
Article:
Burke, SM orcid.org/0000-0001-8097-2026, Brunet, J, Wurz, A et al. (2 more authors) (2017) Cycling Through Cancer: Exploring Childhood Cancer Survivors' Experiences of Well- and Ill-Being. Adapted Physical Activity Quarterly, 34 (4). pp. 345-361. ISSN 0736-5829

https://doi.org/10.1123/apaq.2016-0011

Abstract

The benefits of informal physical activity (PA) during recovery from childhood cancer have rarely been investigated. This study adopted a multiple case study approach to explore the impact of recreational cycling on childhood cancer survivors' experiences of well- and ill-being. Three semi-structured interviews were conducted over a 3-month period with four survivors to explore their experiences of physical, psychological, and social well- and ill-being. Within-case analysis followed by cross-case analysis identified three themes that captured their well- and ill-being experiences: (a) cultivating feelings and emotions; (b) experiencing physical changes; and (c) encountering positive and negative social interactions. The results from this study showed that recreational cycling may be a useful adjunct to conventional treatments for the self-management of multiple domains of well-being and ill-being during recovery from childhood cancer.

Cycling through cancer: Exploring childhood cancer survivors' experiences of well- and ill-being

Globally, over 175,000 children under the age of 15 years are diagnosed with cancer each year (Ward et al., 2014). An estimated 80% of children are expected to live 5 years or more following their cancer diagnosis (DeSantis et al., 2014). However, the medical procedures necessary to induce remission and reduce mortality may result in negative side effects (Diller et al., 2009; Hudson et al., 2013), such as pain, fatigue, weight and appearance changes, physical impairments, loss of balance, and social isolation (Rueegg et al., 2013; Smith et al., 2013). These negative effects may lessen the likelihood that childhood cancer survivors will participate in health-promoting behaviors (Ness, Wall, Oakes, Robison, & Gurney, 2006). Recent research shows childhood cancer survivors engage in less physical activity (PA) than their healthy siblings (Ford, 2014). Lack of PA, combined with negative side effects can predispose childhood cancer survivors to a lifetime of health problems that span physical, psychological, and social domains of well-being (Hudson et al., 2013; Ness & Gurney, 2007; Rueegg et al., 2013).

Well-being is a complex construct that can be broadly defined as optimal experience and functioning (Ryan & Deci, 2001), and thus represents more than absence of illness. Two approaches have been used to define well-being. The hedonistic approach, underpinning subjective well-being (Diener, 2000), defines well-being as the attainment of happiness through the occurrence of positive affect, the absence of negative affect, and the experience of life satisfaction. The eudaimonic approach, underpinning psychological well-being (Ryff, 1989), defines well-being through six aspects of human actualization: self-acceptance, positive relationships with others, purpose in life, self-determination, managing one's environment, and feelings of progressing toward one's potential (Deci & Ryan, 2008). Within self-determination theory (SDT), Deci and Ryan (2008), posit that well-being is enhanced

through the satisfaction of three basic psychological needs: autonomy (i.e., a feeling of ownership over behavior), competence (i.e., a feeling that one can successfully complete personally challenging tasks), and relatedness (i.e., a feeling of belongingness and connection with important others). Cancer and its treatments can jeopardize survivors' well-being by limiting satisfaction of these psychological needs (Fuemmeler, Elkin, & Mullins, 2002). For example, a diagnosis of cancer during childhood can prolong dependency on parents and foster unusual strong attachments that threaten children's normal development of autonomy (Dietz & Mulrooney, 2011). Moreover, treatment-related side effects (e.g., fatigue) can increase rates of absenteeism at school, which can limit time spent with peers (Katz, Leary, Breiger, & Friedman, 2011).

On the other hand, ill-being is recognized as a separate construct and is defined as the overt manifestation of negative emotions or affect (Ryff et al., 2006), not just the absence of well-being. Li, Chung, and Chiu (2010) have found that cancer and its treatment can increase experiences of ill-being through feelings of sadness, worry, and depression. As such, investigating interventions that can both promote well-being and reduce ill-being in childhood cancer survivors is of particular importance especially since prognostic factors are influenced by experiences of well-being and ill-being (Robison & Hudson, 2014).

PA and Childhood Cancer

The efficacy of formal PA (i.e., structured activities involving rules, objectives, planning, and direction by a designated leader, coach, or instructor; King, Petrenchik, Law, & Hurley, 2009), for improving well-being and reducing ill-being has been tested empirically in children with cancer (Baumann, Bloch, & Beulertz, 2013; Huang & Ness, 2011). Formal PA has been shown to improve fatigue, physical fitness, strength and flexibility in childhood cancer survivors (Braam et al., 2013; Gohar, Comito, Price, & Marchese, 2011; Marchese, Chiarello, & Lange, 2004; Moyer-Mileur, Ransdell, & Bruggers, 2009; Perondi et al., 2012;

Speyer, Baijens, Heijnen, & Zwijnenberg, 2010). Despite the evidence that participating in formal PA is beneficial, few children engage in formal PA after cancer (Chamorro-Vina, Wurz, & Culos-Reed, 2013). This may be because children recovering from cancer may have few opportunities and lack support required to take part in formal PA.

Informal PA, which is spontaneous, unstructured, initiated by the children themselves (King, Petrenchik, Law, & Hurley, 2009), and typically undertaken in a natural environment (e.g., park, woodland, countryside) may offer children an alternative way to remain active after cancer. Informal PA has been shown to promote experiences of well-being and mitigate experiences of ill-being in children (Li, Chung & Chiu, 2010) and adolescents with chronic illnesses (Carlson & Cook, 2007). For example, Li et al. (2013) reported that childhood cancer survivors (aged 9 to 16 years) reported significantly greater self-efficacy and quality of life after participating in an integrated adventure-based training and health education program designed to encourage non-competitive, spontaneous activities as compared to an attention-control group. Several studies with adult breast cancer survivors participating in outdoor adventure activities (e.g., dragon boating, scaling Mt Kilimanjaro) also provide evidence that informal PA can impact experiences of well- and ill-being (Burke & Sabiston, 2010; Sabiston, McDonough, & Crocker, 2007; McDonough, Sabiston, & Ullrich-French, 2011). However, there is a marked absence of research exploring the benefits of informal PA during recovery from childhood cancer.

Present Study Context and Purpose

"Cyclists Fighting Cancer" is a charitable organization (http://www.cyclistsfc.org.uk) that was formed to improve the lives of young people affected by cancer by providing them with bicycles, tandems, and specially adapted tricycles. Recipients are not instructed on how much cycling they should do. The purpose of this study was to explore experiences of well-

and ill-being among childhood cancer survivors who participated in recreational cycling over a 3-month period as a result of receiving a bicycle from "Cyclist Fighting Cancer."

Method

The present study was guided by a multiple case study approach (Stake, 2005), which enabled an in-depth understanding of the complex and multi-dimensional processes underpinning childhood cancer survivors' experiences of well- and ill-being within the context of recreational cycling. This approach enabled individual cases to be examined independently, as well as comparisons across cases to be made (Stake, 2005). This study was framed by ontological relativism (i.e., reality is multiple, created, and mind-dependent) and epistemological constructionism (i.e., knowledge is constructed and subjective).

Participants

Using purposeful sampling, four boys who ranged in age from 8 to 13 years old (M_{age}=10.5; SD=2.5) at the time of the study were recruited. Inclusion criteria involved: (a) completed active treatment for any childhood cancer type, (b) listed to receive a bicycle from the charity "Cyclists Fighting Cancer", (c) able to perform PA, (d) able to provide assent to participate, and (e) fluent in English. Participants were excluded if they were currently undergoing care at the National Health Service. Of note, both boys and girls were invited to take part in the study but only boys (and their respective parents) agreed to participate.

The age of participants at cancer diagnosis ranged from 4 to 10 years. All four participants had undergone chemotherapy treatment and one participant received radiotherapy and surgery. All of the participants were at least 1-month post-intensive treatment. Three participants were on a 2-year course of maintenance therapy. Participants were no longer in regular contact with their oncologist, and had all returned to school. Participants had some experience with cycling prior to their cancer diagnosis, but had stopped participating in PA altogether while undergoing treatment.

Procedures

Ethical approval was obtained from [name withheld for blinded peer review], and permission to undertake the study was granted from the founder and Chief Executive Officer of the charity "Cyclists Fighting Cancer". The charity's family liaison administrator identified eligible participants from a list of childhood cancer survivors scheduled to receive a bicycle. Of the 84 children who applied to the charity for a bicycle, 24 met the inclusion criteria and were therefore sent information about the study. Interested participants contacted the research team directly for further information about the study.

All four participants were interviewed three times over a 3-month period. The first interview focused on getting to know participants and their experiences since their diagnosis and included broad questions such as "Can you tell me about any changes (i.e., physical, emotional, social) you have experienced in your life since becoming sick?" The second and third interviews focused on participants' well- and ill-being experiences since receiving/using their bike. Sample questions included: "How does cycling make you feel?" and "Can you describe any changes you have experienced in your life since getting your bike?" During all three interviews, probes were used to encourage participants to provide more detail on their physical (e.g., functional ability), psychological (e.g., feelings, moods), and social (e.g., peer interactions) experiences. The interview guide was developed and pilot tested with the first participant. None of the questions posed any issues; thus no modifications, deletions, or additions were made, and data from the pilot interview were included in the analysis (Holloway, 1997). Interviews lasted on average 30 minutes and were conducted at participants' homes.

The first interview was conducted before participants received their bicycles from the charity, and the second and third interviews were conducted approximately 4 and 8 weeks thereafter, respectively. Prior to the interviews, parents reviewed the interview guide to

ensure they were aware of what was to be discussed and remove any questions they felt may be too distressing for their child; no parent requested any changes. Written informed participant assent and parental consent was obtained, and parents completed a brief demographic form with questions on their child's age and type of cancer. Parents then left the room where the interview took place, but stayed in the home. All of the interviews were audio recorded and transcribed verbatim. During the transcription process, all identifying information was removed and replaced with an arbitrary pseudonym to protect participants' anonymity.

Data Analysis

Data were analyzed within and across cases to illuminate participants' individual experiences, as well as to highlight the commonalities that existed across cases (Stake, 2005). Both inductive and deductive approaches (Merriam, 2009) were used to guide data analysis. First, the data were analyzed using deductive procedures which involved identifying themes that reflected the three broad domains of well- and ill-being (i.e., physical, psychological, social). Second, the data were analyzed using inductive procedures which involved identifying themes from the raw data without making links to predetermined constructs or theories.

The within-case analysis (Ayres, Kavanaugh, & Knafl, 2003) involved reading and re-reading the transcripts to identify meaning units relevant to participants' experiences of well- and ill-being. Next, similar meaning units within each transcript were grouped together into themes. Specifically, the aim of the within-case analysis was to explore participants' accounts individually and in detail to compile the unique features that were deemed to be critical to understanding their personal experiences. This led to chronicled and summarized accounts for each participant. To focus analysis on data within the scope of the research question, the possibility that participants' experiences of well- and ill-being would change as a result of

their participation in recreational cycling was kept in the foreground of the researchers' minds (Baxter & Jack, 2008). The cross-case analysis (Stake, 2005) involved making comparisons between themes that emerged from each case. This involved identifying commonalities (i.e., shared experiences across cases) and differences (i.e., disparities in the ways in which participants described their experiences) across cases. The transcripts were then re-read to ensure all relevant data had been coded (Stake, 2005).

To assess the quality of this study, a relativist or non-foundational approach (Sparkes & Smith, 2009) was used. Adopting criteria used in previous work (Smith & Caddick, 2012; Tracy, 2010), the following criteria were considered appropriate for assessing the rigor and validity of this particular study: First, rigor was established by including a sample appropriate for the purpose of the study and generated data that provided meaningful and significant accounts via strong rapport (i.e., conducting three interviews with each participant to facilitate deeper participant disclosure). Second, transparency was achieved by providing a detailed and clear documentation of the research and analytical process. Third, independent coders analyzed and interpreted the data and participant quotations were used to support the researchers' interpretations. Fourth, detailed contextual information was provided to offer readers an opportunity to judge for themselves if the findings can be transferred to other settings and populations.

Results

The results are presented in two sections. In the first section, each case is presented to provide background information on each participant and depict how cancer and its treatments impacted participants' experiences of well- and ill-being. This section also includes brief information related to each participant's experience with recreational cycling. In the second section, common themes that emerged from the data and represent participants' shared experiences of well- and ill-being are presented. Three broad interconnected themes that

capture a dichotomy of well- and ill-being experiences were identified: (a) cultivating feelings and emotions; (b) experiencing physical changes; and (c) encountering positive and negative social interactions.

Participants' Personal Experiences of Well- and Ill-Being

Matthew was a 12-year-old boy who was diagnosed with a medullablastoma, a type of brain tumour, at the age of 10. His treatments involved surgery, radiotherapy, and chemotherapy over a 1-year period. Matthew talked about how he was always sick and vomited every day at school during the initial stages of his illness. This worsened during treatment making him feel weak and leading him to use a wheelchair. Matthew reacted with frustration and anger to the unfairness of being diagnosed. He shared: "You just get angry sometimes... I usually kick and punch. And sometimes I go upstairs and throw all my stuff around" (Interview #1). He often asked himself "Why me?" Overall, his cancer journey was fraught with negative experiences and he struggled to be happy. Since completing treatment in 2012, he has enjoyed getting back into sports such as football, swimming, and bowling, and more recently cycling. On average, he spent 2.5 hours cycling per week.

Andrew was a 13-year-old boy who was diagnosed with acute lymphoblastic leukemia (ALL) at the age of 12. He was immediately admitted to the hospital for a 3-month period and then received 1 year of intensive chemotherapy, which forced him to miss school. Andrew felt intense anxiety about his yearlong absence from school. At the time of the first interview, he was receiving maintenance therapy as an out-patient, and had 1 year to go. Although he was able to attend school again, he was still uncertain and nervous about his academic ability and reintegrating with his peers. He was happy to be able to participate in PA again, which mainly consisted of cycling. This was different from participation prior to his diagnosis, which consisted of a wide range of activities (e.g., running, mountain biking, and sports). Andrew spent on average 3.5 hours cycling per a week.

John was an 8-year-old boy who was diagnosed with ALL at the age of 5. He received intensive chemotherapy for 2.5 years, which forced him to miss the first 1.5 years of school. He had become very close with his mother and found the intensive treatments to be very negative. The procedures such as injections and chemotherapy, hospital stays, pain, and weight gain were at the forefront of John's memory. After transitioning to maintenance chemotherapy, he started school again, but often felt uncomfortable around his peers and had difficulties making friends. At the time of the first interview, John had 1 year left of maintenance chemotherapy. Nevertheless, he was enjoying being able to play outside again. He was very excited to have received a new bicycle and cycled on average 1 hour per week.

Oliver was an 8-year-old boy who was diagnosed with ALL at the age of 6. He received a bone marrow transplant and intensive chemotherapy for 8 months. Oliver felt weak, fatigued, and socially isolated while receiving treatments. He had broken his foot and wrist, likely because of his weakened bones and struggled immensely with having to use a wheelchair for 9 months. He talked about feeling sad when he could not play outside with his friends. At the time of the first interview, he had completed intensive therapy and started maintenance therapy. He had joined a taekwondo class, returned to football practice with his friends, and started school again where he received social support. He also enjoyed learning new tricks and racing with his friends on his new bicycle. He spent on average 3 hours per week cycling.

Participants' Shared Experiences of Well- and Ill-Being

Cultivating feelings and emotions. Participants reported that their experiences with cancer and its treatment evoked adverse feelings and emotions. Conversely, they shared that once intensive treatment was completed and they had started cycling, they began experiencing positive feelings and emotions.

Instilling negative feelings and emotions. When reflecting on their experiences with cancer, participants conveyed a range of negative feelings and emotions such as anger, upset, sadness, and worn out. Certain treatment-related procedures caused distress among participants. As John (Interview # 1) shared: "Umm, I can remember when I had cannula (i.e., a tube for insertion into a vessel, duct, or cavity to deliver medication or drain fluid) I used to try and get away because I didn't like the needles... my stepdad and my proper dad used to have to hold me down. It made me really upset." Some participants experienced anger as a result of having cancer because it interfered with their ability to act on their own desires or goals. As shared by Matthew (Interview # 1):

> "Sometimes I do get a bit angry because of all the stuff… Well just being ill, like why is it always me? It makes me feel horrible… Err, Don't really know. You just want to go and do things but you feel a bit poorly."

Evoking positive feelings and emotions. In contrast, when sharing their experiences of riding their bicycles, participants reported mainly positive feelings and emotions such as happiness, feeling accomplished, pride, and excitement. When asked how cycling made him feel, John (Interview # 2) explained: "Happy… because then I'm not just stuck inside all day and I'm actually doing some exercise. It makes me worn out but that's fine because I like it." Oliver (Interview # 2) shared: "Like I'm flying... because you're going so fast through the air and the wind makes you feel like your flying." For Andrew (Interview # 3), cycling filled him with pride:

> "When you have done a cycle you feel like you have achieved something even though you've only achieved a couple of miles. Like when you do a 15-mile cycle you feel very proud of yourself, like yeah I did a 15-mile cycle."

Cycling cultivated varied feelings and emotions ranging from fear and feeling worn out to proud and excitement. These were interpreted as being positive and contributed to

participants' overall well-being. Cycling fast, racing for fun, and doing stunts, wheelies and other tricks were deemed important to participants and contributed to their recovery.

Experiencing physical changes. Participants' explained that cancer had a significant adverse physical impact on them, but also explained that cycling was helpful to feel positive about their physical self again. The participants suggested this might have been because cycling helped to reverse or improve some of the physical losses due to their treatments.

Losing strength and physical ability. Participants discussed how cancer weakened their physical strength, fitness, and abilities, which made it more difficult for them to participate in school-based (e.g., sport clubs) and leisure-time activities (e.g., play). Oliver (Interview # 1) commented that: "It [treatment] makes my muscles not as strong... It's harder to go on the trampoline. I can't jump as high now... I used to jump higher than the fence now I can only jump half of the fence." Similarly, Matthew (Interview # 1) highlighted: "My speed because I used to be really fast and now I am not as fast as I used to be and my legs have become weak, they've got weaker." John (Interview # 1) explained: "I think vincristine (i.e., chemotherapy medication) makes me feel very tired and it makes my muscles not as strong, but I have to move so the muscles come back up."

Fatigue was also highlighted as a problematic side effect of cancer because it interfered with seemingly easy tasks or activities that participants engaged in prior to their diagnosis. Andrew (Interview # 2) shared: "We were going to do a few mile loops we used to do for my first cycle in ages and I just couldn't do it. I got to [name] street and just came back because I was too tired. And I get tired so if I was to run 100 meters I would be really tired compared to before."

(Re)discovering physical self-beliefs. The negative side effects of their treatments did not prevent participants from registering to receive a bicycle from the charity "Cyclists Fighting Cancer". By starting to cycle after intensive treatments were completed, participants

noticed improvements in their physical confidence and competence. As time passed, seeing that they could cycle quicker and for longer, they started believing in themselves again. This had a positive impact on their overall perceptions of their physical abilities. They described finding confidence in their ability to ride a bicycle again. For instance, Andrew (Interview # 2) felt his general fitness and his cycling ability improved, which he felt brought him closer to where he was prior to his cancer diagnosis:

> "I have no aches and pains or anything. I just feel fit enough and fine in general. When I first got back on my bicycle I could barely do a mile on it. I was annoyed because I used to be able to cycle really well. I'm quite good at cycling again now. I can keep up with my mum and I enjoy beating her sometimes too."

Gaining confidence and feeling competent was a gradual process. The participants had to learn to trust themselves again and deal with their self-doubt. However, as they skillfully mastered cycling, their confidence grew. Matthew (Interview # 3) commented: "Obviously [I am] a bit nervous because there's always that feeling that you're going to fall off, but it's slowly getting better and I'm getting a bit more confident and stuff." Through cycling, participants also developed an ability to participate in other activities they used to participate in. Andrew (Interview # 3) stated: "I reckon my legs have gotten stronger from it [cycling] and I can climb trees again." Moreover, by recognizing that they were able to cycle with more proficiency and ease, they became confident and aware about their growing abilities in other activities. Matthew (Interview # 3) believed that becoming physically stronger as a result of cycling made him a better football player because he improved his ability to run for longer:

> "I've been out on my bike a lot more and it's helped me because I've got stronger. I was able to do more distance on my bike and even at football it's making me get better because now I can do two laps of the Astro without stopping... Basically, it just

helps me when I go running. It helps me actually like breathe because when I've been out on it [his bicycle], it's getting my heart rate up."

For different reasons, John (Interview # 3) also felt cycling made him a better football player. By gaining strength by cycling, he became stronger and kicked further. He stated: "It [biking] is quite good because it's also benefitting me in football because I can now kick it quite hard and far." Invariably, cycling was reported as instrumental in bringing about improvements in participants' physical abilities, which served to develop their physical self-confidence and skillfully handle other types of physical activities they did before cancer.

Encountering positive and negative social interactions. On the one hand, going through cancer served to foster relationships between participants and their families because family members nurtured them and helped them through difficult times. On the other hand, it put a strain on their relationships with peers and made them feel lonely. Through cycling, they were able to build meaningful friendships and foster relationships with their parents, which made them, feel supported.

Maintaining and strengthening relationships with family. Participants described having good relationships with their family and explained how their family was an ongoing source of support because they understood and cared about what they needed. Matthew (Interview # 3) shared:

"They [family] help me all the time. Since I've gone through treatment, they've always been there for me... my mum she used to stay there every time I stayed [in hospital] and then my stepdad he always used to come up and make sure I was ok in [the hospital] and he also made me have a few laughs too which cheered me up."

Participants saw cycling as an opportunity to foster their relationships and spend more time with their family. By cycling together, it allowed them to see each other in a different way; outside the roles of 'caregiver' and 'patient'. It also allowed participants to feel

understood and cared for in a different context (i.e., non-medical). One of the most powerful ways Matthew's father showed this was by keeping an eye out of him. He shared (Interview #3):

> "My family's still a good support for me. They are always helping me and making sure I'm doing okay... My dad slows his pace [when out cycling] usually I go ahead of him because then he can make sure I'm there and alright."

Seeking opportunities to build lost friendships. Having to undergo intensive treatments and feeling weak resulted in lost opportunities to spend time with friends. This was upsetting for the participants. Oliver (Interview # 3) described his experiences of being unable to get involved with his friends during his illness: "I was sad because I wanted to go to my friend's party and couldn't go." Similarly, John (Interview # 1) shared: "It makes me feel horrible when I can't go on holidays or play with my friends at the whacky warehouses because I am [feeling] poorly." Without this kind of face-to-face time, their friendships started to erode.

Participants also felt and looked different from children their age, and even if others knew they had cancer, they still felt uncomfortable, vulnerable, and embarrassed. They did not feel understood by their peers. As exemplified by Andrew (Interview # 1):

> "I've got stretch marks down my legs... Apparently it's the type of drug, it's a steroid but whenever I told someone it's a steroid they're like ahh so you will be really pumped up but it does the exact opposite of getting you pumped up, it just withers you away to skin and bone pretty much... friends are friends really, they don't really get it."

Furthermore, participants did not feel their peers were sensitive to the physical changes they were experiencing (e.g., hair loss, scars). They did not seem to convey empathy. Unwanted comments made by peers about participants' changes made them feel bad. John

(Interview # 1) shared: "All my hair used to keep on falling out in the night so then my dad cut it all off. So then in year two, it wasn't very nice because a boy kept on calling me baldy." However, cycling was a way for participants to get close to and connect with friends again. It allowed them to focus on something they both enjoyed and created a common interest. Cycling together was viewed as beneficial because it was a way for participants' friends to see them in a new light (i.e., a kid again instead of a 'cancer patient'). By taking on new challenges and showing their friends that they were just as capable as them, they were able have fulfilling friendships. Oliver (Interview # 3) explained:

> "Yeah I go out all the time... well before when I didn't have a bike I didn't really go out and play with my friends as much because they all had bikes... Now, they all chase after me [on the bike] because I'm all the way up there and they can't keep up!"

In this way, cycling helped participants' foster relationships with their friends and overcome feelings of isolation they had experienced during treatment.

Discussion

The present study portrays the lived experiences of well- and ill-being among four childhood cancer survivors who participated in recreational cycling over a 3-month period. Experiences of well- and ill-being were captured in three broad themes providing support for the suggestion that well and ill-being are complex, multidimensional constructs (De Civita et al., 2005; Diener, 2000; Eiser, 2001). In addition, these findings help to better understand children's perspectives on the benefits of recreational cycling by showing that cycling helped to promote experiences of hedonic, eudomonic, and subjective well-being, and minimize experiences of ill-being. This study extends previous knowledge on the benefits of informal PA for childhood cancer survivors (Braam et al., 2013; Gohar, Comito, Price, & Marchese, 2011; Marchese, Chiarello, & Lange, 2004; Moyer-Mileur, Ransdell, & Bruggers, 2009;

Perondi et al., 2012; Speyer, Baijens, Heijnen, & Zwijnenberg, 2010) and suggests that recreational cycling should be considered when trying to promote survivors' recovery.

Similar to findings from survey research (Diller et al., 2009; Hudson et al., 2013; Robison & Hudson, 2014; Smith et al., 2013; Zeltzer et al., 2008), participants in this study reported negative physical, psychological, and social side effects of cancer that seemed to contribute to experiences of ill-being. Specifically, the cancer experience led to negative feelings and emotions, reduced self-confidence, stigma, feelings of isolation, and strained relationships with peers. Drawing on SDT (Deci & Ryan, 2008), experiences with cancer (e.g., medical procedures, hospital visits) may have thwarted participants' feelings of competence, autonomy, and relatedness, which in turn could have contributed to their experiences of ill-being. Specifically, the uncertain and uncontrollable nature of cancer may have prevented them from experiencing a sense of personal control over treatment decisions and the consequences of the disease. Moreover, the adverse consequences of cancer could have diminished their perceived ability to successfully achieve desired outcomes and manage different challenges in their lives. In addition, experiences with stigmatization and missing school may have reduced opportunities to feel connected and cared for by peers. As such, autonomy supportive contexts, whereby people with authority (e.g., parents, health care providers) take the perspectives of children into account, offer relevant information and opportunities for choice, encourage initiative, provide optimal challenges and positive feedback, and facilitate a secure environment for social interactions (Roemmich et al., 2012), should be promoted.

Paradoxically, participants' cancer experience fostered a sense of closeness with family, namely with parents. This is consistent with previous research that has examined the positive psychosocial impact of childhood cancer (Barakat, Alderfer, & Kazak, 2006; Sundberg, Lampic, Bjork, Arvidson, & Wettergren, 2009; Wakefield et al., 2010). From a

post-traumatic growth (Tedeschi & Calhoun, 2004) perspective, struggling together with a highly challenging life circumstance can serve as a catalyst for growth and positive change in interpersonal relationships. Spending more time together while hospitalized may have generated solidarity between parents and children, which increased participants' feeling of belongingness. Further, participants may have become increasingly attached to and dependent on their parents (Katz, Leary, Breiger, & Friedman, 2011), which could have facilitated intimacy and deep and meaningful connections. Therefore, future research should continue to investigate the ways in which parent-child relationships can be strengthened during cancer while continuing to encourage children's autonomy (Dietz & Mulrooney, 2011).

The present study contributes to the small but growing literature on informal PA by showing that recreational cycling was an enjoyable activity that helped childhood cancer survivors to feel positive and build their confidence in their physical abilities (Carlson & Cook, 2007; Li, Chung & Chiu, 2010) Over the 3-month period, participants transitioned into seeing themselves as proficient cyclers and able to perform other forms of PA and sports. Self-efficacy theory (Banduara, 1977) can help to explain the mechanisms potentially underlying this shift. As, participants cycled more, they discussed how they were able to cycle faster and for longer and felt they were better able to master tasks, which is a predictor of self-efficacy beliefs. Considering that self-efficacy development is closely intertwined with perceptions of competence (Hughes, Galbraith, & White, 2011) and both are key aspects of well-being, future research should consider testing the tenets of self-efficacy theory more explicitly. Nevertheless, these findings suggest that recreational cycling could be promoted as a way to develop children's physical self-efficacy during recovery from cancer.

As the current findings and previous studies show (Pendley, Dahlquist, & Dreyer, 1997), a childhood cancer diagnosis can hinder social functioning and peer relationships. In this study, children were unable to spend time with peers and were seen as different and

stigmatized. Other studies have also found that childhood cancer survivors struggle to foster meaningful relationships with peers at school (Griffiths, Schweitzer, & Yates, 2011) as they tend to be seen by their peers as sick and fatigued, and absent from school (Schultz et al., 2007). However, recreational cycle provided opportunities to (re)build friendships thereby promoting social re-integration, strengthening social connections, and enhancing experiences of well-being. Other types of PA have also been shown to provide a context for experiencing enhanced social well-being in children by facilitating opportunities for positive social interactions (Eime, Young, Harvey, Charity, & Payne, 2013). These positive social interactions could relate to the satisfaction of their need for relatedness (Deci & Ryan, 2008), and possibly enhance feelings of normalcy. As such, the results from this study provide early evidence that children recovering from cancer should be encouraged to participate in activities such as recreational cycling that allow for meaningful interpersonal interactions.

Future research should continue to investigate the role of recreational cycling, or informal PA more generally, for promoting well-being and reducing ill-being among childhood cancer survivors both with and without a history of PA. In doing so, they should draw on theories such as self-efficacy theory and SDT to elucidate the mechanisms underlying the benefits of PA. In addition, it would be informative to investigate if the same themes observed herein would emerge across different diagnoses, sexes, age ranges, and treatment statuses. As well, from a general health perspective, informal PA may enable childhood cancer survivors to self monitor their PA behavior and tailor their participation (i.e., dose, frequency, and duration) to meet their individual needs (e.g., cardiac deconditioning, muscle atrophy, fatigue) to instill freedom of choice and feelings of competence. Accordingly, it would be interesting to disentangle what aspects of informal PA contribute to well- and ill-being as compared to formal PA. As well, it would be interesting to

explore if there are some children that might be more interested in informal PA versus formal PA so as to target these children.

Limitations

There are limitations of this study that should be considered. First, the sample consisted of boys (M_{age}=10.5 years) who had either completed treatment for a brain tumour or were undergoing maintenance therapy for ALL. Additional themes and subthemes may have emerged if children diagnosed with other types of cancer or at different points along the cancer trajectory were included in this study. Second, participants' accounts cannot be attributed solely to cycling. It is likely that several factors contributed to this. For example, participants may have reported enhanced well-being as a function of having completed intensive treatment, going back to school, or engaging in other forms of PA. Nevertheless, participants specifically acknowledged cycling as a key contributor to their well-being following treatment for cancer during their interviews which underscore that cycling does play a key role. Third, most participants had previous PA experience and/or sport socialization which may have impacted their post-treatment experiences with PA.

Conclusion

The findings suggest that participation in recreational cycling may promote experiences of well-being by helping childhood cancer survivors' view themselves and their lives in a way that is more enjoyable, socially involved, and physically engaged. In addition to confirming that PA is beneficial for childhood cancer survivors, the present study adds to the limited body of evidence on informal PA by drawing attention to the importance of unstructured PA contexts for facilitating social participation and autonomy. It is important to continue advancing our understanding of children's perceptions of activities that may help improve their lives post-cancer. From an applied perspective, healthcare practitioners should promote programs that offer informal PA opportunities for childhood cancer survivors. This

highlights the importance of looking for appropriate community-based partners to invest in the development of informal PA opportunities in order to facilitate well-being and reduce ill-being in this population.

Acknowledgments: The authors would like to express their gratitude to "Cyclists Fighting Cancer" for supporting this research and the participants for sharing their experiences with us. This manuscript was prepared while Amanda Wurz was supported by Vanier Canada Graduate Scholarship.

References

Ayres, L., Kavanaugh, K.,& Knafl, K. A. (2003). Within-Case and Across-Case Approaches to Qualitative Data Analysis. Qualitative Health Research, 13 (6), 871-883. doi: 10.1177/1049732303255359

Barakat, L. P., Alderfer, M. A., & Kazak, A. E. (2006). Posttraumatic growth in adolescent survivors of cancer and their mothers and fathers. Journal of Pediatric Psychology, 31(4), 413-419. doi:10.1093/jpepsy/jsj058

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Baumann, F. T., Bloch, W., & Beulertz, J. (2013). Clinical exercise interventions in pediatric oncology: A systematic review. Pediatric Research, 74(4), 366-374.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. The Qualitative Report, 13(4), 544-559.

Braam, K. I., van der Torre, P., Takken, T., Veening, M. A., van Dulmen-den Broeder, E., & Kaspers, G. J. (2013). Physical exercise training interventions for children and young adults during and after treatment for childhood cancer. Cochrane Database Systematic Reviews, 4, CD008796. doi:10.1002/14651858.CD008796.pub2

Burke, S. M., & Sabiston, C. M. (2010). The meaning of the mountain: Exploring breast cancer survivors' lived experiences of subjective well-being during a climb on Mt. Kilimanjaro. Qualitative Research in Sport, Exercise, and Health, 2: 1–16.

Carlson, K. P & Cook, M. (2007). Challenge by choice: Adventure-based counselling for seriously ill adolescents. Child and Adolescent Psychiatric Clinics of North America, 16(4), 909-919. doi: 10.1016/j.chc.2007.05.002

Chamorro-Viña, C., Wurz, A. J., & S. Culos-Reed, N. (2013). Promoting Physical Activity in Pediatric Oncology. Where Do We Go from Here? Frontiers in Oncology, 3, 173. doi: 10.3389/fonc.2013.0017

De Civita, M., Regier, D., Alamgir, A. H., Anis, A. H., Fitzgerald, M. J., & Marra, C. A. (2005). Evaluating health-related quality-of-life studies in paediatric populations: some conceptual, methodological and developmental considerations and recent applications. Pharmacoeconomics, 23(7), 659-685.

Deci, E. L., & Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: An introduction. Journal of Happiness Studies, 9, 1-11.

DeSantis, C. E., Lin, C. C., Mariotto, A. B., Siegel, R. L., Stein, K. D., Kramer, J. L., . . . Jemal, A. (2014). Cancer treatment and survivorship statistics, 2014. CA: A Cancer Journal for Clinicians, 64(4), 252-271. doi:10.3322/caac.21235

Diener, E. (2000). Subjective well-being: The science of happiness, and a proposal for national index. American Psychologist, 55, 34-43.

Dietz, A. C., & Mulrooney, D. A. (2011). Life beyond the disease: Relationships, parenting, and quality of life among survivors of childhood cancer. Haematologica, 96(5), 643–645.

Diller, L., Chow, E. J., Gurney, J. G., Hudson, M. M., Kadin-Lottick, N. S., Kawashima, T. I., . .. Sklar, C. A. (2009). Chronic disease in the Childhood Cancer Survivor Study cohort: A review of published findings. Journal of Clinical Oncology, 27(14), 2339-2355.

Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. International Journal of Behavioural Nutrition and Physical Activity, 10, 98. doi:10.1186/1479-5868-10-98

Eiser, C., Morse, R. (2001). Quality-of-life measures in chronic diseases of childhood. Health Technology Assessment, 5(4), 1-157.

Ford, J. S., Barnett, M., Werk, R. (2014). Health behaviors of childhood cancer survivors. Children, 1(3), 355-373.

Fuemmeler, B. F., Elkin, T. D., & Mullins, L. L. (2002). Survivors of childhood brain tumors: Behavioral, emotional, and social adjustment. Clinical Psychology Review, 22(4), 547-585.

Gohar, S. F., Comito, M., Price, J., & Marchese, V. (2011). Feasibility and parent satisfaction of a physical therapy intervention program for children with acute lymphoblastic leukemia in the first 6 months of medical treatment. Pediatric Blood Cancer, 56(5), 799-804. doi:10.1002/pbc.22713

Griffiths, M., Schweitzer, R., & Yates, P. (2011). Childhood experiences of cancer: An interpretative phenomenological analysis approach. Journal of Pediatric Oncology Nursing, 28(2), 83-92. doi:10.1177/1043454210377902

Holloway, I. (1997). Basic concepts for qualitative research. London: Blackwell Science.

Huang, T. T., & Ness, K. K. (2011). Exercise interventions in children with cancer: A review. International Journal of Pediatrics, 2011, 461512.

Hudson, M. M., Ness, K. K., Gurney, J. G., Mulrooney, D. A., Chemaitilly, W., Krull, K. R., . . . Robison, L. L. (2013). Clinical ascertainment of health outcomes among adults treated for childhood cancer. Journal of the American Medical Association, 309(22), 2371-2381. doi:10.1001/jama.2013.6296

Hughes, A., Galbraith, D., & White, D. J. (2011). Perceived competence: a common core for self-efficacy and self-concept? Journal of Personality Assessment, 93(3), 278-89. doi: 10.1080/00223891.2011.559390.

Katz, L. F., Fainsilber, L., Leary, A., Breiger, D., & Friedman, D. (2011). Pediatric Cancer and the Quality of Children's Dyadic Peer Interactions. Journal of Pediatric. Psychology, 36 (2), 237-247.

King, G., Petrenchik, T., Law, M., & Hurley, P. (2009). The enjoyment of formal and informal recreation and leisure activities: A comparison of school-aged children with and without physical disabilities. International Journal of Disability, Development, and Education, 56(2), 109–130.

Li, H. C., Chung, O. K., & Chiu, S. Y. (2010). The impact of cancer on children's physical, emotional, and psychosocial well-being. Cancer Nursing, 33(1), 47-54.

Li, H. C., Chung, O. K., Ho, K. Y., Chiu, S. Y., & Lopez, V. (2013). Effectiveness of an integrated adventure-based training and health education program in promoting regular exercise among childhood cancer survivors. Psychooncology, 22, 2601–2610.

Marchese V.G, Chiarello L.A, Lange B.J. (2004). Effects of physical therapy intervention for children with acute lymphoblastic leukemia. Pediatric Blood Cancer, 42, 127–133.

McDonough, M.H., Sabiston, C., & Ullrich-French, S. (2011). The development of social relationships and support in a dragon boating team for breast cancer survivors. Journal of Sport & Exercise Psychology, 33, 627-648. PubMed PMID: 21984639

Moyer-Mileur L.J, Ransdell L., Bruggers C.S. (2009). Fitness of children with standard-risk acute lymphoblastic leukemia during maintenance therapy: Response to a home-based exercise and nutrition program. Journal of Pediatric Hematology/Oncology, 31, 259–266.

Merriam, S. B. (2009). Qualitative research: A guide to design and implementation. San Francisco, CA: Jossey-Bass.

Ness, K. K., & Gurney, J. G. (2007). Adverse late effects of childhood cancer and its treatment on health and performance. Annual Review of Public Health, 28, 279-302. doi:10.1146/annurev.publhealth.28.021406.144049

Ness, K. K., Wall, M. M., Oakes, J. M., Robison, L. L., & Gurney, J. G. (2006). Physical performance limitations and participation restrictions among cancer survivors: A

population-based study. Annals of Epidemiology, 16(3), 197-205. doi:10.1016/j.annepidem.2005.01.009

Pendley, J. S., Dahlquist, L. M., & Dreyer, Z. (1997). Body image and psychosocial adjustment in adolescent cancer survivors. Journal of Pediatric Psychology, 22(1), 29-43. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9019046

Perondi, M. B., Gualano, B., Artioli, G. G., de Salles Painelli, V., Filho, V. O., Netto, G., . . . de Sa Pinto, A. L. (2012). Effects of a combined aerobic and strength training program in youth patients with acute lymphoblastic leukemia. Journal of Sports Science and Medicine, 11(3), 387-392.

Robison, L. L., & Hudson, M. M. (2014). Survivors of childhood and adolescent cancer: Life-long risks and responsibilities. Nature Reviews Cancer, 14(1), 61-70. doi:10.1038/nrc3634

Roemmich, J. N., Lambiase, M. J., McCarthy, T. F., Feda, D. M., & Kozlowski, K. F. (2012). Autonomy supportive environments and mastery as basic factors to motivate physical activity in children: A controlled laboratory study. International Journal of Behavioral Nutrition and Physical Activity, 9(16).

Rueegg, C. S., Gianinazzi, M. E., Rischewski, J., Beck Popovic, M., von der Weid, N. X., Michel, G., & Kuehni, C. E. (2013). Health-related quality of life in survivors of childhood cancer: The role of chronic health problems. Journal of Cancer Survivorship, 7(4), 511-522. doi:10.1007/s11764-013-0288-4

Ryan, R. M., & Deci, E. L. (2001). Happiness and human potentials: A review of research on hedonic and eudaimonic well-being. Annual Review of Psychology, 52, 141-166.

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. Journal of Personality and Social Psychology, 57, 1069-1081.

Ryff, C. D., Dienberg Love, G., Urry, H. L., Muller, D., Rosenkranz, M. A., Friedman, E. M., . . . Singer, B. (2006). Psychological well-being and ill-being: Do they have distinct or mirrored biological correlates? Psychotherapy and Psychosomatics, 75(2), 85-95.

Sabiston, C. M., McDonough, M. H., & Crocker, P. R. E. (2007). Psychosocial experiences of breast cancer survivors involved in a dragon boat program: Exploring links to positive psychological growth. Journal of sport and Exercise Psychology, 29, 419-438.

Schultz, K. A., Ness, K. K., Whitton, J., Recklitis, C., Zebrack, B., Robison, L. L., . . . Mertens, A. C. (2007). Behavioral and social outcomes in adolescent survivors of childhood cancer: A report from the childhood cancer survivor study. Journal of Clinical Oncology, 25(24), 3649-3656. doi:10.1200/JCO.2006.09.2486

Smith, A. W., Bellizzi, K. M., Keegan, T. H., Zebrack, B., Chen, V. W., Neale, A. V., . . . Lynch, C. F. (2013). Health-related quality of life of adolescent and young adult patients with cancer in the United States: the Adolescent and Young Adult Health Outcomes and Patient Experience study. Journal of Clinical Oncology, 31(17), 2136-2145. doi:10.1200/JCO.2012.47.3173

Smith, B., & Caddick, N. (2012). Qualitative methods in sport: A concise overview for guiding social scientific sport research. Asia Pacific Journal of Sport and Social Science, 1, 60-73.

Sparkes, A. C., & Smith, B. (2009). Judging the quality of qualitative inquiry: Criteriology and relativism in action. Psychology of Sport and Exercise, 10, 491-497.

Speyer, R., Baijens, L., Heijnen, M., & Zwijnenberg, I. (2010). Effects of therapy in oropharyngeal dysphagia by speech and language therapists: A systematic review. Dysphagia, 25(1), 40-65. doi:10.1007/s00455-009-9239-7

Stake, R. E. (2005). Multiple case study analysis. The Guildford Press.

Sundberg, K. K., Lampic, C., Bjork, O., Arvidson, J., & Wettergren, L. (2009). Positive and negative consequences of childhood cancer influencing the lives of young adults. European Journal of Oncology Nursing, 13(3), 164-170. doi:10.1016/j.ejon.2008.05.009

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. Psychological Inquiry, 15(1), 1-18.

Tracy, S. J. (2010). Qualitative quality: Eight "Big Tent" criteria for excellent qualitative research. Qualitative Inquiry, 16(837-851).

Wakefield, C. E., McLoone, J., Goodenough, B., Lenthen, K., Cairns, D. R., & Cohn, R. J. (2010). The psychosocial impact of completing childhood cancer treatment: A systematic review of the literature. Journal of Pediatric Psychology, 35(3), 262-274. doi:10.1093/jpepsy/jsp056

Ward, E., DeSantis, C., Robbins, A., Kohler, B., & Jemal, A. (2014). Childhood and adolescent cancer statistics. CA: A Cancer Journal for Clinicians, 64, 83–103.

Zeltzer, L. K., Lu, Q., Leisenring, W., Tsao, J. C., Recklitis, C., Armstrong, G., . . . Ness, K. K. (2008). Psychosocial outcomes and health-related quality of life in adult childhood cancer survivors: A report from the childhood cancer survivor study. Cancer Epidemiology, Biomarkers, and Prevention, 17(2), 435-446. doi:10.1158/1055-9965.EPI-07-2541