, I have to live with it", and go on

19. Do you have very mixed-up feelings and ideas?

1	2	3	4	5	6	7
very often						very seldom or never

20. When you do something that gives you a good feeling:

1	2	3	4	5	6	7
it's certain that you'll go on feeling good						it's certain that something will happen to spoil the feeling

21. Does it happen that you have feelings inside you would rather not feel?

1	2	3	4	5	6	7
very often						very seldom or never

22. You anticipate that your personal life in the future will be:

1	2	3	4	5	6	7
totally without meaning or purpose						full of meaning and purpose

23. Do you think that there will *always* be people whom you'll be able to count on in the future?

1	2	3	4	5	6	7
you're certain there will be						you doubt there will be

24. Does it happen that you have the feeling that you don't know exactly what's about to happen?

1	2	3	4	5	6	7
very often						very seldom or never

25. Many people-even those with a strong character-sometimes feel like sad sucks (losers) in certain situations. How often have you felt this way in the past?

1	2	3	4	5	6	7
never						very often

26. When something happened, have you generally found that:

1	2	3	4	5	6	7
you overestimated or underestimated its importance						you saw things in the right proportion

27. When you think of difficulties you are likely to face in important aspects of your life, do you have the feeling that:

1	2	3	4	5	6	7
you will always succeed in overcoming the difficulties						you won't succeed in overcoming the difficulties

28. How often do you have the feeling that there's little meaning in the things you do in your daily life?

1	2	3	4	5	6	7
very often						very seldom or never

29. How often do you have feelings that you're not sure you can keep under control?

1	2	3	4	5	6	7
very often						very seldom or never

Appendix I- Nature-Relatedness 6-Item Scale

Nature Relatedness Scale Participant ID:_____Date:_____

Instructions: For each of the following, please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think "most people" feel.

1 Disagree Strongly	2 Disagree a Little	3 Neither Agree or Disagree	4 Agree a Little	5 Agree Strongly

1. My ideal vacation spot would be a remote, wilderness area.

_____

2. I always think about how my actions affect the environment.

_____

3. My connection to nature and the environment is a part of my spirituality.

_____

4. I take notice of wildlife wherever I am.

_____

5. My relationship to nature is an important part of who I am.

_____

6. I feel very connected to all living things and the earth.

_____

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Appendix J- Functional Assessment of Chronic Illness Therapy- Spirituality (Additional Concerns Only)

FACIT-Sp (Version 4)

Participant ID:_____ Date:_____

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

	ADDITIONAL CONCERNS	Not at all	A little bit	Some-what	Quite a bit	Very much
Sp1	I feel peaceful	0	1	2	3	4
Sp2	I have a reason for living	0	1	2	3	4
Sp3	My life has been productive	0	1	2	3	4
Sp4	I have trouble feeling peace of mind	0	1	2	3	4
Sp5	I feel a sense of purpose in my life	0	1	2	3	4
Sp6	I am able to reach down deep into myself for comfort	0	1	2	3	4
Sp7	I feel a sense of harmony within myself	0	1	2	3	4
Sp8	My life lacks meaning and purpose	0	1	2	3	4
Sp9	I find comfort in my faith or spiritual beliefs	0	1	2	3	4
Sp10	I find strength in my faith or spiritual beliefs	0	1	2	3	4
Sp11	My illness has strengthened my faith or spiritual beliefs	0	1	2	3	4
Sp12	I know that whatever happens with my illness, things will be okay	0	1	2	3	4

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Appendix K- One Nature Activity Calendar (example from Winter intervention)

November-December 2019 Activity Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	30 Minutes? 5 YES NO What did you do? ACTIVITY REST	30 Minutes? 6 YES NO What did you do? ACTIVITY REST	30 Minutes? 7 YES NO What did you do? ACTIVITY REST	30 Minutes? 8 YES NO What did you do? ACTIVITY REST	30 Minutes? 9 YES NO What did you do? ACTIVITY REST
30 Minutes? 10 YES NO What did you do? ACTIVITY REST	30 Minutes? 11 YES NO What did you do? ACTIVITY REST	30 Minutes? 12 YES NO What did you do? ACTIVITY REST	30 Minutes? 13 YES NO What did you do? ACTIVITY REST	30 Minutes? 14 YES NO What did you do? ACTIVITY REST	30 Minutes? 15 YES NO What did you do? ACTIVITY REST	30 Minutes? 16 YES NO What did you do? ACTIVITY REST
30 Minutes? 17 YES NO What did you do? ACTIVITY REST	30 Minutes? 18 YES NO What did you do? ACTIVITY REST	30 Minutes? 19 YES NO What did you do? ACTIVITY REST	30 Minutes? 20 YES NO What did you do? ACTIVITY REST	30 Minutes? 21 YES NO What did you do? ACTIVITY REST	30 Minutes? 22 YES NO What did you do? ACTIVITY REST	30 Minutes? 23 YES NO What did you do? ACTIVITY REST
30 Minutes? 24 YES NO What did you do? ACTIVITY REST	30 Minutes? 25 YES NO What did you do? ACTIVITY REST	30 Minutes? 26 YES NO What did you do? ACTIVITY REST	30 Minutes? 27 YES NO What did you do? ACTIVITY REST	30 Minutes? 28 YES NO What did you do? ACTIVITY REST	30 Minutes? 29 YES NO What did you do? ACTIVITY REST	30 Minutes? 30 YES NO What did you do? ACTIVITY REST
30 Minutes? (DEC) 1 YES NO What did you do? ACTIVITY REST	30 Minutes? 2 YES NO What did you do? ACTIVITY REST	30 Minutes? 3 YES NO What did you do? ACTIVITY REST	30 Minutes? 4 YES NO What did you do? ACTIVITY REST			

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Samantha Morris' Contact Information: C- (647)-920-0676 E- smorri14@lakeheadu.ca
Version 2. 2019

NOTES FOR ONE NATURE CHALLENGE (OPTIONAL)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
(DEC) 1	2	3	4			

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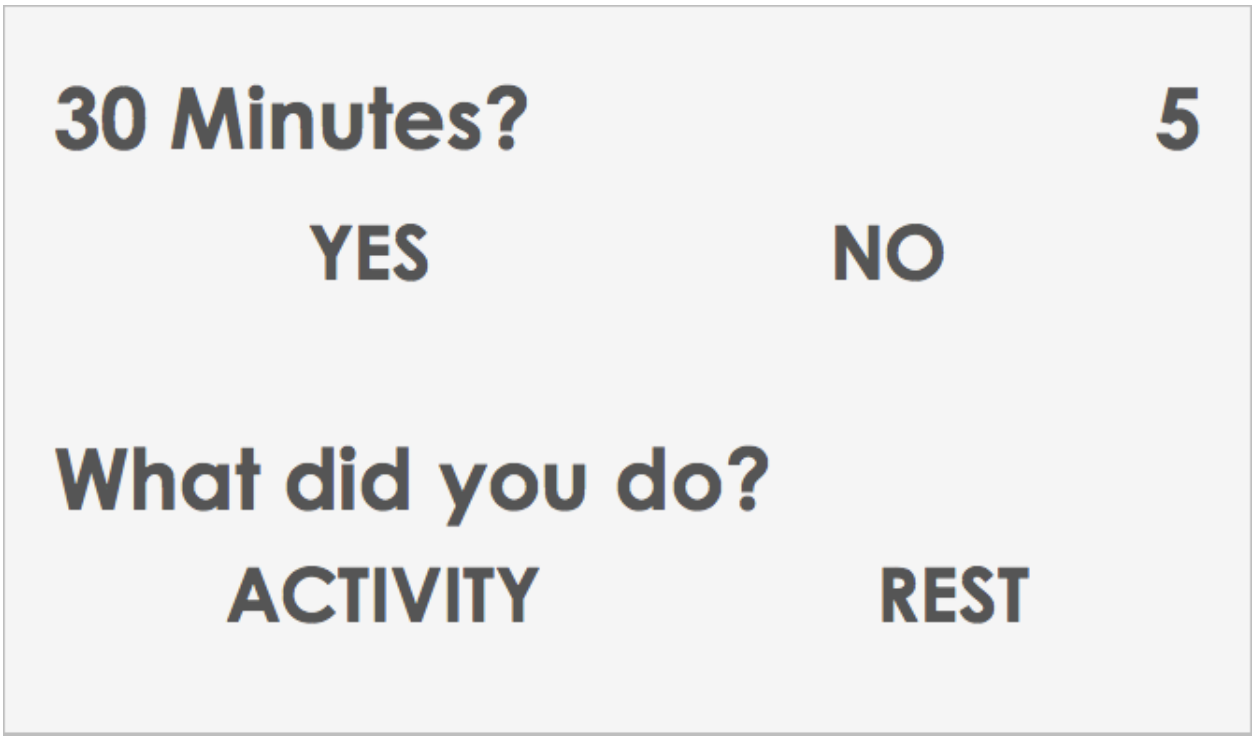
Version 2. 2019

Appendix L- Snapshot of Single Day for One Nature Activity Calendar



Appendix M –Semi-structured Interview Guide for Phase Two

Guiding questions and sub-questions include:

1. What did you enjoy about getting outside? Explain.
    a. What activity did you perform in nature? Did you perform them with others?
    b. Was there a location you liked to visit? Why?
    c. Did the activities performed differ from your normal daily routine?

2. How did your experience in nature make you feel?
    a. Did these sensations experienced outside differ from those experienced while exercising in WE-Can?

3. Were there any obstacles you encountered while completing the One Nature Challenge?
    a. Did this impact your ability to complete the challenge?
    b. If consequences were experienced, did this impact your effort put forth in the WE-Can program?

4. Did the One Nature Challenge add to your WE-Can experience? If so, explain how.

Appendix N- Normalized Data Calculations for Phase One Analysis

Percent Change for Aerobic Fitness

% Aerobic Change= (Post-Test Score – Pre-Test Score)/860 * 100

Percent Change for Flexibility

% Flexibility Change= (Post-Test Score – Pre-Test Score)/16.25 * 100

Percent Change for Strength

% Strength Change= (Post-Test Score – Pre-Test Score)/29.5 * 100

Percent Change for Handgrip

% Handgrip Change= (Post-Test Score – Pre-Test Score)/61 * 100

Percent Change for Systolic Blood Pressure

% Systolic Blood Pressure Change= (Post-Test Score – Pre-Test Score)/160 * 100

Percent Change for Diastolic Blood Pressure

% Diastolic Blood Pressure Change= (Post-Test Score – Pre-Test Score)/90 * 100

Percent Change for Mental Component Score

% Perceived Mental Well-Being Change= (Post-Test Score – Pre-Test Score)/100 * 100

Percent Change for Physical Component Score

% Perceived Physical Well-Being Change= (Post-Test Score – Pre-Test Score)/100 * 100

Percent Change for Patient-Specific Functional Scale

% Patient Functional Scale Change= (Post-Test Score – Pre-Test Score)/11 * 100

Percent Change for FACIT-F

% Chronic Fatigue Change= (Post-Test Score – Pre-Test Score)/52 * 100

Percent Change for Brief Fatigue Inventory

% Acute Fatigue Change= (Post-Test Score – Pre-Test Score)/11 * 100

Percent Change for Sense of Coherence

% Sense of Coherence Change= (Post-Test Score – Pre-Test Score)/203 * 100

Appendix O- Bivariate Correlations Between Cancer-Based Health-Related Outcome Measures

		Patient Specific Functional Scale	SF-36v2 Physical Component Summary	SF-36v2 Mental Component Summary	FACIT-F Total Score	Brief Fatigue Inventory	Orientation to Life Questionnaire
Patient Specific Functional Scale	Pearson	1	**.371****	**.198***	**.322****	**-.186***	**.261***
	Sig.		**.000**	**.015**	**.000**	**.021**	**.033**
	N	156	149	149	153	154	67
SF-36v2 Physical Component Summary	Pearson	**.371****	1	.015	**.546****	**-.424****	.221
	Sig.	**.000**		.849	**.000**	**.000**	.052
	N	149	168	168	166	166	78
SF-36v2 Mental Component Summary	Pearson	**.198***	.015	1	**.622****	**-.471****	**.693****
	Sig.	**.015**	.849		**.000**	**.000**	**.000**
	N	149	168	168	166	166	78
FACIT-F Total Score	Pearson	**.322****	**.546****	**.622****	1	**-.750****	**.651****
	Sig.	**.000**	**.000**	**.000**		**.000**	**.000**
	N	153	166	166	174	172	80
Brief Fatigue Inventory	Pearson	-.186	**-.424****	**-.471****	**-.750****	1	**-.327****
	Sig.	.021	**.000**	**.000**	**.000**		**.003**
	N	154	166	166	172	176	79
Orientation to Life Questionnaire	Pearson	**.261***	.221	**.693****	**.651****	**-.327****	1
	Sig.	**.033**	.052	**.000**	**.000**	**.003**	
	N	67	78	78	80	79	80

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

		6-Minute Walk Test	Chair Squats	Handgrip	Avg. Bicep Curls	Avg. Backscratch Test	Avg. Sit and Reach	Systolic Blood Pressure	Diastolic Blood Pressure
6-Minute Walk Test	Pearson	1	**.575****	.151	**.386****	**.215****	.130	**-.277***	-.009
	Sig.		**.000**	.051	**.000**	**.005**	.092	**.013**	.935
	N	169	169	168	168	168	169	80	80
Chair Squats	Pearson	**.575****	1	**.194****	**.652****	**.333****	**.375****	-.111	.008
	Sig.	**.000**		**.010**	**.000**	**.000**	**.000**	.328	.940
	N	169	178	176	175	176	177	80	80
Handgrip	Pearson	.151	**.194****	1	**.452****	-.046	.005	.198	.196
	Sig.	.051	**.010**		**.000**	.544	.949	.079	.082
	N	168	176	176	174	175	176	80	80
Avg. Bicep Curls	Pearson	**.386****	**.652****	**.452****	1	**.217***	**.363****	-.111	.006
	Sig.	**.000**	**.000**	**.000**		**.004**	**.000**	.327	.955
	N	168	175	174	175	174	175	80	80
Avg. Backscratch Test	Pearson	**.215****	**.333****	-.046	**.217***	1	**.360****	-.179	-.048
	Sig.	**.005**	**.000**	.544	**.004**		**.000**	.114	.676
	N	168	176	175	174	176	176	79	79
Avg. Sit and Reach	Pearson	.130	**.375****	.005	**.363****	**.360****	1	-.115	-.036
	Sig.	.092	**.000**	.949	**.000**	**.000**		.308	.751
	N	169	177	176	175	176	177	80	80
Systolic Blood Pressure	Pearson	**-.277***	-.111	.198	-.111	-.179	-.115	1	**.412****
	Sig.	**.013**	.328	.079	.327	.114	.308		**.000**
	N	80	80	80	80	79	80	80	80
Diastolic Blood Pressure	Pearson	-.009	.008	.196	.006	-.048	-.036	**.412****	1
	Sig.	.935	.940	.082	.955	.676	.751	**.000**	
	N	80	80	80	80	79	80	80	80

**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)