

Examining the feasibility and acceptability of a telehealth behaviour change intervention for
rural-living young adult cancer survivors

Jenson Price

A thesis submitted in partial fulfillment of the requirements for the
Master's of Arts degree in Human Kinetics

School of Human Kinetics

Faculty of Health Sciences

University of Ottawa

Abstract

Regular physical activity (PA) participation and fruit and vegetable (FV) consumption confers numerous positive health outcomes for cancer survivors, including prevention of cancer recurrence, second primary cancers, and other non-communicable chronic diseases. Rural-living young adult cancer survivors (YAs) possess unique barriers and concerns that influence their ability to participate in traditional face-to-face behaviour change interventions. Few researchers have explored alternative means for delivering behaviour change interventions grounded in theory utilizing a mixed-methods approach to assess processes of change and behavioural outcomes. To fill this gap and provide recommendations for future interventions and services focused on positive health behaviours in this population, the objective of the research presented in this thesis was to explore the feasibility and acceptability of a 12-week theory-based telehealth behaviour change intervention aiming to improve PA and FV consumption using a single-arm, mixed methods pilot trial. Over a 7-month period, 14 YAs self-referred. Of these 14, 5 were eligible and consented to participate with 3 completing the study. Retention to the study was 73% and adherence to the health coaching program ranged from 66.67-100% with a 40% attrition rate. Inquiry into the acceptability of the intervention offered insight into participants experiences, which was summarized within five themes: (1) *the more time the better*, (2) *the human factor*, (3) *supporting access*, (4) *influencing the basic psychological needs*, and (5) *finding motivation*. Collectively, the findings suggest the methods used require minor modifications before being deemed feasible despite the general acceptability of the intervention. Importantly, they highlight the necessity of more expansive recruitment strategies and a need to explore participants' underlying intentions for participating in behaviour change interventions. Further, recommendations are made based on the findings to improve this style of intervention,

including testing stepped down models of support because it may help some YAs maintain behaviour change post-intervention.

Keywords: Telehealth; Health behaviour change; Self-determination theory; Mixed methods; Rural; Young adults; Cancer

Acknowledgements

To my supervisor, Dr. Jennifer Brunet:

Thank you for sharing your vast knowledge and skill with me, your continued dedication and willingness to guide me through each new endeavor has ensured I have the strongest foundation possible for any future pursuits. Thank you for each and every new opportunity I had the pleasure to explore within the last two years. At times they may have tested my patience, resilience, and reasons for doing research but, they also provided me with a greater understanding of myself, those around me, and research as a whole. So, most importantly, thank you for helping me to find what I love and allowing me to find my own way to pursue that passion. I look forward to continuing this journey with you as I start my PhD in the Fall.

To my committee members, Dr. Diane Culver and Dr. Erin McGowan:

Thank you for keeping an open mind and ensuring the bumps in the road I experienced did not become road blocks to completing this thesis. Your comments, guidance, and input have positively shaped my experience and this thesis.

To the members of the Physical Activity and Health Promotion Lab:

Thank you for your continued support throughout this journey. Specifically, thank you Amanda, Meagan, Emily, and Melissa for being a sounding board for ideas, sharing your insights and thoughts, as well as endless encouraging words.

To the individuals who participated in this research:

I do not know how to thank you enough. At its core, this research would not be possible without the time (significant amounts of time) that each of you dedicated to this process. Your belief in not only your own abilities to make positive changes but your belief that this program could make a difference is a neverending source of encouragement and reminder of the strength

each of us possesses. Thank you for sharing your struggles and triumphs with me, I feel truly grateful to have had the opportunity to meet and get to know each of you.

To my friends:

A thesis is not a sprint, it is a marathon and I do not have to explain my hatred of running to any of you - so thank you for making this the most enjoyable run possible. There are far too many of you to list and thank properly, but nevertheless, thank you. Whether it was a much needed coffee break, a chance to celebrate a milestone, or an excuse to forget about my stress for a few hours - you were there. Thank you, thank you, thank you.

To my family:

Despite each of you openly admitting, at one point or another, that you do not know what I do, you had an endless belief in my ability to do it. So thank you, Heather and Aaron Smith and Raymond Price, you have all in turn encouraged my neverending curiosity and never once questioned my journey through higher education.

Table of Contents

List of Abbreviations	ix
List of Tables	x
Positionality statement	xi
Chapter 1: Introduction	1
Study Purpose and Research Objectives	3
Chapter 2: Literature Review	4
Positive Health Behaviours and Cancer	4
Rural-Living Young Adult Cancer Survivors	5
Telehealth Interventions	7
Description of Theoretical Framework	9
SDT-Based Telehealth Interventions	11
Key Gaps in Knowledge	12
Current Study	13
Chapter 3: Methods Article.....	14
Author's Contributions.....	14
Title Page.....	15
Abstract	16
Keywords	16
Background	17

Methods	19
Study design.....	19
Eligibility criteria.....	20
Intervention	21
Sample size	23
Recruitment.....	24
Participant timeline	24
Feasibility outcome measures	24
Acceptability outcome measures	25
Putative outcome measures	26
Data analysis.....	28
Discussion	30
Conclusion.....	32
Funding	32
Conflict of interest	32
References	33
Chapter 4: Results Article	44
Author's Contributions.....	44
Title Page.....	45
Abstract	46
Background	48
Theoretical Framework	50
Current Study	51
Methods.....	51

Participants.....	51
Protocol.....	52
Health coaching intervention	52
Measures	53
Sample Size.....	54
Data Analysis.....	54
Results	55
Participants' personal experiences	55
Feasibility data.....	57
Acceptability data	57
Discussion	65
Conclusion.....	69
References	71
Chapter 5: Global Discussion	84
References.....	92
Appendix A: Research Board Ethics Approval Notice.....	110
Appendix B: Questionnaires and Assessment Tools Used.....	112
Questionnaires	113
Interview Guide.....	135

Notes. SDT=self-determination theory

List of Abbreviations

BCTs=Behaviour change techniques

BPNT=Basic psychological needs theory

BRFSS-FV=Behavioural risk factor surveillance system – fruit and vegetable questionnaire

COT= Causality orientations theory

DSR=Dietary self-regulation questionnaire

FV(s)=Fruit(s) and vegetable(s)

HCCQ=Health care climate questionnaire

IPAQ-S=International physical activity questionnaire – short form

MPVA=Moderate-to-vigorous intensity physical activity

PA=physical activity

PNS=Psychological need satisfaction questionnaire

PNSE=Psychological need satisfaction in exercise scale

RM-ANOVA=repeated measures analysis of variance

SDT=self-determination theory

SPIRIT= Standard protocol items: Recommendations for interventional trials

SPSS=Statistical package for social sciences

TSRQ-E=Exercise treatment self-regulation questionnaire

YAs=Young adult cancer survivors

List of Tables

Chapter 3

Table 1: Behaviour change techniques utilized in telehealth behaviour change intervention for rural-living young adult cancer survivors.....	Page 44
--	---------

Chapter 4

Table 1: Description of putative measures used in 12-week theory-based telehealth behaviour change intervention for rural-living young adult cancer survivors.....	Page 83
Table 2: Changes in participant questionnaire scores from baseline to post-intervention.....	Page 84

Positionality statement

This thesis was guided by a constructivist epistemological approach, wherein the underlying belief is that each individual has a unique perspective that is useful and valid [1]. Constructivists consider that nothing can be completely objective and individuals gain understanding from their subjective experiences [1]. For this reason, I would like to acknowledge my position (e.g., social position, values) in relation to the research conducted herein. I am an able-bodied, young adult female. I do not have my own cancer experience, but childhood friends and close family members have experienced cancer. I grew up in rural Southwestern Ontario and have first hand-experience of the limited resources within rural communities. Although I did not pursue this research topic because of my background, it may have influenced my perspective while analyzing and interpreting the results.

Chapter 1: Introduction

Each year, approximately 1 million young adults between the ages of 20-39 will be diagnosed with cancer worldwide [2]. Approximately 80% will survive the disease 5-years after their diagnosis [3]. However, most cancer survivors will experience adverse side effects during and after treatment [4]. Engaging in regular physical activity (PA) and eating a healthy diet comprised of fruits and vegetables (FV) can help cancer survivors manage various side effects and promote overall health [5, 6]. Consequently, it is widely recommended that cancer survivors accumulate a minimum of 150 minutes of moderate-to-vigorous intensity PA (MVPA) per week and eat at least five servings of FV daily [6, 7]. Less than 20% of cancer survivors meet this FV consumption recommendation and over 50% do not meet this PA recommendation [8].

Moreover, rural-dwelling cancer survivors report engaging in less PA and consuming less nutritionally dense food such as FVs than their urban counterparts [9], which may explain, in part, why rural-dwelling cancer survivors are at an increased risk for cancer-related morbidity and mortality [10]. This is especially concerning for young adults between the ages of 20 and 39 years who live in rural areas as 80% of young adults diagnosed with cancer are expected to live at least 5 years after being diagnosed [11]. As such, rural-living young adult cancer survivors (YAs) represent a key growing population to target for PA and FV behaviour change interventions.

Based on past research with older rural-living cancer survivors [12-16], rural-living YAs can experience several barriers to PA and FV consumption, including a lack of physician/specialist availability, knowledge, time, access to affordable FV, recreational athletic centres, and reliable transportation. Whilst facility-based interventions may be effective in promoting lifestyle behaviours among cancer survivors generally [17], such interventions may

not be feasible for rural living YAs as they do not adequately address barriers related to living in such areas and may not address the values and preferences of YAs [18, 19].

Designing PA and FV behaviour change interventions that address the aforementioned barriers, are tailored to YAs' values and preferences, and are easily accessible will allow greater access to support services in a typically underserved population of YAs. To address the growing need to reach often underserved populations telehealth interventions are increasing in popularity [20]. Telehealth interventions offer a mode of delivery that could circumvent some barriers associated with being a rural-living YA [21]. Recent reviews of studies testing the effectiveness of telehealth interventions suggest they can promote PA participation and FV consumption [22-26]. Further, telehealth interventions offer ease of access and ability to deliver tailored information consistent with YAs' values and preferences [18, 27, 28]. Researchers have indicated that the success of such interventions stems from their ability to address participants' needs for knowledge, skill, and motivation to change their behaviours [29, 30]. Yet, few interventions incorporate theoretical perspectives that focus on fostering participants' knowledge, skill, and motivation [21, 31].

A useful theoretical framework is self-determination theory (SDT; [32, 33]) as it provides an explanation for the underlying mechanisms to target in an intervention to ensure it leads to desired changes in participants' behaviours [34]. According to Deci and Ryan [33], increased basic psychological need satisfaction (i.e., heightened perceptions of competence, autonomy, and relatedness) leads to more internalized (or self-determined) motivation. In turn, increased self-determined motivation, which occurs when individuals engage in a behaviour because it is internally rewarding, leads to greater task adherence [33]. In support of these theoretical propositions, several researchers have provided empirical evidence to support the associations

between SDT-constructs and various health behaviours, including PA participation and FV consumption [35-38]. To this end, researchers have suggested that interventions that create need supportive environments can contribute to higher levels of PA and FV consumption by promoting basic psychological need satisfaction and self-determined motivation [37, 39, 40].

Although the results of previous SDT-based interventions are valuable, there are several limitations with the current state of the knowledge. First, most studies to date have been conducted with children, middle-age adults, and older adults who live in urban centres, and therefore may not directly apply to YA cancer survivors who live in rural settings and who may face varying difficulties in accessing health services. Second, few researchers have explored alternative modes to deliver health behaviour change interventions. Third, most have been grounded in the positivist paradigm, which limits researchers understanding of participant experience utilizing these styles of interventions. Last, the use of theory in the design, implementation, and evaluation of PA and FV behaviour change interventions in an online setting has been lacking.

Study Purpose and Research Objectives

To address the limitations in the extant literature, the purpose of our study was to explore the feasibility and acceptability of a 12-week SDT-based telehealth coaching intervention intended to promote PA participation and FV consumption among rural-living YAs. The specific objectives were to: (1) assess feasibility of the intervention and procedures (i.e., recruitment, enrollment, retention, attrition, adherence, missing data), (2) explore participants' thoughts, feelings, and opinions on the acceptability of the intervention, and (3) examine SDT-based constructs (i.e., autonomy support, basic psychological need satisfaction, behavioural regulations) that may be associated with changes in PA participation and FV consumption.

Chapter 2: Literature Review

Positive Health Behaviours and Cancer

Based on published meta-analyses [6, 41-43], regular PA participation and FV consumption confers numerous positive health outcomes for cancer survivors, including prevention of cancer recurrence, second primary cancers, and other non-communicable chronic diseases. Regular PA post-diagnosis can reduce the risk of all-cause mortality in cancer survivors [44] and confer additional physical benefits (e.g., improved aerobic capacity, energy, body composition) [45]. Schwedhelm and colleagues conducted a recent systematic review and found that consumption of a diet high in FVs is inversely associated with overall mortality among cancer survivors [46]; it can also promote physical, psychological, and social health [47-49].

Drawing on the cumulative evidence pointing to the benefits of regular PA [41, 50, 51], guidelines recommending that cancer survivors participate in at least 150 minutes of aerobic training at moderate-to-vigorous intensity each week and strength training twice per week have been developed and widely distributed to the public by various organizations (e.g., Canadian Cancer Society, American College of Sports Medicine; [50]). Moreover, on the basis of evidence that benefits are accrued when consuming a healthy diet [52-55], guidelines recommending that cancer survivors consume at least five servings of FVs each day have also been developed and distributed to the public [6, 7]. Yet, less than 50% of cancer survivors meet the PA recommendations and approximately 20% of cancer survivors meet the FV consumption recommendations [8, 9]. The low compliance with these guidelines has led the development of interventions to increase adults' adherence to these guidelines post-cancer diagnosis and treatment [56, 57]. Although these efforts are important, researchers have raised concerns that such interventions may not reach all cancer survivors because they are often delivered by

research staff in hospitals or at research facilities located primarily in urban centres [15, 20, 58-60].

Rural-Living Young Adult Cancer Survivors

Numerous researchers have chronicled the many health disparities associated with living in a rural community [20]. Individuals in rural communities report poorer overall health outcomes than their urban counterparts, which may be associated with limited or lack of resources for positive health behaviours [13, 14, 61]. Specifically, rural residents are less likely to meet the PA and FV consumption guidelines, placing them at a higher risk for non-communicable chronic diseases (e.g., diabetes, cardiovascular disease). For FV consumption, rural residents experience greater economic burden, increased spatial distance, lower quality, and limited availability of FVs [62-65]. PA participation in rural communities is hindered by the active living built environment (e.g., limited parks, sidewalks, and streetlights), long distances to recreational athletic centres, poor transportation and walkability (e.g., high speed limits, winding roads), and minimal variety for PA types [66, 67]. Cancer survivors living in rural communities are not exempt from these circumstances. Across developed and underdeveloped nations, data on geographical location point to an increase in cancer-related morbidity and mortality for those in rural communities in comparison to urban dwellers [68]. Cancer survivors in rural communities report lower overall quality of life, lower functional well-being, and increased complaints of cancer-specific symptoms than urban living cancer survivors [69].

In addition to the above-mentioned constraints associated with living in a rural community, YAs have unique needs compared to children and older adult cancer survivor populations [70-74]. YAs not only have to manage the adverse cognitive, physical, and psychosocial sequelae (e.g., anxiety, depression, physical decondition, fatigue) associated with a

cancer diagnosis and subsequent treatment [73-76], but must navigate a period in their life that is laden with developmental milestones (e.g., gaining independence, establishing romantic relationships) [71, 76-79]. In a 2015 study with adolescent and YAs, Murnane and colleagues [80] suggest they experience considerable difficulties returning to pre-diagnosis PA levels. This young cohort of cancer survivors have also reported a myriad of barriers and concerns for participating in health-promoting behaviours including competing life responsibilities (e.g., work, children), necessary transportation, limited guidance from health professionals, and changes in social support (e.g., transitioning from parental support to independent and/or romantic relationships) [81, 82]. Further, Wu and colleagues [83] reported lack of resources, negative thoughts and feelings, and negative social and environmental influences as barriers specific to PA participation and FV consumption for YAs.

Although the number of new cancer cases is lower among young adults than middle-age and older adults, nearly 1 million young adults are diagnosed yearly worldwide [2]. Eighty percent of these young adults are expected to survive for at least 5 years after diagnosis [11], suggesting this population has the potential for numerous healthy years of life if supported to participate in health-promoting behaviours. Cross-sectional studies examining YAs participation in health-promoting behaviours support this contention as approximately 10-30% meet the PA participation guidelines [80, 84] and 20-30% meet the FV consumption guidelines [84, 85]. For rural-living adult cancer survivors, 19-50% meet guidelines for health-promoting behaviours [9, 16, 86], which is often lower than their urban counterparts [86, 87]. Thus, these data suggests rural-living YAs are in need of support for these health-promoting behaviours behaviours.

A systematic review of lifestyle interventions for rural-living individuals with chronic illness found there was need to develop tailored interventions that adequately addressed the

limited access to and availability of healthcare resources, and facilities that reduce lifestyle risk for chronic diseases [20]. Distance-based interventions utilizing different delivery modes (e.g., teleconference, website) have begun to be examined as a means of addressing access concerns for rural-living cancer survivors and YAs. The RENEW project [88] was a yearlong, iteratively-tailored, social cognitive theory-based behavioural intervention focused on promoting MVPA, strength training, and proper nutrition delivered via mailed print materials, telephone prompts, and stepped telephone counseling. The intervention saw modest improvements in PA participation and FV consumption for rural participants suggesting distance-based modes of delivery, coupled with support may be feasible and effective for this population. Further, YAs have reported various needs and preferences for facilitating participation in health behaviour change interventions, including a focus on promoting knowledge, skill, access to lifestyle information, and guidance for health-promoting behaviours [18, 27, 89, 90]. Further, YAs report a preference for interventions that offer high accessibility (e.g., distance-based interventions utilizing the Internet) and state flexible timing of delivery as a favourable means of receiving health-promoting behavioural information [18, 27, 89, 90].

Telehealth Interventions

Telehealth is the use of telecommunications (e.g., Internet, phone) and information technology to deliver health assessments, interventions, and/or additional health services across distance [91]. To address the growing need to reach rural-living YAs, telehealth interventions to support the adoption and maintenance of health-promoting behaviours are increasing in popularity [26] as they offer a means of facilitating participants' knowledge, skills, and motivation to change their lifestyle behaviours [92]. For individuals unable to travel to urban centres, telehealth interventions provide similar quality of patient care to produce the same

outcomes as compared to face-to-face interventions [93]. For this reason, telehealth interventions can increase patients' access to care by reducing hospital and travel costs [93].

Recent reviews examining the effectiveness of telehealth interventions suggest they can have positive effects on health behaviour change in variety of populations [22-25]. Of these reviews, Davies et al. [23] concluded that tailored telehealth interventions that provide educational material on behaviour change are effective in increasing PA participation in a variety of populations, including the general population and those with diabetes, overweight, mental illnesses. Further, there is evidence to suggest that interventions utilizing multiple behaviour change techniques (e.g., stress management, goal setting, motivational interviewing) may have a more significant impact on increasing the desired health behaviours than interventions that only focus on the use of one behaviour change technique [25, 56]. However, it is unclear what mode of delivery is the most effective for facilitating behaviour change in telehealth interventions [24]. Collectively, the results of these reviews [22-25] suggest that telehealth interventions can increase health behaviours, but the specific intervention design components necessary to facilitate the change still need to be tested.

In addition, there is still need to develop interventions grounded in theory as they provide a framework for understanding health behaviour change. To date most interventions have employed theory sporadically in the design, implementation, or evaluation of the intervention [94]. A theory-based intervention requires consistent application of theory from design through to evaluation as it allows for a more in-depth analysis of the impact of the intervention on behaviour change [95]. One particular theory that is used to guide the development, implementation, and evaluation of behaviour change interventions is SDT [33]. Though seldom

used to guide telehealth interventions as of yet [22-25], evidence supporting the utility of SDT is mounting, suggesting it should be considered in such interventions [26, 34, 96].

Description of Theoretical Framework

SDT is a useful theoretical framework to guide the development and evaluation of health behaviour change interventions as it offers insight into the underlying mechanisms driving people's behaviour [34]. SDT is a macro-theory that centers on an individual's motivation toward volitional behaviours [32]. As outlined in organismic integration theory (OIT), a sub-theory of SDT, Deci and Ryan [33] describe motivation as a multidimensional construct that lies on a continuum ranging from fully self-determined motivation to a lack of self-determination. Intrinsic motivation is the highest level of self-determined motivation and occurs when an individual participates in an activity for the inherent pleasure it provides him or her [33]. Integrated regulation (i.e., when an individual participates in an activity to obtain a goal or integrates the behaviour with other aspects of their life) and identified regulation (i.e., when an individual undertakes an activity because the outcome is valued) are adjacent to intrinsic motivation [33] and occur when an individual participates in the activity for his or her own internal reasons, and are thus considered to be self-determined. Often, intrinsic, integrated and identified regulation are combined into a self-determined index or autonomous motivation score [97]. Further on the continuum is introjected motivation which lies next to identified motivation and occurs when an individual participates in an activity to avoid feeling guilty or to gain social approval. Next, external regulation occurs when an individual participates in an activity to avoid punishment or obtain a reward separate from the activity [33]. Both introjected motivation and external regulation are considered non-self-determined and are often combined into controlled

motivation [97]. Last, amotivation is at the opposite end of the continuum from intrinsic motivation and occurs when an individual is lacking motivation [33].

Deci and Ryan [33] stipulate that higher levels of autonomous (or self-determined) motivation lead to greater adoption and enjoyment of behaviour, whereas higher levels of controlled motivation and amotivation undermine behaviour. Past research in PA contexts largely supports Deci and Ryan's [32] theoretical propositions and shows that self-determined forms of motivation (i.e., intrinsic motivation, integrated regulation, identified regulation) are associated with greater intention and long-term adherence to PA within different populations, including cancer survivors [36, 98, 99]. Similarly, support for Deci and Ryan's [32] macro-theory has been seen in interventions that target eating behaviours [100, 101], whereby greater intention and adherence to changing and maintaining healthy food choices were seen among adults who had higher levels of self-determined motivation.

Given the important role of motivation, Deci and Ryan [33] also theorized about the factors that can increase self-determined forms of motivation and proposed the basic psychological needs theory (BPNT) and the causality orientations theory (COT), two theories couched within the larger SDT framework. According to Deci and Ryan [33], social contexts that are appraised as supportive can promote the satisfaction of the three basic psychological needs (i.e., autonomy, competence, and relatedness), which in turn is associated with higher levels of self-determined forms of motivation (i.e., intrinsic, integrated, identified) and lower levels of introjected regulation, external regulation, and amotivation. Autonomy is defined as the sense that the individual is in control of his or her environment and not being controlled by others [102]. Competence is defined as an individual's perception of being able to complete a task or activity [103]. Relatedness is defined as the belief that an individual is being supported and feels

connected to others [104]. In support of Deci and Ryan's [33] theorizing, need supportive environments have been shown to enhance need satisfaction, and in turn increase participants' level of intrinsic motivation and overall adherence to tasks in a variety of populations, including cancer survivors [99, 105-109]. In addition, several studies have highlighted that autonomy support for psychological need satisfaction has a positive impact on increasing PA participation [100, 110-112] and healthy eating behaviours (e.g., higher consumption of FV) [40, 100, 110]. Therefore, the literature would suggest that SDT is a viable framework worth investigation for an intervention designed to change multiple health behaviours in rural-living YAs.

SDT-Based Telehealth Interventions

Participation in PA and consumption of FV can be difficult for rural-living YAs due to aforementioned barriers [12-16]. There is a need for tailored programs that are accessible from individuals' homes to better accommodate the needs and preferences of rural-living YAs. As such, SDT-based telehealth interventions focused on facilitating health behaviour change are a potential solution. Though SDT has not been explicitly used as a framework for the design and implementation of telehealth behaviour change interventions [22-25], a limited number of telehealth interventions have drawn on principles of SDT to develop a behaviour change intervention to promote PA among adolescents, as well as interpret the results of an intervention (e.g., [94, 113, 114]). For example, Pingree et al. [94] developed an evidence-based e-health intervention to provide participants with chronic illnesses (e.g., cancer, HIV infection, Alzheimer's disease) with positive health support information. Though the intervention was not originally designed and implemented using SDT, the researchers evaluated the effect of the system on participants using SDT. The researchers concluded that positive outcomes (e.g., increased quality of life) could be the result of elements of the system fulfilling the three basic

psychological needs. In another study implementing a telehealth intervention that drew on SDT principles, Patrick and Williams [34] showed that participants who were assigned to work with a need-supportive computerized personal trainer had increased PA compared to those who were assigned to work with a neutral computerized trainer. While not conducted with rural-living YAs, these findings highlight the utility of a SDT-based telehealth intervention designed to enhance psychological need satisfaction and motivation. Thus, it is plausible to suggest that such an intervention may have a positive impact on PA participation and FV consumption in rural-living YAs.

Key Gaps in Knowledge

There are various limitations to the current state of knowledge that need to be addressed in future research. The current extant literature does not adequately explore or address the specific needs of rural living YAs, has not fully explored the feasibility of a telehealth behaviour change interventions for rural-living cancer survivors, and is sporadic in the application of theory from design to evaluation. First, most of the research to date with cancer survivors has been conducted with children and older adults living in (or willing to travel to) urban centers [115]. Current findings on the impact of telehealth interventions may not directly apply to rural living YAs as they are distinct from their younger and older counterparts biologically, physically, and psychosocially [70, 76, 92] with additional geographical barriers. As such, they have unique barriers and facilitators that influence their participation in positive health behaviours [94, 116]. Second, the limited exploration of alternative intervention delivery modes does not adequately communicate the feasibility and acceptability of telehealth interventions in general and for rural-living YAs, specifically. Therefore, there is a lack of understanding regarding the practical issues that might arise when delivering a telehealth intervention to rural-dwelling YAs. Third, few

studies have adequately assessed the potential mechanisms of change related to increasing positive health behaviours [41], in part because most of the research to date on cancer survivors has inconsistently applied theory at all stages of the interventions. This is especially of concern for the conduct of telehealth interventions as the necessary components that facilitate change are unclear.

Current Study

To address the aforementioned limitations, our mixed-methods study: (1) assessed feasibility of the intervention and procedures (i.e., recruitment, enrollment, retention, attrition, adherence, missing data), (2) explored participants' thoughts, feelings, and opinions on the acceptability of the intervention and delivery mode, and (3) examined SDT-based constructs (i.e., autonomy support, basic psychological need satisfaction, behavioural regulations) that may be associated with changes in PA participation and FV consumption.

Chapter 3: Methods Article

This chapter presents the manuscript that emanated from the design and development (i.e., methods) of the health coaching intervention utilized in this Master's thesis. It has been formatted and submitted to the *Health Education Journal*. We feel this article fits well with the scope of this peer-reviewed journal as the manuscript offers insights into the intervention development process of a novel intervention for a special population.

Author's Contributions

Jenson Price, BA, conceptualized the design of the intervention, developed the materials, and drafted and revised the manuscript. Jennifer Brunet, PhD, contributed to the intervention conception and design, supervised the first author and mentored on material development, reviewed drafts of the manuscript, provided critical feedback, and approved the final version to be published.

Title Page

Title: Telehealth coaching for rural-living young adult cancer survivors

Authors: Price, J^a & Brunet, J^{abc}

Affiliations

a – University of Ottawa, 125 University Private, Montpetit Hall, Room 339, Ottawa, ON, Canada, K1N 6N5

b – Institut du savoir de l'Hôpital Montfort (ISM), Montfort Hospital, 713 Montreal Road, Ottawa, ON, Canada, K1K 0T2

c – Ottawa Hospital Research Institute (OHRI), 1053 Carling Avenue, Ottawa, ON, Canada, K1Y 4E9

Corresponding author: Jennifer Brunet, PhD, School of Human Kinetics, University of Ottawa, 125 University Private, Montpetit Hall, Room 339, Ottawa, Ontario, Canada K1N 6N5

Phone: 613-562-5800 ext. 3068

Fax: 613-562-5497

Email: jennifer.brunet@uottawa.ca

Abstract

Objective: Rural-living young adult cancer survivors (YAs) have reported barriers to participating in health behaviours due to their geographical location and developmental trajectory. Existing health behaviour change interventions have generally been delivered face-to-face and have not been tailored to rural-living YAs' preferences, and thus do not adequately address rural-living YAs' needs. This trial will examine the feasibility and acceptability of a 12-week telehealth coach intervention that draws on self-determination theory and aims to promote participation in two key health behaviours, namely physical activity and fruit and vegetable consumption. **Design:** The intervention will be pilot tested with rural-living YAs who: are between the ages of 20 and 39 years, have completed primary treatment, live in an area with fewer than 35,000 inhabitants, are not currently meeting physical activity and fruit and vegetable consumption guidelines, have access to the Internet and audio-visual devices, are ambulatory, and are able and willing to provide informed consent. The target sample size is 15. **Method:** Feasibility data will be collected by recording recommended outcomes continuously throughout the trial. Additional feasibility data, as well as acceptability data, will be collected using an online questionnaire administered pre- and post-intervention and a semi-structured interview. **Results:** Results may inform the design and implementation of supportive care services for rural-living YAs, and potentially other rural-living adults who experience similar barriers to participating in health behaviours. **Conclusion:** This trial represents one of the first to explore the feasibility and acceptability of a theory-based telehealth behaviour change intervention targeting rural-living YAs in order to mitigate the disease burden.

Keywords Intervention; Health Behaviour Change; Self-Determination Theory; Feasibility; Acceptability

Background

Though advances in treatments offer adults diagnosed with cancer a positive prognosis (Siegel et al., 2016), survivors often face a range of adverse physical and psychosocial side effects (e.g., fatigue, pain, depression) (Jones et al., 2016; Maass et al., 2015) that can impair their health and wellbeing (Keim-Malpass et al., 2017; Schmidt et al., 2012). Participating in a minimum of 150 minutes of moderate-to-vigorous physical activity (PA) per week and eating at least five servings of fruits and vegetables (FV) per day can help reduce many side effects and promote wellbeing among cancer survivors (Rock et al., 2012). It can also reduce the risk of cancer recurrence, second primary cancers, and several non-communicable diseases (Buffart et al., 2014; Demark-Wahnefried et al., 2015; Lahart et al., 2015; Rock et al., 2012).

Compliance with PA and FV guidelines is typically low among cancer survivors (Schmidt et al., 2018), which has led researchers to develop interventions to increase adults' adherence to PA and FV guidelines post-cancer diagnosis and treatment (Fleig et al., 2015; Kanera et al., 2017). Nonetheless, current interventions may not reach adult cancer survivors living in rural areas when delivered in person within urban centres (Miedema et al., 2013; Rauh et al., 2018; Rutledge et al., 2017; Smith and Ansa, 2016; Umstattd Meyer et al., 2016), leaving this population underserved. For adult cancer survivors living in rural areas, the chronicled health disparities are numerous and may attribute to their lower compliance with health behaviour guidelines (Rogers et al., 2011; Olson et al., 2014). This is concerning for young adult cancer survivors aged 20 and 39 years (YAs)(Fidler, 2017) who live in rural areas because 80% of this young cohort are expected to live at least 5 years after being diagnosed with cancer (Lewis et al., 2014). Thus, if supported to participate in health-promoting behaviours, they can potentially live for numerous healthy years of life. From the minimal research conducted with this population,

we understand YAs living in rural areas have limited access to support for health-promoting behaviours (Miedema et al., 2013). Accordingly, YAs living in rural areas represent a key growing population to target for health promotion interventions.

Efforts to develop evidence-based interventions to support participation in health-promoting behaviours among YAs living in rural areas are lacking. Moreover, interventions designed to promote compliance with PA and FV guidelines have typically targeted children or older adults diagnosed with cancer (Pugh et al., 2016; Pugh et al., 2017) and the few that have targeted YAs have focused on adolescent and YAs lower on the age spectrum (i.e., <25 years of age) (Richter et al., 2015; Pugh et al., 2016). Although the reported effect sizes (i.e., small-to-medium) are encouraging, existing interventions may not adequately address the values, preferences, and/or barriers of YAs (Pugh et al., 2017; Erickson et al., 2013) and this can influence intervention engagement and success (Pugh et al., 2017; Erickson et al., 2013). Based on past research with older cancer survivors living in rural areas (Martinez-Donate, 2013; McDonald et al., 2017; Rutledge et al., 2017; Olson et al., 2014), YAs living in rural areas may experience several barriers to meeting PA and FV guidelines, including a lack of physician/specialist availability, knowledge, time, access to affordable FVs, recreational athletic centres, and reliable transportation. Designing interventions that address these barriers, are tailored to YAs' values and preferences, and are easily accessible can allow greater access to health support services in a typically underserved population of YAs. They may also serve as a blueprint for designing intervention for other adults living in rural areas for whom low PA and FV consumption are problematic (e.g., racial/ethnic minorities, individuals with diabetes) (James et al., 2017; Yankeelov et al., 2015).

Telehealth interventions offer a mode of delivery that could help circumvent some of the aforementioned barriers (Balatsoukas et al., 2015). Reviews of studies testing the effectiveness of telehealth interventions suggest they can promote participation in PA and FV consumption (Brouwer et al., 2011; Davies et al., 2012; Jenkins et al., 2008; Webb et al., 2010; Silva et al., 2010). Further, telehealth interventions offer ease of access and ability to deliver tailored information consistent with YAs' values and preferences (Pugh et al., 2016; Pugh et al., 2017; Richter et al., 2015). Beyond considering the delivery mode, there is building evidence supporting the use of theory in the development, implementation, and evaluation of telehealth interventions to target and evaluate mechanisms of change (Pingree et al., 2010; Davis et al., 2015; Pagato and Bennett, 2013). Though seldom used to guide telehealth interventions as of yet (Brouwer et al., 2011; Davies et al., 2012; Jenkins et al., 2008; Webb et al., 2010), evidence supporting the utility of self-determination theory (SDT; Deci and Ryan, 2000) for health behaviour change is mounting (Schosler et al., 2014; Patrick H. and Williams, 2012; Silva et al., 2010).

To address these concerns in the literature, we designed an intervention that incorporates digital technology and flexible scheduling while incorporating strategies to address the frustration of the basic psychological needs. This paper describes the protocol of a feasibility trial seeking to evaluate the feasibility and acceptability of a 12-week SDT-based telehealth coaching intervention aiming to promote PA participation and FV consumption among YAs living in rural areas.

Methods

Study design

A mixed-methods single-arm design will be used to address the study objective. The study protocol has been approved by the Research Ethics Board at the University of Ottawa and it has been registered in the ClinicalTrials.gov database (registration #: NCT03691545). Reporting will follow the 2013 SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) reporting guidelines for intervention trials (Chan A-W et al., 2013).

Following recommendations (Thabane et al., 2010; Abbott, 2014), feasibility outcomes include: (1) recruitment rate, (2) enrollment rate, (3) retention and attrition rates, (4) adherence rate, and (5) percentage of missing data at each assessment. Acceptability will be determined by exploring participants' thoughts, feelings, and opinions through semi-structured interviews. The interview will be guided by a set of open-ended questions about the intervention itself as well as the delivery mode. In addition, questions will be asked to elicit participants' perspectives regarding the intervention's ability to effectively address key SDT-constructs (i.e., autonomy, competence, relatedness) and behavioural regulations for PA and FV consumption. Interview data will be triangulated with quantitative responses collected pre- and post-intervention to examine the potential mechanism of change within the intervention.

Eligibility criteria

Regardless of age at diagnosis, YAs are eligible if they: (1) are currently between 20 to 39 years of age, (2) live in a rural community, defined as areas with less than 35,000 inhabitants, (3) self-report participating in less than 150 minutes of moderate-to-vigorous PA per week as assessed using a single-item screening question: "*How much moderate-to-vigorous physical activity do you participate in, that is activity that increases your heart rate and causes you to sweat, per week?*", (4) self-report consuming less than five servings of FVs per day, (5) have completed primary treatment for cancer (i.e., completion of chemotherapy, radiation therapy,

and/or immunotherapy given after surgery), (6) have access to the Internet and audio-visual devices, (7) are able to read and speak English, (8) are able and willing to provide written informed consent, (8) are ambulatory, and (9) do not have any physical impairments precluding participation in PA (e.g., symptomatic heart or vascular diseases) as assessed using a single-item screening question: “*To the best of your knowledge, do you have a serious medical condition that would make it unsafe for you to participate in physical activity?*”.

Intervention

The 12-week intervention was designed based on previous behaviour change intervention literature (Michie et al., 2011). It is comprised of weekly 60-minute sessions delivered by a health coach (JP) via an online video platform (e.g., Google Hangouts, Skype). To ensure the health coach had the necessary knowledge and skills to implement the intervention, she received formal training on behaviour change, stress management techniques, self-regulation skills, conflict resolution, techniques for increasing and maintaining motivation and group dynamics by taking courses at Laurentian University. She also received informal training on motivational interviewing, SDT and behaviour change techniques (BCTs) from a prominent researcher who has experience developing and implementing similar interventions (JB). Further, she participated in mock sessions to ensure she was able to be autonomy supportive and apply the BCTs and motivational interviewing techniques in real-life situations.

Prior to each session, participants are provided with the material that will be covered. During each session, the health coach provides autonomy support (i.e., interactions that convey active support for the participant’s capacity to be self-initiating and autonomous) (Ryan et al., 2006/2015) and uses motivational interviewing techniques (Markland et al., 2005; Patrick H. and Williams, 2012) to aid participants in understanding how they can self-manage their health

through fostering their perceptions of the basic psychological needs (i.e., autonomy, competence, relatedness).

In terms of content, the health coach provides education on pertinent topics, offers valuable and relevant links, engaging worksheets, and facilitative question and answer periods. At the onset of the intervention, the health coach will inquire about participants' previous PA participation and FV consumption, general lifestyle (e.g., family, work), behavioural intentions, and ensure safety of recommending an increase of PA participation via a recommended screening tool (Bredin et al., 2013). The material covered during each session was designed in line with BCTs that have been shown to elicit change in PA participation and FV consumption (Michie et al., 2011). Table 1 presents the BCTs used during each session and examples of activities that will be completed. Sessions 1 and 2 focus on providing information about PA participation and FV consumption to ensure participants are knowledgeable in the current PA and FV guidelines and have adequate knowledge to initiate behaviour change. Sessions 3 and 4 will build on their understanding from sessions 1 and 2 by discussing, developing, and evaluating health behaviour goals based on their own intentions for behaviour change. Sessions 5 and 6 focus on recognition and overcoming of barriers that participants may have encountered while attempting to reach their goals set during the previous sessions. In addition, these sessions will provide them with the necessary tools to address future barriers. At the half-way point, the BCTs utilized by the health coach are designed to facilitate participants continued engagement in PA and FV consumption post-intervention. As such, sessions 7 and 8 focus on assessing and encouraging social support to encourage participants to look for support beyond the health coach. Sessions 9 and 10 focus on developing self-monitoring techniques to facilitate greater independence and transfer responsibility to the participant for evaluating progress post-

intervention. Sessions 11 and 12 focus on ways to modify participants' external environment to make it more supportive of PA participation and FV consumption. Finally, throughout the intervention, participants will be encouraged to implement strategies and systems of behavioural self-evaluation learnt and elicit plans for increasing or maintaining behaviour change.

To ensure the health coach interacts with participants in an autonomy supportive manner during the intervention and adheres to the intervention protocol for each participant, she will complete a self-report checklist developed in accordance with fidelity guidelines (Schoenwald et al., 2011) after each session. The checklist includes: (1) core content covered, (2) key activities conducted, and (3) autonomy supportive actions taken during the session. A self-report checklist was selected to monitor the health coach's behaviours and adherence to the intervention protocol because it is a pragmatic approach that is most likely to be used in real world supportive care service settings in the future (Schoenwald et al., 2011). Further, a self-report questionnaire (Williams et al., 1996) is included in the follow-up questionnaire package to allow participants to rate the health coach's overall adherence to SDT-construct behaviours (e.g., autonomy support, relatedness, facilitating competence) because the use of multiple indices of adherence is in line with guidance for behavioural interventions (Nelson et al., 2012). In addition, the research team will meet regularly to discuss the health coach's concerns, evaluate use of time and materials used, and identify problem-solving strategies to troubleshoot difficulties, if any, with implementing the intervention. As the intervention is tailored to each participant, the above steps will be taken to ensure participants have similar interactions with the health coach.

Sample size

As this is a feasibility trial, no formal sample size calculations were performed (Julious, 2005). Instead, this study follows sample size recommendations for intervention studies and aims

to have at least 12 participants who complete the intervention and assessments. Thus, the target sample size is 15 participants to compensate for a 20% dropout. This number of participants is deemed adequate to provide sufficient information on key feasibility outcomes such as recruitment rate and acceptability of the intervention and delivery mode (Julious, 2005).

Recruitment

The study is being advertised on social media websites, online postings on bulletin boards/discussion groups, and cancer-related websites. The research team regularly attends local cancer care centres to present the study, answer questions, and distribute recruitment flyers. Additionally, enrolled participants are encouraged to share information about the study to other individuals whom they think may be interested in the study, who can then contact the research team to learn more about it. Last, flyers are posted at various locations that offer services to cancer survivors in the Ottawa area. Those who contact the research team regarding participation in the study are assessed for eligibility over the phone.

Participant timeline

Once eligibility is confirmed, participants are emailed a link to a digital consent form and secure online baseline survey. They are asked to provide consent and complete the survey within a week; the 12-week intervention commences after these tasks have been completed. At the completion of the intervention, participants will be emailed a link to a secure online follow-up survey and asked to complete it within a week. Once they have done so, the interview will be scheduled.

Feasibility outcome measures

Recruitment rate is measured by recording the number of individuals per month that contact the research team regarding participation in the study over a 1-year period. Enrollment

rate is measured by recording the number of individuals that consent to participate in the intervention out of those who contact the research team. Adherence rate will be measured by recording how many of the intervention sessions participants attend out of 12. Retention and attrition rates are measured by recording how many of the assessments participants complete and the number of participants who drop out of the intervention, including the reasons. The percentage of missing data is computed for quantitative measures administered pre- and post-intervention. Based on recent telehealth feasibility studies with underserved populations that have reported barriers to PA and/or FV consumption similar to those reported by YAs living in rural areas (e.g., Magnus et al., 2018; Albanese-O'Neill et al., 2018), targets have been set a priori and feasibility of the trial and intervention will be deemed if: (a) 1-2 YAs per month contact the research team regarding participation in the study, (b) >60% of YAs who express contact the research team meet eligibility criteria and consent to participate, (c) >70% of participants complete all assessments and remain in the intervention, (d) participants attend >70% of sessions (i.e., 8 sessions), and (e) missing data at each assessment is <10%.

Acceptability outcome measures

Acceptability is assessed by asking participants about their thoughts, feelings, and opinions regarding the intervention and delivery mode during a 45 to 60-minute semi-structured video-platform or telephone-based interview guided by open-ended questions addressing: (1) relevance of the intervention, (2) suitability of the intervention, (3) impressions of guidance provided by the health coach, (4) perceived benefits of the intervention, and (5) problems/concerns experienced during the intervention. Questions inquiring about observed behaviour changes and intentions to sustain changes are also asked (see appendix A).

The interview schedule is informed by qualitative research guidelines for topical interviews, narrowly focusing on the what, when, and why of the intervention (Rubin and Rubin, 2011; Gubrium et al., 2012). Participants who have poor session attendance or dropped out are still invited to take part in an interview, whereby they will also be asked about reasons for disengaging with the intervention and recommendations for a more acceptable intervention. Interviews will be audio-recorded and transcribed verbatim.

Putative outcome measures

The data collected with the following measures will be used to describe participants and estimate the magnitude of the associations between changes in putative mechanisms of change and behavioural outcomes. Participant responses will be triangulated with interview data to provide greater insight into mechanisms of change and behavioural outcomes.

International Physical Activity Questionnaire-Short form (IPAQ-S; Booth, 2000)

Participation in PA is assessed using the IPAQ-S, previously used to assess PA among cancer survivors (e.g., Johnson-Kozlow et al., 2006). It includes seven questions about their participation in vigorous and moderate activity, as well as their participation in walking and sedentary behaviours.

Behavioural Risk Factor Surveillance System-FV questionnaire (BRFSS-FV; Trowbridge et al., 1990)

FV consumption is assessed using the BRFSS-FV, used in previous studies with the general population and individuals with chronic illnesses (e.g., Fahimi et al., 2008; Hu et al., 2011). It includes six questions about their consumption of fruits, vegetables, and potatoes.

Psychological Need Satisfaction in Exercise Scale (PNSE; Wilson et al., 2006)

Perceptions of autonomy, competence, and relatedness in PA contexts are assessed using the PNSE, which has been used in studies with cancer survivors (e.g., Peddle et al., 2007). It consists of 18 items that assesses the degree to which participants' need to feel competent, autonomous, and socially connected/related are satisfied during exercise. For this study, the word 'exercise' has been replaced with the words 'physical activity'. Each item is rated on a scale ranging from *1=false* to *6=true*.

Psychological Need Satisfaction questionnaire (PNS; Gagne, 2003; Deci et al., 2001) – modified to FV

Perceptions of autonomy, competence, and relatedness in relation to FV consumption are assessed using a modified version of the PNS, which has previously been modified for studies that focus on eating behaviours (e.g., Thogersen-Ntoumani et al., 2010). The adapted questionnaire assesses the degree to which the basic psychological needs are fulfilled in participants' consumption of FV. Each item is rated on a scale ranging from *1=not at all true* to *7=very true*.

Exercise Treatment Self-Regulation Questionnaire (TSRQ-E; Williams et al., 1998)

The TSRQ-E, which has been used in past studies with cancer survivors (e.g., Danaei et al., 2005), is used to assess behavioural regulations in relation to PA. The TSRQ-E consists of four subscales that assess: external regulation, introjected regulation, identified regulation, and intrinsic motivation. For this study, the word 'exercise' has been replaced with the words 'physical activity'. Each item is rated on a 7-point Likert scale ranging from *1=not at all true* to *7=very true*.

Dietary Self-Regulation questionnaire (DSR; Williams et al., 1998)

The DSR has been adapted to assess behavioural regulations in relation to FV consumption. It consists of three subscales that assess: autonomous motivation, controlled motivation, and amotivation. Each item is rated on a 7-point Likert scale ranging from *1=not at all true* to *7=very true*.

Health Care Climate Questionnaire (HCCQ; Williams et al., 1996)

An adapted version of the HCCQ is used to assess perceived autonomy support. Unlike previously described measures, it is only administered post-intervention. For this study, the statement ‘Health Care Provider’ has been replaced with the statement ‘Health Coach’. The adapted HCCQ consists of 15 items that represent situations and feelings that may influence perceived autonomy support. Each item is rated on a scale ranging from *1=strongly disagree* to *7=strongly agree*.

In addition to completing the aforementioned questionnaires, participants are asked to complete questions at baseline to gather data on their age, sex, level of education, socioeconomic status, occupation, date of cancer diagnosis, cancer treatment history, and stage of cancer.

Data analysis

Quantitative data will be analyzed using Statistical Package for Social Sciences (SPSS) version 25 (IBM, 2017) and will consist of descriptive statistics (e.g., means, standard deviations, frequencies, ranges) for each feasibility outcome. As per recommendations (Thabane et al., 2010; Abbott, 2014), feasibility outcomes will be assessed individually and then as a whole to gauge the overall success of the intervention and to provide recommendations for modifications (as necessary) to increase future success of randomized controlled trials or supportive care services. Whilst not powered to detect significant changes in behavioural outcomes nor correlations between changes in putative mechanisms of change and behavioural

outcomes, repeated measures analysis of variance (RM-ANOVA) and bivariate correlations will be calculated to describe the magnitude of changes and associations. Effect sizes (d) will be computed, with effect sizes of $d=\pm.20$ interpreted as small, $d=\pm.50$ as medium, and $d=\pm.80$ as large (Cohen, 1988) and correlation coefficients (r) of $r=\pm.10$, $r=\pm.30$, $r=\pm.50$ interpreted as small, moderate, and large correlations, respectively (Bobko, 2001).

Qualitative data will be analyzed following guidelines for thematic analysis, resulting in the development of codes and eventual overarching themes (Braun et al., 2016). As multiple facets of the intervention will be explored during the interviews (e.g., acceptability of intervention design, materials, health coach, mechanism of change), a deductive-inductive approach (also referred to as *abductive*) will be employed for a more complete understanding of participants' experiences. The authors will employ a fluid method of analysis that involves movement back and forth between the two approaches (Graneheim et al., 2017). Deductive analysis will be used to establish how findings fit with, add to, or undermine the existing research regarding telehealth interventions and SDT. Inductive analysis will allow additional pertinent concepts to emerge regarding the acceptability of intervention components, which will add to the depth and greater understanding in the interpretation of the results. A detailed semantic and latent level analysis will be conducted to explore relevant themes that are present across the interviews. Both authors will engage in critical dialogue during the assessment of pertinent codes and again when constructing meaningful themes. Using recent recommendations (Smith and McGannon, 2017), this will be accomplished through reflection, exploration, and discussion aimed at understanding each authors' interpretation of the data. Codes will be managed in Microsoft Excel.

Qualitative and quantitative data from the questionnaires will be triangulated by comparing individual quantitative results from the questionnaires and results from the RM-ANOVA against the emergent themes of participants' interviews regarding behavioural regulations and basic psychological needs. Examining potential divergent and convergent results will lend a deeper understanding of participants' perspectives on how SDT-constructs within the intervention translate to current perceived engagement with these behaviours and their intentions to participate in these health-promoting behaviours post-intervention.

Discussion

To date, studies focused on promoting PA participation and FV consumption among cancer survivors predominately recruit and enrol children or older adults diagnosed with cancer, with a recent systematic review reporting recruitment and enrollment of YAs in less than 25% ($n=3$) of studies (Pugh et al., 2016). This feasibility trial is designed to test a theory-based telehealth coaching approach to increasing PA participation and FV consumption among YAs living in rural areas across North America. The intervention incorporates autonomy support and motivational interviewing techniques, as well as evidence-based BCTs. It is the intention that the results of this study inform the design of larger scale studies and/or supportive care services for YAs living in rural areas.

YAs have been difficult to engage in research trials for a variety of reasons, including engagement in other activities and limited access to recruitment (Gattuson et al., 2005; Hendricks-Ferguson et al., 2013; Harlan et al., 2011). To be effective, positive health behaviour interventions targeting participation in YAs need to include strategies tailored to address the inherent difficulties of engaging this population in research and subsequent health behaviours. Studies have consistently shown that YAs desire access to supportive care services that are

tailored and easily accessible while focused on encouraging participation in positive health behaviours (Pugh et al., 2018; Pugh et al., 2017; Murnane et al., 2015). This intervention was specifically designed to appeal to YAs by incorporating digital technology and flexible scheduling to make their participation in the intervention easier and more convenient.

In addition, the intervention is designed to be accessible to individuals who live in areas that make access to supportive care services difficult to ultimately engage people in these communities and enhance health outcomes. The Internet is increasingly leveraged to deliver and enhance supportive care services for cancer survivors with websites, support groups, and a broad range of mobile applications (Richter et al., 2015; Pugh et al., 2017). Yet, there is limited research exploring the ability of telehealth behaviour change interventions to facilitate YAs' basic psychological needs. This is despite evidence suggesting many YAs report barriers to these health-promoting behaviours that are related to the frustration of the basic psychological needs (e.g., lack of resources, negative thoughts and feelings, negative social and environmental influences) (Wu et al., 2015). Exploring the acceptability of SDT-based materials and interactions through a telehealth platform will ultimately inform the design of future studies and supportive care services.

Notwithstanding the strengths of this protocol, there are limitations that need to be acknowledged. It is the intention of the researchers to have the first author perform the intervention and the acceptability interviews, which may influence participants' responses such that they may respond more positively than they actually want to the questions. Moving forward, utilizing a third-party to conduct acceptability interviews may allow for a more nuanced understanding of intervention acceptability. Similarly, the use of self-report measures may have inherent limitations (e.g., recall bias, social desirability) and influence interpretations of

acceptability and impact on increasing these health-promoting behaviours. To obtain accurate estimates of PA participation and FV consumption, researchers may wish to use more objective measures.

Conclusion

Cancer survivors living in rural areas report engaging in less PA and consuming fewer FVs than their urban counterparts (Rogers et al., 2011), which may place them at an increased risk of cancer recurrence, second primary cancer, and non-communicable diseases (Paskett et al., 2004). As the number of YAs continues to grow (Zebrack and Isaacson, 2012; Epelman, 2013), it is necessary to develop interventions to increase compliance with PA and FV guidelines that will be well received by YAs. Given that the literature lacks evidence-based interventions tailored to address the barriers of living in a rural community in this age group, this study will provide important information about whether a novel, SDT-based 12-week telehealth coaching intervention may help to foster compliance with PA and FV guidelines in this young adult population.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Abbott JH. (2014) The distinction between randomized clinical trials (RCTs) and preliminary feasibility and pilot studies: What they are and are not. *Journal of Orthopaedic & Sports Physical Therapy* 44: 555-558.
- Albanese-O'Neill A, Beauchamp G, Thomas N, et al. (2018) Transition education for young adults with type 1 diabetes: Pilot feasibility study for a group telehealth intervention. *JMIR Diabetes* 3: e10909.
- Balatsoukas P, Kennedy C, Buchan I, et al. (2015) The role of social network technologies in online health promotion: A narrative review of theoretical and empirical factors influencing intervention effectiveness. *Journal of Medical Internet Research* 17: e141.
- Bobko P. (2001) Correlation and regression. 2 ed. Thousand Oaks, California: SAGE Publications, Inc.
- Booth ML. (2000) Assessment of physical activity: An international perspective. *Research Quarterly for Exercise and Sport* 71: 114-120.
- Braun V, Clarke V and Weate P. (2016) Using thematic analysis in sport and exercise research. *Routledge handbook of qualitative research in sport and exercise*. London, UK: Routledge, 191-205.
- Bredin SSD, Gledhill N, Jamnik VK, et al. (2013) PAR-Q+ and ePARmed-X+. *Canadian Family Physician* 7: 35-38.
- Brouwer W, Kroeze W, Crutzem R, et al. (2011) Which intervention characteristics are related to more exposure to internet-delivered healthy lifestyle promotion interventions? A systematic review. *Journal of Medical Internet Research* 13: e2.

- Buffart LM, Galvao DA, Brug J, et al. (2014) Evidence-based physical activity guidelines for cancer survivors: Current guidelines, knowledge gaps, and future research directions. *Cancer Treatment Reviews* 40: 327-340.
- Chan A-W, Tetzlaff JM, Altman DG, et al. (2013) SPIRIT 2013 statement: Defining standard protocol items for clinical trials. *Annals of International Medicine* 158: 200-207.
- Cohen J. (1988) *Statistical power analysis for the behavioral sciences*, Hillsdale, NJ: Lawrence Erlbaum Associates.
- Danaei G, Vander Hoorn S, Lopez AD, et al. (2005) Causes of cancer in the world: Comparative risk assessment of nine behavioral and environmental risk factors. *Lancet* 366: 1784–1793.
- Davies CA, Spence JC, Vandelanotte C, et al. (2012) Meta-analysis of internet-delivered interventions to increase physical activity levels. *International Journal of Behavioural Nutrition and Physical Activity* 9.
- Davis R, Campbell R, Hildon Z, et al. (2015) Theories of behaviour and behaviour change across the social and behavioural sciences: A scoping review. *Health Psychology* 9: 323-344.
- Deci EL and Ryan RM. (2000) Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology* 25: 54-67.
- Deci EL, Ryan RM, Gagne M, et al. (2001) Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-sectional study of self-determination. *Journal of Personality and Social Psychology* 27: 930-942.
- Demark-Wahnefried W, Rogers LQ, Alfano CM, et al. (2015) Practical clinical interventions for diet, physical activity, and weight control in cancer survivors. *CA: A Cancer Journal for Clinicians* 65.

- Epelman CL. (2013) The adolescent and young adult with cancer: State of the art - psychosocial aspects. *Current Oncology Reports* 15: 325-331.
- Erickson JM, Macpherson CF, Ameringer S, et al. (2013) Symptoms and symptom clusters in adolescents receiving cancer treatment: A review of the literature. *International Journal of Nursing Studies* 50: 847-869.
- Fahimi M, Link M, Schwartz. DA, et al. (2008) Tracking chronic disease and risk behavior prevalence as survey participation declines: statistics from the behavioral risk factor surveillance system and other national surveys. *Preventing Chronic Disease* 5: 1-16.
- Fidler MM, Gupta, S., Soerjomataram, I., Ferlay, J., Steliarova-Foucher, E., & Bray, F. (2017) Cancer incidence and mortality among young adults aged 20-39 years worldwide in 2012: A population-based study. *The Lancet Oncology* 18: 1579-1589.
- Fleig L, Kuper C, Lippke S, et al. (2015) Cross-behaviour associations and multiple health behaviour change: A longitudinal study on physical activity and fruit and vegetable intake. *Journal of Health Psychology* 20: 525-534.
- Gagne M. (2003) Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology* 15: 372-390.
- Gattusson J, Hinds P, Tong X, et al. (2005) Monitoring child and parent refusals to enrol in clinical research protocols. *Methodological Issues in Nursing Research* 53: 319-326.
- Graneheim UH, Lindgren BM and Lundman B. (2017) Methodological challenges in qualitative content analysis: A discussion paper. *Nurse Educ Today* 56: 29-34.
- Gubrium JF, Holstein JA, Marvasti AB, et al. (2012) *The SAGE handbook of interview research: The complexity of the craft*, Thousand Oaks, CA: Sage.

- Harlan LC, Lynch CF, Keegan TH, et al. (2011) Recruitment and follow-up of adolescent and young adult cancer survivors: The AYA HOPE Study. *Journal of Cancer Survivorship* 5: 305-314.
- Hendricks-Ferguson VL, Cherven BO, Burns DS, et al. (2013) Recruitment strategies and rates of a multi-site behavioral intervention for adolescents and young adults with cancer. *Journal of Pediatric Health Care* 27: 434-442.
- Hu SS, Pierannunzi C and Balluz L. (2011) Integrating a multimode design into a national random-digit-dialed telephone survey. *Preventing Chronic Disease* 8: A145.
- James CV, Moonesinghe R, Wilson-Frederick SM, et al. (2017) Racial/ethnic health disparities among rural adults — United States, 2012–2015. *Morbidity and Mortality Weekly Report* 66: 1-9.
- Jenkins A, Christensen H, Walker JG, et al. (2008) The effectiveness of distance interventions for increasing physical activity: A review. *American Journal of Health Promotion* 24: 102-117.
- Johnson-Kozlow M, Sallis JF, Gilpin EA, et al. (2006) Comparative validation of the IPAQ and the 7-Day PAR among women diagnosed with breast cancer. *International Journal of Behavioural Nutrition and Physical Activity* 3.
- Jones JM, Olson K, Catton P, et al. (2016) Cancer-related fatigue and associated disability in post-treatment cancer survivors. *Journal of Cancer Survivorship* 10: 51-61.
- Julious SA. (2005) Sample size of 12 per group rule of thumb for a pilot study. *Pharmaceutical Statistics* 4.
- Kanera IM, Willems RA, Bolman CAW, et al. (2017) Long-term effects of a web-based cancer aftercare intervention on moderate physical activity and vegetable consumption among

- early cancer survivors: A randomized controlled trial. *International Journal of Behavioural Nutrition and Physical Activity* 14: 1-13.
- Keim-Malpass J, Mihalko SL, Russell G, et al. (2017) Problems experienced by ovarian cancer survivors during treatment. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 46: 544-554.
- Lahart IM, Metsios GS, Nevill AM, et al. (2015) Physical activity, risk of death and recurrence in breast cancer survivors: A systematic review and meta-analysis of epidemiological studies. *Acta Oncologica* 54: 635-654.
- Lewis DR, Seibel NL, Smith AW, et al. (2014) Adolescent and young adult cancer survival. *Journal of National Cancer Institute Monographs* 49: 228-235.
- Maass SW, Roorda C, Berendsen AJ, et al. (2015) The prevalence of long-term symptoms of depression and anxiety after breast cancer treatment: A systematic review. *Maturitas* 82: 100-108.
- Magnus M, Edwards E and Dright A, Gilliam, L., Brown, A., Levy, M., Sikka, N., Siegel, M., Criss, V., Watson, C.C., Machtinger, E., & Kuo, I. (2018) A feasibility study of a telehealth intervention on health care service utilization among transgender women of color in Washington, DC. *Applied Clinical Informatics* 2: e1-e9.
- Markland D, Ryan RM, Tobin VJ, et al. (2005) Motivational interviewing and self-determination theory. *Journal of Social and Clinical Psychology* 24: 811-831.
- Martinez-Donate AP, Halverson, J., Simon, N., Strickland, J.S., Trentham-Dietz, A., Smith, P.D., Linskens, R., & Wang, X. (2013) Identifying health literacy and health system navigation needs among rural cancer patients: Findings from the rural oncology literacy enhancement study (ROLES). *Journal of Cancer Education* 28: 573-581.

- McDonald YJ, Goldberg DW, Scarinci IC, et al. (2017) Health service accessibility and risk in cervical cancer prevention: Comparing rural versus nonrural residence in New Mexico. *Journal of Rural Health* 33: 382-392.
- Michie S, Ashford S and Sniehotta FF, Dombrowski, S.U., Bishop, A., & French, D.P. (2011) A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALO-RE taxonomy. *Psychology & Health* 26: 1479-1498.
- Miedema B, Easley J and Robinson L. (2013) Comparing urban and rural young adult cancer survivors' experiences: a qualitative study. *Rural and Remote Health* 13: 1-12.
- Murnane A, Gough K, Thompson K, et al. (2015) Adolescents and young adult cancer survivors: Exercise habits, quality of life and physical activity preferences. *Supportive Care in Cancer* 23: 501-510.
- Nelson MC, Cordray DS, Hulleman CS, et al. (2012) A procedure for assessing intervention fidelity in experiments testing educational and behavioral interventions. *The Journal of Behavioral Health Services & Research* 39: 374-396.
- Olson EA, Mullen SP, Rogers LQ, et al. (2014) Meeting physical activity guidelines in rural breast cancer survivors. *American Journal of Health Behavior* 38: 890-899.
- Pagato S and Bennett GG. (2013) How behavioural science can advance digital health. *Translational Behavioural Medicine* 3: 271-276.
- Paskett ED, Tatum C, Rushing J, et al. (2004) Racial differences in knowledge, attitudes, and cancer screening practices among triracial rural population. *Cancer* 101: 2650-2659.

- Patrick H. and Williams GC. (2012) Self-determination theory: Its application to health behaviour and complementarity with motivational interviewing. *International Journal of Behavioural Nutrition and Physical Activity* 9: 1-12.
- Peddle CJ, Plotnikoff RC, Wild TC, et al. (2007) Medical, demographic, and psychosocial correlates of exercise in colorectal cancer survivors: An application of self-determination theory. *Supportive Care in Cancer* 16: 9-17.
- Pingree S, Hawkins R, Baker T, et al. (2010) The value of theory for enhancing and understanding e-health interventions. *American Journal of Preventive Medicine* 38: 103-109.
- Pugh G, Gravestock HL, Hough RE, et al. (2016) Health behaviour change interventions for teenage and young adult cancer survivors: A systematic review. *Journal of Adolescent and Young Adult Oncology* 5: 91-105.
- Pugh G, Hough R, Gravestock H, et al. (2018) The lifestyle information and intervention preferences of teenage and young adult cancer survivors: A qualitative study. *Cancer Nursing* 41: 389-398.
- Pugh G, Hough RE, Gravestock HL, et al. (2017) The health behaviour information needs and preferences of teenage and young adult cancer survivors. *Journal of Adolescent and Young Adult Oncology* 6: 318-326.
- Rauh LA, Saks EJ, Nakad-Rodriguez D, et al. (2018) Cervical cancer care in rural Virginia: The impact of distance from an academic medical center on outcomes & the role of non-specialized radiation centers. *Gynecol Oncol* 150: 338-342.

- Richter D, Koehler M, Friedrich M, et al. (2015) Psychosocial interventions for adolescents and young adult cancer patients: A systematic review and meta-analysis. *Critical Reviews in Oncology/Hematology* 95: 370-386.
- Rock CL, Doyle C, Demark-Wahnefried W, et al. (2012) Nutrition and physical activity guidelines for cancer survivors. *CA: A Cancer Journal for Clinicians* 62: 242-274.
- Rogers LQ, Markwell SJ, Courneya KS, et al. (2011) Physical activity type and intensity among rural breast cancer survivors: Patterns and associations with fatigue and depressive symptoms. *Journal of Cancer Survivorship* 5: 54-61.
- Rubin HJ and Rubin IS. (2011) *Qualitative interviewing: The art of hearing data*, London, UK: Sage.
- Rutledge TL, Kano M, Guest D, et al. (2017) Optimizing endometrial cancer follow-up and survivorship care for rural and other underserved women: Patient and provider perspectives. *Gynecologic Oncology* 145: 334-339.
- Ryan RM, Deci EL, Grolnick WS, et al. (2006/2015) The significance of autonomy and autonomy support in psychological development and psychopathology. In: Cicchetti D and Cohen DJ (eds) *Developmental psychopathology: Volume one, theory and method*. Second ed. Hoboken, NJ: John Wiley & sons, 795-849.
- Schmid D, Behrens G, Arem H, et al. (2018) Pre- and post-diagnosis physical activity, television viewing, and mortality among hematologic cancer survivors. *PLOS One* 13: 1-14.
- Schmidt ME, Chang-Claude J, Vrieling A, et al. (2012) Fatigue and quality of life in breast cancer survivors: Temporal courses and long-term pattern. *Journal of Cancer Survivorship* 6: 11-19.

- Schoenwald SK, Garland AF, Chapman JE, et al. (2011) Toward the effective and efficient measurement of implementation fidelity. *Administration and Policy in Mental Health and Mental Health* 38: 32-43.
- Schosler H, de Boer J and Boersema JJ. (2014) Fostering more sustainable food choices: Can self-determination theory help. *Food Quality and Preference* 35: 59-69.
- Siegel RL, Miller KD and Jemal A. (2016) Cancer statistics, 2016. *CA: A Cancer Journal for Clinicians* 66: 7-30.
- Silva MN, Vieira PN, Coutinho SR, et al. (2010) Using self-determination theory to promote physical activity and weight control: A randomized controlled trial in women. *Journal of Behavioural Medicine* 33: 110-122.
- Smith B and McGannon KR. (2017) Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology* 11: 101-121.
- Smith SA and Ansa B. (2016) A systematic review of lifestyle interventions for chronic diseases in rural communities. *J Ga Public Health Assoc* 5: 304-313.
- Thabane L, Ma J and Chu R, Cheng, J., Ismaila, A., Rios, L.P., Robson, R., Thabane, M., Giangregorio, L., Goldsmith, C.H. (2010) A tutorial on pilot studies: The what, why and how. *BMC Medical Research Methodology* 10: 1-10.
- Thogersen-Ntoumani C, Ntoumanis N, Cummings J, et al. (2010) When feeling attractive matters too much to women: A process underpinning the relation between psychological need satisfaction and unhealthy weight control behaviours. *Motivation and Emotion* 34: 413-422.

Trowbridge F, Wong F, Byers T, et al. (1990) Methodological issues in nutrition surveillance: The CDC experience. *Journal of Nutrition* 120: 1512-1518.

Umstattd Meyer MR, Moore JB, Abildso C, et al. (2016) Rural active living: A call to action. *Journal of Public Health Management & Practice* 22: E11-20.

Webb TL, Joseph J, Yardley L, et al. (2010) Using the internet to promote behaviour change: A systematic review and meta-analysis of the impact of theoretical basis, use of behaviour change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research* 12: e4.

Williams GC, Deci EL and Ryan RM. (1998) Building health-care partnerships by supporting autonomy: Promoting maintained behavior change and positive health outcomes. In: A. L. Suchman, Hinton-Walker P and Botelho R (eds) *Partnerships in healthcare: Transforming relational process* Rochester, NY: University of Rochester Press, 67-87.

Williams GC, Grow VM, Freedman ZR, et al. (1996) Motivational predictors of weight loss and weight-loss maintenance. *Journal of Personality and Social Psychology* 70: 115-126.

Wilson PM, Rogers WT, Rodgers WM, et al. (2006) Psychological need satisfaction in exercise scale. *Journal of Sport and Exercise Psychology* 28: 231-251.

Yankeelov PA, Faul AC, D'Ambrosio JG, et al. (2015) "Another day in paradise": A photovoice journey of rural older adults living with diabetes. *Journal of Applied Gerontology* 34: 199-218.

Zebrack B and Isaacson S. (2012) Psychological care of adolescent and young adult patients with cancer and survivors. *Journal of Clinical Oncology* 30: 1221-1226.

Table 1.

Behaviour change techniques utilized in telehealth behaviour change intervention for rural-living young adult cancer survivors

Sessions	Behaviour change techniques	Example activities
<i>Session 1 & 2</i>	• Provide information on consequences of behaviours in general • Provide information about the benefits and costs of action or inaction to participants	• Review cancer specific guidelines for PA participation and FV consumption • Discuss benefits of health-promoting behaviours and illicit participants' reasons for increasing behaviours • Examine cost/benefit of current behaviours and changing behaviours
<i>Session 3 & 4</i>	• Goal setting for behavioural resolution • Outcome goal setting achieved by behavioural means • Action planning	• Review SMART goal approach • Facilitate short- and long-term goal development • Situate goals in larger contextual environment
<i>Session 5 & 6</i>	• Action planning • Barrier identification/problem solving • Set graded tasks	• Illicit potential barriers that participants may experience • Develop plans to overcome barriers
<i>Session 7 & 8</i>	• Plan social support/social change • Instruction to perform behaviours • Prompt practice	• Review four main types of social support • Encourage participants to examine social network • Develop reasons and plans to include others in their lifestyle changes
<i>Session 9 & 10</i>	• Record of specified behaviours • Record of outcomes related to specific behaviours	• Review methods of self-monitoring • Encourage the use of a self-monitoring technique to evaluate progress post-intervention
<i>Session 11 & 12</i>	• Provide information on where and when to perform behaviours • Environmental restructuring • Relapse prevention/coping planning	• Encourage participants to examine their current behaviours in the larger contextual environment • Have participants examine their current environment and determine methods for creating a health-promoting environment

Chapter 4: Results Article

This chapter presents the manuscript that emanated from the results of this Master's thesis. It has been formatted for submission to the *Journal of Rural Health*. We feel this article fits well with the scope of this peer-reviewed journal as the manuscript offers insight into the feasibility and acceptability of a novel intervention for increasing health-promoting behaviours in rural living YA cancer survivors.

Author's Contributions

Jenson Price, BA, conceptualized the study, recruited participants, collected data, analyzed the data, and interpreted the results. She also drafted and revised the manuscript. Jennifer Brunet, PhD, contributed substantially to the study conception and design, supervised the first author and mentored on data analysis, helped interpret the results, reviewed drafts of the manuscript, provided critical feedback, and approved the final version to be published.

Title Page

Title: Examining the feasibility and acceptability of a telehealth coaching program for health-promoting behaviours in rural-living young adult cancer survivors

Authors: Price, J^a & Brunet, J^{abc}

Affiliations

a – University of Ottawa, 125 University Private, Montpetit Hall, Room 339, Ottawa, ON, Canada, K1N 6N5

b – Institut du savoir de l'Hôpital Montfort (ISM), Montfort Hospital, 713 Montreal Road, Ottawa, ON, Canada, K1K 0T2

c – Ottawa Hospital Research Institute (OHRI), 1053 Carling Avenue, Ottawa, ON, Canada, K1Y 4E9

Corresponding author: Jennifer Brunet, PhD, School of Human Kinetics, University of Ottawa, 125 University Private, Montpetit Hall, Room 339, Ottawa, Ontario, Canada K1N 6N5

Phone: 613-562-5800 ext. 3068

Fax: 613-562-5497

Email: jennifer.brunet@uottawa.ca

Abstract

Background: Rural-living young adult cancer survivors (YAs) possess unique barriers and concerns that influence their ability to participate in traditional face-to-face behaviour change interventions. We conducted a single-arm, mixed methods pilot trial to assess the feasibility and acceptability of the delivery mode and intervention components of a 12-week theory-based telehealth behaviour change intervention on physical activity (PA) and fruit and vegetable (FV) consumption. **Methods:** Individuals were recruited through community-based methods. If eligible, they were asked to complete an online consent form and baseline questionnaire. Participants met with the health coach weekly for 60 minutes for 12 weeks. Sessions incorporated education on pertinent topics, offered relevant resources, provided engaging worksheets, and facilitative question and answer periods. Feasibility measures included rates of recruitment, enrollment, adherence, attrition and retention, as well as percentage of missing data. Additional feasibility and acceptability data were collected using an online questionnaire administered pre- and post-intervention and using semi-structured interviews. **Results:** Over a 7-month period, 14 YAs self-referred. Of these 14, 5 were eligible and consented to participate with 3 completing the study. Retention to the study was 73% and adherence to the health coaching program ranged from 66.67-100%. Inquiry into the acceptability of the intervention offered insight into participants experiences, which was summarized within five themes: (1) *the more time the better*, (2) *the human factor*, (3) *supporting access*, (4) *influencing the basic psychological needs*, and (5) *finding motivation*. **Conclusions:** Collectively, findings highlight the value of feasibility trials and provides critical guidance that can be used to refine studies seeking to increase access and optimize participation in positive health behaviours for this population. Indeed, they suggest the methods used herein require minor modifications before

being deemed feasible despite the general acceptability of the intervention. Importantly, it is necessary to employ more expansive recruitment strategies in future studies and explore participants' underlying intentions for participating in behaviour change interventions. Also, testing stepped down models of support may help some YAs maintain behaviour change post-intervention.

Keywords: Health behaviour change; Cancer survivors; Young adults; Rural; Feasibility; Recruitment; Telehealth; Mixed Methods

Trial registration: NCT03691545

Background

Regular physical activity (PA) participation and fruit and vegetable (FV) consumption can reduce cancer-related mortality and morbidity while conferring numerous positive health benefits for cancer survivors [1-5]. The physical, psychological, and social health benefits of these health-promoting behaviours for individuals diagnosed with cancer are evident across the disease trajectory, age groups, and cancer types [1, 3, 6-8]. Accordingly, guidelines for PA participation and FV consumption are now widely distributed to the public by various organizations (e.g., Canadian Cancer Society, American College of Sports Medicine; [7, 9, 10]). It is recommended that cancer survivors participate in at least 150 minutes of aerobic training at moderate-to-vigorous intensity each week, strength training twice each week, and consume at least five servings of FVs each day. However, the majority of cancer survivors are not meeting these guidelines [11, 12], which has led to the development of interventions to increase adherence to these guidelines post-cancer diagnosis and treatment [13, 14]. Although these efforts are important, researchers have raised concerns that such interventions may not reach all cancer survivors as they are often delivered by research staff in hospitals or at research facilities located primarily in urban centres [15-19].

Researchers have begun to explore factors that may influence participation in these health-promoting behaviours for individuals living in rural communities [20-26]. Recent environmental scans suggest that people living in rural communities often experience higher food prices, have limited variety in available FVs, and see less promotion of healthy choices [21]. In addition, there are considerable differences in the active living-built environments (e.g., limited parks, sidewalks, and streetlights) that can pose challenges and they must commute longer distances to recreational athletic centres without adequate public transportation [25]. For

young adult cancer survivors (YAs) living in rural communities there are additional constraints to participating in PA and FV consumption [27-29]. Many YAs are managing the adverse cognitive, physical, and psychosocial sequelae (e.g., anxiety, depression, physical decondition, fatigue) associated with cancer and its treatment [30-33] while trying to balance the emerging responsibilities associated with this period in their life (e.g., building a family, advancing a career) [28, 33-36]. Further, these individuals lack necessary transportation, guidance from health professionals, and social support (e.g., transitioning from parental support to independent and/or romantic relationships) to participate in health-promoting behaviours [37, 38].

Due to the limited number of studies conducted with rural-living YAs, there are knowledge gaps that prevent concrete recommendations to inform the development, evaluation, and implementation of supportive care services for health-promoting behaviours for this population. For instance, few have examined alternative modes of delivery for health behaviour change interventions and most have used cross-sectional study designs grounded in a positivist paradigm. These study features do not allow researchers to fully assess and understand the processes associated with participant experience within the intervention, only the outcome related to the utility of the method of delivery. Additionally, feasibility and acceptability data for health behaviour change interventions in rural-living YAs remain unclear. Therefore, a large-scale study may encounter time- and resource-consuming problems that could have been avoided. Understanding population-specific barriers to recruitment and adherence to a health behaviour change intervention is vital to conserve valuable research resources and enhance the likelihood of successful supportive care services. Last, the use of theory in the design, implementation, and evaluation of health behaviour change interventions has been inconsistent. Within the context of motivation, this prevents an understanding of the underlying mechanisms

for intervention components (e.g., mode of delivery, materials, health coach) and whether the components facilitate the desired outcomes.

Theoretical Framework

Utilizing a guiding theory in the design, evaluation, and implementation of an intervention provides researchers with a framework to assess underlying mechanisms that may influence behaviour change. Self-determination theory (SDT; [39, 40]) has been used to achieve these aims in other contexts (e.g., children, individuals with diabetes, women, older cancer survivors [41-44]) and examine change in PA participation and FV consumption. SDT describes motivation as a multidimensional construct that lies on a continuum ranging from highly self-determined motivation (or autonomous motivation) to a lack of self-determination [40]. Higher levels of self-determined motivation lead to greater adoption and enjoyment of behaviour, whereas higher levels of less self-determined motivation (or controlled motivation) and amotivation undermine behaviour. Factors that can increase self-determined forms of motivation are associated with environmental contexts that are appraised as supportive of the three basic psychological needs: autonomy (i.e., the sense that the individual is in control of his or her environment), competence (i.e., an individual's perception of being able to complete a task or activity), and relatedness (e.g., the belief that an individual is being supported and feels connected to others). Researcher have reported that self-determined forms motivation (i.e., intrinsic motivation, integrated regulation, identified regulation) are associated with greater behavioural intentions and long-term adherence to PA within cancer survivor populations [41, 45]. Though not in cancer survivors, interventions that targeted eating behaviours showed greater behavioural intentions and adherence to changing and maintaining healthy food choices among adults when levels of self-determined motivation increased [44, 46]. SDT represents a strong

theoretical base for this study as many YAs report barriers that are related to the frustration of the basic psychological needs (e.g., lack of resources, negative thoughts and feelings, negative social and environmental influences) to have a negative impact on PA participation and FV consumption [47].

Current Study

Understanding the feasibility and acceptability of health behaviour change interventions grounded in SDT could generate useful information to guide the design of future studies and the development of supportive care services for rural-living YAs. As such, we developed a single-arm, mixed-methods pilot trial to examine the feasibility and acceptability of a 12-week SDT-based telehealth behaviour change intervention aiming to promote PA participation and FV consumption in rural-living YAs. The protocol was registered in the ClinicalTrials.gov database (registration #: NCT03691545) and was approved by the University of Ottawa Research Ethics Board.

Methods

Participants

Three participants completed the study. Eligible participants were YAs who were currently between 20 to 39 years of age and lived in a rural community, defined as areas with less than 35,000 inhabitants [19, 48]. Other inclusion criteria were: (1) self-reported participating in less than 150 minutes of moderate-to-vigorous intensity PA each week, (2) self-reported consuming less than five servings of FVs each day, (5) had completed primary treatment for cancer, (6) had access to the Internet and audio-visual devices, (7) able to read and speak English, (8) able and willing to provide written informed consent, and (8) ambulatory. YAs who self-reported physical impairments precluding participation in PA (e.g., symptomatic heart or

vascular diseases, severe hypertension, recent stroke, chronic obstructive pulmonary disease, severe insulin-dependent diabetes mellitus, renal disease, and/or liver disease) were not eligible.

Protocol

A detailed description of the protocol was accepted for publication (Price & Brunet, 2019). Briefly, YAs were recruited across a 7-month period starting in September 2018 through community-based recruitment methods. Interested individuals that contacted the first author (JP) were telephone-screened to determine eligibility. Interested and eligible individuals were emailed instructions and a link to an online consent form, wherein after consenting they were directed to an online questionnaire that collected medical and sociodemographic information and assessed self-reported PA participation, self-reported FV consumption as well as basic psychological need satisfaction and behavioural regulation for both health behaviours. Within 7 days of completing this baseline questionnaire, participants were contacted by JP via email to schedule their first of 12 sessions. After the completion of the 12th session, participants were asked to complete a post-intervention assessment, which consisted of completing a questionnaire containing measures similar to the baseline questionnaire and taking part in a semi-structured interview over the telephone or using an online video platform.

Health coaching intervention

The 12-week intervention was designed based on previous behaviour change intervention literature [49] and systematic reviews that indicate 12-weeks as the median length in distance-based interventions [50, 51]. It comprised of weekly 60-minute sessions delivered by JP via an online video platform of the participants choosing (e.g., Google Hangouts, Skype). Prior to each session, participants were provided with online resources and the material that would be covered. During each session, JP aimed to foster participants' perceptions of the basic psychological

needs (i.e., autonomy, competence, relatedness) by providing autonomy support (i.e., interactions that convey active support for the participants' capacity to be self-initiating and autonomous) [52] and using motivational interviewing techniques [53, 54]. The content of the sessions focused on providing education on pertinent topics, offering relevant links and engaging worksheets, and engaging in facilitative discussions regarding self-managing one's PA participation and FV consumption. The material covered during each session was designed in line with behaviour change techniques (BCTs) that have been shown to elicit change in PA participation and FV consumption [49, 55]. The order of sessions was developed based on empirical evidence suggesting long-term behaviour adoption and maintenance is facilitated by individuals developing action plans and then methods for coping [56].

Measures

Feasibility [throughout the trial]. To assess feasibility, recruitment, enrollment, adherence, retention, and attrition rates were collected. Recruitment rate was measured by recording the number of individuals per month that indicated interest in participating in the study over a 7-month period. Enrollment rate was measured by recording the number of individuals that consented to participate in the intervention out of those who indicated interest in the study. Adherence rate was measured by recording how many of the intervention sessions participants attend out of 12. Retention and attrition rates were measured by recording how many of the assessments participants completed and the number of participants who dropped out of the intervention, including the reasons. In addition, the percentage of missing quantitative data on both questionnaires was recorded.

As recommended for pilot studies [57, 58], a priori targets for each feasibility outcome were set using relevant literature [e.g., 59, 60]: (a) 1-2 YAs per month indicate interest in

participating in the study, (b) >60% of YAs who express interest meet eligibility criteria and consent to participate, (c) participants attend >70% of sessions (i.e., 8 sessions), (d) >70% of participants complete all assessments and the intervention, and (e) missing data at each assessment is <10%.

Acceptability [week 13]. All participants were asked to complete an audio-recorded semi-structured interview about their thoughts, feelings, and opinions regarding key intervention components (e.g., delivery mode, materials, health coach) via a teleconferencing platform of their choice. The interview was guided by open-ended questions addressing: (1) relevance of the intervention, (2) suitability of the intervention, (3) impressions of guidance provided by the health coach, (4) perceived benefits of the intervention, and (5) problems/concerns experienced during the intervention. Questions inquiring about observed behaviour changes and intentions to sustain changes were also asked. Average interview length was 59 minutes (range = 51-63) and interviews were transcribed verbatim by the first author.

Putative outcomes [week 0, week 12]. The data collected in the baseline and post-intervention questionnaires was used to describe the sample and estimate the magnitude of the associations between changes in putative mechanisms of change and behavioural outcomes. Table 1 presents a description of measures used.

Sample Size

No formal sample size calculations were performed based on the study objectives [61]. However, a target sample size of 15 was set to account for a 20% dropout rate to allow for sufficient information on feasibility and estimate the magnitude of the associations for quantitative outcomes.

Data Analysis

We conducted quantitative and qualitative analyses. Descriptive statistics, consisting of means, standard deviations, and frequencies were estimated using IBM SPSS (Version 25). These data were used to describe the sample and report on feasibility outcomes. Thematic analysis of the transcribed acceptability interviews was conducted to ascertain acceptability outcomes [62]. To assess the interventions ability to address participants basic psychological needs and behavioural regulations, we compared participants' individual results from both questionnaires with their individual responses to the questions asked during the interviews.

Results

The results are presented in three sections. In the first section, each participant is presented to provide context for their experiences in the intervention, including changes in their PA participation and FV consumption from baseline to post-intervention. Refer to Table 2 for more information. In the second section, feasibility data for the trial is presented. In the third section, the acceptability of the intervention is explored.

Participants' personal experiences¹

Sarah was 37 years of age at the time of the intervention and had completed active treatment for acute lymphocytic T-cell leukemia 1 week before enrolling in the study. She was single, had no children, and was living with her parents while awaiting clearance to return to work. At baseline, she was consuming on average three servings of FVs per day and her goal (established during session three) was to consume eight to 10 servings of FVs per day by the end the intervention. She successfully achieved this goal. For PA participation, she was not participating in any MVPA at baseline and her goal (established during session three) was to walk approximately 8000-10,000 steps per day by the end of the 12 weeks. She not only

¹ Names have been changed to pseudonyms

achieved her walking goal, but was participating in 100 minutes of MVPA per week by the end of the intervention. Sarah had a 100% adherence rate to the intervention.

Lauren was 34 years of age at the time of the intervention and had completed active treatment for non-Hodgkin lymphoma three months prior to enrolling in the study and was awaiting clearance to return to work. She was married and had a child who was 4 years of age. She was consuming on average three servings of FVs per day and her goal was to consistently (i.e., every day) consume five servings of FVs by the end the intervention. She successfully achieved this goal. For PA participation, pre-intervention she reported participating in 15 minutes of moderate intensity physical activity per week and walking 20 minutes per week. She established a goal of walking for 45 minutes per day while incorporating 30 minutes of MVPA every other day. She was able to successfully achieve her walking goal as she was consistently walking for 1 hour everyday at the end of the intervention. Further, she successfully increased her MVPA to 100 minutes per week, often participating in MVPA on consecutive days. Lauren had a 100% adherence rate to the intervention.

Stephanie was 35 years of age at the time of the intervention and had completed active treatment for thyroid cancer 19 months before enrolling in the study. She was married, with three children ranging in age from 12 to 17 years, and was continuing to fulfil the role of homemaker. At baseline, she was consuming on average two servings of FVs per day and her goal was to consume greater than five servings of FVs per day by the end the intervention. She surpassed this goal, averaging seven to eight servings per day. For PA participation, she was inconsistently participating in MVPA up to 120 minutes per week at baseline and her goal was to consistently participate in MVPA everyday for at least 30 minutes. She successfully achieved this goal. Stephanie had a 66% adherence rate to the intervention.

Feasibility data

Recruitment and enrollment. In total, 14 YAs self-referred across a 7-month period (recruitment rate=57%), with monthly self-referrals ranging from zero to six YAs. Of these, 12 were assessed for eligibility (two could not be reached after three contact attempts) and 7 were not eligible. Reasons for non-eligibility were: no diagnosis of cancer ($n=1$) and did not live in a rural community ($n=6$). All who were eligible consented to participate in the study (enrollment rate=41.67%).

Retention and attrition. Three participants completed all study assessments and two participants withdrew after completing the baseline questionnaire (retention rate=73%). One participant withdrew prior to the start of session; one without providing a reason and the other withdrew after session one citing having to take on additional responsibilities due to spousal injury as the reason (attrition rate=40%).

Adherence to intervention. Adherence to the intervention protocol was 88.67%, as individual adherence was 66.67% to 100%. Sessions were missed due to illness ($n=1$), vacation ($n=1$), and family commitment ($n=2$).

Missing data. There were <10% missing data for responses on the baseline and post-intervention questionnaires. All participants completed the acceptability interview post-intervention.

Acceptability data

Analysis of the interviews suggest participants found the intervention to be relevant, suitable, and beneficial. This contributed to the overall acceptability of the intervention for these participants. Five themes emerged from the data: (1) *the more time the better*, (2) *the human factor*, (3) *supporting access*, (4) *influencing the basic psychological needs*, and (5) *finding*

motivation. For themes 4 and 5, responses to interview questions were compared to participants' quantitative responses on the basic psychological needs satisfaction and behavioural regulations questionnaires for both PA and FVs. The agreement and discrepancies that were present between the interview and questionnaires will be analyzed. Each theme is accompanied with representative quotations from the interviews. In the quotations, [...] indicates text omitted to enhance clarity.

The more time the better

Regardless of individual participant goals, the length of the intervention (i.e., 12 weeks) was perceived as a key component in their ability to successfully accomplish their goals. Participants believed the length of the intervention fostered confidence in their ability for behaviour change. This was alluded to when Stephanie described her confidence in her abilities at the start of the program: *"I would say that it was gradual, it took a little bit of warming up. The first session I was like, 'alright, okay'. Second session I was like, 'okay I can do this'. It took a little bit of telling myself that I can really do this"*. The ability to successfully achieve multiple short-term goals (i.e., progress goals) was motivation to work towards long-term goals (i.e., outcome goals). Sarah discussed this when she described working towards her goals: *"It made me feel like I was accomplishing something every week, that I was gradually increasing my steps and it didn't feel like it was a burden"*. Similarly, Lauren stated: *"Once I got the feel for it [physical activity] and I could just do it, I just went for it, sort of. It was hard in the beginning but by the middle it was just 'okay, get up you have to do this, get it done'"*. Participants offered suggestions as to how the intervention could facilitate maintenance of behaviour change post-intervention, such as incorporating a step-down model of delivery after the 12-week intervention: *"I think it would depend on the person, for me, monthly check-ins but some people might like a*

text message ‘okay, how are you doing today? Are you up walking around?’ or ‘have you eaten your vegetables?’ For different folks different things work, it would have to be tailored, but a monthly check-in or 6 months in would be good for people doing the program because it would be encouragement” (Sarah).

The human factor

Participants felt the ability to communicate back and forth with the health coach was an integral component of the intervention. Participants relied on her to make necessary changes to the program when they were struggling to achieve their goals or needed additional information to facilitate their goals. This was highlighted by Sarah when she said: *“You listened to where I was in the beginning and we modified it, so the program worked for me. There wasn’t like ‘you have to do this, or you have to do that’ and if you don’t do it, you’re not succeeding in the program. Even throughout you were always asking if I wanted to modify or change anything”*. Participants resonated with the on-going encouragement and compassion that the health coach provided for changing and/or maintaining their behaviour change, especially if they were struggling or unsure how to progress forward. Stephanie explained: *“I think the biggest thing of the whole intervention is actually having you at the other end. To have a person to actually talk to. Like yeah, I can go out and buy a Fitbit myself and I can do these planning things all by myself but to know you’re there every week, to say ‘how are you doing’ - the check-ins and seeing where you are, that was the biggest part that I think helped me”*. Yet, what participants found most beneficial about having a health coach was the instilled sense of accountability provided. This was illustrated by Lauren when she said: *“I really am not good at being accountable for myself but if I said, ‘no I have to do these because my health coach is depending on me to do it’ then I am more apt to do something than not”*. This was supported by participants’ responses to the

Health Care Climate Questionnaire (HCCQ; Williams et al., 1996). For example, their scores on questions such as: ‘*The health coach conveyed confidence in my ability to make changes regarding my health*’ and ‘*I feel that the health coach accepted me whether I followed their recommendations or not*’ was a 7 (*strongly agree*) on a 7-point Likert scale.

Supporting access

Participants discussed the importance of access to programs for supporting health-promoting behaviours. Participants repeatedly acknowledged the limited (or lack of) resources for health-promoting behaviours post-treatment. This was underscored by Sarah, when she described her motivation for participating in the study: “*There really is not any programs designed specifically for cancer patients, whether you are young or old, to help you when you have finished treatment to sit down and say ‘okay, this is what you should be eating or exercise more’*”. She then went on to say: “*the supports aren’t really there, this was a great way to get those supports*”. The ability to complete the intervention at convenient times and locations was appreciated as it addressed the busy schedule associated with being a YA. This was described by Lauren when she said: “*The time saver thing was great, because I could just jump on the computer and there you were instead of driving into town 15-20 minutes in and back and finding parking and babysitters or whatever, it was definitely easier to do the online*”. Similarly, Stephanie stated: “*It’s great to know that you aren’t on a time limit to get home for your kids because you do it all here [at home]*”. In addition, participants felt the program was beneficial for cancer survivors, regardless of age or geographical location. Lauren emphasized this when she stated: “*I know just from myself, I lived in a very urban setting before in my life and I could be just as inactive there as I could be here. I definitely think it could be modified for anyone,*

even ages. It would be easy for children, up to a certain age and I think even older adults, you could tweak it here and there so that it could work for everyone”.

Influencing the basic psychological needs

The intervention was designed to facilitate the satisfaction of the basic psychological needs (i.e., autonomy, competence, relatedness). Participants’ baseline scores on the *Psychological Need Satisfaction questionnaire* (PNS; [63, 64]) modified for FV consumption and the *Psychological Need Satisfaction in Exercise Scale* (PNSE; [65]) were compared to their post-intervention questionnaire scores and interview responses. Despite all three participants describing the health coach’s behaviours and the intervention design as satisfying their perceived sense of autonomy, competence, and relatedness, participants varied in their reported changes for basic psychological needs for PA and FVs.

For autonomy, Sarah believed she had an adequate amount of input into the intervention: *“I felt really good about it, because you listened to where I was in the beginning and we modified it, so the program worked for me”*. However, this did not transfer to her perceived autonomy for the behaviours outside the intervention as there was minimal change pre- to post-intervention on the questionnaires. As Sarah had to move back in with her parents during treatment, this may be the result of decreased independence throughout her daily life. On the other hand, Lauren and Stephanie’s interview and questionnaire responses indicated that they experienced autonomy support throughout the intervention which translated in to an increase in autonomy for both behaviours. For instance, Stephanie explained: *“There was a lot of me giving you information and if it was something that you thought would work a little bit better we were able to switch it back and forth,”* which lead to more instances of autonomy in her daily life: *“When I had my full*

body scan, on the way home he [her husband] looks at me and goes 'do you want to stop at McDonalds' and I was like 'are you crazy, I'm going home - I have fruit waiting for me'".

For competence, participants expressed that the intervention supported their perceived sense of competence for participating in PA and FVs during the interview. For instance, Sarah felt the intervention contributed to her knowledge and confidence to maintain the change in her behaviour: *"I feel really confident, I mean from where we started and then I reached my goals, and you have given me links to recipes and exercises, which will help me to continue to reach my goals"*. Whilst Sarah and Lauren's responses on the post-intervention questionnaire for both behaviours reflect this belief, Stephanie reported no change in her perceived sense of competence for PA.

Finally, relatedness had the greatest variability between participants' interview and questionnaire responses. Sarah's perceived sense of relatedness for FV consumption had no change and minimal change for PA at follow-up, but she described a strong sense of relatedness with the health coach during the intervention and positive changes in her relationships with others. This was highlighted when she was describing the support of others for her behaviour change: *"Mom, especially, when she was making meals she was taking into consideration the extra FV as well she was telling me to go for walks and some of my friends they were the same. If we went somewhere, they would park their car a bit farther to help out"*. As previously mentioned, Sarah had moved from her life in the city and may not have an adequate support network in her rural community. For Lauren, similar to the other constructs, her interview responses reflected the positive increases in perceived relatedness reported in the questionnaire for both behaviours. This was illustrated when she was discussing the support she had received throughout the intervention: *"My husband was definitely a big support, you obviously, my family*

was really accommodating with a lot of things. My husband and son both tried new veggies or recipes that they wouldn't have otherwise, and so did I. Friends and family were supportive, not everyone knew about it [the intervention] but they knew I was trying to do a new normal".

Though Stephanie felt more connected to those around her after the intervention for her FV consumption, she reported a decrease in perceived relatedness for PA. Throughout the intervention, Stephanie discussed her limited support network, which she may have become more aware of as a result of the intervention, especially as her family was willing to eat more FVs with her but did not participate in PA with her.

Finding motivation

In addition to fostering the basic psychological needs, the intervention was designed to encourage autonomous forms of motivation for PA participation and FV consumption. Participants' baseline scores on the *Exercise Treatment Self-Regulation Questionnaire [TSRQ-E; 66]* and *Dietary Self-Regulation questionnaire [DSR; 66]* were compared to their post-intervention questionnaire and interview responses. Although participants discussed the benefits of the intervention on their motivation, they often expressed external motivations that influenced their engagement with these behaviours. For instance, despite Sarah's positive changes (as discussed in section 1.1), she experienced only a minimal increase in autonomous forms of motivation for FV consumption and mostly no change or declines in the other areas of her behavioural regulations. During her interview, she often reflected on the perceived sense of accountability provided by the intervention as motivation to change her behaviour: *"I would say the weekly check-ins because it made me accountable"*. Further, when discussing the likelihood of maintaining her changes post-intervention she stated: *"I think I am able to do it, but I will need someone to check-in with, so it will have to be one of my friends so that there is still a*

person there on my shoulder". Although, it would seem the intervention encouraged positive behaviour change it did not have a positive influence on her overall motivation. In contrast, Lauren reported increases in autonomous and external forms of behavioural regulations for both behaviours, indicating that her reasons for participating in these behaviours have possibly changed and are multifaceted. Throughout the interview, she considered her different motivations for behaviour change, including her weight: *"I was at a point I didn't feel good about myself or my weight, and kind of needed that kick in the butt to sort of get started, to get over the hurdle, to stop self-loathing and just get going and do something about it,"*, her family: *"It gave me good tools both eating and activity wise to work on things I want to work on, plus it gave me more motivation to show healthy activities to my family,"*, and her own enjoyment: *"I do prefer going for walks by myself - it is a meditative type thing"*. For Lauren, the intervention offered her the opportunity to explore a new lifestyle which was ultimately fueled by a spectrum of reasons for behaviour change. Similarly, Stephanie reported increases in her autonomous behavioural regulations for both behaviours and external behavioural regulation for her FV consumption, but decreased in external behavioural regulation for PA. For Stephanie, her FV consumption had two main influences, finding FVs she enjoyed and setting a good example for her family. However, for her PA she was less concerned about others but was focused on achieving her daily step goal and addressing her own concerns about her perceived sense of accountability. She illustrated this when she said: *"I never did hold myself accountable before so when we did the day on holding yourself accountable, literally figuring things out that was kind of where I really went crap, I really need to hold myself accountable for what I am doing"*. Stephanie was enthusiastic about her reasons for participating in these behaviours despite her varied motivations.

Discussion

The purpose of this single-arm, mixed-methods pilot was to explore the feasibility and acceptability of a 12-week SDT-based telehealth coaching intervention aiming to promote PA participation and FV consumption among rural-living YAs. Though retention, adherence, and missing data rates were better than targets set a priori, attrition, recruitment and enrollment rates were below target. Nevertheless, participants had a positive response to the intervention as a whole, including the length of the intervention, the presence of a health coach, and the ability of the intervention to fill a gap in supportive care services for YAs. In terms of mechanism of change and the theoretical base of this intervention, the results suggest that an autonomy supportive style of delivery may be well received but does not necessary translate into a change in the satisfaction of the basic psychological needs in relation to PA participation and FV consumption. The results of this study indicate that this style of intervention is a positive step towards providing adequate survivorship care for YAs, regardless of geographical location. As such, modifications to both the study methods and the intervention are warranted before proceeding to a larger-scale study incorporating this type of telehealth coaching into supportive care services.

The higher than anticipated attrition rate suggests that it may be difficult to engage or maintain active participation of YAs in a telehealth behaviour change intervention. This result is in line with other health-promoting interventions with adolescent and YAs (e.g., [67-69]). Typically, a low retention rate would prompt evaluation of intervention and/or study design [57, 58]; however, participants did not cite the study methods or the intervention as a reason for dropout in this study. The attrition rate in this population may reflect unique challenges associated with the developmental stage of YAs, including the competing demands associated

with the importance of ‘normality’, evolving social relationships (e.g., seeking independence, developing romantic partnerships), and the distractibility associated with the on-going cognitive development of early adulthood [29, 30, 32, 69]. Researchers may wish to explore the feasibility and acceptability of interventions designed to adequately equip YAs to manage life events (e.g., transitioning back to work, family planning) and foster engagement in PA and FV consumption.

The low recruitment and enrollment rates indicate the difficulty researchers are likely to encounter when seeking to conduct large-scale health behaviour change trials with rural-living YAs in a timely fashion. This may be due in part to the limited number of YAs that live in rural communities [70] and the documented difficulties recruiting YAs to trials, including limited access to recruitment [71-74]. This highlights the critical need to conduct multi-site trials utilizing hospital or clinic staff to increase the pool of potential participants and the importance of identifying additional recruitment strategies beyond those used herein (i.e., advertisements placed on social media websites, online bulletin boards/discussion groups, websites that provide supportive care and/or services to YA cancer survivors, snowball sampling). For the former, researchers could consider partnering with healthcare providers, attending hospital rounds to recruit in-person, emailing and/or mailing the study information using tumour registries and/or well-recognized YA supportive service providers, and attending cancer-survivorship events/groups [75]. In addition, researchers may wish to explore the feasibility of telehealth coaching for YAs regardless of where they live as nearly half the individuals that self-referred were from urban centres. This indicates there is interest among YAs for telehealth coaching from urban and rural areas, alike. For the latter, focus groups should be conducted to explore what recruitment strategies are optimal for YAs and whether they differ based on sociodemographic factors (e.g., geographical location).

Though participant burden in trials is a prominent discussion in intervention literature [76, 77], this study met a priori rates set for retention and missing data which is promising for those seeking to conduct longer trials that incorporate multiple data collection methods. Moreover, participants had a positive response to the duration of the intervention and were able to successfully commit the 12-week intervention (as suggested by adherence rate), which is promising as systematic reviews suggest there is greater effectiveness in behavioural adoption and/or maintenance in interventions with longer durations [50, 51]. Despite the low enrollment rate, the high retention rate suggests telehealth interventions for health-promoting behaviour change may be well received by this population, as seen in other studies [78, 79]. However, this result should be interpreted cautiously as this may represent a form of response bias. Individuals interested in the topic or the outcome may be more likely to engage in and remain in lengthy and/or cumbersome trials, therefore retention rate may not accurately reflect the likelihood of successful retention in RCTs or interest/motivation to utilize services. Moving forward, it will be necessary to elucidate individuals' reasons for participating (or not participating) in similar trials. Doing so may broaden our understanding of engagement with services and could ultimately inform research and supportive care programs to aid in appropriately designing trials/programs for the population needs.

Findings from inductive analysis of the interviews underscore the importance of human connection for communicating information and working through concerns in health behaviour change interventions for rural-living YAs. This is congruent with the results of a recent systematic review of telehealth interventions for cancer survivors [80] that found email communication between adult cancer survivors and service providers (e.g., oncologists, counsellors) was considered impersonal. Similarly, though participants appreciated the length of

the intervention, their responses underscore the importance of exploring the stepped down model of delivery for interventions (i.e., transitioning from weekly sessions to check-ins post-intervention). This is being explored with other populations of cancer survivors [81] and researchers may wish to explore stepped-down models of delivery that provide YAs with adequate support whilst facilitating independence post-intervention.

Triangulation of participant interviews and changes in responses to quantitative measures on basic psychological needs and behavioural regulations provided interesting insight into the mechanism of change underlying motivation for YAs in this context. Specifically, the incongruencies in the satisfaction of the basic psychological needs suggest that satisfaction within one domain (i.e., the intervention) does not translate to satisfaction within another domain (i.e., PA participation, FV consumption). Indeed, participants' responses regarding their motivations for participation in these health-promoting behaviours indicate that successful behaviour change is motivated by a multitude of reasons to engage that surpass enjoyment and other motivations that reflect autonomous motivation. This is in contrast to the theoretical tenets of SDT which posit that social environments that nurture these basic needs facilitate autonomous motivation and subsequent behaviour change and maintenance [40]. It may be necessary to explore the impact of different motivations on long-term maintenance of PA and FV consumption for YAs as it could provide insight into what motivations are necessary to promote within interventions designed for this population.

Notwithstanding the implications from this study, there are limitations that must be considered. First, the majority of participants enrolled self-identified as Caucasian, female, and above the age of 30 years. It is possible that including the perspectives of a more diverse sample might have influenced the acceptability of the mode of delivery or intervention components.

Second, the first author performed the intervention and all assessments (including the acceptability interviews), which may have influenced participants' responses such that they responded more positively than they actually wanted. Third, the eligibility criteria were selected to identify individuals that were not meeting the aerobic PA guidelines. However, it is possible that participants may have been meeting the strength training recommendations (i.e., participating in at least two times per week for each major muscle group) prior to the beginning of the intervention, which may influence their engagement with the intervention. Fourth, the results presented herein are only applicable to the mode of delivery and individualized 12-week telehealth coaching program piloted and could be different based on other delivery styles, intervention component, and/or contexts. Modifications to each may result in additional challenges/barriers to feasibility and acceptability. Fifth, participants were able to complete the intervention at various stages of their cancer experience, and although this helped to provide maximal variance within our homogenous sample, it is possible that individuals at different stages of the cancer continuum may have different experiences participating in the intervention.

Conclusion

In conclusion, the methods comprising this single-arm, mixed-methods feasibility trial require minor modifications before being deemed feasible despite the general acceptability of the intervention. Findings highlight the potential for developing multimodal interventions that address the concerns of YAs beyond health-promoting behaviours. Further, results suggest the necessity of more expansive recruitment strategies to reach a larger number of YAs. Researchers should also consider expanding criteria to YAs in urban centres as participants eluded to the limited resources available for fostering PA participation and FV consumption for YAs. In addition, researchers may wish to explore participants' underlying intentions for participating in

behaviour change interventions as it may provide insight into motivations and the likelihood of successful large-scale studies or implementation of services. Finally, testing stepped down models of support may help some YAs maintain behaviour change post-intervention. Taken together, this study provides insight into the feasibility and acceptability of a 12-week telehealth behaviour change intervention for rural-living YAs and provides suggestions as to future considerations for the design of a large-scale study and/or implementation of supportive care services.

References

1. Kroenke, C.H., et al., *Dietary patterns and survival after breast cancer diagnosis*. Journal of Clinical Oncology, 2005. **23**: p. 9295–9303.
2. Schwedhelm, C., et al., *Effect of diet on mortality and cancer recurrence among cancer survivors: A systematic review and meta-analysis of cohort studies*. Nutrition Reviews, 2016. **74**(12): p. 737-748.
3. George, S.M., et al., *Postdiagnosis diet quality, the combination of diet quality and recreational physical activity, and prognosis after early-stage breast cancer*. Cancer Causes Control, 2011. **22**(4): p. 589-598.
4. Oyebode, O., et al., *Fruit and vegetable consumption and all-cause cancer and CVD mortality: Analysis of Health Survey for England data*. Journal of Epidemiology Community Health, 2014. **68**(8): p. 856-862.
5. Mishra, S.I., et al., *Exercise interventions on health-related quality of life for cancer survivors*. Cochrane Database of Systematic Reviews, 2012. **15**(8): p. CD007566.
6. Baumann, F.T., W. Bloch, and J. Beulertz, *Clinical exercise interventions in pediatric oncology: A systematic review*. Pediatric Research, 2013. **74**(4): p. 366-374.
7. Schmitz, K.H., et al., *American College of Sports Medicine roundtable on exercise guidelines for cancer survivors*. Medicine & Science in Sports & Exercise, 2010. **42**(7): p. 1409-1426.
8. Continuous Update Project Team, W.C.R.F.I., *Systematic review on diet, nutrition, physical activity and survival and second cancers in breast cancer survivors*. London, UK: World Cancer Research Fund International, 2014.

9. Society, C.C. *Physical activity and cancer*. 2017; Available from: <http://www.cancer.ca/en/prevention-and-screening/live-well/nutrition-andfitness/physicalactivity/?region=en>.
10. Rock, C.L., et al., *Nutrition and physical activity guidelines for cancer survivors*. CA: A Cancer Journal for Clinicians, 2012. **62**(4): p. 242-274.
11. Blanchard, C.M., K.S. Courneya, and K. Stein, *Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: Results from the American cancer society's SCS-II*. Journal of Clinical Oncology, 2008. **26**(13): p. 2198-2204.
12. Rogers, L.Q., et al., *Physical activity type and intensity among rural breast cancer survivors: Patterns and associations with fatigue and depressive symptoms*. Journal of Cancer Survivorship, 2011. **5**(1): p. 54-61.
13. Fleig, L., et al., *Cross-behaviour associations and multiple health behaviour change: A longitudinal study on physical activity and fruit and vegetable intake*. Journal of Health Psychology, 2015. **20**(5): p. 525-534.
14. Kanera, I.M., et al., *Long-term effects of a web-based cancer aftercare intervention on moderate physical activity and vegetable consumption among early cancer survivors: A randomized controlled trial*. International Journal of Behavioural Nutrition and Physical Activity, 2017. **14**(1): p. 1-13.
15. Miedema, B., J. Easley, and L. Robinson, *Comparing urban and rural young adult cancer survivors' experiences: A qualitative study*. Rural and Remote Health, 2013. **13**(2324): p. 1-12.

16. Rauh, L.A., et al., *Cervical cancer care in rural Virginia: The impact of distance from an academic medical center on outcomes & the role of non-specialized radiation centers*. *Gynecol Oncol*, 2018. **150**(2): p. 338-342.
17. Rutledge, T.L., et al., *Optimizing endometrial cancer follow-up and survivorship care for rural and other underserved women: Patient and provider perspectives*. *Gynecologic Oncology*, 2017. **145**(2): p. 334-339.
18. Smith, S.A. and B. Ansa, *A systematic review of lifestyle interventions for chronic diseases in rural communities*. *Journal of the Georgia Public Health Association*, 2016. **5**(4): p. 304-313.
19. Umstattd Meyer, M.R., et al., *Rural active living: A call to action*. *Journal of Public Health Management & Practice*, 2016. **22**(5): p. E11-20.
20. Byker Shanks, C., et al., *Availability, price, and quality of fruits and vegetables in 12 rural montana counties, 2014*. *Preventing Chronic Disease*, 2015. **12**: p. E128.
21. de Souza, R.J., et al., *Environmental health assessment of communities across Canada: Contextual factors study of the Canadian Alliance for Healthy Hearts and Minds*. *Cities & Health*, 2018: p. 1-18.
22. Miller, V., et al., *Availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels: Findings from the Prospective Urban Rural Epidemiology (PURE) study*. *The Lancet Global Health*, 2016. **4**(10): p. e695-e703.
23. Pinard, C.A., et al., *An integrative literature review of small food store research across urban and rural communities in the U.S*. *Prev Med Rep*, 2016. **3**: p. 324-32.
24. Cleland, V., et al., *A qualitative study of environmental factors important for physical activity in rural adults*. *PLoS One*, 2015. **10**(11): p. e0140659.

25. Hansen, A.Y., et al., *Built environments and active living in rural and remote areas: A review of the literature*. Current Obesity Reports, 2015. **4**(4): p. 484-493.
26. Hastert, T.A., et al., *Disparities in cancer incidence and mortality by area-level socioeconomic status: A multilevel analysis*. Journal of Epidemiology and Community Health, 2015. **69**(2): p. 168-176.
27. Cancer, C.P.A., *Adolescents & Young Adults with Cancer: A System Performance Report*. 2017, Canadian Partnership Against Cancer: Toronto, ON.
28. Zebrack, B., & Isaacson, S. , *Psychological care of adolescent and young adult patients with cancer and survivors* Journal of Clinical Oncology, 2012. **30**(11): p. 1221-1226.
29. Epelman, C.L., *The adolescent and young adult with cancer: State of the art - psychosocial aspects*. Current Oncology Reports, 2013. **15**(4): p. 325-331.
30. Tricoli, J.V., et al., *Biological and clinical characteristics of adolescent and young adult cancers: Acute lymphoblastic leukemia, colorectal cancer, breast cancer, melanoma and sarcoma* Cancer Treatment Reviews, 2016. **122**(7): p. 1017-1028.
31. Tricoli, J.V., et al., *Unique characteristics of adolescent and young adult acute lymphoblastic leukemia, breast cancer, and colon cancer*. Journal of National Cancer Institute, 2011. **103**(8): p. 628-635.
32. Tai, E., et al., *Health status of adolescent and young adult cancer survivors*. Cancer, 2012. **118**(19): p. 4884-91.
33. Epelman, C.L., *The adolescent and young adult with cancer: State of the art - psychosocial aspects*. Current Oncology Reports, 2013. **15**: p. 325-331.

34. D'Agostino, N.M., Penney, A., & Zebrack, B., *Providing developmentally appropriate psychosocial care to adolescent and young adult cancer survivors*. Cancer Treatment Reviews, 2011. **117**.
35. Husson, O., et al., *Cancer in adolescents and young adults: Who remains at risk of poor social functioning over time?* Cancer, 2017. **123**(14): p. 2743-2751.
36. Warner, E.L., et al., *Social well-being among adolescents and young adults with cancer: A systematic review*. Cancer Treatment Reviews, 2016. **122**: p. 1029-1037.
37. Smits-Seemann, R.R., et al., *Barriers to follow-up care among survivors of adolescent and young adult cancer*. J Cancer Surviv, 2017. **11**(1): p. 126-132.
38. Berg, C.J., et al., *Young adult cancer survivors' experience with cancer treatment and follow-up care and perceptions of barriers to engaging in recommended care*. Journal of Cancer Education, 2016. **31**(3): p. 430-442.
39. Deci, E.L. and R.M. Ryan, *The general causality orientations scale: Self-determination in personality*. Journal of Research in Personality, 1985. **19**(2): p. 109-134.
40. Deci, E.L. and R.M. Ryan, *Intrinsic and extrinsic motivations: Classic definitions and new directions*. Contemporary Educational Psychology, 2000. **25**(1): p. 54-67.
41. Milne, H.M., et al., *Self-determination theory and physical activity among breast cancer survivors*. Journal of Sport and Exercise Psychology, 2008. **30**(23-38).
42. Silva, M.N., et al., *Using self-determination theory to promote physical activity and weight control: A randomized controlled trial in women*. Journal of Behavioural Medicine, 2010. **33**: p. 110-122.

43. K, B.O., et al., *Self-determined motivation and physical activity in children and adolescents: A systematic review and meta-analysis*. Preventive Medicine, 2014. **67**: p. 270-279.
44. Williams. G.C., et al., *Testing a self-determination theory process model for promoting glycemic control through diabetes self-management*. Health Psychology, 2004. **23**(1): p. 58–66.
45. Peddle, C.J., et al., *Medical, demographic, and psychosocial correlates of exercise in colorectal cancer survivors: An application of self-determination theory*. Supportive Care in Cancer, 2007. **16**: p. 9-17.
46. Verstuyf, J., et al., *Motivational dynamics of eating regulation: A self-determination theory perspective*. International Journal of Behavioral Nutrition and Physical Activity, 2012. **9**(21): p. 1-16.
47. Wu, Y.P., et al., *Barriers and facilitators of healthy diet and exercise among adolescent and young adult cancer survivors: Implications for behavioral interventions*. Journal of Adolescent and Young Adult Oncology, 2015. **4**(4): p. 184-91.
48. Canada, S. *Rural and small town Canada*. 2002; Available from: <http://www.statcan.gc.ca/pub/21-006-x/21-006-x2001003-eng.pdf>.
49. Michie, S., S. Ashford, and F.F. Sniehotta, Dombrowski, S.U., Bishop, A., & French, D.P., *A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALO-RE taxonomy*. Psychology & Health, 2011. **26**(11): p. 1479-1498.
50. Eakin, E.G., et al., *Telephone interventions for physical activity and dietary behavior change: A systematic review*. Am J Prev Med, 2007. **32**(5): p. 419-34.

51. Goode, A.D., M.M. Reeves, and E.G. Eakin, *Telephone-delivered interventions for physical activity and dietary behavior change: An updated systematic review*. American Journal of Preventive Medicine, 2012. **42**(1): p. 81-88.
52. Ryan, R.M., et al., *The significance of autonomy and autonomy support in psychological development and psychopathology*, in *Developmental psychopathology: Volume one, theory and method*, D. Cicchetti and D.J. Cohen, Editors. 2006/2015, John Wiley & sons: Hoboken, NJ. p. 795-849.
53. Markland, D., et al., *Motivational interviewing and self-determination theory*. Journal of Social and Clinical Psychology, 2005. **24**(6): p. 811-831.
54. Patrick H. and G.C. Williams, *Self-determination theory: Its application to health behaviour and complementarity with motivational interviewing*. International Journal of Behavioural Nutrition and Physical Activity, 2012. **9**(18): p. 1-12.
55. Samdal, G.B., et al., *Effective behaviour change techniques for physical activity and healthy eating in overweight and obese adults: Systematic review and meta-regression analyses*. International Journal of Behavioral Nutrition and Physical Activity, 2017. **14**(42): p. 1-14.
56. Sniehotta, F.F., et al., *Action planning and coping planning for long-term lifestyle change: Theory and assessment*. European Journal of Social Psychology, 2005. **35**(4): p. 565-576.
57. Thabane, L., et al., *A tutorial on pilot studies: The what, why and how*. BMC Medical Research Methodology, 2010. **10**(1): p. 1-10.

58. Abbott, J.H., *The distinction between randomized clinical trials (RCTs) and preliminary feasibility and pilot studies: What they are and are not*. Journal of Orthopaedic & Sports Physical Therapy, 2014. **44**(8): p. 555-558.
59. Magnus, M., E. Edwards, and A. Dright, Gilliam, L., Brown, A., Levy, M., Sikka, N., Siegel, M., Criss, V., Watson, C.C., Machtinger, E., & Kuo, I., *A feasibility study of a telehealth intervention on health care service utilization among transgender women of color in Washington, DC*. Applied Clinical Informatics, 2018. **2**: p. e1-e9.
60. Albanese-O'Neill, A., et al., *Transition education for young adults with type 1 diabetes: Pilot feasibility study for a group telehealth intervention*. JMIR Diabetes, 2018. **3**(4): p. e10909.
61. Julious, S.A., *Sample size of 12 per group rule of thumb for a pilot study*. Pharmaceutical Statistics, 2005. **4**(287-291).
62. Braun, V., V. Clarke, and P. Weate, *Using thematic analysis in sport and exercise research*, in *Routledge handbook of qualitative research in sport and exercise*. 2016, Routledge: London, UK. p. 191-205.
63. Gagne, M., *Autonomy support and need satisfaction in the motivation and well-being of gymnasts*. Journal of Applied Sport Psychology, 2003. **15**(4): p. 372-390.
64. Deci, E.L., et al., *Need satisfaction, motivation, and well-being in the work organizations of a former eastern bloc country: A cross-sectional study of self-determination*. Journal of Personality and Social Psychology, 2001. **27**(8): p. 930-942.
65. Wilson, P.M., et al., *Psychological need satisfaction in exercise scale*. Journal of Sport and Exercise Psychology, 2006. **28**: p. 231-251.

66. Williams, G.C., E.L. Deci, and R.M. Ryan, *Building health-care partnerships by supporting autonomy: Promoting maintained behavior change and positive health outcomes*, in *Partnerships in healthcare: Transforming relational process* A. L. Suchman, P. Hinton-Walker, and R. Botelho, Editors. 1998, University of Rochester Press: Rochester, NY. p. 67-87.
67. Cantrell, M.A., et al., *Recruitment and retention of older adolescent and young adult female survivors of childhood cancer in longitudinal research*. Oncology Nursing Forum, 2012. **39**(5): p. 483-490.
68. Sansom-Daly, U.M., et al., *Feasibility, acceptability, and safety of the Recapture Life videoconferencing intervention for adolescent and young adult cancer survivors*. Psychooncology, 2019. **28**(2): p. 284-292.
69. Vandermorris, A., K.W. Parsons, and M.L. Greenberg, *Adherence to treatment regimes in adolescent and young adult cancer patients*, in *Cancer in Adolescents and Young Adults*. 2017, Springer. p. 565-581.
70. Fidler, M.M., et al., *Cancer incidence and mortality among young adults aged 20-39 years worldwide in 2012: A population-based study*. The Lancet Oncology, 2017. **18**(12): p. 1579-1589.
71. Barr, R., et al., *Adolescent and young adult oncology: Historical and global perspectives*, in *Cancer in Adolescents and Young Adults*. 2017, Springer. p. 1-6.
72. Gattuson, J., et al., *Monitoring child and parent refusals to enrol in clinical research protocols*. Methodological Issues in Nursing Research, 2005. **53**(3): p. 319-326.

73. Hendricks-Ferguson, V.L., et al., *Recruitment strategies and rates of a multi-site behavioral intervention for adolescents and young adults with cancer*. Journal of Pediatric Health Care, 2013. **27**(6): p. 434-442.
74. Harlan, L.C., et al., *Recruitment and follow-up of adolescent and young adult cancer survivors: The AYA HOPE Study*. Journal of Cancer Survivorship, 2011. **5**(3): p. 305-14.
75. Rabin, C., S. Horowitz, and B. Marcus, *Recruiting young adult cancer survivors for behavioral research*. Journal of Clinical Psychology in Medical Settings, 2013. **20**(1): p. 33-36.
76. Rolstad, S., J. Adler, and A. Ryden, *Response burden and questionnaire length: Is shorter better? A review and meta-analysis*. Value Health, 2011. **14**(8): p. 1101-1108.
77. Ulrich, C.M., et al., *Respondent burden in clinical research: When are we asking too much of subjects?* IRB: Ethics and Human Research, 2005. **27**(4): p. 17-20.
78. Moscato, E.L., et al., *Feasibility and acceptability of an online problem-solving therapy intervention for adolescent and young adult brain tumor survivors*. Clinical Practice in Pediatric Psychology, 2019. **7**(1): p. 68-78.
79. Devine, K.A., et al., *Digital health interventions for adolescent and young adult cancer survivors*. American Society of Clinical Oncology, 2019. **7**(1): p. 68-78.
80. Cox, A., et al., *Cancer survivors' experience with telehealth: A systematic review and thematic synthesis*. Journal of Medical Internet Research, 2017. **19**(1): p. e11.
81. Dalzell, M., et al., *Rehabilitation and exercise oncology program: Translating research into a model of care*. Current Oncology, 2017. **24**(3): p. e191.

Table 1. *Description of putative measures used in 12-week theory-based telehealth behaviour change intervention for rural-living young adult cancer survivors*

	Purpose	Example question	Scale	Citing article
Behavioural Outcomes				
<i>International Physical Activity Questionnaire-Short form</i>	Assess participation in vigorous and moderate intensity physical activity, as well walking	<i>During the last 7 days, on how many days did you do vigorous physical activities?</i>	Descriptive	Booth, 2000
<i>Behavioural Risk Factor Surveillance System-FV questionnaire</i>	Assess an individual's consumption of fruits, vegetables, and potatoes	<i>Not including juices, how often did you eat fruit?</i>	Descriptive	Trowbridge, Wong, Byers, & Serdula, 1990
Psychological need satisfaction				
<i>The Psychological Needs Satisfaction in Exercise Scale</i>	Assesses the degree to which the needs to feel competent, autonomous, and socially connected/related are satisfied during physical activity	<i>I feel confident in my ability to do exercises that personally challenge me</i>	Ordinal, 18-items using a 6-point Likert scale	Wilson, Rogers, Rodgers, & Wild, 2006
<i>The Psychological Need Satisfaction questionnaire</i>	Assesses the degree to which the needs to feel competent, autonomous, and socially connected/related are satisfied in relation to fruit and vegetable consumption	<i>I feel like I am in charge of my fruit and vegetable consumption decisions</i>	Ordinal, 21-items using a 7-point Likert scale	Deci, Ryan, Gagne, Leone, Usunov, & Kornazheva, 2001; Gagne, 2003
Behavioural regulations				
<i>Exercise Treatment Self-Regulation Questionnaire</i>	Assesses external regulation, introjected regulation,	<i>I try to be physically active on a regular basis because I feel like</i>	Ordinal, 16-intems using a 7-point Likert scale	Williams, Deci, & Ryan, 1998

	identified regulation, and intrinsic motivation for participation in physical activity	<i>it's the best way to help myself</i>		
<i>Dietary Self-Regulation questionnaire</i>	Assesses amotivation, controlled motivation, and autonomous motivation for consumption of fruit and vegetables	<i>I would eat a diet high in fruits and vegetables because I would feel guilty or ashamed of myself if I did not</i>	Ordinal, 15-items using a 7-point Likert scale	Williams, Deci, & Ryan, 1998
Perceived autonomy support				
<i>Health Care Climate Questionnaire</i>	Assesses perceived autonomy support provided by the health coach	<i>I feel the health coach provided me choices and options about my health</i>	Ordinal, 15-items using a 7-point Likert scale	Williams, Grow, Freedman, Ryan, & Deci, 1996
Sample Description				
<i>Sociodemographic and medical questionnaire</i>	Information on the participant's age, level of education, socioeconomic status, occupation, date of diagnosis, brief treatment history, and stage of their cancer at diagnosis			

Table 2.

Changes in participant questionnaire scores from baseline to post-intervention.

	Sarah		Lauren		Stephanie	
	Baseline	Post-Intervention	Baseline	Post-Intervention	Baseline	Post-Intervention
FV consumption						
(servings/day)	3	8	3	5	2	7.5
MVPA						
(minutes/week)	0	60	15	100	120	245
FV basic psychological need satisfaction						
Autonomy	4.29	4.29	5.6	6.43	4.2	6.1
Competence	4.6	5.3	4	5.5	4.8	6.5
Relatedness	4.8	4.7	5.1	6.1	3.3	4.8
PA basic psychological need satisfaction						
Autonomy	6	6	3.8	5.6	5	6
Competence	2.3	4	2.5	4.8	4	4
Relatedness	5.1	6	1.5	4.1	3	2
FV behavioural regulations						
Autonomous	6.3	7	5.8	7	5.5	6.7
Controlling	5	5	1.8	3	2	1.5
PA behavioural regulations						
Autonomous	6.75	6.25	4.9	6	5	6.1
Controlling	4.75	3.1	1.5	2.75	2.7	1

Notes. FV=fruit and vegetable. MVPA=moderate-to-vigorous intensity physical activity. PA=physical activity. All names have been changed to pseudonyms to protect participants' anonymity.

Chapter 5: Global Discussion

Participating in a minimum of 150 minutes of moderate-to-vigorous intensity physical activity (MVPA) per week and eating at least five servings of fruits and vegetables (FV) per day can help reduce side effects and promote wellbeing among cancer survivors [5, 6]. Rural-living cancer survivors report engaging in less physical activity (PA) and consuming fewer FV than their urban counterparts [9]. This is especially concerning for young adult cancer survivors (YAs) between the ages of 20 and 39 years living in rural areas, as 80% of YAs are expected to live at least 5 years after being diagnosed with cancer [11]. Therefore, addressing the survivorship health needs of this group is key because they have the potential for many long and healthy years ahead of them. The literature on rural-living older adult cancer survivors [12-16] suggests rural-living YAs experience numerous geographical and developmental barriers to PA participation and FV consumption (e.g., access to facilities, competing responsibilities). However, there is scant guiding literature on the feasibility and acceptability of alternative modes of delivery for behaviour change interventions for this population as the majority of the literature is focused on younger or older adult cancer survivors [27]. Further, the utilization of theory in the design, implementation, and evaluation of intervention research is lacking. Consequently, the underlying mechanisms influencing change within the intervention is unclear. Thus, this thesis sought to explore the feasibility and acceptability of a 12-week theory-based telehealth coaching intervention intended to promote PA participation and FV consumption among rural-living YAs. The following discussion will delve into the results in greater detail, relate findings to the literature, and provide recommendations for future research in survivorship care for YAs.

The first objective of this study was to assess the feasibility of the intervention. The intervention was designed in line with behaviour change techniques (BCTs) that have been

shown to elicit change in PA participation and FV consumption [117] and was delivered in a mode that had been deemed preferable by YAs – namely via videoconferencing [27, 89, 118]. The order of sessions was developed based on empirical evidence suggesting long-term behaviour adoption and maintenance is facilitated by individuals developing action plans and then methods for coping [119]. The importance of these features can be seen in the successful achievement of feasibility benchmarks for adherence and retention rates as well as for missing data, which was minimal. However, the high attrition rate and the low recruitment and enrollment rates suggest there are inherent barriers to engagement in behaviour change interventions for this population that may influence the feasibility of future large-scale studies or implementation of telehealth supportive care services.

While recognition of the importance of research conducted with YAs has increased, the evidence base to support concrete recommendations for increasing engagement (and subsequent feasibility) in health-promoting behaviour change interventions for this population is still needed. Currently, researchers suggest that the burden of research methods, design issues (e.g., multiple data points, time commitment), and limited access to recruitment may influence uptake of YAs into research trials [120-122]. Yet, the participants in this sample did not have issue with the methods used nor the design, as suggested by feasibility and acceptability results. Furthermore, in attempt to cast as wide of net as possible for recruitment the study was advertised across multiple social media websites, online postings on bulletin boards/discussion groups, and cancer-related websites, some of which have traffic from more than 8,000 cancer survivors on a daily basis. Nevertheless, participation in the study was reliant on self-referral indicating that participants were actively seeking to change their PA participation and FV consumption. This

indicates that there may be differences regarding the importance of increasing health-promoting behaviours within the broader context of survivorship for YAs.

A common theme amongst participants was the notion that they felt they “needed” to make a change and had nothing to lose by participating in the study. It is possible that these YAs were capitalizing on the “teachable moment” often discussed in psychosocial oncology literature; a transition period after a life event (e.g., cancer diagnosis, hospitalization, pregnancy) that has the potential to motivate individuals to adopt health-protective behaviours [123, 124]. Although it may seem intuitive to promote utilization of the “teachable moment” at the completion of treatment, this phenomenon may not operate in the same context for all YAs. The “teachable moment” relies on the notion of individual development, either development forestalled by a life-altering event or development enhanced by the same event. As previously mentioned, this population is in the middle of numerous developmental milestones, most of which are often hindered while they go through treatment [71, 76-79]. After treatment, some YAs may be more focused on returning to achieving social development milestones (e.g., building a family, advancing in a career) over initiating health-promoting behaviours. As participants were at different stages of survivorship, it is not possible to draw conclusions regarding the opportune time to intervene with this style of intervention for this population. As such, researchers may wish to explore what stage of survivorship is most beneficial for recommending behaviour change in this population as there is currently limited guiding literature on this phenomenon.

The second objective of this study was to explore participants’ thoughts, feelings, and opinions regarding the acceptability of the intervention. The duration of the intervention coupled with the presence of a health coach providing a supportive care service that they did not have access to were the most salient features of the intervention for participants. Further, findings

from the triangulation of the quantitative and qualitative data on the basic psychological needs suggests the presence of the health coach may be the most relevant form of motivation for some YAs. Therefore, it may be necessary to explore alternative designs that could provide YAs with additional supports, if necessary. As discussed in Chapter 4, a stepped down model of care may provide YAs with a smoother transition from weekly support to no support [125]. Although participants acknowledged the benefit that a post-intervention check-in could provide, they placed varying levels of importance on this form of support. Thus, it may be necessary to incorporate a flexible approach that allows participants' unique needs and preferences to determine the amount or type of support to provide post-intervention.

Santa-Mina and colleagues [126] have suggested a pathway for triaging individuals post-treatment to the appropriate PA resources based on the context, preferences, and opportunities of the individual. The pathway has two streams whereby physicians can refer individuals to either a supervised structured exercising program or a program aimed at promoting physical activity on one's own. In particular, the exercising program stream is offered to those who were deemed at risk during an assessment, whereas the latter stream is offered to those who may not have access to resources for PA (e.g., exercise programs) and places an emphasis on providing self-management resources for cancer survivors that promote regular PA throughout the cancer care continuum. Within the context of this model, the intervention in this study would be considered a resource in the physical activity promotion stream. However, this intervention utilizes a tailored, yet independent and unsupervised approach therefore, triaging could be employed to determine the stepped down model of support required for each individual participant. Further, in a recent systematic review and meta-analysis of maintenance of PA behaviour change in cancer survivors after intervention suggests that stratified support to those who need it most may be of marked

importance for facilitating behaviour maintenance [127]. For instance, the utility of stratified support for those most in need is supported by findings from a distance-based multimodal lifestyle intervention in older long-term cancer survivors [128]. Individuals with poorer baseline scores experienced decline overtime whereas those with considerably higher baseline scores saw marked improvement during and post-intervention. It may be necessary to determine whether baseline PA and FV consumption impacts motivation to maintain behaviour change and whether a triaged, stepped down approach would facilitate sustained behaviour maintenance.

The third objective of this study was to examine self-determination theory (SDT; [32, 33]) constructs (e.g., autonomy support, basic psychological need satisfaction, behavioural regulations) that may be associated with changes in PA and FV consumption. Though SDT is a useful theoretical framework to guide the development and evaluation of health behaviour change interventions [34], there is little research exploring its use in an online setting [22-25]. To date, no researchers to our knowledge have incorporated SDT and BCTs targeting SDT constructs into the development and evaluation of a telehealth intervention for rural-living YAs. Within the context of this study, we explored the ability of the intervention to address the basic psychological needs of participants and promote autonomous (or self-determined) forms of behavioural regulation.

As discussed in Chapter 4, participants felt the health coach interacted with them in an autonomy supportive manner, but it did not translate to a consistent increased sense of perceived satisfaction of the basic psychological needs for PA participation and FV consumption. Nevertheless, it seems that the intervention and health coach's behaviour filled other voids in the lives of participants. Participants noted that they relied on the health coach to provide informational support that was currently lacking in their social support network. According to a

qualitative survey of 1514 cancer survivors, younger cancer survivors typically report a greater number of unmet needs than older adult cancer survivors [129], with educational and informational needs as the third highest unmet need [129]. The social support literature defines informational support as the action of providing advice, suggestions, and feedback [130]. Within the intervention, the health coach's autonomy supportive behaviours were focused on eliciting and acknowledging the participant's perspective, providing a rationale for advice given, and minimizing control, while avoiding judgment [131]. The constructs are definitionally similar and have been successfully utilized in behaviour change interventions among cancer survivors, separately [132, 133]. Moreover, during the social support sessions (sessions 7 & 8), participants struggled to identify a member within their social support network that would fulfill the informational support role beyond the health coach. Indeed, a systematic review of social well-being among adolescents and YAs found that this population consistently reports concerns with the maintenance and development of peer and family relationships, intimate and marital relationships, and peer support [134], often leading to a sense of social isolation [78, 134, 135]. Although not specifically addressed in the design of the intervention nor assessed for in the study, it is possible the social support needs typically experienced by YAs post-treatment may have been present and addressed during the intervention instead of the basic psychological need of relatedness.

Coleman and Iso-Ahola [136] have discussed the potential mediating role of social support and self-determined dispositions within leisure activity on one's ability to cope with stress in the general population. While findings from cross-sectional research do suggest causal pathways between SDT and social support in contexts outside of health-promoting behaviours (e.g., [137]), the conceptual overlap between components of the two approaches is not clear. To

tease apart whether there is a connection or substantial difference between these two factors, a grounded theory approach may facilitate a greater understanding of the nuances inherent in these concepts and provide a new approach to intervention design.

Implications

This study makes a number of contributions to the current literature investigating intervention design, specifically for rural-living YAs. First, the feasibility data described herein and in Chapter 4 suggest that engagement in health behaviour change interventions may be influenced by larger contextual factors associated with this age group (e.g., gaining independence, establishing romantic relationships; [71, 76-79]). Findings highlight the potential for developing multimodal interventions that address the concerns of YAs beyond health-promoting behaviours. By providing YAs with necessary supports for successful transition from primary care to survivorship, they may be able to capitalize on the “teachable moment” and integrate more PA and FV consumption into their daily lives. Second, the acceptability data provides insight into the components that are necessary to include in an intervention targeting rural-living YAs, notably that there be a health coach with whom participants can interact with. However, it also raises concerns around the sustainability of change observed within health behaviour change interventions that seek to foster perceptions of relatedness and offer social support as a means of fostering change for those with a limited social support network. For this reason, investigation into a triaged, stepped down model of delivery with an emphasis on expanding participants’ social support networks may ease the transition from support to no support for YAs that may have the greatest need.

Limitations

Although the study comprising this thesis provides theoretical and practical contributions, there are some limitations. First, as with most studies conducted with YAs this thesis is limited by the small sample size. Although perspectives offered by the three participants who completed the intervention and study assessments provide worthwhile insight into relevant, suitable, and beneficial components of intervention design for this population, it is possible that a larger sample of more diverse group of rural-living YAs would yield a different result. Second, a quantitative measure of acceptability was not included in the post-intervention questionnaire. Consequently, the importance of the intervention components to participants are not included herein and would be a worthwhile avenue of future inquiry. In regards to more specific study limitations, Chapters 3 and 4 provide greater depth.

Conclusion

Overall, the findings from this thesis contribute to the limited literature on PA participation and FV consumption interventions for rural-living YAs. We have highlighted the feasibility and acceptability associated with the delivery style and intervention components of the program as well as offered preliminary data on motivational context in an online setting. Combined findings from this thesis offer guidance for others seeking to develop and deliver interventions to rural-living YAs and contribute to a limited literature base for this population. Exploring the suitability of this type of program highlights the potential of utilizing telehealth to deliver health services to individuals that may not be able to access traditional programs and services.

References

1. Crotty, M., *The foundations of social research*. 1998, London, United Kingdom: SAGE.
2. Fidler, M.M., et al., *Cancer incidence and mortality among young adults aged 20-39 years worldwide in 2012: A population-based study*. *The Lancet Oncology*, 2017. **18**(12): p. 1579-1589.
3. Statistics., C.C. *Physical activity and cancer*. 2017; Available from: <http://www.cancer.ca/en/cancer-information/cancer-101/canadian-cancer-statistics-publication/?region=on>.
4. Blaney, J.M., Lowe-Strong, A., Rankin-Watt, J., Campbell, A., & Gracey, J. H., *Cancer survivors' exercise barriers, facilitators and preferences in the context of fatigue, quality of life and physical activity participation: A questionnaire–survey*. *Psycho-Oncology*, 2013. **22**(1): p. 186-194.
5. Mishra, S.I., Scherer, R. W., Geigle, P. M., Berlanstein, D. R., Topaloglu, O., Gotay, C. C., & Snyder, C., *Exercise interventions on health-related quality of life for cancer survivors (Review)*. *Cochrane Database Systematic Review*, 2012. **8**: p. CD007566.
6. Rock, C.L., et al., *Nutrition and physical activity guidelines for cancer survivors*. CA: A Cancer Journal for Clinicians, 2012. **62**(4): p. 242-274.
7. Society, C.C. *Physical activity and cancer*. 2017; Available from: <http://www.cancer.ca/en/prevention-and-screening/live-well/nutrition-andfitness/physicalactivity/?region=on>.
8. Blanchard, C.M., Courneya, K.S., & Stein, K., *Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: Results*

- from the American cancer society's SCS-II. Journal of Clinical Oncology, 2008. 26(13): p. 2198-2204.*
9. Rogers, L.Q., et al., *Physical activity type and intensity among rural breast cancer survivors: Patterns and associations with fatigue and depressive symptoms. Journal of Cancer Survivorship, 2011. 5(1): p. 54-61.*
 10. Paskett, E.D., et al., *Racial differences in knowledge, attitudes, and cancer screening practices among triracial rural population. Cancer, 2004. 101(11): p. 2650-2659.*
 11. Lewis, D.R., et al., *Adolescent and young adult cancer survival. Journal of National Cancer Institute Monographs, 2014. 49: p. 228-35.*
 12. Clark, R.E., et al., *"I do not have time. Is there a handout I can use?": Combining physicians' needs and behavior change theory to put physical activity evidence into practice. Osteoporos International, 2017. 28(6): p. 1953-1963.*
 13. Martinez-Donate, A.P., Halverson, J., Simon, N., Strickland, J.S., Trentham-Dietz, A., Smith, P.D., Linskens, R., & Wang, X., *Identifying health literacy and health system navigation needs among rural cancer patients: Findings from the rural oncology literacy enhancement study (ROLES). Journal of Cancer Education, 2013. 28(3): p. 573-581.*
 14. McDonald, Y.J., et al., *Health service accessibility and risk in cervical cancer prevention: Comparing rural versus nonrural residence in New Mexico. Journal of Rural Health, 2017. 33(4): p. 382-392.*
 15. Rutledge, T.L., et al., *Optimizing endometrial cancer follow-up and survivorship care for rural and other underserved women: Patient and provider perspectives. Gynecologic Oncology, 2017. 145(2): p. 334-339.*

16. Olson, E.A., et al., *Meeting physical activity guidelines in rural breast cancer survivors*. American Journal of Health Behavior, 2014. **38**(6): p. 890-899.
17. Irwin, M.L., Smith, A. W., McTiernan, A., Ballard-Barbash, R., Cronin, K., Gilliland, F. D., ... & Bernstein, L., *Influence of pre-and post diagnosis physical activity on mortality in breast cancer survivors: The health, eating, activity, and lifestyle study*. Journal of Clinical Oncology, 2008. **26**(24): p. 3958-3964.
18. Pugh, G., et al., *The health behaviour information needs and preferences of teenage and young adult cancer survivors*. Journal of Adolescent and Young Adult Oncology, 2017. **6**(2): p. 318-326.
19. Erickson, J.M., et al., *Symptoms and symptom clusters in adolescents receiving cancer treatment: A review of the literature*. International Journal of Nursing Studies, 2013. **50**(6): p. 847-69.
20. Smith, S.A. & Ansa, B., *A systematic review of lifestyle interventions for chronic diseases in rural communities*. Journal of the Georgia Public Health Association, 2016. **5**(4): p. 304-313.
21. Balatsoukas, P., et al., *The role of social network technologies in online health promotion: A narrative review of theoretical and empirical factors influencing intervention effectiveness*. Journal of Medical Internet Research, 2015. **17**: p. e141.
22. Brouwer, W., et al., *Which intervention characteristics are related to more exposure to internet-delivered healthy lifestyle promotion interventions? A systematic review*. Journal of Medical Internet Research, 2011. **13**(1): p. e2.

23. Davies, C.A., et al., *Meta-analysis of internet-delivered interventions to increase physical activity levels*. International Journal of Behavioural Nutrition and Physical Activity, 2012. **9**(52).
24. Jenkins, A., et al., *The effectiveness of distance interventions for increasing physical activity: A review*. American Journal of Health Promotion, 2008. **24**(2): p. 102-117.
25. Webb, T.L., et al., *Using the internet to promote behaviour change: A systematic review and meta-analysis of the impact of theoretical basis, use of behaviour change techniques, and mode of delivery on efficacy*. Journal of Medical Internet Research, 2010. **12**(1): p. e4.
26. Silva, M.N., et al., *Using self-determination theory to promote physical activity and weight control: A randomized controlled trial in women*. Journal of Behavioural Medicine, 2010. **33**: p. 110-122.
27. Pugh, G., et al., *Health behaviour change interventions for teenage and young adult cancer survivors: A systematic review*. Journal of Adolescent and Young Adult Oncology, 2016. **5**: p. 91-105.
28. Richter, D., et al., *Psychosocial interventions for adolescents and young adult cancer patients: A systematic review and meta-analysis*. Critical Reviews in Oncology/Hematology, 2015. **95**(3): p. 370-86.
29. Fenner, A.A., Straker, L.M., Davis, M.C., & Hagger, M.S., *Theoretical underpinnings of a need-supportive intervention to address sustained healthy lifestyle changes in overweight and obese adolescents*. Psychology of Sport and Exercise, 2013. **14**(6): p. 819-829.

30. Kuijpers, W., Groen, W.G., Aaronson, N.K., & van Harten, W.M., *A systematic review of web-based interventions for patient empowerment and physical activity in chronic diseases: Relevance for cancer survivors*. Journal of Medical Internet Research, 2013. **15**(2): p. e37.
31. McAlphine, H., Joubert, L., Martin-Sanchez, F., Merolli, M., & Drummond, K.J., *A systematic review of types and efficacy of online interventions for cancer patients*. Patient Education and Counseling, 2015. **98**(3): p. 283-295.
32. Deci, E.L. & Ryan, R.M., *The general causality orientations scale: Self-determination in personality*. Journal of Research in Personality, 1985. **19**(2): p. 109-134.
33. Deci, E.L. & Ryan, R.M., *Intrinsic and extrinsic motivations: Classic definitions and new directions*. Contemporary Educational Psychology, 2000. **25**(1): p. 54-67.
34. Patrick H. and G.C. Williams, *Self-determination theory: Its application to health behaviour and complementarity with motivational interviewing*. International Journal of Behavioural Nutrition and Physical Activity, 2012. **9**(18): p. 1-12.
35. Owen, K.B., Smith, J., Lubans, D.R., Ng, J.Y.Y., & Lonsdale, C., *Self-determined motivation and physical activity in children and adolescents: A systematic review and meta-analysis*. Preventive Medicine, 2014. **67**: p. 270-279.
36. Teixeira, P.J., Carraca, E.V., Markland, D., Silva, M.N., & Ryan, R.M., *Exercise, physical activity, and self-determination theory: A systematic review*. International Journal of Behavioural Nutrition and Physical Activity, 2012. **9**(78): p. 1-30.
37. Teixeira, P.J., Carraca, E.V., Marques, M.M., Rutter, H. Oppert, J., Bourdeaudhuij, I.D., ... Brug, J., *Successful behaviour change in obesity interventions in adults: A systematic review of self-regulation mediators*. BMC Medicine, 2015. **13**(84).

38. Vlachopoulos, S.P., Karageorghis, C.I., & Terry, P.C., *Motivation profiles in sport: A self-determination theory perspective*. Research Quarterly for Exercise and Sport, 2013. **71**(4): p. 387-397.
39. Thøgersen-Ntoumani, C., & Ntoumanis, N., *The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations*. Journal of Sport Sciences, 2006. **24**: p. 393-404.
40. Verstuyf, J., et al., *Motivational dynamics of eating regulation: A self-determination theory perspective*. International Journal of Behavioral Nutrition and Physical Activity, 2012. **9**(21): p. 1-16.
41. Buffart, L.M., et al., *Evidence-based physical activity guidelines for cancer survivors: Current guidelines, knowledge gaps, and future research directions*. Cancer Treatment Reviews, 2014. **40**(2): p. 327-340.
42. Demark-Wahnefried, W., et al., *Practical clinical interventions for diet, physical activity, and weight control in cancer survivors*. CA: A Cancer Journal for Clinicians, 2015. **65**.
43. Lahart, I.M., et al., *Physical activity, risk of death and recurrence in breast cancer survivors: A systematic review and meta-analysis of epidemiological studies*. Acta Oncologica, 2015. **54**(5): p. 635-654.
44. Schmid, D., et al., *Pre- and post-diagnosis physical activity, television viewing, and mortality among hematologic cancer survivors*. PLOS One, 2018. **13**(1): p. 1-14.
45. Burnham, T.R., & Wilcox, A., *Effects of exercise on physiological and psychological variables in cancer survivors*. Medicine & Science in Sports & Exercise, 2002.

46. Schwedhelm, C., et al., *Effect of diet on mortality and cancer recurrence among cancer survivors: A systematic review and meta-analysis of cohort studies*. *Nutrition Reviews*, 2016. **74**(12): p. 737-748.
47. Blanchflower, D.G., Oswald, A.J., & Stewart-Brown, S., *Is psychological well-being linked to the consumption of fruit and vegetables?* *Social Indicators Research*, 2013. **114**(3): p. 785-801.
48. Hill, E., Clinton, S., Grainger, E., Braun, A., Moran, N., Fitz, E., Chitchumroonchokchai, C., Failla, M., & Spees, C., *Growing Hope: A comprehensive lifestyle intervention increases fruit and vegetable intake and carotenoid status in overweight cancer survivors*. *Journal of the Academy of Nutrition and Dietetics*, 2016. **116**(9): p. A82.
49. McMartin, S.E., Jacka, F.N., & Colman, I., *The association between fruit and vegetable consumption and mental health disorders: Evidence from five waves of a national survey of Canadians*. *Preventive Medicine*, 2013. **56**(3): p. 225-230.
50. Schmitz, K.H., et al., *American College of Sports Medicine roundtable on exercise guidelines for cancer survivors*. *Medicine & Science in Sports & Exercise*, 2010. **42**(7): p. 1409-1426.
51. Mishra, S.I., et al., *Exercise interventions on health-related quality of life for cancer survivors*. *Cochrane Database of Systematic Reviews*, 2012. **15**(8): p. CD007566.
52. Continuous Update Project Team, W.C.R.F.I., *Systematic review on diet, nutrition, physical activity and survival and second cancers in breast cancer survivors*. London, UK: World Cancer Research Fund International, 2014.

53. George, S.M., et al., *Postdiagnosis diet quality, the combination of diet quality and recreational physical activity, and prognosis after early-stage breast cancer*. *Cancer Causes Control*, 2011. **22**(4): p. 589-598.
54. Kroenke, C.H., et al., *Dietary patterns and survival after breast cancer diagnosis*. *Journal of Clinical Oncology*, 2005. **23**: p. 9295–9303.
55. Oyebode, O., et al., *Fruit and vegetable consumption and all-cause cancer and CVD mortality: Analysis of Health Survey for England data*. *Journal of Epidemiology Community Health*, 2014. **68**(8): p. 856-862.
56. Fleig, L., et al., *Cross-behaviour associations and multiple health behaviour change: A longitudinal study on physical activity and fruit and vegetable intake*. *Journal of Health Psychology*, 2015. **20**(5): p. 525-534.
57. Kanera, I.M., et al., *Long-term effects of a web-based cancer aftercare intervention on moderate physical activity and vegetable consumption among early cancer survivors: A randomized controlled trial*. *International Journal of Behavioural Nutrition and Physical Activity*, 2017. **14**(1): p. 1-13.
58. Miedema, B., Easley, J., and Robinson, L., *Comparing urban and rural young adult cancer survivors' experiences: A qualitative study*. *Rural and Remote Health*, 2013. **13**(2324): p. 1-12.
59. Rauh, L.A., et al., *Cervical cancer care in rural Virginia: The impact of distance from an academic medical center on outcomes & the role of non-specialized radiation centers*. *Gynecol Oncol*, 2018. **150**(2): p. 338-342.
60. Umstattd Meyer, M.R., et al., *Rural active living: A call to action*. *Journal of Public Health Management & Practice*, 2016. **22**(5): p. E11-20.

61. James, C.V., et al., *Racial/ethnic health disparities among rural adults — United States, 2012–2015*. Morbidity and Mortality Weekly Report, 2017. **66**(23): p. 1-9.
62. Byker Shanks, C., et al., *Availability, price, and quality of fruits and vegetables in 12 rural montana counties, 2014*. Preventing Chronic Disease, 2015. **12**: p. E128.
63. de Souza, R.J., et al., *Environmental health assessment of communities across Canada: Contextual factors study of the Canadian Alliance for Healthy Hearts and Minds*. Cities & Health, 2018: p. 1-18.
64. Miller, V., et al., *Availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels: Findings from the Prospective Urban Rural Epidemiology (PURE) study*. The Lancet Global Health, 2016. **4**(10): p. e695-e703.
65. Pinard, C.A., et al., *An integrative literature review of small food store research across urban and rural communities in the U.S.* Prev Med Rep, 2016. **3**: p. 324-32.
66. Cleland, V., et al., *A qualitative study of environmental factors important for physical activity in rural adults*. PLoS One, 2015. **10**(11): p. e0140659.
67. Hansen, A.Y., et al., *Built environments and active living in rural and remote areas: A review of the literature*. Current Obesity Reports, 2015. **4**(4): p. 484-493.
68. Hastert, T.A., et al., *Disparities in cancer incidence and mortality by area-level socioeconomic status: A multilevel analysis*. Journal of Epidemiology and Community Health, 2015. **69**(2): p. 168-176.
69. Reid-Arndt, S.A. and Cox, C.R., *Does rurality affect quality of life following treatment for breast cancer?* Journal of Rural Health, 2010. **26**(4): p. 402-5.
70. Cancer, C.P.A., *Adolescents & Young Adults with Cancer: A System Performance Report*. 2017, Canadian Partnership Against Cancer: Toronto, ON.

71. Zebrack, B., & Isaacson, S., *Psychological care of adolescent and young adult patients with cancer and survivors* Journal of Clinical Oncology, 2012. **30**(11): p. 1221-1226.
72. Epelman, C.L., *The adolescent and young adult with cancer: State of the art - psychosocial aspects*. Current Oncology Reports, 2013. **15**(4): p. 325-331.
73. Tricoli, J.V., et al., *Biological and clinical characteristics of adolescent and young adult cancers: Acute lymphoblastic leukemia, colorectal cancer, breast cancer, melanoma and sarcoma* Cancer Treatment Reviews, 2016. **122**(7): p. 1017-1028.
74. Tricoli, J.V., et al., *Unique characteristics of adolescent and young adult acute lymphoblastic leukemia, breast cancer, and colon cancer*. Journal of National Cancer Institute, 2011. **103**(8): p. 628-635.
75. Tai, E., et al., *Health status of adolescent and young adult cancer survivors*. Cancer, 2012. **118**(19): p. 4884-91.
76. Epelman, C.L., *The adolescent and young adult with cancer: State of the art - psychosocial aspects*. Current Oncology Reports, 2013. **15**: p. 325-331.
77. D'Agostino, N.M., Penney, A., & Zebrack, B., *Providing developmentally appropriate psychosocial care to adolescent and young adult cancer survivors*. Cancer Treatment Reviews, 2011. **117**.
78. Husson, O., et al., *Cancer in adolescents and young adults: Who remains at risk of poor social functioning over time?* Cancer, 2017. **123**(14): p. 2743-2751.
79. Warner, E.L., et al., *Social well-being among adolescents and young adults with cancer: A systematic review*. Cancer Treatment Reviews, 2016. **122**: p. 1029-1037.

80. Murnane, A., et al., *Adolescents and young adult cancer survivors: Exercise habits, quality of life and physical activity preferences*. Supportive Care in Cancer, 2015. **23**(2): p. 501-10.
81. Smits-Seemann, R.R., et al., *Barriers to follow-up care among survivors of adolescent and young adult cancer*. J Cancer Surviv, 2017. **11**(1): p. 126-132.
82. Berg, C.J., et al., *Young adult cancer survivors' experience with cancer treatment and follow-up care and perceptions of barriers to engaging in recommended care*. Journal of Cancer Education, 2016. **31**(3): p. 430-442.
83. Wu, Y.P., et al., *Barriers and facilitators of healthy diet and exercise among adolescent and young adult cancer survivors: Implications for behavioral interventions*. Journal of Adolescent and Young Adult Oncology, 2015. **4**(4): p. 184-91.
84. Rabin, C. and M. Politi, *Need for health behavior interventions for young adult cancer survivors*. American Journal of Health Behavior, 2010. **34**(1): p. 70-76.
85. Berdan, C.A., et al., *Childhood cancer survivors and adherence to the American Cancer Society Guidelines on Nutrition and Physical Activity*. J Cancer Surviv, 2014. **8**(4): p. 671-9.
86. Weaver, K.E., et al., *Rural-urban differences in health behaviors and implications for health status among US cancer survivors*. Cancer Causes Control, 2013. **24**(8): p. 1481-90.
87. Carriere, R., et al., *Rural dwellers are less likely to survive cancer - An international review and meta-analysis*. Health Place, 2018. **53**: p. 219-227.

88. Gray, M.S., et al., *Rural-urban differences in health behaviors and outcomes among older, overweight, long-term cancer survivors in the RENEW randomized control trial*. Cancer Causes Control, 2019. **30**(4): p. 301-309.
89. Pugh, G., et al., *The lifestyle information and intervention preferences of teenage and young adult cancer survivors: A qualitative study*. Cancer Nursing, 2018. **41**(5): p. 389-398.
90. Rabin, C., et al., *Intervention Format and Delivery Preferences Among Young Adult Cancer Survivors*. Int.J. Behav. Med., 2013. **20**: p. 304–310.
91. Nickelson, D.W., *Telehealth and the evolving health care system: Strategic opportunities for professional psychology*. Professional Psychology: Research and Practice, 1998. **29**(6): p. 527-535.
92. Zebrack, B. and S. Isaacson, *Psychological care of adolescent and young adult patients with cancer and survivors*. Journal of Clinical Oncology, 2012. **30**(11): p. 1221-1226.
93. DelliFraine, J.L., & Dansky, K.H., *Home-based telehealth: A review and meta-analysis*. Journal of Telemedicine and Telecare, 2008. **14**(2): p. 62-66.
94. Pingree, S., et al., *The value of theory for enhancing and understanding e-health interventions*. American Journal of Preventive Medicine, 2010. **38**(1): p. 103-109.
95. Pagato, S. and G.G. Bennett, *How behavioural science can advance digital health*. Translational Behavioural Medicine, 2013. **3**(3): p. 271-276.
96. Schosler, H., J. de Boer, and J.J. Boersema, *Fostering more sustainable food choices: Can self-determination theory help*. Food Quality and Preference, 2014. **35**: p. 59-69.

97. Wilson, P.M., Mack, D.E., & Grattan, K.P., *Understanding motivation for exercisers: A self-determination theory perspective*. Canadian Psychology/Psychologie Canadienne, 2008. **49**(3): p. 250-256.
98. Brunet, J., Burke, S.M., & Sabiston, C.M., *The benefits of being self-determined in promotion physical activity and affective well-being among women recently treated for breast cancer*. Psycho-Oncology, 2013. **22**(10): p. 2245-2252.
99. Peddle, C.J., et al., *Medical, demographic, and psychosocial correlates of exercise in colorectal cancer survivors: An application of self-determination theory*. Supportive Care in Cancer, 2007. **16**: p. 9-17.
100. Hartmann, C., Dohle, S., & Siegrist, M., *A self-determination theory approach to adults' healthy body weight motivation: A longitudinal study focussing on food choices and recreational physical activity*. Psychology & Health, 2015. **30**(8): p. 924-948.
101. Schosler, H., de Boer, J., & Boersema, J.J., *Fostering more sustainable food choices: Can self-determination theory help?*. Food Quality and Preference, 2014. **35**: p. 59-69.
102. DeCharms, R., *Personal causation; the internal affective determinants of behavior*. 1968, New York, NY: Academic Press.
103. White, R.W., *Motivation reconsidered: The concept of competence*. Psychological Review, 1959. **66**(5): p. 297-333.
104. Baumeister, R.F., & Leary, M.R., *The need to belong: Desire for interpersonal attachments as a fundamental human motivation*. Psychological Bulletin, 1995. **117**(3): p. 497-529.
105. Aelterman, N., Vansteenkiste, M., Van Keer, H., De Meyer, J., Van den Berghe, L., & Haerens, L., *Development and evaluation of a training on need-supportive teaching in*

- physical education: Qualitative and quantitative findings*. Teaching and Teacher Education, 2013. **29**: p. 64-75.
106. Bourke, L., Homer, K.E., Thaha, M.A., Steed, L., Rosario, D.J., Robb, K.A., ... Taylor, S.J.C., *Interventions to improve exercise behaviour in sedentary people living with and beyond cancer: A systematic review*. British Journal of Cancer, 2014. **110**(4): p. 831-841.
 107. Mayer, D.K., Landucci, G., McTavish, F., & Gustafson, D.H., *SurvivorCHESS to increase physical activity in colon cancer survivors: Can we get them moving?* Journal of Cancer Survivorship, 2018. **12**(1): p. 82-94.
 108. Tsai, E., Robertson, M.C., Lyons, E.J., Swartz, M.C., & Basen-Engquist, K., *Physical activity and exercise self-regulation in cancer survivors: A qualitative study*. Psycho-Oncology, 2018. **27**(2): p. 563-568.
 109. Van den Berghe, L., Vansteenkiste, M., Cardon, G., Kirk, D., & Haerens, L., *Research on self-determination in physical education: Key findings and proposals for future research*. Physical Education and Sport Pedagogy, 2014. **19**(1): p. 97-121.
 110. Armes, J., Crowe, M., Colbourne, L., Morgan, H., Murrells, T., Oakley, C., ... & Richardson, A., *Patients' supportive care needs beyond the end of cancer treatment: A prospective, longitudinal survey*. Journal of Clinical Oncology, 2009. **27**(36): p. 6172-6179.
 111. Standage, M., Duda, J.L., & Ntoumanis, N., *A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions*. Journal of Educational Psychology, 2003. **95**(1): p. 97-110.

112. Standage, M., Gillison, F.B., Ntoumanis, N., & Treasure, D.C., *Predicting students' physical activity and health-related well-being: A prospective cross-domain investigation on motivation across school physical education and exercise settings*. Journal of Sport and Exercise Psychology, 2012. **34**(1): p. 37-60.
113. B., H., *Enhancing consumer involvement in health care*, in *Healthcare communication in the new media landscape*, T.E. Parker J.C., Editor. 2008, Springer: New York, NY.
114. Wang, C.K.J., Leng, H.K., Kee, Y.H., *Use of Facebook in physical activity intervention programme: A test of self-determination theory*. International Journal of Sport Psychology, 2015. **46**(3): p. 210-224.
115. Eiser, C., Penn, A., Katz, E., & Barr, R., *Psychosocial issues and quality of life*. Seminars in Oncology, 2009. **36**(3): p. 275-280.
116. Zebrack, B., Bleyer, A., Albritton, K., Medearis, S., & Tang, J., *Assessing the health care needs of adolescent and young adult cancer patients and survivors*. Cancer, 2006. **107**(12): p. 2915-2923.
117. Michie, S., S. Ashford, and F.F. Sniehotta, Dombrowski, S.U., Bishop, A., & French, D.P., *A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: The CALO-RE taxonomy*. Psychology & Health, 2011. **26**(11): p. 1479-1498.
118. Pugh, G., et al., *The Health Behavior Information Needs and Preferences of Teenage and Young Adult Cancer Survivors*. J Adolesc Young Adult Oncol, 2017. **6**(2): p. 318-326.
119. Sniehotta, F.F., et al., *Action planning and coping planning for long-term lifestyle change: Theory and assessment*. European Journal of Social Psychology, 2005. **35**(4): p. 565-576.

120. Gattuson, J., et al., *Monitoring child and parent refusals to enrol in clinical research protocols*. Methodological Issues in Nursing Research, 2005. **53**(3): p. 319-326.
121. Hendricks-Ferguson, V.L., et al., *Recruitment strategies and rates of a multi-site behavioral intervention for adolescents and young adults with cancer*. Journal of Pediatric Health Care, 2013. **27**(6): p. 434-442.
122. Harlan, L.C., et al., *Recruitment and follow-up of adolescent and young adult cancer survivors: The AYA HOPE Study*. Journal of Cancer Survivorship, 2011. **5**(3): p. 305-14.
123. McBride, C.M., K.M. Emmons, and I.M. Lipkus, *Understanding the potential of teachable moments: The case of smoking cessation*. Health Education Research, 2003. **18**(2): p. 156-170.
124. Ganz, P.A., *A teachable moment for oncologists: cancer survivors, 10 million strong and growing!* J Clin Oncol, 2005. **23**(24): p. 5458-60.
125. Dalzell, M., et al., *Rehabilitation and exercise oncology program: Translating research into a model of care*. Current Oncology, 2017. **24**(3): p. e191.
126. Mina, D.S., et al., *Connecting people with cancer to physical activity and exercise programs: A pathway to create accessibility and engagement*. Current Oncology, 2018. **25**(2): p. 149-162.
127. Grimmett, C., et al., *Systematic review and meta-analysis of maintenance of physical activity behaviour change in cancer survivors*. International Journal of Behavioral Nutrition and Physical Activity, 2019. **16**(37): p. 1-20.
128. Morey, M.C., et al., *Group trajectory analysis helps to identify older cancer survivors who benefit from distance-based lifestyle interventions*. Cancer, 2015. **121**(24): p. 4433-4440.

129. Burg, M.A., et al., *Current unmet needs of cancer survivors: analysis of open-ended responses to the American Cancer Society Study of Cancer Survivors II*. Cancer, 2015. **121**(4): p. 623-30.
130. Uchino, B.N., et al., *Social support and physical health: Models, mechanisms, and opportunities*, in *Principles and concepts of behavioral medicine: A global handbook*, E.B. Fisher, et al., Editors. 2018, Springer New York: New York, NY. p. 341-372.
131. Ryan, R.M., et al., *The significance of autonomy and autonomy support in psychological development and psychopathology*, in *Developmental psychopathology: Volume one, theory and method*, D. Cicchetti and D.J. Cohen, Editors. 2006/2015, John Wiley & sons: Hoboken, NJ. p. 795-849.
132. Befort, C.A., et al., *Outcomes of a weight loss intervention among rural breast cancer survivors*. Breast Cancer Research and Treatment, 2012. **132**(2): p. 631-639.
133. Mendoza, J.A., et al., *A Fitbit and Facebook mHealth intervention for promoting physical activity among adolescent and young adult childhood cancer survivors: A pilot study*. Pediatr Blood Cancer, 2017. **64**: p. e26660.
134. Warner, E.L., et al., *Social well-being among adolescents and young adults with cancer: A systematic review*. Cancer, 2016. **122**(7): p. 1029-1037.
135. Elsbernd, A., et al., *"On Your Own": Adolescent and young adult cancer survivors' experience of managing return to secondary or higher education in Denmark*. Journal of Adolescent and Young Adult Oncology, 2018. **7**(5): p. 618-625.
136. Coleman, D. and S.E. Iso-Ahola, *Leisure and health: the role of social support and self-determination*. Journal of Leisure Research, 1993. **25**: p. 111+.

137. Dell, E.M., et al., *Using Self-Determination Theory to build communities of support to aid in the retention of women in engineering*. European Journal of Engineering Education, 2017. **43**(3): p. 344-359.

Appendix A: Research Board Ethics Approval Notice

05/09/2018

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

CERTIFICAT D'APPROBATION ÉTHIQUE | CERTIFICATE OF ETHICS APPROVAL**Numéro du dossier / Ethics File Number**

H-08-18-882

Titre du projet / Project Title

Helping rural-living young adult cancer survivors make healthy lifestyle choices: Does having a telehealth personal health coach help?

Type de projet / Project Type

Thèse de maîtrise / Master's thesis

Statut du projet / Project Status

Approuvé / Approved

Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)

05/09/2018

Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)

04/09/2019

Équipe de recherche / Research Team**Chercheur /
Researcher****Affiliation****Role**

Jenson PRICE

École des sciences de l'activité physique / School of Human Kinetics

Chercheur Principal / Principal Investigator

Jennifer BRUNET

École des sciences de l'activité physique / School of Human Kinetics

Superviseur / Supervisor

Conditions spéciales ou commentaires / Special conditions or comments

Appendix B: Questionnaires and Assessment Tools Used

Questionnaires

International Physical Activity Questionnaire – Short Form

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ days per week

☐

No vigorous physical activity– *skip to question 3*

2. How much time did you usually spend doing vigorous physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐

Don't know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate physical activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? **Do not include walking.**

_____ days per week

☐

No moderate PA– *skip to question 5*

4. How much time did you usually spend doing moderate physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐

Don't know/Not sure

Think about all the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place and, any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

_____ days per week

☐

No walking – *skip to question 7*

6. How much time did you usually spend walking on one of those days?

_____ hours per day

_____ minutes per day

☐

Don't know/Not sure

The last question is about the time you spent sitting during the last 7 days. Include time spent at work, at home, while doing course work, and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you usually spend sitting on one of those days?

_____ hours per day

_____ minutes per day

☐

Don't know/Not sure

The Behavioural Risk Factor Surveillance System – fruit and vegetable section

We are interested in finding out about the amount of fruits and vegetables people eat in their everyday lives. The questions will ask you about the number of days you ate specific foods in the last 7 days. Please think about the foods you eat at work, at home, at restaurants, and other places.

Think about all the foods you ate or drank during the past 7 days, including meals and snack.

1. Not including juices, how often did you eat fruit? You can write times per day or times per week.

_____ servings per day

_____ servings per week

☐

Don't know/Not sure

2. Not including fruit-flavoured drinks or fruit juices with added sugar, how often did you drink 100% fruit juice such as apple or orange juice? You can write times per day or times per week.

_____ servings per day

_____ servings per week

☐

Don't know/Not sure

3. How often did you eat a green leafy or lettuce salad, with or without other vegetables? You can write times per day or times per week.

_____ servings per day

_____ servings per week

☐

Don't know/Not sure

4. How often did you eat any kind of fried potatoes, including french fries, home fries, or hash browns? You can write times per day or times per week.

_____ servings per day

_____ servings per week

☐

Don't know/Not sure

5. How often did you eat any other kind of fried potatoes, or sweet potatoes, such as baked, boiled, mashed potatoes, or potato salad? You can write times per day or times per week.

_____ servings per day

_____ servings per week

☐

Don't know/Not sure

6. Not including lettuce salads and potatoes, how often did you eat other vegetables? You can write times per day or times per week.

_____ servings per day

_____ servings per week

☐

Don't know/Not sure

The Health Care Climate Questionnaire - adapted

Please answer the questions below **regarding your relationship with the health coach about physical activity and/or fruit and vegetable consumption**. Choose your answers using the scale below for each question by filling in the blank after each question with a number from 1 to 7.

1. I feel that the health coach had provided me choices and options about my health.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

2. I feel the health coach understood how I saw things with respect to my health.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

3. I was able to be open with the health coach about my health.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

4. The health coach conveyed confidence in my ability to make changes regarding my health.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

5. I feel that the health coach accepted me whether I followed their recommendations or not.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

6. The health coach made sure I really understood my health risk behaviours and the benefits of changing these behaviours without pressuring me to do so.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

7. The health coach encouraged me to ask questions.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

8. I felt a lot of trust in the health coach.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

9. The health coach answered my questions related to my health fully and carefully.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

10. The health coach listened to how I would like to do things regarding my health.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

11. The health coach handled my emotions very well.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

12. I feel that the health coach cared about me as a person.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

13. I don't feel very good about the way the health coach talked to me about my health.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

14. The health coach tried to understand how I saw my health before suggesting changes.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

15. I feel I was able to share my feelings with the health coach.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

Psychological Needs Satisfaction in Exercise Scale - adapted

The following statements represent different feelings people have when they engage in physical activity. Please answer the following questions by considering how you typically feel while you participate in physical activity.

1. I feel like I am in charge of my physical activity decisions.

1	2	3	4	5	6
false					true

2. I feel good about the way I am able to complete challenging activities.

1	2	3	4	5	6
false					true

3. I feel free to make my own physical activity decisions.

1	2	3	4	5	6
false					true

4. I feel like I am the one who decides what activities I do.

1	2	3	4	5	6
false					true

5. I feel close to my physical activity companions who appreciate how difficult physical activity can be.

1	2	3	4	5	6
false					true

6. I feel attached to my physical activity companions because they accept me for who I am.

1	2	3	4	5	6
false					true

7. I feel connected to the people who I interact with while we do physical activity together.

1	2	3	4	5	6
false					true

8. I feel that I am able to complete activities that are personally challenging.

1	2	3	4	5	6
false					True

9. I feel like I get along with the people who I interact with while we do physical activity together.

1	2	3	4	5	6
false					true

10. I feel confident I can do even the most challenging activities.

1	2	3	4	5	6
false					true

11. I feel free to do physical activity in my own way.

1	2	3	4	5	6
false					true

12. I feel like I am capable of doing even the most challenging activities.

1	2	3	4	5	6
false					true

13. I feel a sense of camaraderie with my physical activity companions because we are physically active for the same reasons.

1	2	3	4	5	6
false					true

14. I feel free to choose which activities I participate in.

1	2	3	4	5	6
false					true

15. I feel capable of completing activities that are challenging to me.

1	2	3	4	5	6
false					true

16. I feel like I have a say in choosing the activities that I do.

1	2	3	4	5	6
false					true

17. I feel confident in my ability to perform activities that personally challenge me.

1	2	3	4	5	6
false					true

18. I feel like I share a common bond with people who are important to me when we do physical activity together.

1	2	3	4	5	6
false					true

Psychological Need Satisfaction - adapted

The following statements represent different feelings people have when they engage in a healthy diet (e.g., eating 5 servings of fruits and vegetables). Please answer the following questions by considering how you typically feel while you consume a healthy diet.

1. I feel like I am in charge of my fruit and vegetable consumption decisions.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

2. I really like eating a lot of fruits and vegetables a day.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

3. I do not feel very competent in preparing and consuming fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

4. I feel pressured to eat a diet high in fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

5. People I know tell me I am good at preparing fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

6. My diet high in fruits and vegetables is well received by the people I come into contact with.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

7. I pretty much keep my diet high in fruits and vegetables to myself and don't share it with a lot of people.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

8. I generally feel free to try new fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

9. I consider the people I talk to about eating fruits and vegetables to be my friends.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

10. I have been able to learn new skills for preparing fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

11. In my daily life, I frequently have to eat what I am told.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

12. People in my life care about me and what I eat.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

13. Most days I feel a sense of accomplishment when I eat a lot of fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

14. People I interact with on a daily basis tend to take my diet high in fruits and vegetables into consideration.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

15. In my life I do not get much of a chance to show how capable I am of preparing fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

16. There are not many people that I can share my experience of a diet high in fruits and vegetables with.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

17. I feel like I can pretty much eat a diet high in fruits and vegetables in daily situations.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

18. The people I interact with regularly do not seem to respect my diet high in fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

19. I often do not feel very capable of preparing or eating a diet high in fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

20. There is not much opportunity for me to decide for myself what I will eat in my daily life.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

21. People are generally supportive of my diet high in fruits and vegetables.

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neutral	Slightly agree	Moderately agree	Strongly agree

Exercise Treatment Self-Regulation Questionnaire - adapted

There are a variety of reasons why people participate in physical activity regularly. Please indicate how true each of these reasons is for why you participate in physical activity regularly.

I try to participate in physical activity on a regular basis:

1. Because I would feel bad about myself if I did not.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

2. Because others would be angry at me if I did not.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

3. Because I enjoy participating in physical activity.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

4. Because I would feel like a failure if I did not.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

5. Because I feel like it's the best way to help myself.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

6. Because people would think I'm a weak person if I did not.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

7. Because I feel like I have no choice about participating in physical activity; others make me do it.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

8. Because it is a challenge to accomplish my goal.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

9. Because I believe physical activity helps me feel better.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

10. Because it's fun.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

11. Because I worry that I would get in trouble with others if I did not.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

12. Because it feels important to me personally to accomplish this goal.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

13. Because I feel guilty if I do not participate in physical activity regularly.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

14. Because I want others to acknowledge that I am doing what I have been told I should do.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

15. Because it is interesting to see my own improvement.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

16. Because feeling healthier is an important value for me.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

Dietary Self-Regulation questionnaire - adapted

The following questions relate to the reason why you would either start eating a healthier diet or continue to do so. Different people have different reason for doing that, and we want to know how true each of the following reasons is for you.

The reason I would eat a diet high in fruits and vegetables is:

1. Because I feel that I want to take responsibility for my own health.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

2. Because I would feel guilty or ashamed of myself if I did not eat a healthy diet high in fruits and vegetables.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

3. Because I personally believe it is the best thing for my health.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

4. Because others would be upset with me if I did not.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

5. I really don't think about it.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

6. Because I have carefully thought about it and believe it is very important for many aspects of my life.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

7. Because I would feel bad about myself if I did not eat a diet high in fruits and vegetables.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true

true

true

8. Because it is an important choice I really want to make.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

9. Because I feel pressure from others to do so.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

10. Because it is easier to do what I am told than think about it.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

11. Because it is consistent with my life goals.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

12. Because I want others to approve of me.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

13. Because it is very important for being as healthy as possible.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

14. Because I want others to see I can do it.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

15. I don't really know why.

1	2	3	4	5	6	7
Not at all			Somewhat			Very true
true			true			

Sociodemographic and Medical Questionnaire

This part of the questionnaire is needed to help understand the characteristics of the people participating in the study. For this reason, it is very important information. All information is held in strict confidence.

1. Age (years): _____

2. Sex:

☐ Male

☐ Female

☐ You do not have an option that applies to me. I identify as (please specify):

3. Civil status (i.e., relationship status):

☐ Never married

☐ Married

☐ Common law

☐ Dating

☐ Widowed

☐ Divorced

☐ Separated

☐ In a relationship

4. Education (please check highest level attained):

☐ Some high school

☐ Completed high school

☐ Some university/college

☐ Completed university/college

☐ Some graduate school (e.g., master's degree, PhD)

☐ Completed graduate school (e.g., master's degree, PhD)

5. Annual household income in Canadian dollars:

☐ < 20,000

☐ 20-39,999

☐ 40-59,999

☐ Do not know

☐ 60-79,999

☐ 80-99,999

☐ >100,000

☐ Prefer not to respond

6. Employment status (please select all those that apply):

☐ Student

☐ Disability

☐ Other (please specify):

☐ Full-time work

☐ Homemaker

☐ Part-time work

☐ Unemployed

7. Has a doctor or nurse ever told you that you have the following?

- | | | |
|---------------------------|------------------------------|-----------------------------|
| 1. Angina | ☐ Yes | ☐ No |
| 2. Heart attack | ☐ Yes | ☐ No |
| 3. Stroke | ☐ Yes | ☐ No |
| 4. Diabetes | ☐ Yes | ☐ No |
| 5. High blood pressure | ☐ Yes | ☐ No |
| 6. High blood cholesterol | ☐ Yes | ☐ No |

9. Has a doctor or nurse ever told you that you have any other health condition(s) that were not listed above?

- ☐ Yes, I have been told I have (please specify): _____
- ☐ No

10. People living in Canada come from many different cultural and racial backgrounds. Which of the following best describes your background?

- | | | |
|---|---|---|
| ☐ Aboriginal (Inuit, Metis, North American Indian) | ☐ Korean | ☐ Japanese |
| ☐ Chinese (e.g., Chinese, Taiwanese) | ☐ South Asian (e.g., Bangladeshi, Punjabi, Sri Lankan) | ☐ South East Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian) |
| ☐ West Asian (e.g., Afghan, Assyrian, Iranian) | ☐ Arab (e.g., Egyptian, Kuwaiti, Libyan) | ☐ Black (e.g., African, Nigerian, Somali) |
| ☐ Latin American (e.g., Chilean, Costa Rican, Mexican) | ☐ Filipino | ☐ White (Caucasian) |
| ☐ Other visible minority not included above (please specify):
_____ | ☐ Multiple visible minorities (please specify):
_____ | ☐ Prefer not to respond |

10. What was the date of your cancer diagnosis (month/year)? _____

11. What type of cancer were you diagnosed with (please select those that apply)?

☐ Leukemia (e.g., acute lymphoblastic leukemia, chronic myeloid leukemia)

☐ Germ cell tumour

☐ Lymphoma (e.g., Burkitt's lymphoma, Hodgkin's lymphoma)

☐ Breast cancer

☐ Soft tissue sarcoma

☐ Melanoma

☐ Osteosarcoma

☐ Colorectal

☐ Cervical

☐ Other cancer not listed (please specify)

12. What stage of cancer were you diagnosed with?

☐ Stage 0

☐ Stage I

☐ Stage II

☐ Stage III

☐ Stage IV

☐ Do not know

☐ Not applicable, staging does not apply to my cancer

13. When did you complete active treatment (month/year)? _____ ☐ Do not remember

14. Are you still receiving treatment (e.g., hormonal therapy)? ☐ Yes ☐ No

If you are still receiving treatment, please specify: _____

15. Please indicate which medical treatments you received for cancer and the date (month/year) of the last treatment, if applicable.

a. Surgery ☐ Yes ☐ No

If you received surgery, please indicate the date of your last surgery.

Date (month/year): _____

☐ Do not remember

b. Chemotherapy ☐ Yes ☐ No

If you received chemotherapy, please indicate the date of your last chemotherapy treatment.

Date (month/year): _____

☐ Do not remember

c. Radiotherapy ☐ Yes ☐ No

If you received radiotherapy, please indicate the date of your last radiotherapy treatment.

Date (month/year): _____

☐ Do not remember

d. Hormonal therapy ☐ Yes ☐ No

If you received hormonal therapy (or are still receiving hormonal therapy), please indicate the date of your last hormonal therapy treatment.

Date: _____

☐ Do not remember

e. Other treatment ☐ Yes, I also received (please specify): _____ ☐ No

If you received "other treatment" please indicate the date of your last "other" treatment.

Date: _____

☐ Do not remember

16. Are you currently on any medications?

☐ Yes, I am on (please specify): _____

☐ No

Interview Guide

Introduction

- Today, I want to hear about your opinions, thoughts, and feelings about your experience in participating in the 12-week telehealth intervention for increasing physical activity behaviours and fruit and vegetable consumption.
- I want to understand the (1) relevance of the intervention, (2) suitability of the intervention, (3) impressions of guidance provided by the health coach, (4) perceived benefits of the intervention, and (5) problems/concerns experienced during the intervention.
- Before we start, I just want to remind you that if we start talking about something on this topic that is strongly important to you, please feel free to talk openly and honestly about it. Also, if you do not want to talk about a certain topic, that is okay as well. Remember, there are no right or wrong answers for any of the questions I ask during this interview.
- This interview will also be audio-taped, in that way, I will be able to better listen to you without writing, although I may take notes if there is a topic I would like to follow-up with you later. Your name as well as other names used during this interview will be kept confidential and will be removed when I transcribe the interview. Then, I will delete the audio-recording. In this way, your confidentiality and anonymity will be assured.
- Do you have any questions or concerns before we begin?

Interview Questions

1. Could you tell me why you decided to participate in this study?
2. Please describe for me your current physical activity behaviour, meaning since you completed your last session online.
[Probes: How often do you participate in physical activity in an average week? How much time do you spend doing the activity? What is the type of activity you do (e.g., aerobic or strength or flexibility)? What is the intensity of the activity (mild, moderate, or vigorous, mix)? What activities do you do? Where do you do most of your activity? With whom, if anyone, do you do most of your physical activity with?]
 - a. How does your current physical activity behaviour compare with your behaviour before you started this intervention?
 - b. How does the context (e.g., where, with whom) compare with the context you had before you started this intervention?
 - c. Could you describe your physical activity behaviour during the intervention?
3. On the basis of your response to the previous question, do you think this intervention helped you (or did not help you) become more active?
[Probes: What aspects of the intervention helped? Can you give examples?]
 - i. Do you think you will use what you learned to continue to be active?
 1. If yes, what will you continue to use? Why? How?
 2. If no, why not?
 - b. (If not helpful), What would it have taken to help you become more active?
4. Do you have any plans to change your physical activity behaviour in the future?
 - a. If yes, why and in what ways?

- [Probes: In what context? Do you plan to change the intensity, frequency, and/or amount?]*
- b. If yes, what about the intervention made you want to change your behaviour?
 - c. If no, why?
[Probes: Are you satisfied with current behaviour? Are you unable to make changes? Are you uninterested in physical activity? Are you uninterested in changing your physical activity behaviours? Are there barriers to changing your physical activity?]
5. Please describe for me your current fruit and vegetable intake.
[Probes: How often do you eat fruits and vegetables in an average week? What fruits and vegetables do you eat? Who usually prepares your meals and who usually does your groceries? With whom do you usually eat, if anyone?]
- a. How does your current fruit and vegetable intake compare with the intake you had before you started this intervention?
 - b. Could you describe your fruit and vegetable intake during the intervention?
6. On the basis of your previous response, do you think this intervention helped you (or did not help you) to eat more fruits and vegetables?
- a. If so, why?
[Probes: What aspects of the intervention helped? Can you give examples?]
 - i. Do you think you will use what you learned to continue to eat fruits and vegetables?
 1. If yes, what will you continue to use? How?
 2. If no, why not?
[Probes: are there any barriers?]
 - b. (If not helpful), What would it have taken to help you eat more fruits and vegetables?
7. Do you have any plans to change your fruit and vegetable intake in the future?
- a. If yes, why and in what ways?
 - i. Will you use what you have learned during the intervention? Why or why not?
 - b. If no, why?
8. How did having a health coach for an hour a week influence your motivation toward changing your lifestyle?
- a. How did it influence what you think about physical activity and your eating patterns?
 - b. How did it influence your health goals and how you think about your abilities to make changes to your physical activity behaviours and fruit and vegetable intake?
[Probes: Have your health goals changed? In what ways? How do you feel about the amount of control you have over your physical activity behaviours and fruit and vegetable intake?]
 - c. What would you say had the biggest impact on your motivation to participate in physical activity and eat more fruits and vegetables?
 - d. Tell me about anything that occurred as a result of the intervention that had an influence, either positive or negative, on your motivation to participate in these health behaviours?
9. How do you feel about the amount of choice, options, and input you were allowed to

- have throughout the intervention? How do you feel about this?
10. Did you feel you were supported throughout the intervention?
 - a. If so, by whom?
 - b. Why?
 - i. What did these individuals do to make you feel supported?
 - ii. Was it the type of support(s) you wanted?
[Probes: Did you receive different types of support, such as emotional, instrumental, informational, and companionship? Was there a type of support you would have liked to receive more of? Less of?]
 - iii. How satisfied were you with the support you received from each of these individuals?
 - c. If not, why?
 - i. What could have been done better or changed to support you better?
 11. What did you think about the weekly activities? How helpful were they?
 - a. Were there any that were particularly helpful?
 - b. Were there any that you felt were a waste of time?
 - c. Were there activities that we did that you didn't like? Why or why not?
 - d. Were there activities that you would have liked to have tried?
 12. Did you feel like the intervention empowered you to make lifestyle changes? How so?
 13. How has this intervention influenced how competent you feel about participating in physical activity and eating more fruits and vegetables?
[Probes: How has your knowledge about physical activity and eating fruits and vegetables changed? How has your confidence in your ability to participate in physical activity and eat fruits and vegetables changed?]
 14. How has this intervention influenced your relationships with others? Has it allowed you to be more connected to people around you (friends, family)? How so?
 15. What difficulties or challenges did you experience as a result of participating in this intervention?
 - a. Were you able to resolve any of these difficulties or challenges? If so, how? If no, what would it have taken to resolve these?
 16. What expectations did you have when you joined this study?
 - a. How did you feel about meeting with a health coach for one hour per week online and did you expect that it would help you increase your physical activity and fruit and vegetable intake? If so, please explain.
 - b. Were your expectations met? How so?
 - c. In what ways were they not met?
 - d. In what ways did your expectations about what you would get from the intervention change throughout the intervention?
 17. Were there ways in which you thought an online intervention would be more or less beneficial than an in-person intervention? Please explain?
 18. Can you tell me about your overall experience in participating in this intervention?
 - a. What did you like about the intervention?
 - b. What did you dislike about the intervention?
 - c. What would you recommend be changed?
 19. What did this intervention mean to you?

Closing questions

1. Do you have anything else that you would like to share before we conclude this interview?