Feasibility of an Acceptance and Commitment Therapy-Based Intervention for the Promotion of Physical Activity in Parents with Young Children

Joe Barton

Bachelor of Arts, University of Victoria, 2021

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF ARTS

In the School of Exercise Science, Physical and Health Education

We acknowledge and respect the Lək^{w}əŋən (Songhees and X^{w}sepsəm/ Esquimalt) Peoples on whose territory the university stands, and the Lək^{w}əŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

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By

Joe Barton

Supervisory Committee

Dr. Ryan Rhodes, UVic Department of Health

Supervisor

Dr. Sam Liu, UVic Department of Health

Committee Member

Abstract

Background: Parents with children under the age of six experience lower levels of physical activity (PA) compared to the general population. The transition to parenthood brings with it an increase in incidental affect such as fatigue and anxiety, as well as an increased workload. Acceptance and Commitment Therapy (ACT) has been shown to improve the initiation and maintenance of physical activity. However, no research has applied ACT to PA promotion in parents with children under six.

Purpose: This study aimed to evaluate the feasibility of a 6-week mobile app PA intervention based on ACT for parents with children under six, compared to an active control group, receiving health information about PA. The Multi-Process Action Control (M-PAC) framework was used to further guide the structure and components of the mobile app. Primary outcomes were recruitment, retention, and acceptability of the intervention. Secondary outcomes explored changes in PA, ACT constructs (PA-related experiential acceptance, cognitive defusion, and valued living), and M-PAC constructs (affective and instrumental attitudes towards PA, perceived opportunity for and perceived capability over PA, PA identity, and habit of PA).

Methods: A mixed-methods, randomized feasibility trial was conducted with parents with a child under the age of six who engaged in a 6-week ACT-based mHealth intervention. Participants were randomized (1:1) to the intervention or control group. The intervention group completed 7 app modules, with accompanying worksheets, based on ACT. The control group received the Canadian 24-Hour Movement guidelines. Measurement was taken at baseline and at 6-week follow-up using a modified Godin Leisure-Time Exercise Questionnaire (GLTEQ), the M-PAC battery, PA Acceptance Questionnaire (PAAQ), Drexel Defusion Scale (DDS), and Valuing Questionnaire (VQ). The intervention group also completed the mHealth Satisfaction

Questionnaire (MSQ), mHealth App Usability Questionnaire (MAUQ), and exit interviews at 6-week follow-up. Independent samples t-tests and one-way ANCOVAs were used for the quantitative analysis, and reflexive thematic analysis of exit interviews was conducted for the qualitative analysis.

Results: The study met progression criteria for retention (78.46%) and engagement (71.43%), but not recruitment (22.87%). MSQ and MAUQ scores indicated adequate acceptability (M = 3.43/5; M = 4.29/7). Qualitative findings showed overall enjoyment of the intervention, with some recommendations for change, such as incorporating the worksheets into the app. There was no difference in PA ($\eta_p^2 = 0.00$). Most effect sizes for ACT and M-PAC constructs were small or negligible, with medium effects trending towards the control for affective attitude towards PA ($\eta_p^2 = 0.07$) and trending towards the intervention for habit of PA ($\eta_p^2 = 0.06$).

Conclusion: Feasibility outcomes were positive and suggest a full-scale trial is feasible with a longer study period and minor changes to the intervention content (e.g., more in-depth content, increased M-PAC focus, incorporation of social/environmental components) and delivery (e.g., integrating worksheets within the app, adding a second check-in meeting, adding module release reminders) to improve engagement and retention.

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Acknowledgments

First and foremost, I'd like to sincerely thank my supervisor, Dr. Ryan Rhodes. I am so grateful and fortunate to have had such a supportive and engaged supervisor guide me through this journey over the past 2 years. Whether through courses, working on papers, or developing this thesis, you have continually cultivated an easy-going, supportive environment while still pushing me to put forth my best; traits I truly admire. Your expertise and interest in my research have been invaluable, and I am deeply grateful for the contributions you have made to my research and my growth as a researcher.

I would like to thank my committee member, Dr. Sam Liu for his valuable feedback and support with this thesis. Thank you for taking the time to review my work and provide meaningful feedback. I am grateful to have had your expertise in digital health help guide this research.

I would also like to thank my lab members. To Dr. Carol Brennan, thank you for your expertise and help with the qualitative analysis. To Dr. Alfred Lee, thank you for your support with the quantitative analysis. To Heather Hollman, thank you for contributing to the co-design process and offering valuable insight as a parent.

Lastly, I would like to thank all the participants who took part in this study. Thank you for taking the time to participate in this study during such a busy time in your lives. I hope you were all able to benefit from this research in some way. Without you this research wouldn't be possible, and I am grateful for your contributions.

Dedication

This research is dedicated to my parents, Alan and Kelly. Thank you for your continuous support through everything I've done. From years of hockey to my undergrad and Master's, you both have been there to support me however you could every step of the way. I'm thankful to have had you by my side during this journey, I wouldn't have been able to do this without your help and encouragement.

Chapter 1: Introduction

Regular moderate to vigorous intensity physical activity (MVPA) has been consistently shown to have a multitude of both physical and mental health benefits. For example, higher levels of MVPA are associated with reduced chances of, and improvements in, type 1 and type 2 diabetes, cardiovascular disease, osteoporosis, and certain cancers (E. Anderson & Durstine, 2019; McTiernan et al., 2019; Pinheiro et al., 2020; Rhodes et al., 2017). Furthermore, MVPA provides mental health benefits such as alleviated depressive symptoms, and improvements in self-esteem, self-concept, and mental well-being (Gilani & Dashipour, 2017; Jacob et al., 2020; Liu et al., 2015; Mikkelsen et al., 2017).

Despite numerous health benefits, a large portion of the population still struggle to meet PA guidelines (Guthold et al., 2018). In 2022, 31.3% of the world's population was not meeting the recommended 150 minutes of MVPA a week (Strain et al., 2024). In Canada, over a third of adults do not participate in sufficient MVPA per week (Strain et al., 2024). Thus, it is of critical importance to explore effective ways of promoting PA.

Certain groups, such as older adults and individuals who are overweight, are at an increased risk of being physically inactive (Cassidy et al., 2017; Strain et al., 2024). Another group that is at an elevated risk of physical inactivity is parents with children under the age of six (Abbasi & van den Akker, 2015; Rhodes & Quinlan, 2015). The birth of a child marks a significant decrease in MVPA for couples (Rhodes et al., 2014a). New mothers seem to be particularly at risk of inactivity with MVPA decreasing at the start of pregnancy and staying

relatively low post-delivery, rarely returning to pre-pregnancy MVPA levels (Abbasi & van den Akker, 2015; Gaston et al., 2014). While much of this research focuses on mothers, fathers have been shown to experience the same decline in MVPA during early parenthood (Bellows-Riecken & Rhodes, 2008; Hull et al., 2010; Pot & Keizer, 2016).

With the increased prevalence of physical inactivity in new parents, it's important to consider and understand the specific factors involved in PA for this group to implement effective interventions. The transition into parenthood represents a major lifestyle shift that brings with it many new stressors and obstacles to PA (Deave et al., 2008). During the transition to parenthood, one of the strongest correlates to PA is perceived behavioural control (PBC). PBC refers to the belief that a certain behaviour is under one's ability and the perceived difficulty of that behaviour (Ajzen, 1991). New parents' attitudes towards PA do not typically change, rather their perception of their ability to perform PA behaviours tends to decrease over time compared to their childless counterparts (Rhodes et al., 2014b). The association between PBC and PA is most strongly seen in new mothers (Rhodes et al., 2014b).

Further, PBC seems to be an indirect correlate of PA, influencing parents PA behaviour through intentions (McIntyre & Rhodes, 2009). Factors that commonly effect new parents PA intentions include underlying perceptions of control such as lack of time, childcare commitments, and a lack of social support (Bellows-Riecken & Rhodes, 2008). However, even positive intentions do not always lead to successful behaviour (Feil et al., 2023; Rhodes & de Bruijn, 2013). Forty-eight percent of individuals who have the intention to exercise do not translate that intention into PA behaviour; this is known as the intention-behaviour gap (Rhodes, 2024). Among parents, there is a 36% intention-behaviour gap, meaning over one-third of parents who intend to be physically active do not translate that intention into PA behaviour

(Grant et al., 2022). The previous research on the intention-behaviour gap demonstrates that having some PBC and the intention to exercise is not enough on its own to turn that intention into behaviour.

It's possible that one of the mechanisms explaining this intention-behaviour gap in new parents is daily affect. New parents face increased negative incidental affect due to the daily stressors of parenthood – such as role demands and conflicts, and lack of sleep – which has been shown to decrease intentional follow-through (Grant et al., 2022; Hagen et al., 2013; Nomaguchi & Milkie, 2020). Incidental affect plays a large role in PA behaviour (Ruissen et al., 2022). Incidental affect refers to the affect an individual experiences throughout the day, which is unrelated to the target behaviour but may still affect it (Stevens et al., 2020). Emotions and moods such as sadness, anger, and happiness, as well as other states such as fatigue fall into this category of affect. Incidental affect can be both positively and negatively valenced, and these have different effects on intention and overall PA (Stevens et al., 2020).

Positively valenced affect refers to the positive emotions experienced throughout the day, and these have been shown to increase individuals' intentions to exercise and increase the likelihood of initiation and maintenance of PA (Allen Catellier & Yang, 2013; Kim et al., 2017). The negatively valenced affect individuals experience also plays a role in PA behaviours. Negative incidental affect such as stress has been shown to significantly decrease the likelihood of PA (Burg et al., 2017; Ruissen et al., 2022). Individuals with lower negative affect and less variability in their negative affect tend to participate in greater levels of MVPA. Moreover, increased levels of PA seem to decrease negative affect over time (Kerrigan et al., 2020).

The research in this area has consistently shown that new parents face increased affective challenges to PA that likely stem from incidental affect (Bellows-Riecken & Rhodes, 2008;

Grant et al., 2022). Moreover, the majority of the research to date has been observational (Bellows-Riecken & Rhodes, 2008; Chasan-Taber et al., 2007; Rhodes et al., 2014a). One way to reduce negative incidental affect is to reduce the stressors that produce those affective challenges through strategies such as situation selection (Webb et al., 2018). However, these strategies are not likely to be effective for parents as many of these challenges stem from unavoidable parental responsibilities (Deave et al., 2008). As such, it's important to identify effective interventions for new parents that target emotion regulation - the ability to effectively manage and respond to emotional experiences in a way that allows the individual to engage with their environment in a meaningful way - and teach new parents to accept these affective challenges and to continue moving in a meaningful direction (Fancourt et al., 2019). As such, it may be beneficial for interventions to specifically target emotion regulation in order to properly manage incidental affect.

Mindfulness-based interventions (MBI) are one such approach that have been shown to increase positive affect and decrease negative affect (Hofmann et al., 2010). Mindfulness allows the individual to accept their present state and redirect their attention to the present moment (Huang et al., 2019). This can be helpful for new parents to overcome the affective challenges they face, such as stress, fatigue, and anxiety. MBIs aim to teach individuals to cultivate a non-judgemental present moment awareness (Shapero et al., 2018). MBIs have been shown to improve individuals' emotional regulation abilities, potentially because they promote an accepting, non-judgemental attitude and help develop attentional control (Huang et al., 2019). A recent systematic review found MBIs to have a positive effect on PA, especially when the mindfulness training targeted psychological factors specific to PA (Schneider et al., 2019). Research has shown that individuals who are more mindful tend to have more positive health

outcomes and increased levels of PA (Murphy et al., 2012; Sala et al., 2021; Ulmer et al., 2010). Regardless of an individual's baseline mindfulness, MBIs have consistently been associated with increases in PA and other health related behaviours (Sala et al., 2021; Zhang et al., 2021).

However, mindfulness does not address motivation, which is a key component of initiating and maintaining PA (P. J. Teixeira et al., 2012). Therefore, an effective intervention should also foster a strong sense of motivation. According to Social Cognitive Theory (SCT), values are a common source of motivation that are similar, yet distinct, to goals that aid in the self-regulation of behaviour (Levontin & Bardi, 2019). Values are the personal beliefs and principles an individual believes are important in life, and they have been shown to affect our choices and behaviours (Sagiv & Roccas, 2021). Values are also important in the formation of identity, which is integral to exercise behaviour (Arieli et al., 2020; Hitlin, 2011; Rhodes et al., 2016; Verplanken & Holland, 2002).

One approach that includes emotion regulation, identity, and the importance of overcoming the intention-behaviour gap is the Multi-Process Action Control (M-PAC) framework which suggests that behaviour change is created and sustained through the interaction of reflective, regulatory, and reflexive processes (Rhodes, 2021). Reflective processes refer to the consciously deliberated expectation of performing PA. These include instrumental attitude (evaluation of the expected benefits of PA participation), affective attitude (evaluation of the expected pleasure of PA participation), perceived capability (evaluation of one's ability to perform PA), and perceived opportunity (evaluation of the perceived social and environmental factors influencing PA participation). Regulatory processes refer to the behavioural, cognitive, and affective regulation strategies employed to convert PA intention into behaviour. These include planning (development of specific strategies or steps to achieve a goal), monitoring

(tracking one's behaviour or progress towards a goal), and emotion regulation (the ability to manage and respond to emotions in order to engage meaningfully with one's environment). Finally, reflexive processes refer to constructs that develop over time due to repeated action control. These include habits (learned stimulus-response associations) and identity (an individual's self-categorization in a role) (Rhodes, 2021). M-PAC takes a layered approach wherein the decision, or intention, to be more active comes first followed by the translation of those intentions into the desired behaviour through planning and emotion regulation. Lastly, the behaviour is maintained by working it into one's identity and building it into a habit. Research has shown that M-PAC is an effective framework for physical activity behaviour change, demonstrating that reflective, regulatory, and reflexive processes are key to successfully translating intention into behaviour (Rhodes, 2024).

M-PAC's focus on emotion regulation, identity, and goal-driven behaviour can be augmented by combining it with approaches that share similar components, such as Acceptance and Commitment Therapy (ACT), which has been shown to be effective in PA behaviour change (Rhodes et al., 2025). ACT approaches attempt to foster mindfulness with a focus on valued living (Butryn et al., 2011). ACT is a form of behavioural therapy that promotes mindfulness and valued living through its six core processes of present moment awareness, defusion, acceptance, self as context, value identification, and committed action (Butryn et al., 2011). Much like the M-PAC framework, ACT focuses on emotion regulation techniques and creating a strong identity. ACT has been shown to be efficacious in the treatment of a broad range of conditions including anxiety, depression, and substance use (Bai et al., 2020; Coto-Lesmes et al., 2020; Gloster et al., 2020). The literature on ACT approaches and PA is scarce, however, a systematic review and meta-analysis by Rhodes et al. (2025) found that ACT-based approaches increased

both the initiation and maintenance of PA. Mindfulness and values-based interventions provide a promising approach for the promotion of PA. However, there has yet to be any research on their effectiveness on PA promotion applying ACT among new parents. Due to the lack of research in this area, it is important to conduct a feasibility study to determine the acceptability of this type of intervention with this population. Conducting a feasibility study allows us to gauge the interest in an intervention of this type, as well as to determine the overall acceptability of the intervention material and its delivery.

The purpose of this thesis is therefore to test the feasibility and effectiveness of an ACT-based mindfulness and values intervention grounded in the M-PAC theoretical framework for the promotion of PA in new parents. It is hypothesised that the intervention will be accepted by the participants and will be effective in promoting PA. As a feasibility study, the primary outcome of interest is the feasibility and acceptability of the intervention which will be measured through study attrition, program usage, questionnaire, and exit interviews. This study will aim to have a recruitment rate of ≥ 30%, retention rate of ≥ 70%, and engagement rate of ≥ 60%, based on similar research (Cox & Rhodes, 2023; Grant et al., 2024; Hollman et al., 2022; Husband et al., 2019). The secondary outcomes of this study include the interventions effectiveness at increasing PA and values and mindfulness related cognitive factors, such as PA-related experiential acceptance, emotion regulation, identity, and valued living, which will be assessed by questionnaire.

Chapter 2: Literature Review

This chapter will detail the physical and mental health benefits of regular PA, including the recommended weekly amount. The prevalence of PA, both globally and nationally, will be covered, as well as certain groups more at risk of physical inactivity such as new parents. Lastly, the determinants of physical activity in new parents, as well as approaches that target these factors, will be discussed.

2.1 PA and Chronic Disease

There is overwhelming evidence for the numerous physical health benefits of regular PA. Participating in regular PA has been associated with improvements in health outcomes such as hypertension, certain cancers, and type 2 diabetes. Importantly, there is no minimum threshold for these benefits, meaning that any increase in PA is beneficial. The health benefits of regular PA are often more pronounced in individuals moving from inactivity to activity, and the required amount of PA is often below the amount suggested in most international guidelines (Dhuli et al., 2022; Warburton & Bredin, 2017).

Regular PA – minimum 150 minutes of MVPA a week – has been shown to aid in the management of many health conditions. Individuals with type 2 diabetes who participate in PA see improvements in insulin action, glycemic control, and metabolic abnormalities (Kanaley et al., 2022). Regular PA can also improve conditions for individuals with type 1 diabetes (Rhodes et al., 2017). Further, regular PA - both aerobic and resistance training - is associated with lower mortality in individuals with diabetes (Sigal et al., 2018).

Daily PA also aids in the management of cardiovascular disease by improving myocardial function, lowering systolic blood pressure, and lowering blood catecholamine levels (E. Anderson & Durstine, 2019; Perry et al., 2023). Further evidence for the effect of PA on cardiovascular health was demonstrated in a systematic review that found that participating in a minimum of 150 minutes of moderate-intensity PA, 75 minutes of vigorous-intensity PA, or an equivalent combination per week is associated with reductions in coronary heart disease, stroke, and heart failure risk that amount to approximately 75% of the maximum benefit attainable through PA (Kraus et al., 2019).

Regular PA - specifically weight-bearing exercises and resistance training - also provides benefits to bone health by increasing bone mineral density (Kitsuda et al., 2021). A recent meta-analysis examining the effects of PA on bone health found that aerobic, resistance, and combined training all significantly improve bone mineral density and could therefore play a role in the prevention of osteoporosis (Hejazi et al., 2025).

A systematic review examined the effects of PA on cancer prevention and survival outcomes (McTiernan et al., 2019). The review found that increased PA was associated with a reduced risk of cancer by up to 20% for cancers such as bladder, breast, and colon. Moreover, PA was associated with up to a 50% reduction in all-cause and cancer-specific mortality (McTiernan et al., 2019). These findings are supported by more recent research showing that as activity level increases, risk of cancer decreases (Diao et al., 2023). It's clear from the research that PA provides immense benefits to physical health, but what about its effect on mental health?

2.2 PA and Mental Health

Participating in consistent PA has been shown to provide numerous mental health benefits (Mahindru et al., 2023). Research has shown that regular PA can decrease both the

frequency and the severity of depression (Mikkelsen et al., 2017). Meeting the PA guidelines of 150 minutes of MVPA per week was associated with a 25% reduction in depression (Pearce et al., 2022). Further research has supported the association between increased levels of PA and decreased incidence and severity of depressive symptoms (Callow et al., 2020; Cunningham et al., 2020).

Individuals who are more active may also experience improved self-esteem. Research conducted with middle-aged women found that higher levels of PA were associated with higher levels of self-esteem (Dąbrowska-Galas & Dąbrowska, 2021). A recent systematic review examining the effects of PA on self-esteem in school-aged children showed that PA interventions improved self-esteem, along with quality of life and body image (Hale et al., 2023).

A meta-analysis conducted by Zamorano-Garcia et al. (2023) showed significant positive effects of PA on self-concept. Specifically, the study found that PA was associated with improved self-perceived physical appearance, self-perceived sport competence, self-perceived physical fitness, physical self-concept, and global self-concept. Regular PA can aid in the development of a positive self-concept, which can lead to improved psychological well-being (Fernández-Bustos et al., 2019).

Research has shown that lower levels of PA are associated with lower levels of mental well-being, with individuals who experience a decrease in PA levels also experiencing decreases in mental health and well-being (Faulkner et al., 2021). Conversely, participating in greater levels of PA is associated with improved well-being and overall mental health (Symanzik et al., 2022). Engaging in any amount of PA provides mental health benefits, as individuals reporting no PA in the previous week had lower well-being than those reporting any other amount of PA (M. A. Harris, 2018).

Research has consistently shown that participating in regular PA provides numerous physical and mental health benefits, including management of cardiovascular disease, cancer prevention, and alleviation of depressive symptoms (Diao et al., 2023; Pearce et al., 2022; Perry et al., 2023). Because of these benefits, it's important to understand what percentage of the population are meeting the recommended PA guidelines, and what groups are at an increased risk of physical inactivity.

2.3 PA Prevalence

Despite the many well-known benefits of regular PA, physical inactivity is still a large global problem with many people struggling to be physically active (Rhodes, 2024). 31.3% of the global population does not meet the World Health Organization (WHO) guidelines of 150 minutes of MVPA per week, with women being slightly less active than men on average (Guthold et al., 2018; Strain et al., 2024).

In Canada, PA prevalence is even lower. According to Strain et al. (2024), 37.2% of Canadians do not meet the Canadian guidelines of 150 minutes of MVPA a week (Ross et al., 2020). Additionally, the Canadian guidelines suggest no more than 8 hours of sedentary time per day. However, Canadian adults average 9.8 hours of sedentary time per day (Government of Canada, 2022). Some factors influencing PA participation include race, gender, and socioeconomic status (SES). Higher SES is associated with higher PA participation, and males and Caucasians are more likely to be physically active (Armstrong et al., 2018; O'Donoghue et al., 2018). Additionally, individuals living in areas with greater income inequality are more likely to be physically inactive, regardless of the income level of their country (SFM et al., 2020).

The global and national research on PA prevalence clearly demonstrates that many people struggle to participate in sufficient PA. However, there are certain demographics of the population that are at an increased risk of being physically inactive. For instance, women are more likely to be physically inactive compared to men, and adults aged 60 and older are more likely to be physically inactive compared to those younger (Strain et al., 2024).

2.4 PA and Parents of Young Children

Parents are another group that are at risk of being physically inactive. Specifically, parents with children 5 years old or younger (Abbasi & van den Akker, 2015; Rhodes & Quinlan, 2015). Parents with a youngest child 6 years of age or older are less likely to struggle with PA (Palomäki et al., 2023). Therefore, it is during the transition and early years of parenthood that individuals are most at risk of physical inactivity (Saxbe et al., 2018). As mentioned, women are 5 percentage points more likely to be physically inactive compared to men (Strain et al., 2024). This difference is exacerbated in early parenthood where new mothers experience decreases in MVPA at the start of pregnancy and continue to experience lower levels post-pregnancy, with MVPA rarely returning to pre-pregnancy levels (Abbasi & van den Akker, 2015).

While new mothers are more likely to be less active, new fathers are also at risk of physical inactivity during early parenthood. Less research has focused on new fathers compared to new mothers. However, during the first few years of parenthood, new fathers are still more likely to experience decreases in MVPA compared to non-fathers (Bellows-Riecken & Rhodes, 2008). Pot and Keizer (2016) provided further evidence that fathers, especially those of young children, participate in less MVPA than non-fathers.

During early parenthood, parents see nearly a three hour decrease in weekly PA compared to their childless counterparts (Hull et al., 2010). Parent's PA rarely returns to their pre-birth levels (Perales et al., 2015). Research has shown that couples expecting a child experience a significant decrease in MVPA at birth, and parents expecting a second child experience further decreases (Rhodes et al., 2014a). In fact, research has found that parents with more children and higher parental stress are more likely to be physically inactive (Goldberg et al., 2019).

Research has demonstrated that parents engage in less MVPA than non-parents. Consistent with the larger population, parents with higher SES are more likely to be physically active than those with medium or low SES (Mesquita et al., 2023). While parents in general are less active than non-parents, the largest decrease in MVPA is seen in early parenthood with children under the age of 6 (Gaston et al., 2014; Palomäki et al., 2023). While the exact reasons for this are unknown, one explanation could be that children begin school around the age of six, alleviating some of the workload from parents. Given the drastic need to increase PA in new parents, it's important to first understand the determinants and correlates of PA in this demographic.

2.5 Determinants of PA in Parenthood

Childbirth and the transition to parenthood bring with them a major lifestyle change and many new stressors and obstacles to PA (Deave et al., 2008; Lang et al., 2024). Parent's attitudes towards PA and their intentions to be physically active do not tend to change during this transition. However, individuals transitioning into parenthood do experience a decrease in perceived behavioural control (PBC) (Rhodes et al., 2014b). PBC refers to an individual's

perception of the difficulty of performing a certain behaviour (Ajzen, 1991). Therefore, during the transition to parenthood, individuals begin to perceive PA behaviours as more difficult.

PBC is an indirect correlate of PA, most commonly affecting PA behaviour through intentions (Rhodes et al., 2022). The decrease in PBC seen in early parenthood tends to lead to fewer intentions for PA (Rhodes et al., 2014b). Intentions play a key role in PA behaviour, with mothers who intend to exercise being more likely to follow through than those who do not intend to exercise (Rhodes, Beauchamp, et al., 2021). However, simply having the intention to exercise often does not translate into PA behaviours (Rhodes, 2024).

Research has shown that nearly half of individuals who have the intention to exercise are not successful in translating that intention into behaviour (Rhodes, 2024). This disparity is called the intention-behaviour gap. Intentions have long been thought to be the proximal antecedent to PA behaviour, however the research has demonstrated that there is more involved in translating intentions into behaviour (Rhodes & de Bruijn, 2013). Translating intentions into behaviour is dependent on several factors, including self-efficacy, habit, and identity (Grant et al., 2022).

Affect is another factor that has been shown to affect intention follow-through (Stevens et al., 2020). Individuals transitioning into parenthood experience many affective challenges such as fatigue and stress, as well as increased workload and responsibilities (Deave et al., 2008; Sanders et al., 2022). Due to these additional stressors of parenthood, strategies that would typically increase intention follow-through (e.g. planning) may instead widen the intention-behaviour gap by adding to parents' workload (Rhodes et al., 2019).

Incidental affect, which refers to the emotions and feelings one has throughout the day, plays a large role in PA behaviour (Stevens et al., 2020). Parents often attribute the daily fatigue involved with childcare as one of the major reasons for their decreased PA (Hull et al., 2015).

Fatigue increases drastically with the birth of a child and remains high afterwards, in large part due to significant sleep disruption. This fatigue is associated with increased stress, depression, and poorer overall sleep quality (Loutzenhiser et al., 2015; Przybyła-Basista et al., 2025).

Early parenthood brings with it numerous new stressors, responsibilities, and a perceived loss of control (Deave et al., 2008; Rhodes et al., 2014b). These factors contribute to the drastic decline in MVPA seen at the onset of parenthood (Abbasi & van den Akker, 2015; Palomäki et al., 2023; Rhodes & Quinlan, 2015). A successful intervention aimed at promoting PA engagement in parents should therefore address these affective challenges.

2.6 Emotion Regulation and Mindfulness

Emotion regulation refers to the ability to effectively manage and respond to emotional experiences in a way that allows the individual to engage with their environment in a meaningful way (Fancourt et al., 2019). It involves reacting and adapting to internal experiences in the moment and includes strategies such as cognitive reappraisal (e.g., reinterpreting or reframing), response modulation (e.g., changing how an emotion is expressed, suppression), and attentional deployment (e.g., refocusing or changing focus) (Gross, 2014). Emotion regulation strategies like these may be beneficial for new parents by allowing them to redirect their attention towards their desired PA behaviours and their PA intentions during times of high stress and workload (Pears & Sutton, 2021; Rhodes et al., 2025).

A recent systematic review and meta-analysis conducted by Rhodes et al. (2025) examined the effects of emotion regulation on physical activity in adult populations. The study found that emotion regulation interventions produced a small but significant effect on PA. The emotion regulation strategies included mindfulness-based interventions, self-compassion-based interventions, and acceptance-based interventions. The findings from this study suggest that

emotion regulation strategies could be a key component of successful PA behaviour change interventions.

Mindfulness and values are two forms of emotion regulation that could be of use to new parents. Mindfulness refers to the ability to pay attention to and be aware of the present moment without judgement (Schuman-Olivier et al., 2020). Interventions based on mindfulness have been shown to increase PA levels and are most effective when the mindfulness practice is specific to PA (Schneider et al., 2019). For example, pairing exercise with PA-specific mindfulness recordings that encourage awareness and acceptance of thoughts and feelings during activity led to significant improvements in both subjective and objective PA outcomes when compared with an active control (Sala et al., 2021).

MBIs have been shown to be an effective approach for improving emotion regulation, partially because they help develop an accepting awareness of the present moment (Huang et al., 2019). This is particularly beneficial to new parents as they face increased affective challenges during early parenthood. MBIs have been shown to improve parents' ability to cope with the multitude of stressors involved with parenthood, and subsequently have improved parental PA (Millstein et al., 2020; Sala et al., 2021; Zhang et al., 2021).

MBIs also aid in the development of attentional control, which is the ability to focus on relevant or important tasks or stimuli (Luo et al., 2017). The development of this skill may be beneficial to parents as it allows them to continually refocus their attention onto their PA intentions. Often, parent's intentions are not translated into behaviour due to decreased PBC and self-efficacy (Grant et al., 2022; Rhodes et al., 2014b). Importantly, mindfulness is associated with increased self-efficacy (Fallah, 2017; Hanley et al., 2015; Luberto et al., 2014; Sharma &

Kumra, 2022). Ultimately, developing mindfulness in new parents may improve their ability to cope with the daily affective challenges they face and refocus on their PA intentions.

2.7 Values and PA

Values – or valued living – are a form of emotion regulation that focus on individual's values to redirect attention to when facing struggles (Fresco et al., 2013). Valued living entails identifying meaningful values (i.e., hardworking, trustworthy, friendly) and living in a way that fulfills and is in line with those values (Hayes et al., 1999). Research has shown that individuals who are more aware of their PA-related values are more likely to make choices that are in line with those values, which in turn increases PA participation (Levin et al., 2017).

Valued living also serves as a form of long-lasting motivation and as a way to strengthen intentions (Butryn et al., 2011; Thelken & de Jong, 2020). Individuals who are more committed to their values are more likely to have greater PA levels (Stapleton et al., 2020). Because values are a desired quality of ongoing behavioural events, they can never be completed or obtained, unlike goals (Hayes et al., 1999). Therefore, they provide a strong, long-lasting form of motivation that lies much closer to the intrinsic end of the spectrum (Ryan & Deci, 2000).

2.8 Combined Approaches

The M-PAC framework takes a practical approach to PA behaviour change influenced by social cognitive theories and attempts to bridge the intention-behaviour gap (Rhodes, 2017, 2021). M-PAC separates intentions into intention formation and intention translation, often referred to as action control. The M-PAC framework posits that successful PA behaviour change, through the process of intention formation, adoption, and maintenance, is a product of three overlapping and interactive processes. *Reflective processes* occur during intention formation. Initially these include deliberative evaluations such as an individual's perceived capability to be

physically active and their instrumental attitude towards PA (expected benefits from performing PA). An individual's perceived opportunity for PA and their affective judgements of PA (expected pleasure from performing PA) affect intention formation. The latter two processes also predict the adoption of intention into behaviour. *Regulatory processes* occur during the adoption and maintenance of PA behaviour. During this phase, behavioural regulation is used to adopt and maintain PA behaviour. This includes strategies such as emotion regulation, planning, goals, and monitoring. Once a PA behaviour is adopted, these strategies influence its maintenance. *Reflexive processes* occur during the maintenance phase when PA behaviour becomes habitual. During the maintenance phase, the PA behaviour becomes a habit through long-term repetition and becomes incorporated into the individual's identity and self-concept. As evidenced by the descriptions, M-PAC suggests that this is not entirely a linear progression, but rather that these processes continuously interact with each other to maintain PA.

In practice, research has supported the framework and its proposed processes. A recent review found that, of the eleven studies examining action control as a consequence of reflective, regulatory, and reflexive processes, seven supported significant effects of each process. The remaining four studies supported significant effects of regulatory and reflexive processes (Rhodes, La, et al., 2021). More recent research continues to support the effectiveness of M-PAC as a framework to promote PA, especially the regulatory and reflexive processes (Grant et al., 2024; Hartson et al., 2024). The M-PAC framework has also been shown to be effect in family and child PA promotion (Rhodes, Quinlan, et al., 2021).

While M-PAC has been used frequently in family interventions, there are fewer studies examining its impact on solely parent PA. Most research with M-PAC, and the PA field generally, focuses on the family as a whole or the parent in relation to the child. However, a

feasibility study conducted by Hollman et al. (2022) using a web-based intervention informed by M-PAC to improve PA in new mothers found that those in the intervention group trended toward improved PA. Additionally, M-PAC variables have demonstrated effectiveness in predicting PA behaviour in new parents (Rhodes, Beauchamp, et al., 2021). Similar to research with other populations, the regulatory and reflexive processes appear to be more consistently linked to PA outcomes than the reflective processes.

ACT takes a similar approach to the M-PAC framework in creating behaviour change. Where the M-PAC framework uses emotion regulation and identity to create behaviour change, ACT combines mindfulness skills and techniques with values and value-directed living to change PA behaviours (Butryn et al., 2011). ACT is a third-wave behavioural therapy built around relational frame theory (RFT). RFT is a theory of language and cognition that proposes people learn to relate to stimuli in context-dependent ways called relational framing (e.g. “bigger than”, “better than”, etc.). ACT draws on RFT to explain how language can cause psychological suffering through rigid or unhelpful thought patterns (Hayes, 2016).

ACT is comprised of six core processes. *Acceptance* involves actively allowing internal experiences, such as emotions, to occur without attempting to change their frequency or form. In ACT, the opposite of acceptance is experiential avoidance in which an individual struggles with and attempts to change internal events. *Cognitive defusion* involves strategies to change the way we relate to our thoughts. Defusion attempts to remind us that our thoughts are not good or bad, right or wrong, true or false, but rather internal experiences that can be helpful or unhelpful. *Present moment awareness* is the act of being in contact, non-judgmentally, with psychological and environmental events as they occur. *Self as context* attempts to create a more flexible, contextual sense of self. It suggests that identity is not rigid or fixed but rather can change

depending on the situation. *Values* are chosen qualities that drive behaviour and decisions. Values guide how we live but can never be obtained or achieved like a goal. *Committed action* involves setting goals that are in line with chosen values. Together, these six core processes cultivate *psychological flexibility* – the capacity to act in accordance with one's values while remaining open and in contact with the present moment (Hayes et al., 2006).

While ACT has a proven history of being effective in clinical settings, its use in PA promotion is a relatively recent development (Beygi et al., 2023; Martinez-Calderon et al., 2024). However, recent systematic reviews and meta-analyses have shown that ACT is an effective approach to PA promotion (Pears & Sutton, 2021; Rhodes et al., 2025). An ACT-based smartphone app intervention was found to increase PA behaviours compared to control (Levin et al., 2017). A study using an at-home ACT-based DVD intervention found similar results, with participants in the ACT group significantly improving their PA levels (Moffitt & Mohr, 2015). More recent research conducted on early-career professionals implemented an ACT-based, M-PAC informed intervention to promote PA (Grant et al., 2024). The study found that those in the intervention group improved MVPA as well as ACT and M-PAC constructs such as emotion regulation, identity, and valued living. Despite the growing use of ACT in PA promotion research, to date there has been no research targeting parents of young children.

Regular PA delivers a host of both physical and mental health benefits. However, a large majority of the population does not engage in sufficient PA. This is especially true for new parents, who face decreased PBC and an increase in affective challenges which leads to difficulty following through on PA intentions. Behaviour change theories and frameworks such as ACT and M-PAC present a promising solution to this problem as they specifically target affective challenges, motivation, and intentional follow-through. Utilizing these two approaches

in a PA intervention for new parents could prove to be beneficial in building our knowledge on PA promotion in this population.

Chapter 3: Methods

Research Design

This study was a feasibility randomized controlled trial with a pretest-posttest research design. The author received ethics approval from the University of Victoria Human Research Ethics Board and followed the CONSORT guidelines for pilot and feasibility trials (Eldridge et al., 2016). Participants were randomized to either the intervention condition or the control condition using a simple 1:1 randomization generated from random.org. Measurement took place at baseline (pre-randomisation) and post-intervention (week 6). Both primary and secondary outcomes were measured using questionnaires, with a qualitative interview post-intervention for the intervention condition.

Participants

Eligible participants had a child under the age of six, self-reported insufficient PA according to the Canadian PA guidelines - assessed using a modified Godin Leisure-Time Exercise Questionnaire (GLTEQ) - indicated an interest in becoming more active, and had access to a mobile phone (Courneya et al., 2004; Godin & Shephard, 1985; Ross et al., 2020). The age range of five years old and under was chosen because parents with children in this age range have been shown to be at the most risk of physical inactivity (Palomäki et al., 2023). Participants were first recruited from the Capital Regional District of Victoria, British Columbia before expanding recruitment to the entire province of British Columbia. Recruitment was done through the Behavioural Medicine (BMED) Lab's social media accounts, using paid Meta ads, as well as

through posters placed throughout Victoria. Additionally, snowball recruitment was used wherein enrolled participants were given the option to pass along study information to friends and family that might be interested in participating. The consent form can be found in Appendix A.

Intervention Condition

App Development. The intervention material for this study was informed by the web-based ACT intervention used in the feasibility study by Grant et al. (2024). The authors used a web-based intervention informed by ACT and M-PAC, which included lessons, short podcasts, and worksheets. The study showed acceptable feasibility measures as well as positive secondary outcomes and was therefore deemed appropriate to modify the content for this study. The web content was used to create the worksheets for this study and to help guide the structure of app modules.

After creation of the app modules and worksheets, a proof-of-concept (POC) study was conducted to refine the app before the main study began. A small focus group, consisting of parents of young children from the BMED lab and Digital Health lab (DHL) at UVic, was recruited to provide feedback on the app and worksheets. The researcher emailed members of the BMED lab and DHL who had young children to invite them to participate in a focus group to refine the app. Two individuals expressed interest and signed consent forms to participate in the POC. The focus group participants were given access to the app and the worksheets and provided with a short questionnaire to provide feedback on the app and worksheets. For each module, the questionnaire asked "*what do you think of lesson x? Are there any further changes you would make?"*. Other questions included "*how would you feel about 1-2 check-ins to support the learning of the material?"*, "*what do you think about the worksheet and practice material? Are*

there any changes you would make?", and "*what are your thoughts on the order of the modules?"*. Responses from the questionnaire were read through and the intervention material was adjusted according to the recommendations. The overall feedback from the POC was positive. The main recommendations were to add more content concerning how to use and navigate through the app, grammar corrections and recommended changes to wording, and to tailor it more to parents by adding in more references to parenting and parent specific examples of PA. An overview of the changes made can be found in Table 1.

Table 1

Overview of App and Worksheet Development

Original Content	**Initial Changes Made**	**Changes Made After POC**
Content concerning PA benefits and recommendations was based on previous research on the topic (E. Anderson & Durstine, 2019; Jacob et al., 2020; McTiernan et al., 2019; Mikkelsen et al., 2017; Rhodes et al., 2017; Ross et al., 2020; Zamani Sani et al., 2016)	N/A	- Parent-specific PA benefits were added - Parent-specific examples of PA were added
M-PAC worksheets (*building confidence, action planning*) were based on Grant et al. (2024). Material on planning, self-monitoring, and enjoyment of PA was based on previous research on the topics (Mistry et al., 2015; Normand, 2008; D. S. Teixeira et al., 2022)	- Wording of worksheets was changed to reference parents - Module content was adapted to reference parents	- More detail was added to the action planning and social support slides to improve clarity - More parent-specific examples were added
Values worksheets were based on Grant et al. (2024) and Harris (2019). Module content was based on previous research (Hayes et al., 2022; Levin et al., 2017)	- Values content was linked to PA - Material was changed to target parents	- Examples of parent-specific values were added

Committed Action worksheets were based on Grant et al. (2024) and Hayes (2019). S.M.A.R.T. goal content was based on Doran (1981)	- References to parents were added in the worksheets - Parent-specific goal examples were added	- The slide titled "Dead Person's Goal" was changed to "Passive Goal"
Mindfulness worksheets were based on work by Harris (2019) and Hayes (2019). Module content was based on previous research on the topic (Burg et al., 2017; Huang et al., 2019; Lochner, 2016; Rhodes et al., 2014b; Stevens et al., 2020)	- Worksheets were changed to be PA-specific	- Grammar was corrected - The language in the slides on incidental affect was made more informal
Identity worksheets and modules were based Rhodes et al. (2016), Hayes (2019), and Harris (2019)	- The worksheet and module content were modified to reference parents	- Grammar was fixed and additional parent examples were added

App Layout and Content. The final app consisted of seven modules and six worksheets. Each module, excluding the first, was accompanied by a worksheet and contained 1) an overview of the previous module, 2) three multiple choice questions pertaining to the previous module's content, 3) a preview of the current module, 4) the current module's content, 5) directions to the corresponding worksheet, and 6) a goal check-in where the participants could set a PA goal based on the module content. The modules contained both text and videos and were estimated to take 20-30 minutes to complete, including worksheets. An overview of the app and worksheet content can be found in Table 2 with the BCTs used in each module (Michie et al., 2013). All worksheets can be found in Appendix B.

Module one was titled "Introduction: Program Overview and Physical Activity Basics". This module contained information on the layout of the app and what to expect from the intervention, PA information including benefits, safety, and recommended amount, and a prompt to set an initial PA goal for the study. This module contained the reflective M-PAC process and

the BCTs *information about antecedents* (4.2) and *information about health consequences* (5.1). *Module two* was titled "Building Motivation" and contained modules on self-efficacy, social support, how to choose enjoyable activities, action and coping planning, and self-monitoring. The worksheets for this module included a brainstorming activity for overcoming barriers to PA, a brainstorming activity to choose enjoyable activities, an action planning worksheet, and a coping planning worksheet. This module contained the regulatory M-PAC process and the BCTs *problem solving* (1.2)*, action planning* (1.4)*, self-monitoring of behaviour* (2.3)*,* and *social support* (3.1). *Module three* was titled "Values" and contained an overview of ACT and information on what values are, how they differ from goals, how they can motivate you, and how to choose your own values. The worksheets included an exercise to identify values related to PA and the choice point – a tool that helps you decide if your decisions are in line with your values or not. This module contained the reflexive M-PAC process, the ACT construct of values, and the BCT *valued self-identity* (13.4). *Module four* was title "Committed Action" and contained information of goal setting – including S.M.A.R.T. goals and passive goals, how to adjust goals, and how to stay consistent. The worksheets included a S.M.A.R.T. goal template and a practice for incorporating new behaviours into existing routines. This module contained the regulatory M-PAC process, the ACT construct committed action, and the BCTs *goal setting (behaviour)* (1.1), *problem solving* (1.2), *action planning* (1.4), and *commitment* (1.9). *Module five* was titled "Mindfulness and Acceptance" and contained information on the difference between emotions, mood, and affect, incidental affect, mindfulness, cognitive defusion, and acceptance. The worksheets included a defusion practice, an emotional acceptance practice, and a mindfulness practice meant to bring awareness to the present. This module contained the regulatory M-PAC process, the ACT constructs cognitive defusion, acceptance, and present moment awareness, and

the BCT *reduce negative emotions* (11.2). *Module six* was titled "Physical Activity Identity" and contained content on identity – including the traditional view of identity and self as context, PA and identity, and grit. The worksheet for this module was an exercise in which you challenge the rigid and inflexible sense of self. This module contained the reflexive M-PAC process, the ACT construct self as context, and the BCT *incompatible behaviour* (13.3). *Module seven* was titled "Putting It All Together" and contained a recap of all the previous content, and advice on how to combine everything, how to deal with obstacles, and the importance of practicing the intervention material. The worksheet for this module was a toolkit template that the participants could fill out with their favourite worksheet exercises and reference when needed. All M-PAC processes were involved in this module.

The first module was accessible to participants immediately. Subsequent modules were released every four days and were only accessible once the previous module was completed. Once completed, all module material remained accessible to the participants for the remainder of the study, allowing them to reference it throughout. In total, the study lasted 6 weeks. There was a check-in meeting at the 3-week mark between the participant and the researcher. The purpose of the check-in meeting was to assist the participant with any topics they were having difficulty with, as well as to assess their progress with the intervention material. The semi-structured check-in script can be found in Appendix C. Along with the intervention material, the app also sent periodic reminders via push notifications concerning values. Examples of the reminders included "*Have your recent choices moved you closer or further from your physical activity goals? What's one towards move you could make today?*" and "*Are you currently living in line with your physical activity values? What's one thing you could do today that would support your goals?*". After the 4-week mark, the push notification "*Consider taking some time to review the*

modules and worksheets for a refresher. Remember to keep applying the concepts in your daily life!" was sent periodically.

Table 2

Overview of Mobile App Intervention Content

Lesson	Title	Content	Worksheet	M-PAC Process	ACT Constructs/BCTs
1	Introduction: program overview and physical activity basics	- Overview of the program - The benefits of regular PA - PA guidelines - Define ACT	- N/A	- Reflective	4.2 – Information about antecedents 5.1 – Information about health consequences
2	Building Motivation	- Self-efficacy - How to choose enjoyable activities - Action and coping planning - How to monitor behaviour	- 'Building confidence' - 'Enjoyable activities' - 'Action planning' - 'Coping planning'	- Regulatory	1.2 – Problem solving 1.4 – Action planning 2.3 – Self-monitoring of behaviour 3.1 – Social support
3	Values	- What are values - How are they different from goal - Common values - Identifying values	- 'Writing your values' - 'Choice point'	- Reflexive	N/A – Values 13.4 – Valued self-identity
4	Committed Action	- Goal setting - Problem solving - Planning	- 'S.M.A.R.T. goals' - 'Working new habits into old routines'	- Regulatory	N/A – Committed action 1.1 – Goal setting (behaviour) 1.2 – Problem solving 1.4 – Action planning 1.9 – Commitment
5	Mindfulness and Acceptance	- Incidental affect	- 'Give your mind a name'	- Regulatory	N/A – Acceptance N/A – Cognitive defusion

		- Common psychological barriers - Overview of mindfulness - Overview of acceptance - Dealing with difficult thoughts and emotions	- 'Expansion' - 'Notice 5 things'				N/A – Present moment awareness 11.2 – Reduce negative emotions
6	Physical Activity Identity	- Identity - Incorporating PA into your self-concept	- 'I am, I am not'	-	Reflexive		N/A – Self as context 13.3 – Incompatible behaviour
7	Putting it all together	- Recap of program	- 'My Toolkit'	-	Reflective, regulatory, reflexive		N/A

Control Condition

Participants assigned to the control condition were given a copy of the Canadian 24-hour movement guidelines for 18-64 year olds and were asked to try to engage in 150 minutes of MVPA per week. The guidelines cover the general health benefits of PA as well as recommendations for PA, sleep, and sedentary time. For PA, the guidelines recommend an accumulation of at least 150 minutes of MVPA per week, muscle strengthening activities at least twice a week, and several hours of light PA per day. They also recommend 7-9 hours of sleep a night and no more than 8 hours of sedentary time per day. The control group was given no further guidance.

Measures

Primary Outcome Measures: Feasibility

Recruitment and Retention. Recruitment rate was calculated by dividing the number of participants scheduled for a baseline meeting by the number of individuals who expressed initial interest in participating in the study. Retention rate was calculated by dividing the number of

participants who completed the follow-up measures by the number of participants who completed the baseline measures.

Satisfaction and Usability. Intervention satisfaction was measured using the mHealth Satisfaction Questionnaire (MSQ) as well as qualitative exit interviews (Melin et al., 2020). The MSQ is a 12-item questionnaire designed to measure user satisfaction of mobile health apps. The item "*it was too time consuming"* was inadvertently omitted during data collection, and therefore a modified 11-item version was used for analysis. The modified version demonstrated acceptable reliability ($\alpha = 0.91$). The questionnaire uses a 5-point Likert scale with responses ranging from *strongly disagree* to *strongly agree.* Nine items are positively stated, and two items are negatively stated, with the latter being reversed in analysis (Melin et al., 2020). Examples of items include "*it was a disturbance", "the introduction of how to use it was sufficient",* and *"it has motivated me to change my lifestyle habits"*. The exit interviews were semi-structured and took place over zoom. They allowed the participant to elaborate on their experiences with the app and intervention material. Example questions include "*tell me how you felt about the study? What was your favourite/least favourite part?"* and "*what would you change about the study? This could include content of the program or any of the study methods*." The exit interview questions can be found in full in Appendix C. Usability was measured using a modified version the mHealth App Usability Questionnaire (MAUQ) which demonstrated acceptable reliability $\alpha = 0.94$. The modified MAUQ is an 18-item questionnaire designed to measure the acceptability and usability of mobile health apps. The MAUQ uses a 7-point Likert scale with responses ranging from *strongly disagree* to *strongly agree* (Zhou et al., 2019). Example items include "*the app was easy to use", "the navigation was consistent when moving between screens",* and "*the app would be useful for my health and well-being."* All questionnaires for primary and

secondary outcomes can be found in Appendix D. The exit interviews were also used to assess app and worksheet usability, as well as to identify areas for improvement.

App Usage. Average time spent on app (in minutes) per week and per module was used to measure app usage. Additionally, app engagement was calculated by the average number of modules completed per participant.

Secondary Outcome Measures

Physical Activity. Subjective weekly MVPA was measured using a modified Godin Leisure-Time Exercise Questionnaire (Courneya et al., 2004; Godin & Shephard, 1985). The modified GLTEQ asks respondents to report the frequency and duration of light, moderate, and strenuous PA they participated in over the previous week. The moderate and strenuous durations are added and multiplied by their frequencies to determine overall MVPA over the past week.

M-PAC Constructs. A series of questionnaires were used to measure the M-PAC constructs. *Affective attitude towards physical activity* ($\alpha = 0.90$) is a 3-item questionnaire with a 7-point Likert scale ranging from *extremely disagree* to *extremely agree.* The items are "*over the next 6 weeks, engaging in physical activity on a regular basis would be: enjoyable/exciting/pleasant"* (Rhodes & Courneya, 2003). *Instrumental attitude towards physical activity* ($\alpha = 0.84$) is a 3-item questionnaire with a 7-point Likert scale ranging from *extremely disagree* to *extremely agree.* The items are "*over the next 6 weeks, engaging in physical activity on a regular basis would be: wise/beneficial/useful"* (Rhodes & Courneya, 2003). *Perceived capability over physical activity* ($\alpha = 0.72$) is 3-item questionnaire with a 5-point Likert scale ranging from *strongly disagree* to *strongly agree.* Items include "*I possess the skills to do regular physical activity over the next 6 weeks if I wanted to"* (Burrell et al., 2018; Rhodes et al., 2006). *Perceived opportunity for physical activity* is a 3-item questionnaire with a

5-point Likert scale ranging from *strongly disagree* to *strongly agree*. After reliability testing, item three was removed from the measure (α = 0.72). Item one is positively stated (*If I really wanted to do regular physical activity over the next 6 weeks, I would have the chance to do so*) and item two is negatively stated (*I lack the opportunity to do regular physical activity over the next 6 weeks, even if I were really motivated to do so*), with the latter being reversed in analysis (Burrell et al., 2018; Rhodes et al., 2006). *Habit of physical activity* (α = 0.89) is a 4-item questionnaire, adapted from the habit measure by Verplanken and Orbell (2003), with a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. Items include "*physical activity is something: I do automatically/I do without thinking"* (Gardner et al., 2012). *Physical activity identity* (α = 0.87) is a 3-item questionnaire, adapted from the identity measure by Anderson and Cychosz (1994), with a 5-point Likert scale ranging from *strongly disagree* to *strongly agree.* Items include "*I consider myself someone who does regular physical activity"* and "*Others see me as someone who does physical activity regularly"* (Sparks & Shepherd, 1992; Wilson & Muon, 2008).

PA-Related Experiential Acceptance*.* The Physical Activity Acceptance Questionnaire (PAAQ) was used to measure participant's acceptance of PA-related internal experiences. The PAAQ demonstrated acceptable reliability (α = 0.71). The PAAQ is a 10-item questionnaire with a 7-point Likert scale ranging from *seldom true* to *always true*. Items include "*I need to concentrate on getting rid of my urges to stop exercising or put off exercise"* and *"I avoid exercising if it is going to make me feel physically uncomfortable, bored, or pressed for time"* (Butryn et al., 2015).

Emotion Regulation/Defusion*.* The Drexel Defusion Scale (DDS) was used to measure the extent to which participants were able to defuse from negative thoughts and feelings. The

DDS demonstrated acceptable reliability ($\alpha = 0.85$). The DDS is a 10-item questionnaire that uses a 6-point Likert scale ranging from *not at all* to *very much*. Items include *"You become angry when someone takes your place in a long line. To what extent would you normally be able to defuse from feelings of anger?"* and *"Imagine you are having a thought such as ''no one likes me.'' To what extent would you normally be able to defuse from negative thoughts about yourself?"* (Forman et al., 2012).

Valued Living. The Valuing Questionnaire (VQ) was used to measure the extent to which participants were living in line with their chosen values. The VQ demonstrated acceptable reliability ($\alpha = 0.86$) The VQ is a 10-item questionnaire that uses a 7-point Likert scale ranging from *not at all true* to *completely true*. Five items assess progress values (the extent to which one is living in line with their values) and five items assess obstruction values (the extent to which disruptions got in the way of valued living). Higher progress scores and lower obstruction scores are more indicative of psychological health. Items include *"I was proud about how I lived my life", "When things didn't go according to plan, I gave up easily",* and *"I worked toward my goals even if I didn't feel motivated to"* (Smout et al., 2014).

Procedures

Participants for this study were primarily recruited through online advertisements, with recruitment also taking place through posters and snowball recruitment. Specifically, paid Meta advertisements were posted on the BMED labs Facebook and Instagram accounts. In-person recruitment was conducted to a lesser extent by putting up study posters around Victoria. Lastly, enrolled participants were given the option to pass study information along to those they thought might be interested. The snowball recruitment was entirely voluntary. Recruitment took place from January 2025 to May 2025. Participants were actively enrolled in the study from January

2025 to July 2025. Interested individuals filled out a contact form attached to the Meta ad and the author reached out via email with study details and to set up a Zoom meeting to discuss the study details and assess eligibility. In the case of participants recruited through posters and snowball, interested individuals reached out to the author via email. All recruitment and screening call material can be found in Appendices E and F, respectively. During the Zoom call, the author confirmed the individual had at least one child under the age of six, had access to a smartphone, was not meeting the PA guidelines assessed with the modified GLTEQ, and was fit to increase PA assessed by the Get Active Questionnaire (GAQ). Once eligibility was determined, the author discussed study details and sent the individual the consent form if they were interested. Once the author received the signed consent form, the participant was assigned their study ID and sent the baseline questionnaire consisting of the modified GLTEQ, M-PAC battery, PAAQ, DDS, and VQ. Prior to recruitment, the author randomized all study IDs using a simple 1:1 randomization generated from random.org. Participants were assigned IDs in the order that they completed the consent forms. Once the participant completed the baseline questionnaire, they were sent an email informing them of their condition. The participants assigned to the intervention group were given instructions on how to access the app and were given PDF copies of the worksheets. Participants app accounts were set up by the author. Participants assigned to the control group were given a copy of the Canadian 24-Hour Movement Guidelines and asked to follow them for the next 6 weeks. They were informed that after 6 weeks they would receive access to the intervention app. At the 3-week mark, participants in the intervention group were sent an email to set up a check-in meeting to help with any difficulties concerning the app or intervention material. At the 6-week follow up, participants were emailed the follow-up questionnaire consisting of the modified GLTEQ, M-PAC battery, PAAQ, DDS, and VQ.

Additionally, participants in the intervention condition completed the MSQ and MAUQ. Once the participants completed the follow-up questionnaire, those in the intervention group were sent an email to schedule a Zoom meeting for the exit interview and those in the control group were sent an email with the worksheets and instructions on how to access the app. No harms or adverse events were reported during the course of the study.

Analysis and Data Treatment

Following the recommendations of Teresi et al. (2022), this study attempted to recruit a minimum of 30 participants for both the intervention group and the control group. The feasibility of the intervention was analysed by calculating the recruitment, retention, and engagement rates and comparing them to pre-determined success criteria. This study aimed to have a recruitment rate of ≥ 30%, retention rate of ≥ 70%, and engagement rate of ≥ 60%. The MSQ and MAUQ will also be analysed to determine the satisfaction and usability of the intervention material by calculating mean scores for each item as well as a total mean score. We aimed to have mean scores >2.5 and >3.5 for the MSQ and MAUQ respectively. The Zoom recordings of the exit interviews were transcribed using the Echo360 software provided by UVic and Microsoft Word and Excel were used to manage the transcription data. Reflexive thematic analysis was chosen to analyze the data by proceeding through the six stages of thematic analysis identified by Braun and Clarke (Braun & Clarke, 2019, 2021). The process was as follows:

- Phase 1: The author read and methodically revised each transcript and relistened to the audio recordings to familiarize themselves with the data.
- Phase 2 and 3: The author detailed sections of the data by highlighting meaningful phrases and making notes, and then deductively assigned codes to these sections based on

the exit interview questions. Candidate themes were iteratively discussed between the author and C.B., an experienced qualitative researcher.

- Phase 4: The candidate themes were further discussed and debated, with both researchers challenging the assumptions they were making in interpreting the data, leading to refinement of the themes.
- Phase 5: The author and C.B. further developed and refined the themes and concise, informative names were developed for each theme.
- Phase 6: The analysis was written, with constant movement between phase 5 and 6. Participant's ID numbers were used to identify their quotes to maintain anonymity.

All secondary analysis was conducted using the computer program JASP. Descriptive statistics were generated for all secondary outcomes. Baseline differences for all secondary outcomes were analyzed using independent t-tests. Analysis of the effectiveness of the intervention was conducted using a one-way ANCOVA for all secondary measures. The assumption of homogeneity of variance was assessed using Levene's test, Shapiro-Wilk test and Q-Q plot of residuals were used to assess the normality of residuals, and homogeneity of regression slopes was assessed by including an interaction term between the covariate and the treatment group in JASP. Significant outliers in the data were transformed by winsorizing $|z| > 3.25$. Effect sizes were reported using partial eta squared (η_p^2), with values of < 0.01, 0.01 - 0.05, 0.06 - 0.13, and ≥ 0.14 representing negligible, small, medium, and large effects, respectively (Cohen, 1988).

Chapter 4: Results

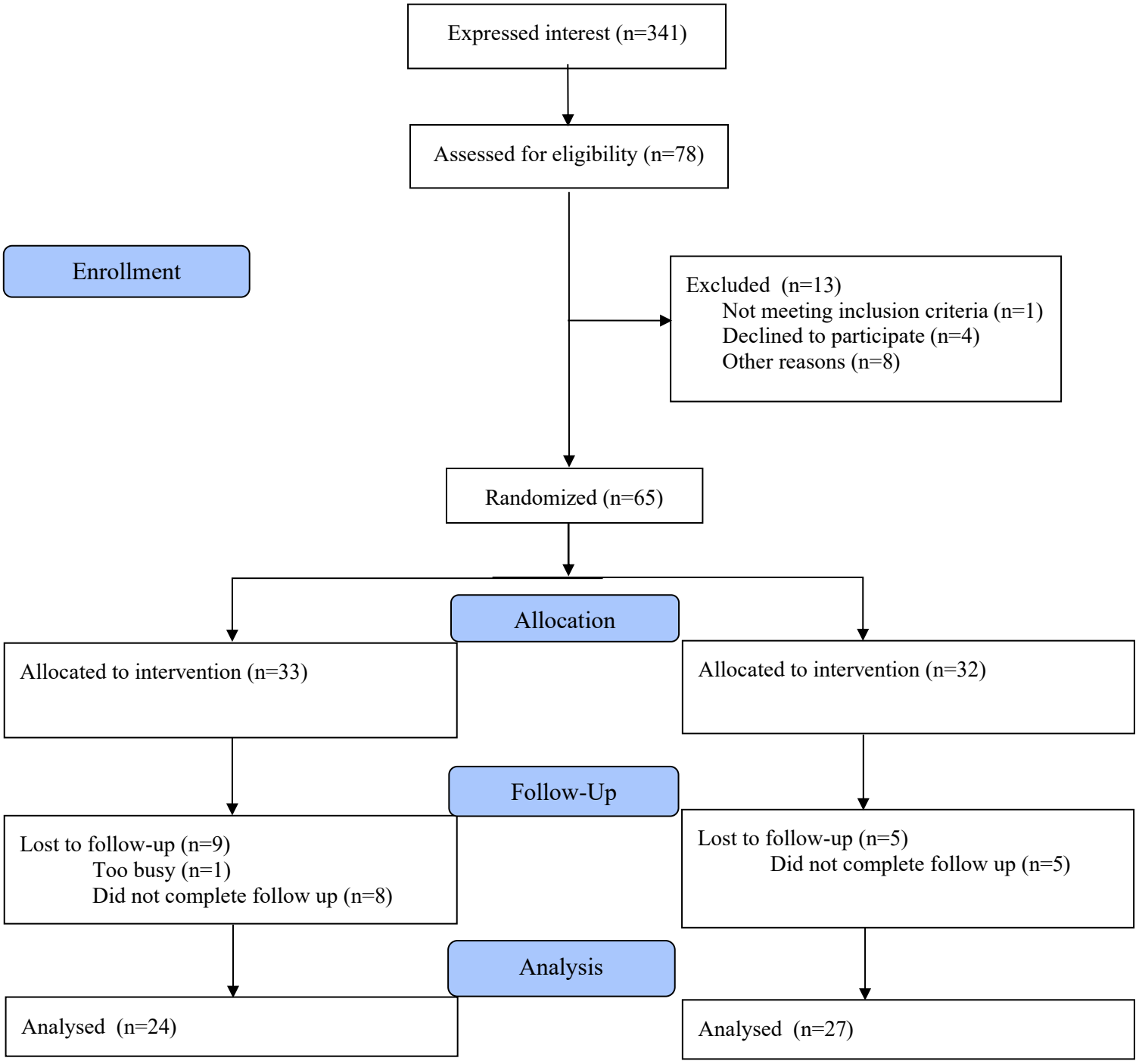
Participant Flow

A total of 66 participants consented to participate in the study from January 31, 2025, to May 25, 2025. In total, 341 individuals expressed interest in participating in the study and were emailed to schedule a screening call. Of those, 78 responded to the email and booked a meeting to be screened for eligibility. Of the 78 individuals who booked a meeting, one was screened out due to already meeting the MVPA guidelines, two failed to attend the meeting, five did not return a signed consent form, and four declined to participate. The reasons for declining to participate were a lack of monetary incentive (n = 2) and the time commitment (n = 2). Once signed consent was obtained, participants were asked to complete the baseline questionnaire. One individual signed consent but did not complete the baseline questionnaire, bringing the enrolled participant count to 65. After the baseline questionnaire was complete, the participants were randomly assigned to either the intervention group (n = 33) or the control group (n = 32). A full overview of participant flow can be found in Figure 1.

For the intervention group, nine participants were lost to follow-up either because they were too busy for the study (n = 1) or did not give a reason (n = 8). For the control group, 5 participants failed to complete the follow-up questionnaire. Therefore, the final number of participants from the intervention group (n = 24) and control group (n = 27) that completed the study was 51.

Figure 1

CONSORT Flow Diagram



Sample Characteristics

The sample (N = 65) was predominantly female (94%) with an average age of 37.4 years old (*SD* = 4.23). The average number of children a participant had was 1.25 (*SD* = 0.59), with an average age of 28.81 months old (*SD* = 19.17). An overview of participant demographics can be found in Table 3. Baseline MVPA per week was 28.52 min (*SD* = 32.73). Independent samples t-test revealed no significant differences in MVPA between control and intervention group at baseline ($t = 0.07$, $p = 0.94$). Independent samples t-tests were conducted on all secondary outcomes and revealed no significant differences between intervention and control at baseline, with the exception of PA identity. The intervention group had a higher PA identity mean score (3.25) than the control group (2.70). See Appendix G for a full overview of baseline differences.

Table 3

Participant Demographics

	Intervention (n=33) **Mean (SD)**	**Control (n=32)** **Mean (SD)**	**Total (n=65)** **Mean (SD)**
Age	37.3 (4.07)	37.5 (4.47)	37.4 (4.24)
Sex	*n* (%)	*n* (%)	*n* (%)
Female	32 (97%)	29 (91%)	61 (94%)
Male	1 (3%)	3 (9%)	4 (6%)
Number of Children	1.34 (0.75)	1.16 (0.37)	1.25 (0.59)
Age of Children (months)	27.29 (19.86)	30.65 (18.42)	28.81 (19.17)

Primary Feasibility Outcomes

Recruitment and Retention

The recruitment rate for the study was 22.87% and took place over a 16-week period. Initially, the sampling frame for this study was the Capitol Regional District in Victoria, British Columbia. Participants were recruited from the CRD for 9 weeks, with an average weekly recruitment of 2.33 participants. The sampling frame was then expanded to include the entire province of British Columbia, with an average recruitment of 7.13 participants over the remaining weeks. Overall, the recruitment rate for this study was 4.59 participants per week.

The majority of participants were recruited through paid Meta ads on Facebook and Instagram (n = 64), with a small number coming from snowball recruitment (n = 2). Of the 78 individuals who booked a screening meeting, 84.62% were eligible and signed consent. 98.48% of those who provided signed consent completed the baseline questionnaire and were assigned to one of the two conditions. Throughout the course of the study, there was a 78.46% retention rate, with 51 of 65 randomized completing the follow-up questionnaire. The intervention group had 72.73% retention (24/33), and the control group had 84.38% retention (27/32).

App Usage

App usage was analyzed for the intervention group only (n = 33). Participants spent an average of 4 minutes and 37 seconds on the app per login, with the most time being spent on the module *Mindfulness and Acceptance* (8 minutes and 14 seconds) and the least time on the module *Building Motivation* (2 minutes and 39 seconds). Participants logged on to the app an average of 1.43 times per module which equates to 6 minutes and 35 seconds per module. Those that completed all seven modules spent on average 37 minutes and 17 seconds in total using the app. Time spent on the app per module is shown in Figure 2.

All participants in the intervention group completed the first module. 57.58% (19/33) of participants completed over half (4/7) of the modules, and 33.33% (11/33) completed all the modules. On average, 3.67 participants did not complete the following module, with the largest drop off (6 participants) coming after the third module. Module completion data is shown in Table 4.

Figure 2

Minutes Spent on App Per Module

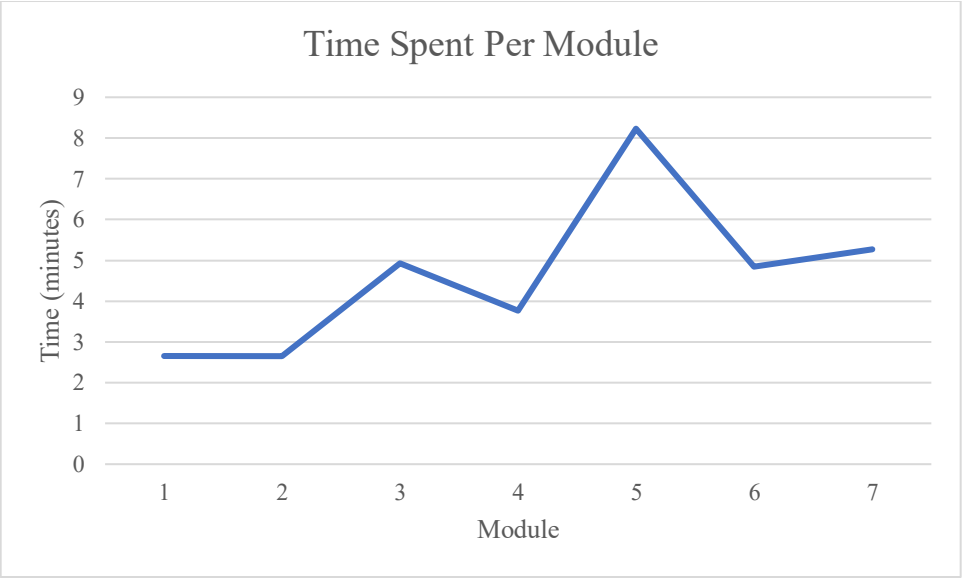


Table 4

Percentage of Modules Completed by Participant

Number of Modules	Number of Participants	Percentage
1/7	33	100%
2/7	30	90.91%
3/7	25	75.76%
4/7	19	57.58%
5/7	17	51.52%

6/7	14	42.42%
7/7	11	33.33%

Satisfaction and Usability

For the questionnaire accessing participant's satisfaction with the app, the average score was 3.43 (SD = 0.58) on a scale of 1-5 (1 – *strongly disagree*, 2 – *disagree*, 3 – *neutral*, 4 – *agree*, 5 – *strongly agree*). For the questionnaire assessing the usability of the app, the average score was 4.29 (SD = 1.03) on a scale of 1-7 (1 – *strongly disagree*, 2 – *disagree*, 3 – *somewhat disagree*, 4 – *neutral*, 5 – *somewhat agree*, 6 – *agree*, 7 – *strongly agree*). No item on the satisfaction questionnaire had a mean score lower than 2.5, and two items had a mean score lower than 3.5 on the usability questionnaire. Those items were "*the app improved my access to healthcare services*" and "*this app has all the functions and capabilities I expected it to have*" with mean scores of 2.83 (SD = 1.34) and 3.04 (SD = 1.34) respectively.

Qualitative Exit Interviews

A total of 17 (70.83%) participants from the intervention group completed the semi-structured exit interview at follow-up. Comments were mostly positive towards the intervention material and delivery. However, most participants (15/17) had at least one suggestion for improving the intervention material and delivery. A summary of exit interview results can be found below in Table 5. Eight themes emerged from the analysis and responses are grouped within those themes. The common themes were *Positive Experience, Enjoyment of Worksheets, Useful Content, Incorporation of Strategies into Daily Life, Appreciation of Parent Focus, Improvements for Intervention, Improvements for App,* and *Barriers and Challenges*.

Table 5

Summary of Results from Exit Interviews Exploring Participant Experience

Theme	Overview of Theme	Exemplar Quote (ID)
Positive Experience	Most participants had a positive experience, finding the app flexible, engaging, and helpful in raising awareness about their personal challenges and opportunities for PA	*"My favourite part of it was just kind of me realizing like 'oh, there are things I can do to fit into my time that are active.' Like yes I have barriers and I can't just do whatever I want as far as activity, but there are things that I can do"* (AP06)
Enjoyment of Worksheets	Worksheets were generally well received, with many noting that active engagement enhanced their learning	*"I like the worksheets…having to pause and actually do something with the information helps it connect more"* (AP01)
Useful Content	Participants found the content informative and relevant, and appreciated features like videos and quizzes	*"The parts that I found that I think made the most difference for me were the values, acceptance, and diffusion stuff"* (AP06)

Incorporation of Strategies into Daily Life	While few participants used all strategies, most applied at least some and found them beneficial in daily life	*"I was definitely able to incorporate some of it and it has certainly made a difference"* (AP43)
Appreciation of Parent Focus	Some participants valued the parent-specific content, noting that they often feel overlooked	*"The modules sort of present the ACT ideas specifically in the context of physical activity and physical activity as a parent of young children, so I appreciated that it brought that information into that context"* (AP15)
Improvements for Intervention	Participants suggested integrating worksheets directly into the app, extending the intervention length, and adding features like a workout database and a more detailed review module	*"I think I would have liked it if there was a PDF booklet that was just everything [lessons and worksheets] or if the worksheets were in the app"* (AP35)
Improvements for App	Feedback on the app included requests for better goal-tracking, push	*"If there's a way for the app to…send me a little notification,*

	notifications, and a more user-friendly interface	*like a new module has opened up"* (AP01)
Barriers and Challenges	A few participants struggled with time constraints and felt that barriers beyond the scope of the intervention limited their engagement	*"I don't feel I used the app as often as I could have or should have. I feel by the time I get home from work and put my daughter to bed, I just want to sit and relax"* (AP45)

Positive Experience

Overall, most participants reported their experience with the intervention as positive. The participants discussed how the intervention's materials and resources enabled them to adhere to the intervention and understand the content provided. Participants explained how they enjoyed the modules' materials and how the flexibility of the app made it easy to fit in time for the study in their busy schedules. Additionally, some participants highlighted that the app increased their awareness of their own situation, with one participant sharing how they are "at a phase in life where there are many new barriers and a lot of things are in flux" (AP43). Another participant noted that despite facing barriers to PA, the app helped them realize that they could still find ways to be more active. Some participants noted that the intervention helped motivate them to be more physically active, with one saying it was "like a kickstart" to get organized and plan more PA (AP55), while another said, "it definitely gave me more motivation to exercise more" (AP65).

Enjoyment of Worksheets

The worksheets were well received with participants describing them as both enjoyable and beneficial. Most participants completed at least half of the worksheets. The values worksheet was frequently reported as participant's favourite. Other worksheets that participants enjoyed were the ones on mindfulness, identity, coping planning, and S.M.A.R.T. goals. One participant stated, "the one that stuck out with me a lot was the one about shifting perspectives and having alternative plans" (AP54). Another commented on the workload of the worksheets, saying "It sometimes felt annoying to have to write down things, but in a useful way. It would be easier to set a goal and not write it down, but then also less likely to do the goal" (AP35). A few participants noted that actively engaging with the information enhanced their ability to persist with and apply what they had learned. For example, one participant stated that they "mostly use[d] the worksheets instead of the app" (AP28).

Useful Content

Most participants considered the information provided to be useful, with one participant reporting "[y]eah, I thought it was informative. I remember reading them and thinking they were interesting" (AP46). Participants frequently reported enjoyment of the content focused on values and identity. Other topics frequently mentioned included defusion, acceptance, and S.M.A.R.T. goals. Some participants also reported enjoying the use of videos in the modules, the quizzes, and the benefit of having all the information in one place, with one participant saying "the S.M.A.R.T. goals, videos, and toolkit were very helpful" (AP18). One participant commented on the time commitment, saying "I think my favourite part were the modules. I thought they were really good…short but clear…so that was great" (AP05).

Incorporation of Strategies into Daily Life

Although few participants reported incorporating all the strategies from the intervention, most incorporated at least a few and found them beneficial. One participant described how they "tried all of the exercises…not all of them worked…some worked and some I still use on a regular basis" (AP28). Another mentioned how they were using the strategies while exercising, "whenever I was exercising, they were coming to mind…I was thinking about them" (AP06). S.M.A.R.T. goals and coping planning were the strategies participants most frequently incorporated into their daily lives, followed by values, mindfulness, and defusion.

Appreciation of Parent Focus

A few participants expressed gratitude for the intervention's parent-tailored content, noting that parental PA is often overlooked. On this topic, one participant commented that they "really appreciate that researchers are looking into the overall health of parents because that usually gets overlooked" (AP18). One participant highlighted their appreciation for the "references to parenting throughout" the modules and worksheets (AP01).

Improvements for Intervention

A key suggestion from the participants was to incorporate the worksheets into the app, instead of having them as separate materials. Participants felt that having the modules and worksheets in separate places created an extra step that made it more difficult to maintain engagement. One participant mentioned that "it wasn't great for doing them on my phone and required the extra step of printing them out and handwriting them" (AP31). Although most feedback on the worksheet content was positive, some participants reported challenges. For example, one participant reported having difficulty with the identity worksheet, while another felt that "nothing stood out as being particularly beneficial" in the worksheets overall (AP45).

Participants frequently suggested incorporating a review module after the final module and lengthening the intervention beyond 6 weeks, pointing out that "6 weeks, in the grand scheme, was actually a very short time" (AP37). Another participant mentioned that "it would be nice if it could link to my Apple watch, so I don't have to manually enter my activity" (AP32). Additional suggestions included providing a workout database, enabling goal progress tracking, and including a second check-in meeting. One participant described the information as "pretty surface level" and that the graphics were "a bit generic" (AP48).

Improvements for App

A few suggestions were specific to the app itself, such as incorporating a more robust goal-tracking feature and adding push notifications to alert them when new modules were released. Of note, one participant expressed that they "don't know that the app interface itself is all that helpful" (AP15). The same participant mentioned wanting a feature that brought you back to the app if you haven't engaged with it in a certain amount of time.

Barriers and Challenges

Two participants explained that, despite their best efforts, their lives were simply too busy to fully participate, resulting in limited use of the app and worksheets. One of these participants said, "in this stage in life I really feel like I'm just surviving" and that they've "had to make peace with the fact that this is just not the time in my life to have a physical activity routine" (AP37). Another participant thought the intervention was better suited for smaller families living in urban areas, stating that they "think that where people live and family size might change the design" (AP65).

Secondary Outcomes

Data Treatment

All secondary outcomes were tested for the assumption of normality of residuals, homogeneity of variance, and homogeneity of regression slopes. MVPA violated the assumption of normality using Shapiro-Wilk test (<0.01, skew = 1.23, kurtosis = 2.57). After winsorizing all outliers $|z| > 3.25$, skew and kurtosis were acceptable (< 1 and <2, respectively), however, Shapiro-Wilk test remained significant (<0.05). Due to the moderate sample size, Q-Q plot, and robustness of ANCOVA, the results were interpreted as valid. The remaining outcomes met all assumptions.

Physical Activity

MVPA data, as well as all other secondary outcome data, can be found in Table 6. After controlling for baseline MVPA, there was no difference in MVPA between conditions at follow-up, $F(1, 39) = 0.09$, $p = 0.77$, $\eta_p^2 = 0.00$. In the intervention group, 79.17% of participants increased MVPA, compared to 74.07% in the control group. Additionally, 18.52% of participants in the control group were meeting MVPA guidelines compared to 12.5% in the intervention group. When breaking down MVPA further, there was a small effect for light PA ($F(1, 43) = 0.41$, $p = 0.52$, $\eta_p^2 = 0.01$), no difference in moderate PA ($F(1, 39) = 0.12$, $p = 0.73$, $\eta_p^2 = 0.00$), and a small effect for vigorous PA ($F(1, 39) = 0.56$, $p = 0.46$, $\eta_p^2 = 0.01$). To examine the impact of the full intervention material, exploratory analysis was conducted for participants who completed all seven modules. There was no difference ($F(1, 27) = 0.61$, $p = 0.44$, $\eta_p^2 = 0.02$) in weekly MVPA minutes when comparing the control group to those in the intervention who completed all modules. 72.73% of those who completed all modules increased MVPA, and 18.18% were meeting MVPA guidelines.

M-PAC Constructs

All M-PAC construct data had acceptable skewness and kurtosis within ±2. After controlling for baseline differences in M-PAC constructs, there was a medium effect on PA habit ($F(1, 48) = 2.95$, $p = 0.09$, $\eta_p^2 = 0.06$). There were small effects on affective attitude towards PA ($F(1, 48) = 0.63$, $p = 0.43$, $\eta_p^2 = 0.01$), perceived opportunity for PA ($F(1, 48) = 2.16$, $p = 0.15$, $\eta_p^2 = 0.04$), and PA identity ($F(1, 48) = 0.32$, $p = 0.58$, $\eta_p^2 = 0.01$). There were negligible effects on instrumental attitude towards PA ($F(1, 48) = 0.11$, $p = 0.74$, $\eta_p^2 = 0.00$), and perceived capability towards PA ($F(1, 48) = 0.22$, $p = 0.64$, $\eta_p^2 = 0.00$). When analyses were restricted to only those participants who completed all intervention material, there were medium effects on affective attitudes towards PA ($F(1, 35) = 2.54$, $p = 0.12$, $\eta_p^2 = 0.07$) and PA habit ($F(1, 35) = 2.22$, $p = 0.15$, $\eta_p^2 = 0.06$). There were small effects for instrumental attitudes towards PA ($F(1, 35) = 1.35$, $p = 0.25$, $\eta_p^2 = 0.04$), perceived capability towards PA ($F(1, 35) = 1.26$, $p = 0.27$, $\eta_p^2 = 0.04$), and PA identity ($F(1, 35) = 0.43$, $p = 0.52$, $\eta_p^2 = 0.01$). There was a negligible effect on perceived opportunity for PA ($F(1, 35) = 0.10$, $p = 0.76$, $\eta_p^2 = 0.00$).

ACT Constructs

All ACT construct data had acceptable skewness and kurtosis within ±2. After controlling for baseline differences in ACT constructs, there were small effects for defusion ($F(1, 48) = 0.42$, $p = 0.27$, $\eta_p^2 = 0.01$) and obstruction values ($F(1, 48) = 0.54$, $p = 0.47$, $\eta_p^2 = 0.01$). There were negligible effects for acceptance ($F(1, 48) = 0.03$, $p = 0.86$, $\eta_p^2 = 0.00$) and progress values ($F(1, 48) = 0.02$, $p = 0.89$, $\eta_p^2 = 0.00$). After secondary analysis was performed for those who completed all the intervention modules, there were small effects for progress values ($F(1, 35) = 0.49$, $p = 0.49$, $\eta_p^2 = 0.01$) and obstruction values ($F(1, 35) = 0.64$, $p = 0.43$,

$\eta_p^2 = 0.02$). There were negligible effects for defusion ($F(1, 35) = 0.06$, p = 0.82, $\eta_p^2 = 0.00$), acceptance ($F(1, 35) = 0.05$, p = 0.83, $\eta_p^2 = 0.00$).

Table 6

Secondary Outcomes Table

	Baseline Mean (SD)	**Follow-Up Mean (SD)**	***n* Improved (%)**	***F*(*df*)**	***p***	η_p^2
MVPA						
Intervention	27.00 (28.49)	75.83 (66.59)	19/24 (79.17%)	0.09 (1, 39)	0.77	0.00
Control	28.64 (35.96)	76.07 (85.12)	20/27 (74.07%)			
Affective attitude towards PA						
Intervention	4.82 (1.28)	5.13 (1.06)	12/24 (50.00%)	0.63 (1, 48)	0.43	0.01
Control	5.16 (1.16)	5.32 (0.86)	17/27 (62.96%)			
Instrumental attitude towards PA						
Intervention	6.43 (0.71)	6.39 (0.79)	10/24 (41.67%)	0.11 (1, 48)	0.74	0.00

Control	6.49 (0.79)	6.44 (0.65)	13/27 (48.15%)			
Perceived capability over PA						
Intervention	4.22 (0.48)	4.00 (0.60)	22/24 (91.67%)	0.22 (1, 48)	0.64	0.00
Control	4.33 (0.61)	4.06 (0.70)	22/27 (81.48%)			
Perceived opportunity for PA						
Intervention	3.29 (0.79)	3.02 (1.13)	8/24 (33.33%)	2.16 (1, 48)	0.15	0.04
Control	3.67 (0.95)	3.41 (1.01)	15/27 (55.56%)			
PA habit						
Intervention	2.18 (0.67)	2.35 (0.80)	9/24 (37.5%)	2.95 (1, 48)	0.09	0.06
Control	2.01 (0.74)	2.03 (0.61)	7/27 (25.93%)			
PA identity						

Intervention	3.06 (0.79)	3.03 (0.78)	20/24 (83.33%)	0.32 (1, 48)	0.58	0.01
Control	2.68 (0.86)	2.90 (0.90)	19/27 (70.37%)			
Defusion						
Intervention	3.31 (0.86)	3.60 (1.00)	4/24 (16.67%)	0.42 (1, 48)	0.27	0.01
Control	3.64 (0.88)	3.77 (0.72)	2/27 (7.41%)			
Acceptance						
Intervention	4.19 (0.68)	4.23 (0.64)	18/24 (75%)	0.03 (1, 48)	0.86	0.00
Control	4.21 (0.77)	4.27 (0.80)	20/27 (74.07%)			
Progress values						
Intervention	3.69 (1.15)	3.91 (0.88)	4/24 (16.67%)	0.02 (1, 48)	0.89	0.00
Control	3.85 (1.10)	3.88 (0.92)	6/27 (22.22%)			
Obstruction values						

Intervention	2.78 (1.35)	2.57 (1.23)	18/24 (75%)	0.54 (1, 48)	0.47	0.01
Control	2.59 (1.26)	2.33 (1.02)	18/27 (66.67%)			

Protocol Changes

The initial protocol was to recruit participants from the Capitol Regional District (CRD) in Victoria, British Columbia. However, after slow initial recruitment, the recruitment zone was expanded to the entire province of British Columbia.

Chapter 5: Discussion

Parents with a child under the age of six are at an increased risk of physical inactivity (Abbasi & van den Akker, 2015; Rhodes & Quinlan, 2015). Parents face increased affective challenges to PA, most commonly in the form of daily incidental affect such as fatigue, which may lead to problems with intention follow-through (Grant et al., 2022). An app-based intervention leveraging M-PAC constructs and ACT strategies has the potential to bridge the intention-behaviour gap and help parents manage daily incidental affect, all while being delivered in an easily accessible format. While M-PAC and ACT interventions have been successful in young adult populations and with web-based interventions, there has yet to be an app-based study focused on parents of young children (Grant et al., 2024). Therefore, it is important to first conduct a feasibility study in order to gauge the practicality and acceptability of such an intervention with this population before considering a larger RCT to examine efficacy.

The main purpose of this study was therefore to examine the feasibility and acceptability of a 6-week app-based intervention based on ACT strategies and framed within the M-PAC framework to promote PA in parents with children under the age of six. Primary outcomes of interest included recruitment, retention, satisfaction, usability, and acceptability. Secondary outcomes of interest included PA, M-PAC constructs, and ACT constructs. Ultimately, this study sought to examine whether the intervention was a viable choice for promoting physical activity in this population before proceeding with a full RCT.

Primary Outcomes

The main purpose of feasibility studies is to determine whether it is suitable to conduct a full-scale RCT (Eldridge et al., 2016). Overall, the primary outcomes of recruitment, retention, satisfaction, usability, and acceptability showed moderate support for proceeding to a full-scale RCT to test effectiveness. However, the findings revealed areas where the intervention and delivery could be improved before moving forward.

This study aimed to have a recruitment rate of ≥ 30%. Recruitment rate for this study was defined as the number of individuals who booked a screening call divided by the number of individuals who expressed interest in the study. This recruitment benchmark was not met, with the recruitment rate being 22.87%. However, it is not drastically different from Grant et al. (2024) and Husband et al. (2019), who reported recruitment rates of 29% and 26% respectively. Recruitment was expected to be a challenge, as parent populations are known to be difficult to recruit (Guagliano et al., 2019). While the overall recruitment rate was not met, there are other ways to breakdown and view recruitment.

Another way to view recruitment is by looking at meetings booked per week. There was an average of 4.59 meetings booked per week, with an average of 3.82 enrolled participants resulting from those meetings. That equates to an average of 15.28 participants per month. These numbers present a more positive outlook for recruitment and are more than acceptable when compared to monthly recruitment rates of similar studies and the monthly target of 6 participants calculated by Rhodes and Cox (2020) for a two-year, two-armed trial (Grant et al., 2024). When recruiting from B.C., the average enrolled participants per month was greater than 23. Lastly, social media advertisement was most successful for this group. Of the 65 participants, 63 were

recruited through paid ads on Facebook and Instagram. Only two participants were recruited through snowball and/or posters. While this number is low, it is in part influenced by a heavy reliance on online advertisements as most recruitment effort was focused on these. Overall, with some adjustments to recruitment, it can be concluded that this study has demonstrated that recruitment for a large-scale efficacy trial is viable.

There are several improvements that could be made to the recruitment for this study. An auto-booking software could be used to book the baseline meetings. This would streamline the booking process and allow interested individuals to book a meeting directly from the online form. As mentioned, recruitment increased after expanding the recruitment zone to B.C. It can be assumed that expanding the recruitment zone across Canada would greatly improve the recruitment rate. Online recruitment was the main method used, so expanding to more platforms, such as X, YouTube, Craigslist, and Reddit, would likely increase the visibility of the study and improve recruitment (Yaremych & Persky, 2023). Moreover, targeting parent-specific groups (i.e. online moms' groups, recreation centers, doctor's offices, daycares, etc.) was done minimally for this study and could be another source of recruitment in the future (Hollman et al., 2022; Rhodes, Beauchamp, et al., 2021). One factor that could improve recruitment is increasing the number of interested individuals who booked a baseline meeting. In this study, individuals were emailed once with study details, and only those who replied received follow-up. As this is a busy population, future recruitment could benefit from additional follow-up with these individuals. Lastly, the sample was primarily female, which is in line with previous research in this area and health behaviour research more broadly (Bellows-Riecken & Rhodes, 2008; Maher et al., 2014; Moseson et al., 2020). This may be because women are more directly affected by childbirth, tend to take on more parenting responsibilities, and experience more stress and fatigue

from parenting (Horowitz, 2023). Research has shown that samples recruited via online advertisement tend to have more females (Moseson et al., 2020). To improve generalizability of findings, changes should be made to the recruitment material to recruit more males. Some research suggests including images of men in the recruitment material, and emphasizing the need for males in the snowball recruitment (J. Ryan et al., 2019).

This study aimed to have a retention rate of 70% or greater. The retention rate for the study was 78.46%, which is above the average retention rate for eHealth app-based interventions (Doumen et al., 2022). The retention rate indicates that the study was successful in maintaining a sufficient number of participants and supports progression to an efficacy trial. However, it is important to note that, of the 14 participants who dropped out, nine were from the intervention group. This is most likely due to the increased workload the intervention group had compared to the control group and may signal a need to examine ways to maintain engagement in the intervention group. Still, the retention rate in the intervention group was above the average found in the review by Doumen et al. (2022) and is not necessarily a cause for concern. Cooper et al. (2018) found that retention rates from pilot trials to longer RCTs differ minimally on average, however there is high variability and therefore must be used with caution. Risk of generalizability biases have also been identified that should be taken into account if this study were to move forward with a longer efficacy trial (Beets et al., 2021). Some potential ways to improve retention for this study and ensure an efficacy trial has similar results include adding a second check-in meeting, making the modules more interactive, and offering a monetary incentive for completion (Joseph et al., 2015).

This study aimed to have an engagement rate of 60% or greater. On average, participants completed 5/7 (71.43%) modules, and one-third completed all seven modules. This average

completion is higher than those seen in other studies, such as the study by Stephens et al. (2022) that found participants completed an average of 42% of the app modules, while a review by Smith & Liu (2020) found participants access 53.5% of intervention material on average. The current study's engagement is similar to the findings from Grant et al. (2024), who reported an engagement rate of 68%. Participants logged on an average of 1.43 times per module and spent an average 6 minutes on each module. For those who completed all modules, the average time spent on the app in total was over 37 minutes, with an average of 9.73 logins in total. This data is in line with other similar research which found average logins over a 10-week period to be 7.94 for a web-based intervention (Hollman et al., 2022). Hollman et al. found that participants spent over 37 minutes per week on the intervention, compared to the 37 minutes over 6 weeks observed in this study. However, their intervention was web-based, whereas this study used an app-based format designed to be more time-efficient.

Considering these findings, engagement and adherence to the intervention content can be considered acceptable. However, there are some improvements recommended. Concerning the discrepancy in usage minutes between the current study and Hollman et al., it is important to note that time spent on worksheets was not tracked and is therefore not reflected in the usage data. It may be beneficial to track time spent on worksheets in future research as the worksheets are an important component of the intervention and usage should be tracked more deliberately. While the usage minutes are partially an indication of the amount of content within each module, it does also suggest that participants may not be spending enough time engaging with the material. Slowing down the participants' progress through the modules (e.g. adding quizzes throughout the module) may help ensure that they are fully engaging with the content and not simply swiping through. Lastly, two participants mentioned being too busy to fully commit to

using the app. This is an important issue to resolve, as uptake and engagement are key to producing successful change. In line with findings from previous mHealth research, improving goal setting/tracking, improving reminders, including a rewards system, and including a social networking aspect, could improve engagement with the intervention (Hosseinpour & Terlutter, 2019; Szinay et al., 2020).

Satisfaction and usability mean scores were above the respective progression criteria of 2.5 and 3.5. Participant's mean satisfaction score on the MSQ was 3.43 (between *neutral* and *agree*), and their mean usability score on the MAUQ was 4.29 (between *neutral* and *somewhat agree*). Importantly, no items on the MSQ were lower than 2.5, and only two items on the MAUQ had a mean score lower than 3.5. This demonstrates that, while the scores weren't overly positive, they were also rarely negative. Satisfaction and usability scores are acceptable and suggest a longer RCT is appropriate.

Qualitative exit interview data helps to shine a light on the user experience (Tenny et al., 2025). Overall, participants experience with the intervention and app were positive, with 14/17 participants reporting at least one positive comment about the intervention. Most participants enjoyed the module and worksheet material and found it to be useful. The material on values was most frequently reported as participants' favourite section. This is consistent with qualitative research indicating that values are one of the more impactful components of ACT (Edwards et al., 2023; Jenkins et al., 2019; Rawlinson et al., 2024; Ruan et al., 2023). There were, however, suggestions for improvements that should be considered if a full-scale RCT were to move forward. The most common feedback regarding improvement was the increased friction of needing to move between the modules and the worksheets, which were PDFs not located on the app. This not only created an extra step for the participants, but also in part defeats the purpose

of the mobile intervention. Most participants used a laptop or computer to complete the worksheets as it is much easier to navigate and fill them out there than it is on a phone. Future RCTs should consider including the worksheets in the app as increased friction in eHealth design has been shown to decrease retention (Jiang et al., 2025; Szinay et al., 2020).

Other notable suggestions to improve the intervention procedures were to add a second check-in meeting and to send module release reminders. Both these changes would likely improve intervention adherence and completion. Research suggests that well-designed reminders and increasing contact with participants aids in decreasing attrition and improving engagement (Joseph et al., 2014; Szinay et al., 2020). Multiple participants mentioned that the check-in meeting reignited their motivation and commitment to completing the modules, and therefore, adding a second meeting may aid in maintaining that level of commitment. At the time that this study was conducted, Pathverse did not have the option to send module release reminders for the specific module release schedule used for this study. However, if in the future that were an option, it would most likely help participants adhere to the intervention.

Of note, one participant indicated that the study was not well-suited to their circumstances, as they had multiple children and lived in a more rural area. This highlights the possibility that psychoeducational interventions to promote PA in this group may benefit from additional structural or practical supports to alleviate role burden. With improvements to the suggested areas, the qualitative data nonetheless indicate an overall positive participant experience and support progression to a full-scale RCT.

The feasibility progression criteria were met for retention, engagement, and app usability and satisfaction. Although the study recruitment rate fell below the 30% benchmark, it was comparable to rates observed in similar studies (Grant et al., 2024; Husband et al., 2019).

Qualitative exit interviews indicated an overall positive experience for participants using the app, with suggested improvements including integrating the worksheets into the app and providing module release reminders. Collectively, these feasibility markers support progression to a longer RCT.

Secondary Outcomes

As this was a feasibility study, these secondary outcomes are presented to illustrate potential influences of the intervention; however, the study was not powered to draw definitive conclusions about effectiveness. The overall findings for the secondary outcomes were modest in the signal for changes. Specifically, the size of effects of the intervention on secondary outcomes did not align with similar research, such as the Hollman et al. (2022) and Grant et al. (2024) studies; however, these studies used passive control groups. Both the intervention and control groups increased their MVPA, with no notable difference between them. A higher percentage of participants in the intervention group increased their PA from baseline, while a higher percentage of participants in the control group were meeting the 24-hour Movement Guidelines at follow-up. When comparing only full completers of the intervention to the control group, there was also no notable difference in mean change, percent that increased, or percent that were meeting MVPA guidelines. The overall change in PA but lack of difference between groups could be due to the fact that an active control was used, with the control group receiving the Canadian 24-hour Movement Guidelines. It's possible that the guidelines were enough to produce a change in the control group. Similar research has found that, when comparing ACT to an active control, differences in PA outcomes over a short intervention period are small (Kangasniemi et al., 2015). Furthermore, the utility of the ACT and M-PAC models could be more in the maintenance of PA, which given the 6-week timeline was not adequately tested. The research by Butryn et al.

(2011) lends some support for this idea, as they found that full completers maintained higher PA levels at follow-up than both control and partial completers. As participants in both groups voluntarily enrolled in the study, it is reasonable to assume they already possessed an intention to be physically active. Consequently, the lack of group differences in PA may reflect that control participants were already highly motivated to engage in PA. Other research has found no difference in self-reported PA between ACT and waitlist control over a similar intervention period (Levin et al., 2021). This resonates with some of the qualitative feedback in which participants expressed that the 6-week intervention was too short to fully implement these strategies and see change. It could also explain why similar studies were able to produce more change in these variables when using longer trial periods (Butryn et al., 2011; Hollman et al., 2022; Moffitt & Mohr, 2015).

As discussed, one of the stronger correlates to PA is PBC. While the ACT material used in this intervention aimed to improve emotion regulation and values directed behaviour, it may not have been enough to attenuate the role of PBC on PA (i.e., either directly or through intention). As such, it may be beneficial for future research to include material directly focused on PBC, such as a larger focus on action and coping planning (Lidong et al., 2025). It is also important to consider the possibility that psychoeducational interventions, without interpersonal and environmental interventions in tandem, may not be enough for this population. As previously mentioned, parents face increased workload and fatigue, often balancing multiple social roles (Deave et al., 2008). Consequently, parents may lack the time and resources to initiate and maintain PA, despite motivational and affective factors. Therefore, while interventions targeting affective regulation alone may be successful in some populations, it may be necessary to incorporate social and environmental components into psychoeducational

interventions to increase PA in parents. Common barriers to PA for parents include family responsibilities, lack of support, and work – none of which were a direct focus of this intervention (Mailey et al., 2014, 2016). Another factor outside the scope of this intervention was SES. Research shows that eHealth interventions for PA promotion are more effective with high SES individuals compared to low SES individuals (Western et al., 2021). While eHealth psychoeducational interventions have the potential to reach more people than face-to-face programs, they must consider varying levels of SES, social factors, and environmental influences when designing the intervention (Krukowski et al., 2024).

When looking at ACT constructs, there was a small effect trending towards the control for defusion and a small effect trending towards the intervention for obstruction values. These findings suggest that the control group was better able to defuse from unhelpful thoughts and navigate obstacles to valued living. However, secondary analysis showed effect sizes suggesting small effects trending in the direction of the intervention group for progress values and obstruction values. This suggests that the participants in the intervention group who completed all modules were better able to live in line with their values. However, higher obstruction value scores also indicates that there were more disruptions in the intervention groups ability to live in line with their values. It could be that by making the participants more aware of their values, they were subsequently more aware of the ways in which they were not able to successfully live in line with their values. Nevertheless, these findings on values corresponds with comments from the exit interviews in which the values module and worksheets were frequently reported as participants' favourite. These findings are also consistent with other research showing the largest effects with mindfulness and values measures (Grant et al., 2024).

As previously stated, the modest findings for the ACT constructs could be due in part to the short timeline of the intervention. Interventions of longer duration have been more consistent in creating change (Manchón et al., 2020; Pears & Sutton, 2021). Another possibility is that the information provided was too basic. One of the objectives when creating the app content was to make it accessible and easy to understand. This was because some aspects of ACT can be difficult for people to grasp at first (Forman et al., 2012). However, according to feedback from the exit interviews, the information provided may have been too surface level for some and not in-depth enough to fully engage some participants to make change (Szinay et al., 2020). Therefore, future research should aim to add more depth, while keeping the intervention material accessible and easy to understand. Additionally, future research may consider adding an "additional readings" section to each module for those interested in learning more. While ACT-related emotion regulation (acceptance, defusion) was measured, it may be beneficial to have a broader emotion regulation measure, such as the emotion regulation questionnaire (ERQ) (Gross & John, 2003). Lastly, as one of the aims of the ACT material was to improve emotion regulation of daily incidental affect, it may be beneficial for future research to directly measure incidental affect, such as through the use of ecological momentary assessment (EMA) (Shiffman et al., 2008).

The results for the M-PAC constructs were similar to the ACT constructs. The effect sizes suggested small effects trending in the direction of the control group for affective attitude towards PA and perceived opportunity for PA, and towards the intervention group for PA identity. Additionally, there was a medium effect trending towards the intervention group for PA habit. Following secondary analysis the effect sizes remained similar, with a few exceptions: there was a medium effect trending towards the control group for affective attitude towards PA,

and small effects trending towards the control group for instrumental attitude towards PA and perceived capability over PA. Similar studies have reported larger changes in M-PAC constructs over longer intervention periods (Hollman et al., 2022). Additionally, Hollman et al. used an inactive control and an intervention more deeply rooted in M-PAC. While the current study was partially framed within the M-PAC framework, the intervention was largely based on ACT. All M-PAC constructs, aside from habit, were discussed in the intervention material; however, it was all presented briefly in one module. Therefore, the small findings for the M-PAC variables could be due to their minimal presence in the intervention material. Future research may consider making M-PAC constructs and theory corresponding BCTs a larger focus of the intervention material (Rhodes, 2017). Interestingly, although the intervention did not directly target habit, it saw the largest trend towards the intervention for M-PAC constructs. This could be in part due to the intervention material on action planning, which has been shown to produce stronger PA habits (Rebar et al., 2025). Previous research has found that habit is a significant predictor of PA and therefore it may be useful to incorporate it into a standalone module in the future (Porter et al., 2024; Rhodes, 2021).

Another finding of note was the trend towards the control group for affective attitude towards PA. The small and medium effects seen in the primary and secondary analysis, respectively, are contrary to what would be expected from an intervention utilizing emotion regulation. However, it's important to note that the affective attitude towards PA measure is of affective judgments, whereas the emotion regulation primarily used in ACT deals with incidental affect. Therefore, this may not be the best indication of changes in emotion regulation and further emphasizes the need for future research to directly measure incidental affect through techniques such as EMA.

The primary and secondary analysis of the secondary findings showed there were no differences on any of the measures between the intervention and control groups. However, effect sizes showed that there were several trends towards the intervention group on both M-PAC and ACT measures. To reiterate, these secondary outcomes are not meant to provide definitive claims about the intervention's effectiveness, but rather to provide some insight into the potential outcomes of a larger trial. As such, these secondary findings should be interpreted with caution. Overall, while these secondary outcome findings are modest, they showed positive trends towards the intervention and lend some support to further research on effectiveness where longer timeframes may aid in the implementation of the intervention strategies.

Limitations

This study was not without its limitations. Firstly, the exit interviews and check-in meetings were conducted by the primary researcher. This may have introduced bias in exit interview responses as participants may not have felt fully comfortable voicing negative feedback. The study would benefit from having separate researchers conducting the exit interviews to ensure participant feedback is as honest as possible. Having said that, the exit interviews were able to shed light on areas for improvement.

Check-in meeting and exit interview completion was rather underwhelming, with around 50% of participants completing them respectively. A higher attendance rate for check-in meetings may have improved module completion rates and engagement, while a higher exit interview attendance would have helped provide more feedback on the intervention. Perhaps it would be useful in the future to have monetary incentives wherein a certain amount of money is allocated for the completion of check-ins and exit interviews.

PA was assessed using self-report questionnaire and is therefore not as accurate or reliable as objective measurements, such as accelerometers (Steene-Johannessen et al., 2016). While this is less important for a feasibility study, it does reinforce the need to interpret the secondary outcomes with caution. The study sample was predominantly female and the timeframe was rather short. The sample being mostly female makes it hard to generalize these findings to all parents. As noted, it is important to find ways to recruit more males for future research in this area. The study's short timeframe may have contributed to the rather small intervention effects witnessed. A longer timeframe consistent with similar research could have helped participants implement the intervention strategies and a larger impact may have been seen. Lastly, limited demographic data was collected for participants and therefore the influence of factors such as income level, relationship status, and education are unknown.

Summary

This study was based on the established theories of ACT and M-PAC, showed modest effects for the intervention group in most measures, and demonstrated adequate feasibility based on recruitment, retention, engagement, exit interview data, and satisfaction and usability scores. The study has met the key criteria laid out by Powell et al. (2021) and, as such, it is recommended that it be considered for a full-scale RCT.

Conclusion

Recruitment rate was slightly below the progression criteria; however, retention and engagement rates were successful, and participant satisfaction and usability ratings were positive, suggesting that a full-scale RCT is feasible with targeted improvements to delivery (e.g., integrating worksheets within the app), adherence (e.g., adding a second check-in meeting, providing module release reminders), and engagement (e.g., incorporating more interactive

module content, more in-depth content). Secondary measures were modest but mostly positive. A larger sample and longer timeline are needed to draw conclusions about effectiveness. Overall, these findings support conducting a full-scale RCT to evaluate the intervention's impact on increasing PA.

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Appendix A

Consent Form

"Feasibility of an ACT-Based Intervention for the Promotion of Exercise in Parents with Young Children"

You are invited to participate in a study entitled **"Feasibility of an ACT-Based Intervention for the Promotion of Exercise in Parents with Young Children"** that is being conducted through the Behavioural Medicine Lab by Joe Barton, a graduate student in the School of Exercise Science, Physical & Health Education at the University of Victoria. As a graduate student, Joe is required to conduct research as part of the requirements for a MA degree in Kinesiology. You may contact him if you have further questions by email at josephbarton@uvic.ca. This research study is being conducted under the supervision of Dr. Ryan Rhodes. You may contact him at rhodes@uvic.ca or 250-721-8384.

Importance of this Research
Regular physical activity can help prevent chronic diseases such as cardiovascular disease, certain cancers, and diabetes. It can also provide mental health benefits such as improved mood, increased self-esteem, and alleviation of depressive symptoms. However, over 80% of adult Canadians do not engage in the recommended amount of physical activity per week. This percentage is even higher in parents with a child under the age of 6. Due to increased stress, workload, and time constraints, physical health is often an afterthought. This study will examine the impact and practicality of an accessible app-based intervention. This research is important because it will increase our knowledge on ways to effectively increase physical activity engagement in this population.

Purpose of this Project
As a feasibility study, our main aim is to determine whether it is worthwhile to implement the intervention on a larger scale. We will examine the acceptability, enjoyment, recruitment rates, drop-out rates, and app usage in order to determine the practicality of an intervention of this nature. As such, we will be using questionnaires, data-usage collected from the app, and interviews to learn about the positive and negative aspects of being a participant in this study.

Participant Selection
You are being asked to participate in this study because you:

1. Have a child under the age of 6
2. Are not meeting the physical activity guidelines (150 minutes of moderate to vigorous physical activity per week)
3. Have access to a smart phone and internet connection

What is Involved
If you consent to voluntarily participate in this research, you will e-sign the consent form, gain access to 4 web-based baseline questionnaires, and be randomized to one of two groups. "Randomized" means that you are put into a group by chance, like flipping a coin. You will have an equal chance of being placed in any group.

Intervention Group

- You will complete the 4 baseline questionnaires on SurveyMonkey and be given access to the mobile app
- The app contains 7 modules with accompanying worksheets/practices to be completed over the course of 6 weeks on your own time at your own pace
- Participation will require roughly a 7 hour time commitment over the 6 weeks, about 1 hour per module
- The app will track how many times you log on, as well as the number of minutes you spend on the app
- A brief 5-10 minute Zoom check-in will happen around the halfway mark of the study to answer any questions you may have about the app, its content, and/or the worksheet material
- Following the 6 week period, you will be asked to complete the 4 questionnaires from baseline as well as 3 new questionnaires on SurveyMonkey
- You will be invited to take part in an exit interview, which will be transcribed

Control Group

- You will complete the 4 baseline questionnaires on SurveyMonkey and be given a copy of the Canadian 24-hour movement guidelines
- You will be asked to follow the guidelines as closely as you can, and to aim for 150 minutes of weekly moderate-to-vigorous intensity exercise
- Participation will require roughly a 1-2 hour time commitment over the 6 weeks
- After the 6 week period you will be asked to complete the 4 baseline questionnaires on SurveyMonkey again
- Following the completion of the follow-up questionnaires, you will be given the opportunity to access the mobile app for 6 weeks
- If you choose, you will download the Pathverse app and sign up using your email. No other app data will be tracked or collected

Inconvenience

Participation in this study may cause you minor inconvenience. There is an approximate 7-hour total time commitment for this study if you are randomized to the intervention group. This time will be spent completing the baseline and follow-up questionnaires and completing the program content. If you are placed in the control group, there is an approximate 1.5-hour time commitment for the baseline and follow-up questionnaires.

Risks

Risks associated with exercise include~~s~~ bruises, falls, sprains, or breaks. These are unlikely, but important to be aware of when participating in physical activity. To mitigate any risks we will use a physical activity readiness screening tool and encourage activities that are appropriate for your fitness level and skill. If you experience any harm from participation in this study, please tell the project coordinator immediately.

Benefits

The potential benefits of your participation in this research include increased knowledge of ways to motivate yourself to engage in physical activity, increased knowledge of ways to deal with uncomfortable thoughts and feelings around physical activity, and potential increased physical activity participation as a result which may elicit health benefits. Finally, this research may have societal benefits if the intervention is eventually disseminated into practice or policy. There is the possibility that there may be no direct benefits to the participants.

Compensation

There is no monetary compensation for your participation in this research.

Voluntary Participation
Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do choose to withdraw from the study, your data will be removed from analysis.

Ongoing Consent
Ongoing consent will be implied when you participate in the remainder of the study. This will be confirmed when you complete the baseline questionnaires. If you are randomized to the intervention group, you will be asked to confirm your ongoing consent on the app halfway through the program.

Anonymity
To protect your anonymity, all participants will be given an identification number and will be identified by this number on all forms with personal data. The master list that pairs ID numbers with participant contact information will be stored in password-protected computers and secure servers in the Behavioural Medicine Lab. All results produced will be from group data and no individuals will be identified.

Confidentiality
Your confidentiality will be protected due to the individual nature of this research. The confidentiality of your data will be protected in the following manner: 1) Data will be stored and secured in locked file cabinets or password-protected computers in the Behavioural Medicine Lab at the University of Victoria and 2) Only lab personnel associated with the study will have access to this information and data. The original questionnaire data will be deleted after 5 years.

Please be advised that non-identifiable information about you that is gathered for this research study uses "Pathverse" and "SurveyMonkey" an app and website that store data in the U.S. As such, there is a possibility that information about you may be accessed without your knowledge or consent by the US government in compliance with the US Freedom Act."

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the form of thesis presentations, the Behavioural Medicine Lab's social media platforms, conference presentations, and online.

Disposal of Data
Data from this study will be disposed of after 5 years. Electronic files will be deleted and paper documents will be shredded.

Contacts
You can request further information regarding this study by contacting Joe Barton at josephbarton@uvic.ca or Dr. Ryan Rhodes at rhodes@uvic.ca or 250-721-8384. In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you consent to participate in this research project.

_____ _____ _____

Name of Participant *Signature* *Date*

A copy of this consent form will be left with you, and a copy will be taken by the researcher.

Ryan E. Rhodes, Ph. D., Professor
250-721-8384
rhodes@uvic.ca

Joe Barton, MA Candidate
250-507-1598
josephbarton@uvic.ca

Appendix B

Worksheets

GIVE YOUR MIND A NAME

This is a mindfulness exercise meant to help you gain some distance from your thoughts. If your mind has a name, then it's different from "you".

When you listen to someone else, you can choose to agree with them or not. And when you disagree, you typically don't try to argue them into agreement with you. This is the same stance you take with your internal voice.

You can give it any name you'd like, or you can simply name it "Mind". Anytime you have an unhelpful thought, simply thank your mind and carry on with what you were doing. For example, if you're tired from an early morning getting your kids ready for school and you have the thought "I'm too tired to exercise today" just say to yourself "thanks Mind" and refocus on your physical activity goals.

Try this with whatever exercise-related thoughts come up for you over the next few days and notice how your relationship to your thoughts changes.

EXPANSION

This is an acceptance exercise meant to help you get used to allowing feelings and sensations to come and go. It's important to note that in this context acceptance does not mean resigning to feeling bad. In Acceptance and Commitment Therapy, acceptance means letting your negative emotions exist without struggling with them or trying to change them. It doesn't mean that you want them or like them, but simply that you're willing to have them in order to do what's important to you.

Expansion involves the following 4 steps:

1. Observe – Spend a few seconds scanning your body and notice which sensation is the strongest. Take some time to get to know it. Notice where it starts and where it stops. If you were to visualize this feeling, what shape would it have? Do you feel it on the surface or deep in your body? Is it moving or still? Hot or cold?

2. Breathe – Take some slow deep breaths and breathe into and around this feeling. Picture your breath filling the space around this sensation. The point of this is not to get rid of the sensation, but to create space for it.

3. Create space – As you continue to breath, imagine that you are opening up to this feeling, giving it room to exist within you.

4. Allow – Once you have created space for this feeling, allow it to be there. Remember the point is not to get rid of this feeling, it's to create space for it and to let it be.

Over the next few days, try using this technique with any difficult feelings that arise around exercise. It could be anxiety about trying a new sport or going to the gym. It could the feeling of soreness in your legs while on a run or hike. It could also be the feeling of being overwhelmed with your parenting duties. Whatever it is, simply follow these 4 steps and refocus on what you were doing.

NOTICE 5 THINGS

This is a mindfulness technique that is useful in bringing your awareness to the present moment.

Anytime you notice that you've been caught up in your thoughts or feelings, take a look around and try to notice:

- 5 things you can hear
- 5 things you can see
- 5 things you can feel

Once you've brought your attention back to the present moment, you are more able to fully engage in whatever it was you were doing. Try this technique over the next few days any time you catch yourself caught up in thoughts and feelings.

I AM, I AM NOT

Below are three unfinished sentences. Fill in each with a positive or negative exercise-related trait you believe about yourself. For instance, “I am unathletic” or “I am strong”.

1. I am
2. I am
3. I am

Now look at what you’ve written and ask yourself: is this true all the time? Everywhere? Without exception? Try to think of a time when the statement wasn’t true. Next, notice how these statements are linked to comparisons. Are you “less athletic” or “strong-ER” than some people?

To begin loosening the hold of these statements, add “or not” to the end of each one. For example, “I am unathletic, or not” or “I am strong, or not”. This opens up possibilities, reminding you that you don’t have to buy into one version of your self-story over another.

Finally, try changing “I am” to “I feel” or “I think” and describe when and how these thoughts arise. For example, “when I lift weights, I feel strong” or “when I focus on others’ abilities, I feel unathletic”. This exercise helps you see how your self-story shifts in different situations, allowing you to stay connected with your deeper sense of self.

Over the next few days, try to notice when you make these exercise-related judgements and see if you can apply these techniques to develop a more flexible sense of self.

WRITING YOUR VALUES

This exercise will help you identify the values that make physical activity important to you. Having clearly defined values makes it much easier to focus on them and create goals around them to help you be more physically active.

In the space below, write down three reasons why engaging in physical activity is important to you. For example, “Physical activity gives me the energy and vitality to show up for my family”.

1. -

2. -

3. -

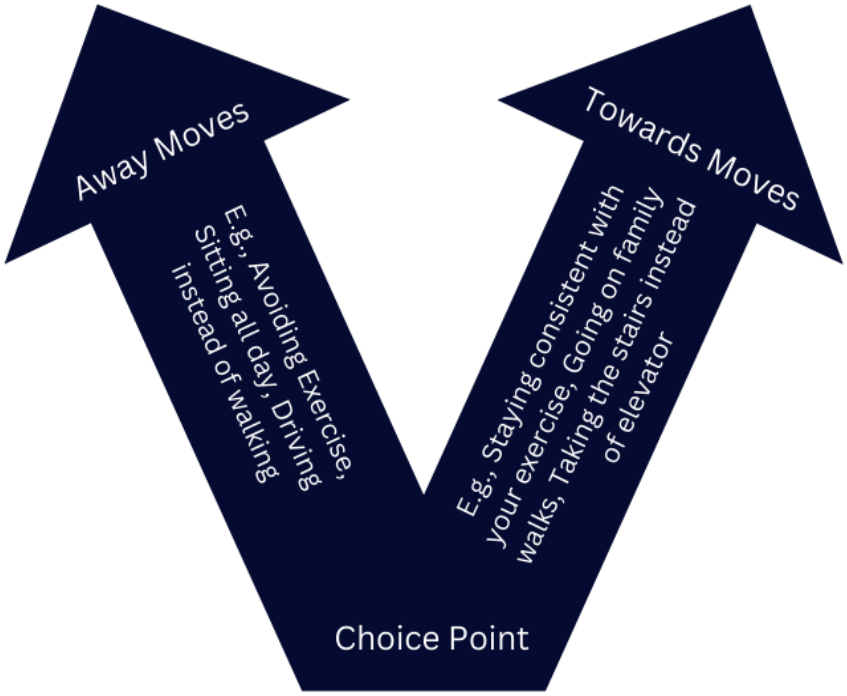
Regularly try to connect with these values throughout your day. Whenever you get caught up in unhelpful exercise-related thoughts and feelings, use your mindfulness skills you’ve learned and refocus on these values.

Below is a list of common exercise related values to help you with this exercise. It’s important to note that there are no right or wrong values, they are unique to everyone. Just because a value is not on this list does not mean it can’t be something you value.

- Health and well-being
- Family bonding
- Personal growth
- Community engagement
- Joy and playfulness
- Role modeling
- Longevity and vitality

CHOICE POINT

The Choice Point is a very useful tool to help you stay connected with your values. You can use this technique anytime you're faced with a decision to make. Think to yourself "is the choice I'm making an *away move* or a *towards move*?". "Away moves" are things that bring you further away from your values and the life you want. "Towards moves" are things that bring you closer to your values and the life you want. Below is an illustration of the Choice Point to help better understand.



Over the next few days, use this tool whenever you're faced with an exercise-related choice. E.g. "Will skipping my yoga class bring me closer or further from the life I want to live? Is it in line with my values?"

SMART GOALS

Goal setting is an integral part of successfully becoming more active. The SMART goal framework is a helpful aid to creating and achieving goals. Fill in the blanks below each prompt, and reuse this for every exercise goal.

Specific – What exactly are you going to do? (e.g., going for a 30 minute run in my neighbourhood on Monday and Wednesday evening at 7pm)

-

Measurable – What will you track and how? (e.g., time runs and keep a daily log)

-

Attainable – Is this goal realistic and do you have the time and skills to achieve it? (e.g., running for 30 minutes at a time twice a week is feasible)

-

Relevant – Is your goal meaningful and aligned with your values? (e.g., running gives me the energy needed to show up for my family)

-

Time-based – How long will it take to achieve this goal? (e.g., in two months time I can work up to a 10km run)

-

SMART Goal – Review what you have written and craft a new goal statement based on what the answers to the questions above have revealed.

-

NEW HABITS, OLD ROUTINES

Sometimes when trying to create a new habit, it can help to pair it with an already existing routine. For example, to increase daily steps you could go for a short walk (either alone or with your family) after your lunch or dinner.

Look at your current routine and see if you can find 2-3 areas where you could add a new habit (either alone or with your family). It's always best to start slow, so start with 1 and wait until you're consistent with it before adding another.

BUILDING CONFIDENCE

Here are some suggestions for building up your confidence for physical activity:

- Keep the physical activity short and simple to start and build up over time
- Exercise at a pace that feels comfortable and gradually build up to a higher intensity
- Find others to engage in physical activity with (such as your kids, your partner, other families, or your friends)
- Focus on making physical activity a positive experience to build your competence

List some of the common barriers to physical activity you face as a parent:

-

-

-

-

-

Now, brainstorm some easy ways you could still be active when faced with these barriers:

-

-

-

-

-

ENJOYABLE ACTIVITIES

Choosing activities that you enjoy is important when it comes to sticking with your physical activity. All too often people try to force themselves to do activities that they don't enjoy. It's much easier to be physically active when you enjoy doing the activity. In the space below, list a few activities you know you enjoy or activities you've been wanting to try. These can be both activities you enjoy alone and ones you enjoy doing with your family.

-

-

-

-

-

ACTION PLANNING

Having a plan for your physical activity can make it a lot easier to stick to it. It can help to break it down into WHAT, WHERE, WHEN, and HOW you will be active. Read the questions below and write your answers in the spaces provided.

WHAT (type of physical activity)

-

WHERE (where will you do this activity)

-

WHEN (when will you do this activity)

-

HOW (how will you do this activity)

-

COPING PLANNING

Often people get stuck in all-or-nothing thinking when it comes to exercise. When obstacles come up it's common to abandon physical activity plans altogether. Coming up with easy back-up plans can help avoid this and keep you on track.

Use the prompts below to brainstorm how you could meet yourself where you are at and get some physical activity when things don't go as planned.

Originally planned activity	**Alternate activity with adjusted intensity**	**Alternate activity with adjusted duration**
Example: Big family hike	*Example: Family walk of similar duration*	*Example: Quick yoga mat exercises*

MY TOOLKIT

The toolkit can be a great way to keep track of the strategies that work best for you. Anytime you're struggling with being more active, you can reach into your toolkit and apply one of your strategies or techniques. Your toolkit can change over time, it isn't set in stone. It simply allows you to have all your personal strategies in one place.

Here is a list of all the strategies we've learned. Pick the ones that have worked for you the most and add them to your toolkit on the next page.

Building Motivation	- Building Confidence - Enjoyable Activities - Action Planning - Coping Planning
Values	- Writing Your Values - Choice Point
Committed Action	- SMART Goals - New Habits, Old Routines
Mindfulness and Acceptance	- Give Your Mind A Name - Expansion - Notice 5 Things
Physical Activity Identity	- I Am, I Am Not

MY TOOLKIT	
Building Motivation	
Values	
Committed Action	
Mindfulness and Acceptance	
Physical Activity Identity	

Appendix C

Check-In/Exit Interview Scripts

Check-In Script

Check-In Questions

1. How are you finding the app so far? Is there anything you would like help/clarification with? What module have you completed up to?

2. How did you find the app content and worksheets? Are there any topics you would like to discuss further?

3. Overall, how do you feel you are doing with your physical activity goal? Do you feel you're on track/headed in the right direction?

Exit Interview Script

Qualitative Interview – Questions for Intervention Condition

1) Tell me how you felt about the study? Probe: What was your favourite part? Probe: Least favourite part?

2) Did you complete all the worksheets? If so, were they useful? If not, how come?

3) Did you find the information that we provided interesting or informative? What did you find most useful? Least useful?

4) Have you been able to incorporate the strategies provided in the lessons? If so, how? If not, how come?

5) What would you change about the study? Probe: This could include content of the program or any of the study methods.

6) Do you have any other comments or is there anything else about being in the study that you'd like to share?

Appendix D

Questionnaires

Modified Godin Leisure-Time Exercise Questionnaire

During a typical 7-day period, how many times on average do you do the following kinds of exercise **for more than 15 minutes** during your free time.

Type of Exercise	Frequency	Duration (minutes)
Strenuous Exercise (Heart beats rapidly) (e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)		
Moderate Exercise (Not exhausting) (e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, dancing)		
Mild/Light Exercise (Minimal effort) (e.g., yoga, archery, fishing, bowling, horseshoes, golf, easy walking)		

Affective Attitude Towards Physical activity

Over the next 6 weeks, engaging in physical activity on a regular basis would be:

	Extremely Disagree	Quite Disagree	Slightly Disagree	Neutral	Slightly Agree	Quite Agree	Extremely Agree
Enjoyable	1	2	3	4	5	6	7
Exciting	1	2	3	4	5	6	7
Pleasant	1	2	3	4	5	6	7

Instrumental Attitude Towards Physical Activity

Over the next 6 weeks, engaging in physical activity on a regular basis would be:

	Extremely Disagree	Quite Disagree	Slightly Disagree	Neutral	Slightly Agree	Quite Agree	Extremely Agree
Wise	1	2	3	4	5	6	7
Beneficial	1	2	3	4	5	6	7
Useful	1	2	3	4	5	6	7

Perceived Capability over Physical Activity

If I had to over the next 6 weeks…

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I possess the skills to do regular physical activity over the next 6 weeks if I wanted to	1	2	3	4	5
I have the physical ability to do regular physical activity over the next 6 weeks if I wanted to	1	2	3	4	5
I am confident that I am capable of engaging in regular physical activity if I had to	1	2	3	4	5

Perceived Opportunity for Physical Activity

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
If I really wanted to do regular physical activity over the next 6 weeks, I would have the chance to do so	1	2	3	4	5
I lack the opportunity to do regular physical activity over the next 6 weeks, even if I were really motivated to do so	1	2	3	4	5
There are places where I can do physical activity at home and at work if I had to	1	2	3	4	5

Physical Activity Identity

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I consider myself someone who does regular physical activity	1	2	3	4	5
When I describe myself to others, I usually include my involvement in physical activity	1	2	3	4	5
Others see me as someone who does physical activity regularly	1	2	3	4	5

Physical Activity Habit

Physical activity is something:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I do automatically	1	2	3	4	5
I do without having to consciously remember	1	2	3	4	5
I do without thinking	1	2	3	4	5
I start doing it before I realize I am doing it	1	2	3	4	5

Drexel Defusion Scale

Defusion refers to the ability to detach or distance yourself from your thoughts and feelings to see them more objectively. Given this definition, please rate each scenario according to the extent to which you would be in a state of **defusion** in the specified situation.

	Not At All	**A Little**	**Somewhat**	**Moderately**	**Quite A Lot**	**Very Much**
You become angry when someone takes your place in a long line. To what extent would you normally be able to defuse from feelings of anger?	0	1	2	3	4	5
You see your favorite food and have the urge to eat it. To what extent would you normally be able to defuse from cravings for food?	0	1	2	3	4	5
Imagine that you bang your knee on a table leg. To what extent would you normally be able to defuse from physical pain?	0	1	2	3	4	5
Things have not been going well at school or at your job, and work just keeps piling up. To what extent would you normally be able to defuse from anxious thoughts like ‘‘I’ll never get this done.’’?	0	1	2	3	4	5
Imagine you are having a thought such as ‘‘no one likes me.’’ To what extent would you normally be able to defuse from negative thoughts about yourself?	0	1	2	3	4	5
You are feeling sad and stuck in a difficult situation that has no obvious end in sight. You experience thoughts such as ‘‘Things will never get any better.’’ To what extent would you normally be able to defuse from thoughts of hopelessness?	0	1	2	3	4	5
Imagine you are having a thought such as ‘‘I can’t do this’’ or ‘‘I just can’t get started.’’ To what extent would you normally be able to defuse from thoughts about motivation or ability?	0	1	2	3	4	5
Imagine you are having thoughts like, ‘‘I’ll never make it’’ or ‘‘I have no future.’’ To what extent would you normally be able to defuse from thoughts about your future?	0	1	2	3	4	5
You are about to give a presentation to a large group. As you sit waiting your turn, you	0	1	2	3	4	5

start to notice your heart racing, butterflies in your stomach, and your hands trembling. To what extent would you normally be able to defuse from sensations of fear?						
Imagine that you lose out on something you really wanted. You have feelings of sadness. To what extent would you normally be able to defuse from feelings of sadness?	0	1	2	3	4	5

Physical Activity Acceptance Questionnaire

Below you will find a list of statements. Please rate the truth of each statement as it applies to you.

	Never True	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
I need to concentrate on getting rid of my urges to stop exercising or put off exercise.	1	2	3	4	5	6	7
My thoughts and feelings about physical activity must change before I can make changes in my exercise.	1	2	3	4	5	6	7
Even if I have the desire to stop while I am exercising, I can still follow my exercise plan.	1	2	3	4	5	6	7
If I have the thought "exercising today won't be enjoyable," it derails me from my exercise plan.	1	2	3	4	5	6	7
I will have better control over my exercise routine if I can control my negative thoughts about exercise.	1	2	3	4	5	6	7
I avoid exercising if it is going to make me feel physically uncomfortable, bored, or pressed for time.	1	2	3	4	5	6	7
I am committing to being physically active no matter what feels uncomfortable or challenging about that.	1	2	3	4	5	6	7
It is okay to experience discomfort (e.g., fatigue, boredom, sweating) while I am exercising.	1	2	3	4	5	6	7
I can keep my commitment to physical activity even when I get busy with other responsibilities (e.g., school, work, family).	1	2	3	4	5	6	7
When I start to feel out of breath or tired during exercise I find a way to keep going.	1	2	3	4	5	6	7

Valuing Questionnaire

Please read each statement carefully and then mark the number which best describes how much the statement was true for you **during the past week, including today.**

The scale ranges from **0 (Not True at All)** to **6 (Completely True).**

I spent a lot of time thinking about the past or future, rather than being engaged in activities that mattered to me	0	1	2	3	4	5	6
I was basically on "auto-pilot" most of the time	0	1	2	3	4	5	6
I worked toward my goals even if I didn't feel motivated to	0	1	2	3	4	5	6
I was proud about how I lived my life	0	1	2	3	4	5	6
I made progress in the areas of my life I care most about	0	1	2	3	4	5	6
Difficult thoughts, feelings or memories got in the way of what I really wanted to do	0	1	2	3	4	5	6
I continued to get better at being the kind of person I want to be	0	1	2	3	4	5	6
When things didn't go according to plan, I gave up easily	0	1	2	3	4	5	6
I felt like I had a purpose in life	0	1	2	3	4	5	6
It seemed like I was just "going through the motions", rather than focusing on what was important to me	0	1	2	3	4	5	6

mHealth Satisfaction Questionnaire

Rate the following statements according to the degree to which you agree or disagree with them.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
It was a disturbance	1	2	3	4	5
The introduction of how to use it was sufficient	1	2	3	4	5
It was boring to use	1	2	3	4	5
It was easy to use	1	2	3	4	5
It was good to use	1	2	3	4	5
The time spent using it has been acceptable	1	2	3	4	5
I can recommend it to others	1	2	3	4	5
It has motivated me to change my lifestyle habits	1	2	3	4	5
It has helped me to understand the benefits of improving my lifestyle habits	1	2	3	4	5
It has helped me to understand how I need to change my lifestyle habits	1	2	3	4	5
It has helped me set personal goals for my lifestyle habits in a way that I could not have done on my own	1	2	3	4	5

mHealth App Usability Questionnaire

Rate the following statements according to the degree to which you agree or disagree with them.

	Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Agree**	**Strongly Agree**
The app was easy to use.	1	2	3	4	5	6	7
It was easy for me to learn to use the app	1	2	3	4	5	6	7
The navigation was consistent when moving between screens.	1	2	3	4	5	6	7
The interface of the app allowed me to use all the functions (such as entering information, responding to reminders, viewing information) offered by the app	1	2	3	4	5	6	7
Whenever I made a mistake using the app, I could recover easily and quickly.	1	2	3	4	5	6	7
I like the interface of the app.	1	2	3	4	5	6	7
The information in the app was well organized, so I could easily find the information I needed.	1	2	3	4	5	6	7
The app adequately acknowledged and provided information to let me know the progress of my action.	1	2	3	4	5	6	7
I feel comfortable	1	2	3	4	5	6	7

using this app in social settings.							
The amount of time involved in using this app has been fitting for me.	1	2	3	4	5	6	7
I would use this app again.	1	2	3	4	5	6	7
Overall, I am satisfied with this app.	1	2	3	4	5	6	7
The app would be useful for my health and well-being.	1	2	3	4	5	6	7
The app improved my access to healthcare services.	1	2	3	4	5	6	7
The app helped me manage my health effectively.	1	2	3	4	5	6	7
This app has all the functions and capabilities I expected it to have.	1	2	3	4	5	6	7
I could use the app even when the Internet connection was poor or not available.	1	2	3	4	5	6	7
This mHealth app provides an acceptable way to receive healthcare services, such as accessing educational materials, tracking my own activities, and performing self-assessment.	1	2	3	4	5	6	7

Appendix E

Recruitment Material

Recruitment Response Email

[Title: UVic ACTive Parent Study]

Hi [name],

Thanks for your interest in the app-based physical activity study for new parents!

This study is examining the feasibility of an app-based behaviour change intervention designed to promote physical activity.

Who is eligible?

- Parents with a child 5 years old or younger
- You must not be meeting the physical activity guidelines of 150 minutes per week of moderate to vigorous intensity physical activity
- You must have a smartphone with access to the internet

What is involved?

If eligible, here's what you can expect:

1. **Baseline Measures**: You'll complete 4 short questionnaires.
2. **Group Assignment**: You'll be randomly assigned to either:
    - The **intervention group**, where you'll use the app and complete supplementary tasks for six weeks.
    - The **control group**, where you'll be given the Canadian 24-Hour Movement Guidelines to follow.
3. **Follow-Up Measures**: At the end of Week 6, you'll complete another set of questionnaires (7 for the intervention group, 5 for the control group).
4. **Exit Interview (Intervention Group Only)**: A brief Zoom interview to gather feedback on your experience.

The total time commitment for this study is **6 hours over 6 weeks,** excluding any time spent being physically active.

Next steps

If you're interested in participating, the next step is a brief Zoom call to confirm your eligibility. I'm currently available during the day on Tuesdays and Wednesdays, and after 5pm on Thursdays and Fridays. Let me know if any of those times work for you!

Thank you for your time and I look forward to hearing from you!

Sincerely,

Joe Barton
MA Candidate
Behavioural Medicine Lab
University of Victoria

Snowball Recruitment Email

Dear Participant,

As I continue recruiting for this study, I am hoping that people who are currently participating will share the study details with people they know who may also want to participate!

There is a recruitment poster attached which is intended to act as advertisement and information for any friends you think might be interested in the study. This is a kind of 'snowball' recruitment to spread the word to people who have missed our other ads.

Some important things you should know before sharing study information with people you know:

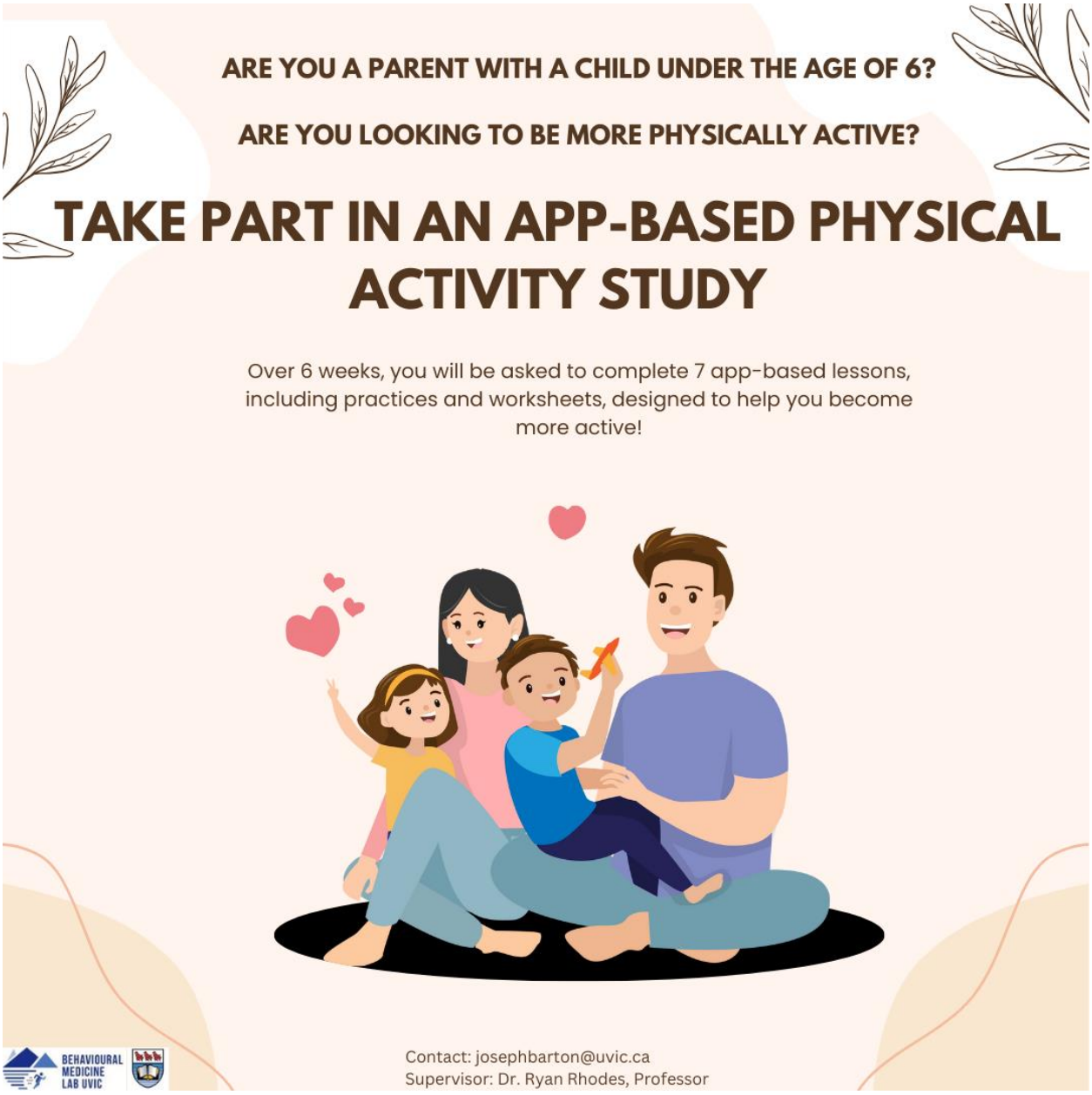
1) **This is optional –** you should only share the flyer if you would like to do so.
2) **People who you give the flyer to cannot be coerced or forced to participate if they do not wish to do so.** The flyer should only be passed along passively to potentially interested individuals. It will be explained to individuals who are recruited via the flyer that this is **voluntary** and they are under **no obligation to participate.**
3) **Only those who are new parents (child under the age of 6) are eligible. Additionally, only those who are engaging in less than 150 minutes of physical activity per week are eligible.**

Thank you,

Joe Barton
MA Candidate
Behavioural Medicine Lab
University of Victoria

Dr. Ryan Rhodes, PhD., Professor
Director, Behavioural Medicine Lab
University of Victoria

Recruitment Posters




JOIN A 6 WEEK
APP-BASED PHYSICAL ACTIVITY STUDY
FOR PARENTS WITH YOUNG CHILDREN
Do you have a child under the age of 6 and are looking to be more active?
WHAT'S INVOLVED?
Complete 7 app-based lessons, as well as worksheets and practices, designed to help you be more active!
BEHAVIOURAL MEDICINE LAB UVIC
Contact: josephbarton@uvic.ca
Supervisor: Dr. Ryan Rhodes, Professor

Appendix F

Screening Call Material

Screening Call Script

Introduction:

Hi, thanks for meeting with me. I just have a few questions to confirm your eligibility.

Do you have a child under 6? Must answer Yes

Do you have a smartphone? Must answer Yes

GLTEQ
These next few questions are about your weekly physical activity. I want you to think back over the last couple weeks to get an average. [Go through GLTEQ]

GAQ
Great, the last thing I need to do before confirming eligibility is to go through a few health questions to make your it's okay for you to start becoming more active. [Go through GAQ]

Study Details
Okay, you're eligible to participate. I'll quickly go over the study in a bit more detail.

You'll complete a baseline questionnaire and then be randomized into either the intervention group or the control group.

If you're assigned to the intervention group, you'll be given access to the app for six weeks and asked to complete the lessons and worksheets. A new lesson comes out every 4 days. Around the 3 week mark there will be a quick check in meeting to assist you with anything you may need help with. After the six weeks, you will be sent a second questionnaire to complete. You will also be asked to participate in an exit interview about your experience with the app.

If you're assigned to the control group, you will be sent a copy of the Canadian 24 hour movement guidelines and asked to follow those. After 6 weeks, you will be sent a second questionnaire. Once you've completed that, you will have the opportunity to access the app for 6 weeks.

Does this sound like something you'd like to participate in?

Consent
Great, I will send you the consent form. Read through it and if you consent sign the form and email it back to me.

[Once signed consent is obtained] That's all for this call. I will send you the baseline questionnaire. Once you filled that out, I will let you know what group you've been assigned to!

Do you have any questions before I end the call?

Appendix G

Baseline Characteristics for Key Secondary Outcomes of Interest

	t	***df***	***p***
MVPA	0.07	52	0.94
Attitudes towards PA	-0.07	63	0.94
Perceived capability over PA	0.04	63	0.97
Perceived opportunity for PA	1.55	63	0.13
PA habit	-1.64	63	0.11
PA identity	-2.62	63	0.01
Defusion	0.79	62	0.43
Acceptance	-0.38	62	0.71
Progress values	0.01	62	0.99
Obstruction values	-0.38	62	0.70