A Remote Acceptance-Based Affect Regulation Intervention to Promote Physical Activity Among Early Career Professionals: A Mixed Methods Examination of Feasibility

by

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Bachelor of Arts, University of Victoria, 2015

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

MASTER OF SCIENCE

in the School of Exercise Science, Physical and Health Education

Supervisory Committee

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Abstract

Background: The benefits of physical activity (PA) are well-established, yet much of the population is insufficiently active to reap optimal health effects. Early career professionals (ECPs) comprise one transitional group at-risk for inactivity and therefore a critical target for PA promotion. A web-based intervention utilizing online modules and podcasts represents an innovative delivery format for this time-pressed population; however, theoretical mechanisms of action and corresponding behaviour change techniques need to be honed to effectively increase PA. Affective state (e.g., challenging emotion or mood) is one factor that contributes to an established intention-behaviour gap and is especially pertinent among ECPs who face many demands and stressors. As such, an intervention designed to foster intention translation, strengthen emotion regulation, and mitigate the effect of incidental affect (e.g., work-related stress on PA engagement) to assist with PA initiation is warranted. This study uses a parallel randomized controlled design to explore the feasibility of a web-based intervention grounded in the Multi-Process Action Control (M-PAC) Framework and with a specific focus on Acceptance and Commitment Therapy (ACT) principles to promote PA among ECPs. **Objectives:** 1) To examine primary outcomes related to the feasibility and acceptability of a six-week web-based intervention and 2) explore the effects of the intervention on secondary outcomes of interest including moderate-to-vigorous PA (MVPA), emotion regulation, M-PAC constructs, and ACT constructs (acceptance, valued living, and mindfulness). **Methods:** Adults aged 25-44 residing in Canada who were employed at least part-time in a desk-based job and identifying as not meeting PA guidelines (<150 min MVPA) were recruited. Participants were randomized into a 6-week online intervention or a wait-list control group using a mixed block design. The intervention group gained access to 6-weekly self-guided online modules incorporating select M-PAC

constructs and integrating ACT principles with an emphasis on affect regulation strategies. Short podcast episodes were offered as a complement to the lesson concepts. Primary feasibility outcomes were descriptive and included recruitment, retention, engagement and adherence. Satisfaction and acceptability were measured via self-report and through qualitative interviews. Secondary outcomes of MVPA, emotion regulation, M-PAC constructs, and ACT constructs were assessed via self-report at baseline and post-intervention at 6 weeks using questionnaires. Effect sizes were calculated using analysis of covariance to control for baseline values. **Results:** Twenty-six adults were recruited and randomized to the web-based intervention (n=14) and waitlist control (n=12) groups. The recruitment rate was 35%, retention was 73%, engagement was 63%, and satisfaction was high (M = 2.68/4; M = 4.07/5). Qualitative feedback was highly positive and suggestions for intervention improvement were themed around ideas for strengthening engagement, increasing podcast awareness, and addressing minor technical issues. Participants logged in 4.57 times (SD = 3.30) and spent 31.6 minutes (SD = 18.25) per week on the intervention. Participants allocated to the intervention improved MVPA ($\eta_p^2 = 0.53$), emotion regulation ($\eta_p^2 = 0.42$), M-PAC action control constructs of behavioural regulation ($\eta_p^2 = 0.48$), affective attitude ($\eta_p^2 = 0.26$), identity ($\eta_p^2 = 0.11$), and ACT-related constructs of mindfulness ($\eta_p^2 = 0.47$), valued living ($\eta_p^2 = 0.20$), and acceptance and action ($\eta_p^2 = 0.07$), **Conclusion:** The recruitment, retention, and engagement rates were adequate while satisfaction was favourable, suggesting a full-scale randomized controlled trial is feasible with minor modifications. Secondary outcomes showed movement in the hypothesized direction suggesting intervention fidelity. A large-scale study is warranted to establish intervention effectiveness.

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List of Abbreviations and Glossary Terms

ACT	Acceptance and Commitment Therapy
ANCOVA	Analysis of covariance
BCT	Behaviour change technique
ECP	Early career professional
M-PAC	Multi-Process Action Control Framework
MVPA	Moderate-to-vigorous physical activity
PA	Physical activity
RCT	Randomized controlled trial

Acknowledgments

The journey to completing my master's degree has not been a straight (or short) path. I am indebted to many who have helped me along the way.

First and foremost, I would like to sincerely thank and acknowledge my supervisor, Dr. Ryan Rhodes. I feel beyond fortunate to have received such incredible guidance and mentorship throughout my academic career. Thank you for providing so many opportunities to learn and grow over the years, which no doubt shaped me into the researcher I am today. I genuinely appreciate your patience, understanding, and kindness through my process.

I would also like to thank Dr. Sam Liu for his time and valuable feedback, as well as his expertise in digital health. This research would not have been possible without an awesome online platform!

I have tremendous gratitude for my colleagues in the BMED Lab. Over the years, this incredible group has served as an important support network, always willing to talk things through, take an active break, offer insight and wisdom, and have some fun.

Thank you to my husband, for your steadfast support as well as the timely reminders about mental toughness. Your steadiness and conviction in my abilities means more than you know.

Finally, I am incredibly grateful for my family and their unwavering support and encouragement. Thank you to my siblings for regularly lending an ear…and also recognizing when it would be better not to ask.

To all those who find stress getting in the way of physical activity (a group I regularly fall into): I hope this research can help you live in line with your values.

Dedication

This research is dedicated to my loving parents. Mom, thank you for always demonstrating determination and grit. Dad, thank you for exemplifying the hard work and perseverance required for grad studies. I find strength and inspiration in the examples you set and the values you instilled in me.

Chapter 1: Literature Review

1.1 Health Benefits of Physical Activity

Regular physical activity (PA) is linked to a host of health benefits and widely accepted as a protective health measure. To this end, a considerable body of research provides well-established evidence that PA is associated with a reduced risk for many chronic diseases including but not limited to cardiovascular disease, diabetes, obesity, hypertension, and some cancers (Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010; Warburton, Nicol, & Bredin, 2006). Conversely, Lee and colleagues (2012) presented persuasive evidence that inactivity has tremendous disease burden globally. Namely, the authors found that inactivity caused 9% of premature mortality which equated to over a 5 million deaths worldwide. This finding underscores the incredible ill-effects of inactivity and highlights the paramount importance of increasing population PA levels. A more recent high-level review indicates that regular PA is an effective preventative measure which guards against at least 25 chronic medical conditions (Rhodes, Janssen, Bredin, Warburton, & Bauman, 2017a). Furthermore, this review suggests risk reduction typically falls in the range of 20-30%, with convincing epidemiological evidence indicating routine PA is associated with a 31% risk reduction for premature all-cause mortality. Importantly, reviews emphasize that even small changes in PA can lead to marked improvements in health status (Rhodes et al., 2017a; Warburton & Bredin, 2017). Taken together, the strength of the evidence is staggering in terms of the physical benefits of regular PA.

In addition to these impressive physical benefits, emerging evidence underlines the importance of regular PA for a vast array of mental health benefits and well-being. For example, a meta-analysis examined the effects of leisure time PA (LTPA) on subjective well-being and found it was associated with positive affect and life satisfaction (Wiese, Kuykendall, & Tay,

2018). Further, a meta-meta-analysis by Rebar et al., (2015) showed that PA participation led to a meaningful reduction in depression and anxiety. Beyond these psychological benefits, health-related quality of life, which is a multidimensional construct that includes perceived mental and physical health over time, is also linked to PA. For example, a systematic review comprised of cross-sectional data reported consistent positive associations between physical activity and health-related quality of life among adults (Bize, Johnson, & Plotnikoff, 2007). Finally, Rhodes and colleagues (2017b) synthesize various systematic reviews demonstrating promising effects on cognition among those that are routinely active. A more recent review corroborates this finding, suggesting physical exercise improved cognitive function in adults over 50 (Northey, Cherbuin, Pumpa, Smee, & Rattray, 2018). Collectively, there is convincing evidence that routine PA is associated with a myriad of mental health benefits.

Clearly, there are overwhelmingly positive physiological and psychological health benefits associated with regular PA. On the other hand, high rates of inactivity are associated with high disease burden and steep health care costs (Ding et al., 2016). Thus, PA promotion can be regarded as a public health priority. Taken together, it is unsurprising that effective methods to promote PA are needed to improve population health. One way to serve this aim of improving population health on a grand scale is to develop cost-effective, accessible, and scalable interventions that can increase PA in large populations.

1.2 Physical Activity Participation Rates

Previous Canadian physical activity guidelines recommended adults aged 18-64 achieve 150 minutes of moderate-to-vigorous physical activity (MVPA) per week in bouts of 10 minutes or more (Tremblay et al., 2011). In 2011, the first nationally representative objective physical activity data measured by accelerometry were published, reporting that during the 2007-2009

cycle of the Canadian Health Measures Survey (CHMS) only 15% of adults were accumulating sufficient MVPA to meet guidelines (Colley et al., 2011). More recent waves of CHMS data provided the opportunity to assess any trends or changes in PA over the years.

A more recent cycle of CHMS (2016 to 2017) found that only one in five (16%) of Canadians were meeting PA guidelines, indicating that the PA of Canadians has remained low and stable with no significant temporal trends over five cycles (Clarke, Colley, Janssen, & Tremblay, 2019). Importantly, Clarke and colleagues (2019) found that many adults accumulate their physical activity in bouts less than ten minutes. This finding is noteworthy, because the bout stipulation was due to insufficient evidence to indicate substantive health benefits in periods of PA less than 10 minutes, yet there is emerging evidence to suggest sporadic PA in shorter bouts is associated with health benefits (ParticpACTION, 2019; Physical Activity Guidelines Advisory Committee, 2018). Accordingly, the most recent American PA guidelines removed the bout stipulation (Piercy et al., 2018). Subsequently, the Canadian 24-Hour Movement Guidelines for Adults followed suit by removing the bout stipulation and thus the recommendation is to achieve 150 minutes per week of MVPA, which can be accumulated in bouts less than 10 minutes (Ross et al., 2020). With the omission of the bout stipulation, considerably more Canadians would accumulate the recommended amount of MVPA minutes (Clarke et al., 2019). Finally, Clarke et al., (2019) note that Canadians accumulate their PA mostly in the moderate intensity despite potentially greater yields of health benefits at the vigorous intensity. Interestingly, international guidelines differ insofar as they prescribe 75 minutes of vigorous PA as an alternative to 150 minutes of MVPA (World Health Organization, 2010). Despite these considerations surrounding guidelines, it is reasonable to conclude there is much room for improvement in terms of PA levels of Canadians.

Canadians are not alone in being insufficiently active; physical inactivity is without a doubt a prevalent and widespread issue. To this end, a study with convincing evidence reports 31% of the world as inactive (Hallal et al., 2012). A more recent pooled analysis of population-based surveys representing most of the global population reports 27.5% of the global population is insufficiently active, with a greater prevalence of inactivity (36.8%) in high-income countries (Guthold, Stevens, Riley, & Bull, 2018). This study is limited by self-reported PA measures, which are of course subject to limitations (e.g., recall bias and social desirability; Prince et al., 2008), however this is balanced by incorporating large amounts of surveillance data from around the world. Unsurprisingly, global inactivity has been recognized by some as a pandemic considering the international reach and broad health, economic, and social repercussions (Kohl et al., 2012).

Although inactivity is a concern worldwide and across age groups, some populations are of particular concern. One such group is young adults, as accelerometer data indicates that a striking 80% of adults aged 18-39 are not active enough to reap the physical and mental health benefits of regular PA as compared to 76% of adolescents aged 12 to 17 (Clarke et al., 2019; Roberts et al., 2017). Admittedly, this finding is complicated by changes in guidelines across age groups (Rhodes et al., 2017b). For this reason, it is prudent to examine differences in daily PA across age groups. To this end, the most recent cycles of national objective physical activity data indicate that youth aged 12-17 achieved an average of 51 minutes per day of MVPA, compared to an average of 31 minutes of MVPA per day among 18 to 39 year olds, and 26 minutes per day for those aged 40 to 59 (Clarke et al., 2019; Colley et al., 2017). This data provides evidence for a negative trend in PA across the life course, but perhaps more importantly, it underscores a dramatic decline in daily PA from youth to young adulthood (a 20-minute decrease in daily

MVPA). However, in order to properly establish changes in PA across age groups, it is useful to examine longitudinal data. A recent meta-analysis of longitudinal cohort data showing PA declines from adolescence to early adulthood suggests young adults are an important target group for PA promotion (Corder et al., 2019). Taken together, this sharp decline in PA during young adulthood represents a compelling opportunity for intervention, in an effort to change PA patterns and subsequently ameliorate PA levels across the lifespan.

1.3 Life Transitions and Physical Activity Patterns

Several systematic reviews have examined the role of critical life-transitions in PA behaviour. Allender and colleagues (2008) define life transitions, or life-change events, as "those occurrences, including social, psychological and environmental, which require an adjustment or effect a change in an individual's pattern of living" (p. 161). There is now substantive evidence indicating key life-changes are indeed negatively associated with PA rates (Allender et al., 2008; Bellows-Riecken & Rhodes, 2008). These reviews suggest transitions such as starting college, marriage, parenthood, and entering the workforce as probable causes for PA declines. The onset of parenthood in particular has been consistently linked with notable declines in PA levels (Bellows-Riecken & Rhodes, 2008). However, despite the abundance of studies, the evidence is mostly cross-sectional in nature and therefore these reviews must be interpreted with caution. Without longitudinal evidence, robust conclusions about PA across these transitions remains unclear.

A more recent review suggests changes in employment status also constitutes an important transition period: beginning work was associated with a decrease in PA in both young men and young women (Engberg et al., 2012). Consistent with this life-transition literature, Kirk and Rhodes (2012) investigated the PA changes during the early career transition among academic

professors and found PA changed across the transition. Interestingly, the magnitude of the PA decline was much larger than prior research (nearly two sessions per week). This study contributed to a limited evidence base for the early career transition among professional occupations, however the findings must be interpreted with caution as retrospective recall was used which may be subject to bias. Nevertheless, the findings suggest professionals in the early career transition are a suitable target. Furthermore, life course transitions have also been identified as a unique opportunity to intervene and strategically promote health behaviour change (Verplanken & Roy, 2016). Taken together, it is reasonable to conclude that entering the workforce is a life event that likely contributes to changes in PA and thus individuals in this transitional period, specifically early career professionals (ECPs) are an important target group.

1.4 Early Career Professionals as a Critical Target Population

The PA decline across the early career transition (Kirk & Rhodes, 2012) is unsurprising, as the formative years of professional occupations such as academia are widely recognized as busy, demanding, and stressful. Kirk and Rhodes (2012) offer evidence to support this conjecture: the authors found that control beliefs related to limited time, inconsistent schedule, work demands, and job pressures to reach professional expectations were correlates which distinguished between those that did and did not remain active across the transition. The barrier of limited time is perhaps most salient for this population. Long work hours are likely a crucial factor that contributes to the PA decline. In Canada, working long hours (50+ per week) is more common in professional occupations which require postsecondary education and among those between the ages of 25-44 (Shields, 1999). Furthermore, young adults working in white-collar (professional) occupations are more likely to report working long hours. It can be reasoned that large amounts of time spent working detracts from opportunities to engage in leisure time

physical activity. Conversely, even early career individuals who are working part-time to full-time may experience employment as demanding, especially if they are balancing other aspects of life. For example, early career professionals may have children or other commitments and obligations which could draw away from physical activity participation. In summary, it is tenable that early career professionals across a range of work arrangements and occupations may experience competing demands, limited time, and job pressure.

In addition to the barriers cited above, professionals' work is often largely desk-based and therefore may provide limited opportunity for PA throughout the day. Knowledge-based work is commonly characterized by reading and computer use which undoubtedly results in low occupational energy expenditure. Indeed, systematic reviews have consistently shown that office work, specifically among professional or white-collar occupations, is associated with the greatest sedentary time and lowest on-the-job PA (Prince, Elliott, Scott, Visintini, & Reed, 2019; Smith et al., 2016). A pertinent systematic review found convincing evidence to support the premise that individuals working in demanding professional occupations have low on-the-job PA are at risk of inactivity (Kirk & Rhodes, 2011). There is also preliminary evidence that psychosocial work demands (e.g., job strain) is negatively associated with leisure time PA (Kirk & Rhodes, 2010). In further support of these ideas, Biswas and colleagues (2020) examined work factors such as psychological demands at work using 12 years of National Population Health Survey (NPHS) longitudinal survey data. The authors reported evidence to suggest as psychological demands increased, the likelihood of transitioning from inactive to active decreased.

Apart from work-related barriers to regular PA, early career professionals often face negative psychological outcomes. For example, new professors aiming for tenure might experience psychological distress due to the heavy demands in a competitive academic

environment. Furthermore, new professors are typically faced with multiple responsibilities such as teaching, research and service. Unsurprisingly, younger faculty have been found to have higher levels of depression, anxiety, and job dissatisfaction compared to older colleagues (Schindler et al., 2006). The case is arguably similar for junior lawyers seeking advancement in their firm, given the first years are commonly known to be a "make it or break it" period. To date, a plethora of research among lawyers indicates they are disproportionately affected by psychological distress as compared to other occupations and the general population. One study using a broad and representative sample of longitudinal data from seven cycles of Statistics Canada's NPHS provides evidence to suggest that working in a regulated occupation (e.g., professionals such as lawyers) exerts a direct effect on mental health (Cadieux & Marchand, 2014). Perhaps of most relevance is the evidence to suggest that being a junior lawyer predicts higher levels of psychological distress (Hopkins & Gardner, 2012).

The COVID-19 pandemic is likely a contributor to increased stress among workers. Evidence from the COVID-19 pandemic is now emerging to suggest workers across the board are experiencing high levels of work-related stress and heightened levels of burnout (Abramson, 2022). Therefore, it can be argued that psychological distress may extend to those working in desk-based careers more broadly. Given these elevated levels of psychological distress among new professionals, ECPs are a group that stands to gain considerable benefits from PA promotion, making them a critical target.

Despite the strong rationale for targeting ECPs, this population is time-pressed and thus carving out time to attend a health promotion program in person may be difficult or impossible for busy professionals. Therefore, in order to appeal to this population and address their time constraints, an appropriate intervention would need to be convenient and accessible. The extant

literature also provides useful intervention targets for early career professional's transitional period relating to the barriers of limited time, work demands and job pressures (Kirk & Rhodes, 2012). Accordingly, ECPs would benefit from interventions targeting beliefs about stress relief and information on how to balance competing demands.

1.5 Theories of Physical Activity Behaviour Change and the Intention-Behaviour Gap

Theoretical frameworks act as useful guides that provide structure to understand and subsequently intervene upon physical activity (Rothman, 2004) and are regarded as essential to PA research (Rhodes & Nigg, 2011). Grounding interventions in theory is commonly considered 'good practice' (Prestwich, Webb, & Conner, 2015). To date, the dominant theoretical approach for physical activity research had been the social cognitive framework (Rhodes, McEwan, & Rebar, 2019). Indeed, many promotion efforts to date have been in the social cognitive tradition, with varying degrees of success (Rhodes et al., 2019). The cornerstone of social cognitive frameworks, such as Social Cognitive Theory (Bandura, 1998) and the Theory of Planned Behavior (Ajzen, 1991), is the basic postulation that changing belief-based variables will affect intention formation, and intentions will subsequently impact the target behaviour. The relative lack of success of these approaches is likely due in part from this positioning of intention as the proximal determinant of behaviour, for example, a meta-analysis which explored the intention-behaviour relationship found that 48% of PA intenders failed to follow through (Rhodes & de Bruijn, 2013). In simple terms, while there was evidence that nearly all of those who succeeded had positive intentions, nearly half of those with good intentions failed to follow through, indicating that intentions are necessary but not sufficient. Indeed, it is this considerable "intention-behaviour gap" that is a common criticism of the social cognitive tradition (Sheeran & Webb, 2016). Unsurprisingly, in recent years there has been some debate surrounding the utility

of theory for various reasons (e.g., Hagger & Weed, 2019; Sniehotta, Presseau, & Araújo-Soares, 2014). In short, although these theories have served a purpose in advancing the field, they lack practical value, especially given the evidence to indicate intentions alone are insufficient for enacting health behaviours (Rhodes, La, Quinlan, & Grant, 2021). It follows that there remains room for improvement in terms of PA promotion effectiveness.

For these reasons, Rhodes and colleagues (2019) suggest that integrated and adapted frameworks that draw on numerous theoretical traditions likely serve behavioural science the best. Moreover, frameworks that take into account intention-behaviour discordance by addressing action control, that is the translation of intentions into behaviour, are a suitable way forward (Rhodes & Yao, 2015). Further, theories which integrate volitional self-regulation strategies to aid translation and promote greater success are timely. In support of this idea, models which use volitional behaviours to strategically hone intentions have sound empirical evidence (Bélanger-Gravel, Godin, & Amireault, 2013; Carraro & Gaudreau, 2013; Kwasnicka, Presseau, White, & Sniehotta, 2013). One such framework is the Multi-Process Action Control approach (M-PAC; Rhodes, 2017a). M-PAC addresses PA promotion from an action control perspective: it utilizes key concepts to bridge the intention-behaviour gap. To this end, regulatory strategies such as goal setting, action planning, and reducing negative emotions are proposed to foster behavioural follow-through. Based on these reasons, an intervention informed through a M-PAC lens would constitute an appropriate theoretical approach to promoting PA among ECPs.

One salient reason why intenders may not follow through is because of challenging mood or emotion throughout the day (e.g., job-related stress), a factor that is especially pertinent among ECPs. Affective determinants of behaviour have been acknowledged within M-PAC. Rhodes and Gray (2018) have previously theorized various pathways through which affect disrupts action

control and Rhodes et al., (2021) propose automatic tendencies relating to incidental affect can negatively impact behavioural follow-through. However, one underdeveloped area of M-PAC relates to the regulation of incidental affect. Strategies to mitigate the effect incidental affect (e.g., job-related stress) has received very little attention in the PA domain and remains largely unexplored at this time (Williams et al., 2019). Therefore, an intervention targeting incidental affect would constitute an important and worthwhile contribution to the field.

1.6 Affective Determinants of Physical Activity

A burgeoning field in the PA domain is related to affective determinants of health behaviours. To this end, Williams and colleagues (2019) suggest a greater emphasis should be placed on how affective factors contribute to health behaviours by integrating into existing health behaviour theories. Research to date has largely focused on the affective response to PA (e.g., Ekkekakis, Parfitt, & Petruzzello, 2011) and affective processing (Stevens et al., 2020; Williams et al., 2019). Conversely, direct intervention upon the moderators of the affect-behaviour link (self-regulation of affect) has received less research attention (Sheeran, Gollwitzer, & Oettingen, 2018). The present study seeks to fill this gap in the literature.

Affect has been conceptualized as follows: *affect* (umbrella term), *core affect* (e.g., hedonic response and arousal), *emotions* (coordinated and distinctive responses and experiential feelings; e.g., anger, fear, joy), *mood* (more diffuse and time-limited; e.g., happy, contented, depressed), *affect processing* (umbrella term consisting of cognitive processing of previous responses) and *incidental affect* (not experienced in the context of a behaviour but may exert influence on the behaviour; e.g., the effects of job-related stress on PA engagement) (Williams et al., 2019). To address the growing literature, the Affect and Health Behaviour Framework (AHBF) aims to clarify and distinguish affect-related constructs (Stevens et al., 2020). The

AHBF proposes affective determinants of PA can be categorized into affective response to PA (e.g., feelings in response to PA); incidental affect (e.g., feelings throughout the day but unrelated to PA); affect processing (e.g., affective judgments); and affectively charged motivation (e.g., hedonic motivation). Incidental affect is the focus of the present study.

As a result of advances in the field of affective science, researchers have been able to glean information on how incidental affect might impact PA. For example, advancements in mobile technology have borne ecological momentary assessment (EMA), which is a time-intensive approach whereby smartphones gather real-time self-reports of behaviors, contexts, and emotional states in naturalistic settings (Dunton, 2017). EMA allows for the assessment of intraindividual fluctuations in PA and dynamic patterns of change. One of the first attempts to synthesize the evidence evaluating the acute relationships between affective states (EMA studies) found that positive affect was associated with subsequent PA, however negative affect did not have a significant relationship (Liao, Shonkoff, & Dunton, 2015). A major strength of this synthesis was that the studies were conducted in free-living, naturalistic settings, yet it was limited to relatively few studies which indicates the relative infancy of the field (only six studies investigated affective states and subsequent PA). More recent evidence bolsters this finding. Specifically, one study using EMA examining short-term intention-behaviour couplings indicated the odds of successfully translating intentions into PA behaviour are greater when positive affect is higher (Maher et al., 2017). EMA has also indicated that incidental affect such as stress of the day may disrupt action control (Almeida et al., 2020). Further, there is now evidence to suggest that displeasure and stress (incidental negative affect) are reliable predictors of inactivity (Almeida et al., 2020; Dunton, 2017). Considering these compelling findings, it can

be concluded interventions to mitigate the effect of negative incidental affect on PA are warranted.

As discussed by Williams et al., (2019), there is a paucity of research targeting factors such as incidental affect, and therefore intervention upon moderators of the affect-behaviour link (affect regulation) has been identified as an area for future direction. Importantly, due to the evolutionary foundation of affect, the constructs might be difficult to actually change, however it may be possible to mitigate their impact on behaviour (Williams, 2019). Fortunately, the authors make several recommendations for potentially effective ways to alter the impact of affect. Habit, identity, implementation intentions and mindfulness have been proposed as possible ways to alter the impact of this type of affect, and other emotion regulation strategies have also been highlighted (Rhodes, & Gray, 2018; Sheeran, Gollwitzer, Oettingen, 2018; Williams et al., 2019). For example, a systematic review of the effectiveness of various means to regulate emotion found that distraction, reappraisal and suppression were effective (Webb, Miles, & Sheeran, 2012). Another potentially useful strategies relevant to emotion regulation are acceptance-based strategies. A review and meta-analysis has shown acceptance strategies for emotion regulation to be useful in other domains (Kohl et al., 2012). For example, one study found that the use of both reappraisal and acceptance led to significantly reduced subjective distress, physiological reaction, and behavioural avoidance compared to a control group (Wolgast, Lundh, & Viborg, 2011). For these reasons, implementation intentions, mindfulness, acceptance, and reappraisal were incorporated into the intervention discussed herein.

1.7 Acceptance and Commitment Therapy (ACT)

Acceptance and Commitment Therapy (ACT) is rooted in clinical psychology (Hayes, 2004; Hayes, Strosahl, & Wilson, 1999). As such, it is considered part of the larger categories of

Cognitive Behavioural Therapy and Functional Contextualism and has been suggested as part of a third wave of behavioural theory. It is a context-driven approach insofar as it acknowledges the social, psychological, and situational context which influences the impact of thought and emotion on behaviour rather than thought content that is unique to each behaviour. Much of ACT's early work targeted mental health, however the approach has been gaining momentum for health behaviour change. Recently it has received attention in the field of health psychology and has been highlighted as a potentially effective and timely approach to health promotion (Zhang et al., 2018).

ACT takes into account the context and function of psychological phenomena and emphasizes experiential change strategies (Hayes et al., 1999). To this end, ACT is unique insofar as it does not aim to directly change internal experiences (e.g., thoughts, feelings, or bodily sensations) (Pears & Sutton, 2020). In lieu, it aims to change the interaction with the internal experience rather than the experience itself. Consequently, a mainstay of ACT is the cultivation of mindfulness and acceptance strategies to enable behavioural regulation even in the presence of these experiences (Zhang et al., 2018). In other words, ACT develops acceptance and mindfulness skills to enhance persistence and foster behavioural follow-through. In short, ACT does not aim to change internal experiences, but aims to foster acceptance and mindfulness skills to increase behavioural regulation. This resulting increase in regulation has been termed psychological flexibility (Zhang et al., 2018).

Zhang and colleagues (2018) suggest ACT improves health behaviours through targeting this key construct of psychological flexibility. Psychological flexibility has been defined as "the ability to contact the present moment more fully as a conscious human being and to change, or persist in, behavior when doing so serves valued ends" (Biglan, Hayes, & Pistorello, 2008). As

such, behavioural commitment to valued life directions is another pillar of ACT. Put simply, through fostering psychological flexibility individuals are able to change their experiences with their thoughts in a way that allows for engagement in a valued target behaviour (e.g., increased PA) despite difficult thoughts (e.g., I'm too stressed) (Pears & Sutton, 2020).

The psychological flexibility model which underpins ACT consists of six main components or processes: defusion, acceptance, flexible attention to the present moment, self-as-context, values, and committed action (Zhang et al., 2018). It has been posited that the psychological flexibility model can facilitate behaviour change in three main ways: a) increasing commitment to valued-based behaviour b) strengthening an accepting method of experiencing psychological events, thereby reducing barriers to behaviour change and c) improving awareness through mindfulness which allows for situation-appropriate behavioural choices (Butryn, Forman, Hoffman, Shaw, & Juarascio, 2011; Zhang et al., 2018)

In sum, targeting the key construct of psychological flexibility through acceptance and mindfulness enables individuals to persist in behaviours that are consistent with their values (such as PA). This can be achieved through targeting the processes that make up the psychological flexibility model. Because ACT offers an alternative for experiencing unwanted psychological experiences, it represents an attractive approach for regulating incidental affect such as the job-related stress experienced by ECPs. Thus, exploring the suitability of an ACT-informed intervention among early career professionals is a worthy line of inquiry.

1.8 ACT Applied to Health Promotion

A convincing evidence base has now amassed for "third wave" therapies such as ACT, which affirms their value for public health (Dimidjian et al., 2016). At this time there is also preliminary evidence to suggest ACT has been effective at changing behaviour in several health-

related domains such as physical activity, smoking cessation, and weight management (Zhang et al., 2018). Naturally, applications of ACT to PA promotion of are particular interest to the present study.

In this regard, there have been numerous interventions informed by ACT in the last decade. One of the first published pilot studies evaluating ACT for PA was conducted by Butryn et al., (2011) who investigated the effectiveness of an ACT intervention to promote PA in the short term. In this study, undergraduate females were randomized to an ACT condition or an education control condition. The ACT intervention was relatively brief (totaling 4 hours) and the data collection period was relatively short (8 weeks). Results indicate those in the ACT condition engaged in significantly more physical activity. There were limitations to this research, including a small sample size and lack of generalizability to other populations. Nonetheless, this pilot study provides useful data to inform the present study. Namely, it signals preliminary efficacy for ACT in promoting physical activity.

Kangasniemi and colleagues (2014) conducted a controlled trial to establish the effectiveness of a value-based intervention based on the ACT framework among inactive adults. Participants were randomly allocated to 1) a feedback condition and 2) an ACT plus feedback condition. The results showed both groups increased their physical activity and no significant difference was found among groups. However, physical activity cognitions among the ACT group did improve and a post-hoc analysis among non-depressive participants showed greater stability in the ACT condition. Findings indicate that a value-based ACT intervention may be beneficial (improved cognitions and increased PA) but underscore important caveats (less effective in depressive populations). The strengths of this study include its randomized design, objective measure of physical activity, and longitudinal nature. Further, it indicates ACT has

some promise, but highlights the need for further investigation. In sum, while this study diverges from the intended research question discussed herein, its rigorous design is useful for demonstrating this type of approach warrants further attention.

Perhaps most relevant to the present research is a randomized trial which allocated participants to either a walking program or a walking program plus ACT DVD condition (Moffitt & Mohr, 2015). Results showed adults who received the ACT DVD engaged in significantly more physical activity compared to quite an intensive comparison condition. Another important finding was that the results indicated physical activity improvements were maintained over the intervention period. In conclusion, this study provides quite compelling evidence for ACT, and suggests the approach is efficacious based on its premise of committed engagement in the face of mental deterrents. Further, it illustrates the efficacy of ACT in assisting with the translation of intentions into behaviour. The authors also discussed how a self-managed ACT DVD provided a simple, efficient, and accessible method for improving physical activity. To this end, this study is particularly pertinent as the intervention was self-directed, accessible, and convenient; all of which are aspects which should be included in the present feasibility trial.

Lastly, Jenkins and colleagues (2019) used qualitative methods to examine the role of psychological flexibility in supporting physical activity maintenance. Using a combination of deductive and inductive thematic analysis of interviews, the authors concluded that some of the constructs (e.g., acceptance, value clarification, and committed action) played a role in physical activity maintenance. It follows that targeting these factors may prove useful for physical activity promotion. For this reason, this study is relevant to the rationale of the proposed research as it provides support for targeting such factors. Given the relative paucity of research targeting

psychological flexibility in the extant physical activity literature, this qualitative investigation provides useful proof-of-concept information.

Finally, a very recent meta-analysis indicated that ACT was indeed promising for increasing PA based on small to moderate effects (Pears & Sutton, 2020). However, these results must be interpreted in the context of their limitations, namely only seven studies were eligible for review and meta-analysis and of these, most studies were restricted by small sample sizes and varied measures of PA. Furthermore, no definitive conclusions could be made regarding the most effective intervention characteristics or components. Nonetheless, this review provides valuable evidence to support further enquiry into ACT for PA promotion. This review is also of particular relevance as it reported common intervention characteristics and Behaviour Change Techniques (BCTs; Michie et al., 2013) which are relevant for the study discussed herein.

To date, the literature which has applied ACT to PA promotion has yet to explore its suitability for incidental affect regulation specifically. Therefore, targeting emotion regulation explicitly through ACT principles and processes warrants research attention. Hence, this research seeks to elucidate whether ACT strategies show promise for mitigating the impact of incidental affect (i.e., work-related stress) and fostering action control.

1.9 Relevant Behaviour Change Techniques

An important development in the field of health psychology was the contribution of the first version of the Behaviour Change Technique Taxonomy (BCTTv1; (Michie et al., 2013). This taxonomy was developed in response to a need for precise reporting in order to advance the science of behaviour change. Behaviour Change Techniques (BCTs) are viewed as the irreducible components that aim to change the processes of behaviour that are observable, replicable, have a measurable effect, and thus are considered the ‘active ingredients’ of an

intervention. In the taxonomy, 93 lower-order strategies which cluster into 16 groups were consensually agreed upon as distinct BCTs. This taxonomy is now a widely used method to report and specify interventions.

In their systematic review, Pears and Sutton (2020) examined eligible ACT studies for intervention components. Importantly, Pears and Sutton (2020) found that very few of the 'active ingredients' of the ACT interventions themselves could be described as BCTs in the existing version of the taxonomy. This is because ACT processes are theoretical constructs rather than intervention techniques. It follows that many of the ACT targets did not fall into the existing BCTTv1 categories, which is unsurprising, given the processes that underlie ACT are relatively new to the field. Nonetheless, an average 5.7 ACT processes out of a possible 7 were included in the interventions. Of the six core processes, *Defusion, Values,* and *Committed action* were targeted in all seven studies, whereas *Acceptance* and *Contact-with-the-Present-Moment* were targeted in six studies, and *Self-as-Context* was only identified in three. Otherwise, the most common BCTs used in addition to ACT were G*oal setting (behaviour)* (1.1), *Action planning* (1.4), *Self-monitoring of behaviour* (2.3), and *Adding objects to the environment* (12.5). Interestingly, these BCTs were identified in all four of the studies which combined additional component with ACT. Finally, three of the BCTs identified in the review (*Commitment* (1.9); *Monitoring of emotional consequences* (5.4); and *Information about emotional consequences* (5.6)) appear to be extremely underrepresented in the PA domain. In fact, these BCTs were not even present in the 26 studies included in a recent review of the investigating the effectiveness of PA interventions (Howlett, Trivedi, Troop, & Chater, 2019). However, only commitment is relevant to the present proposal as emotional consequences are concerned with affective judgments rather than incidental affect (Williams et al., 2019). These gaps in knowledge

surrounding the description and application of ACT processes as 'active ingredients' represents an important opportunity for contribution. Specifically, as suggested by Pears and Sutton (2020) BCTs should be named, regardless of whether or not they are included in the BCTTv1.

As previously discussed, implementation intentions (*Action planning*; 1.4), acceptance, and reappraisal have been suggested as viable strategies to mitigate the impact of incidental affect (Williams et al., 2019) and thus warrant inclusion. Additionally, visualization (*Mental rehearsal of successful performance*; 15.2) is a technique that is commonly employed in the sport setting that may be a relevant regulation strategy to mitigate incidental affect and therefore there is a rationale to include it. Finally, within M-PAC, behaviour is determined in part by reflective components (Rhodes, 2017a), and as such, an intervention based on this schematic should involve at least some strategies relating to reflective expectations such as *Information about health consequences* (5.1). M-PAC also posits that behavioural regulation is crucial for action control, and as a result several self-regulatory strategies have been identified as appropriate BCTs. These strategies are consistent with those outlined above as common additional components to ACT interventions in the review by Pears and Sutton (2020) and include: *Goal Setting (behaviour)* (1.1), *Action Planning* (1.4), *Self-monitoring of behaviour* (2.3).

Taking all this into consideration, the intervention will target the six core ACT constructs (which do not have technique descriptions in the existing taxonomy), strategies for incidental affect regulation (largely unexplored), and commonly employed BCTs aligned with M-PAC (specifically the reflective and regulatory constructs; see Table 1 below). Importantly the behavioural regulation BCTs will be in relation to planning for the implementation of ACT-related mindfulness and acceptance strategies.

Table 1

ACT and Relevant BCTs for a PA Intervention Targeting Incidental Affect Regulation

Construct	BCT number	BCT Label (when applicable)
ACT Processes		
Committed action	1.9	Commitment
Acceptance	N/A	
Contact with the present moment	N/A	
Defusion	N/A	
Values	N/A	
Self-as-context	N/A	
Incidental Affect Regulation		
Reappraisal	N/A	
Implementation intentions	1.4	Action planning
Visualization	15.2	Mental rehearsal of successful performance
Positive self-talk	15.4	Self-talk
M-PAC – Reflective Processes		
Instrumental attitude	5.1	Information about health consequences
Instrumental attitude	5.6	Information about emotional consequences
Perceived opportunity	12.1	Restructuring the physical environment
M-PAC - Regulatory Processes		
Behavioural regulation	1.1	Goal setting (behaviour)
Behavioural regulation	1.2	Problem solving
Behavioural regulation	1.4	Action planning
Behavioural regulation	2.3	Self-monitoring of behaviour
Behavioural regulation	11.2	Reduce negative emotions

1.10 Web-based Interventions for PA Promotion

Although in-person and community-based interventions can be effective, they have several noteworthy limitations that can hinder their capacity to execute change on a large scale. For example, in-person programs have various disadvantages due to the following: limited reach, limited personalization or ability to tailor, and resource intensity because these programs require considerable human input (Liu et al., 2019). Further, carving out time to attend a PA program in person is time-consuming and inconvenient, a factor that poses a particular challenge to busy

professionals. In turn, web-based interventions are well-suited to address these challenges. Specifically, web-based delivery formats possess several notable advantages: they have increased reach at a lower cost, they provide access around the clock which can increase convenience and exposure, and they have the power to instantly deliver content (Joseph, Durant, Benitez, & Pekmezi, 2014). Moreover, with advances in internet technology and widespread access to the internet, an online delivery format represents a feasible and efficient means of delivering PA programs. In Canada, it has been estimated that 91% of the population uses the internet and 94% has access to the internet (Statistics Canada, 2019). More recent estimates place the reach of online services at 96% of the population (Clement, 2019). Evidently, internet-based programs can potentially be deployed to large populations. Finally, this type of approach can be easily scaled and made available to a wide audience thereby advancing the PA promotion agenda for population health.

There is substantial evidence which indicates web-based PA interventions are a promising approach. To this end, one review examining internet-based PA interventions found 44 out of 72 studies (61%) reported significant increases in PA (Joseph et al., 2014). Furthermore, a meta-analysis found a significant increase in PA following internet-based intervention, however the effect size was small (d=0.16; Webb et al., 2010). More recently, there was evidence to support web-based interventions for creating positive, albeit small changes in PA (d=0.14; Davies et al., 2012). Finally a recent review and meta-analysis of randomized controlled trials using web-based interventions found a positive significant effect on increasing PA, yet this same study reported only five of 14 trials found a significant increase in MVPA after intervention (MD=13.42 minutes; Jahangiry et al., 2017). Taken together, there is substantive evidence to

suggest that internet-based interventions have potential for PA promotion. However, their ability to produce clinically meaningful or lasting change remains unclear.

Considering the state of the evidence, namely the small effect sizes found in several reviews, it becomes evident that web-based approaches warrant more sophisticated approaches. Indeed, it is likely a better theory could serve the aim of improving the effectiveness of web-based interventions. Webb and colleagues (2010) provide evidence to this end, as they found more extensive use of theory was associated with increases in effect size. It has been recognized that integrated theoretical frameworks incorporating regulatory aspects which subsequently bridge intentions into actual behaviour are an important future direction in the PA domain (Rhodes et al., 2019). It follows that such an approach could further enhance the effectiveness of web-based intervention. Accordingly, Liu and colleagues (2019) developed a self-guided web-based intervention to promote PA based on the M-PAC framework. This platform served as a useful starting block to build a suitable online intervention for ECPs which utilizes self-regulatory strategies to target incidental affect and ultimately promote PA. Finally, to further augment effectiveness, more involved aspects and tangible tools that can be easily accessed in moments of need could be a fruitful direction.

Despite the multitude of advantages of a web-based approach, there remains one important point of concern: attrition. A narrative review by Joseph and colleagues (2014) found that attrition across 68 studies employing internet-based formats ranged from 0% to 69% with a mean of 22%. The authors argued methods to enhance participant engagement should be prioritized and suggested frequent updates to web-based content and increased contact (e.g., via email, text message, or telephone) as viable strategies to encourage adherence to internet-based physical activity programs. Indeed, Liu and colleagues (2018) found that proactive email

reminders can improve the effectiveness of web-based interventions. For these reasons, for web-based programs it is advisable to use various proactive strategies to mitigate attrition and bolster adherence to the intervention.

In sum, based on its effectiveness, reach, accessibility and scalability, web-based intervention for PA promotion represents a compelling and cost-effective approach to PA promotion. Nonetheless, the state of the evidence indicates more sophisticated internet-based approaches are needed. One such approach would be to incorporate better theory, namely a framework that utilizes volitional self-regulatory strategies and accounts for action control such as M-PAC (Rhodes, 2017b). It can be concluded that a web-based delivery which builds upon an integrated theory is a novel and innovative approach to improve access among the time-pressed population of early career professionals. However, efforts should be made to maximize engagement and adherence while combatting attrition.

1.11 Mobile Health (m-Health) Interventions for PA: Podcasting

As discussed above, face-to-face modes of delivery can be effective, however they are time and resource intensive. Moreover, traditional lifestyle interventions can be inaccessible as they require burdensome elements such as scheduling, travel, and time commitment. It follows that such approaches are not always practical nor easy to disseminate: in-person interventions are less capable of reaching masses of individuals. A burgeoning field of electronic health (eHealth), known as mobile health (mHealth), overcomes these challenges. The World Health Organization defines mHealth as “medical and public health practice supported by mobile devices” (World Health Organization, 2011). It is a rapidly growing and potentially powerful field due to advances in mobile technologies and applications. Furthermore, the vast majority of adults in Canada own a smartphone. Recent estimates from Statistics Canada (2017) put smart phone

ownership at 76% of the population. For this reason, mobile technologies such as smartphones are a salient and potentially potent conduit for health promotion efforts which represent a meaningful way to address the logistical burden of in-person intervention. For example, mobile intervention delivery allows individuals to carry intervention tools with them anywhere and at all hours, and it follows individuals can access the tools they need when they need them (Klasnja & Pratt, 2012).

There is emerging evidence that mHealth holds promise for PA promotion. A recent systematic review and meta-analysis found mHealth interventions had small to moderate effects on PA and walking, however differences between mHealth interventions and standard care did not achieve significance (Direito, Carraça, Rawstorn, Whittaker, & Maddison, 2017). However, this finding must be interpreted with caution because it is likely "active" comparator groups contributed to the null findings and smaller intervention effects. It can be concluded that mHealth research in the PA domain warrants further investigation.

One area of mHealth that remains relatively untapped for PA promotion is the use of podcasts, which are audio files that can be listened to on mobile devices. Podcasting is an electronic media that allows users to listen on the go (e.g., on the way to work), and potentially in moments of need (e.g., deciding whether to exercise or sit on the couch). In addition to being practical and convenient, it is conceivable that podcasting may be a more engaging and novel way to communicate behaviour change information. To this end, one study investigated the delivery of two modes of media for health communication messages and found messages delivered via podcast resulted in greater physiological arousal and were perceived as more novel as compared to a website with similar information (Turner-McGrievy, Kalyanaraman, & Campbell, 2013). There is evidence from other health promotion domains (e.g., weight-loss) that

interventions can be delivered via podcast (Turner-McGrievy et al., 2017; Turner-McGrievy & Tate, 2011). However, to my knowledge, podcasts have not been employed in PA intervention. This represents an important gap in the literature and likely a fruitful area of study.

In summary, employing mHealth, specifically podcasting, is a convenient and scalable mode of delivery, and thus a compelling avenue for PA promotion. For these reasons, employing brief mini-podcasts (which can be used in the moment and on the go) as a supplement to an online lesson-based intervention is an especially practical and novel approach to intervention among a time-pressed population such as early career professionals.

1.12 Study Rationale

The evidence for the health benefits of regular PA is well-established, yet much of the population remains inactive. PA promotion remains a public health priority and accessible, scalable, and cost-effective interventions are needed. There is compelling evidence to indicate lowered PA among young adults. Moreover, transitional periods have been consistently linked with PA decline. Thus, targeting those in transition is a prudent approach to health promotion. One such critical target group is ECPs. Given the rates of inactivity coupled with the prevalence of psychological distress among this group, ECPs stand to gain considerably from PA promotion.

In terms of intervention content, an approach which accounts for action control, such as M-PAC is a suitable way forward. Further, incorporating a suite of techniques that are underpinned by a theory designed to support intention formation and translation is a suitable future direction. While M-PAC encompasses emotion regulation, applications have not focused on targeting the regulation of incidental affect per se. Indeed, despite compelling evidence indicating affective factors determine PA (Stevens et al., 2020), there is a paucity of research targeting incidental affect in the PA domain. This represents a worthwhile opportunity to contribute to the field.

ACT, which cultivates mindfulness and acceptance to foster committed action in valued behaviours can potentially mitigate the effect of incidental affect. To date, the literature which has applied ACT to PA promotion but has yet to explore its suitability for incidental affect regulation specifically. Therefore, targeting emotion regulation explicitly through ACT principles and processes warrants research attention and represents a worthy line of inquiry

As for intervention format, a self-guided web-based delivery format supplemented by practical podcasts represents an appropriately accessible and convenient intervention that is innovative and timely. Taken together, there is a strong rationale for exploring the feasibility of a web-based, ACT-informed M-PAC intervention targeting incidental affect to promote PA among ECPs.

1.13 Overview of Research Objectives

The literature review that was conducted informed the development of a novel and innovative six-week remote intervention guided by the M-PAC Framework. ACT principles and emotion regulation strategies were embedded to target incidental affect regulation and ultimately promote PA among ECPs. The purpose of the study was to evaluate the viability of the resulting program through a feasibility study. The objectives of the study were to 1) determine the feasibility (recruitment, retention, engagement, acceptability) and 2) explore the effects of the intervention on key outcomes of interest including moderate-to-vigorous PA (MVPA), emotion regulation, M-PAC constructs, and ACT constructs (acceptance, valued living, and mindfulness). This research seeks to elucidate whether the intervention strategies show promise for mitigating the impact of incidental affect (i.e., work-related stress) and promoting increased PA.

Chapter 2: A Feasibility Randomized Controlled Trial of a Web-Based Intervention Targeting Affect Regulation for Physical Activity Promotion among Early Career Professionals

2.2 Introduction

2.2.1 Literature Review

The benefits of regular physical activity (PA) are far-reaching and impressive in scope. To this end, there is irrefutable evidence that regular PA is associated with a reduced risk of premature mortality and over 25 chronic medical conditions including but not limited to cardiovascular disease, diabetes, and some cancers (Rhodes et al., 2017a). Additionally, there are numerous mental health benefits associated with regular PA, including reduced depression and anxiety, enhanced well-being, and improved overall quality of life (Bize et al., 2007; Rebar et al., 2015; Rhodes et al., 2017a; Wiese et al., 2018). For these reasons, PA is widely accepted as a preventive measure for numerous health risks.

Despite the well-established positive physical and psychological effects of PA, an overwhelming 84-85% of Canadian adults do not meet the PA recommendations (Clarke et al., 2019; Colley et al., 2011), and over one third of the adult population worldwide has been classified as inactive (Hallal et al., 2012). Nationally representative objectively measured PA data suggests that the sharpest declines in PA behaviour occur during young adulthood and decreases continue over the life course (Clarke et al., 2019; Colley et al., 2017). To this end, a recent meta-analysis of longitudinal data showed that PA declined from adolescence to early adulthood (Corder et al., 2019). Indeed, accelerometer data indicates many young adults are insufficiently active: only 15% of 18 to 34 years old achieve the recommended guidelines (ParticpACTION, 2019). Critical life-transitions such as marriage, parenthood, and entering the

workforce have been suggested as an important contributor to these dramatic PA declines (Allender, Hutchinson, & Foster, 2008; Bellows-Riecken & Rhodes, 2008; Engberg et al., 2012; Kirk & Rhodes, 2012). It follows that targeting transitional periods represents a prudent approach to health promotion.

One discernable group at particular risk of inactivity is early career professionals (ECPs), given this transitional period has shown physical activity decline (Kirk & Rhodes, 2012), likely due to the inherent stress, demands, and time constraints that come with shifting to the workforce. Indeed, office work is frequently associated with elevated stress levels (e.g., Crompton, 2011). Furthermore, new professionals typically experience heavy psychological demands and pressure in the formative years of their careers (e.g., Hopkins & Gardner, 2012; Schindler et al., 2006). Additionally, office work (i.e., desk-based occupations) has been associated with the highest number of work hours per week, greatest sedentary time, and the lowest on-the-job PA (Prince, Elliott, Scott, Visintini, & Reed, 2019; Shields, 1999; Smith et al., 2016). Early career professionals across a range of work arrangements (e.g., part-time) may experience employment as demanding, especially if they are balancing other responsibilities (e.g., children) or commitments (e.g., professional development) that could limit opportunities for PA participation. Given these factors, it is unsurprising PA declines across the early career transition, and by a magnitude of almost two sessions per week no less (d=0.35-0.43; Kirk & Rhodes, 2012). Thus, to prevent patterns of inactivity, ECPs are a critical target for PA promotion that could greatly benefit from an accessible PA intervention.

An appropriately accessible intervention delivery format for this time-pressed population would be web-based. Due to advances in technology and widespread access to the internet, an online delivery format overcomes the challenges of in-person intervention by possessing great

potential for reach and scalability. In addition to feasibility, there is emerging evidence to indicate eHealth interventions may be effective at promoting PA (Davies et al., 2012; Jahangiry et al., 2017; Webb et al., 2010). Furthermore, content delivered via mobile devices (i.e., mHealth) has been recognized as an advantageous conduit for health promotion, as it allows individuals to carry tools on the go and have access in moments of need (Klasnja & Pratt, 2012). Podcasting interventions have been implemented in other health promotion domains such as dietary behaviour (Turner-McGrievy et al., 2017; Turner-McGrievy & Tate, 2011) but remain relatively untapped for PA promotion despite being perceived as novel and engaging (Turner-McGrievy, Kalyanaraman, & Campbell, 2013). For these reasons, an online lesson-based intervention format which utilizes podcasts as a supplement constitutes an innovative and timely delivery approach for promoting PA among early career professionals.

Web-based delivery formats typically have small effect sizes (Davies et al., 2012; Webb et al., 2010), despite the pragmatic advantages and promise for changing behaviour. This indicates that application of theory and the mechanisms of action and corresponding BCT targets need to be honed. Many PA promotion efforts thus far have typically been in the social cognitive tradition, whereby there is a focus on strengthening intention, despite an established intention-behaviour gap in the PA domain (Rhodes & de Bruijn, 2013). Because many intenders fail to follow through (Rhodes & de Bruijn, 2013; Sheeran & Webb, 2016), addressing why people fail to enact their intentions is crucial. Behaviour change models which focus on action control (i.e., the translation of intentions into behaviour) are positioned to overcome intention-behaviour discordance and have shown utility in PA behaviour change (Kuhl, 1984; Rhodes, 2021). Thus, a suitable framework is the Multi-Process Action Control (M-PAC) approach which suggests reflective, regulatory, and reflexive processes are layered and build upon each other to support

PA intention formation, action control adoption, and maintenance (Rhodes, 2021; Rhodes, La, Quinlan, & Grant, 2021). M-PAC also posits that discordance stems from strategic challenges in goal pursuit and automatic tendencies. As such, regulatory processes can assist with behavioural follow-through. The practical value of the emphasis on such tactics supports the application of this approach among ECPs who likely experience many competing demands. Furthermore, the M-PAC framework has been developed into a web-based PA program (Liu et al., 2019) which has shown acceptability and feasibility in pilot tests among other populations (e.g., Hollman, Sui, & Rhodes, 2022). However, whether feasibility extends to ECPs is unknown.

One key reason intenders may not follow through is because of challenging emotions or mood (Maher et al., 2017; Rhodes & Gray, 2018), a factor that is especially pertinent among early career professionals who presumably face a multitude of demands and stressors. Recent advances in the burgeoning field of affective science emphasize how factors such as mood or emotion can determine health behaviours such as PA (Williams et al., 2019). Indeed, there is evidence to suggest that affective states may be a predictor of PA (Liao et al., 2015; Maher et al., 2017; Ruissen et al., 2022) and stress in particular has been shown to disrupt the translation of intentions into behaviour (Almeida et al., 2020). To address the growing literature, the Affect and Health Behaviour Framework (AHBF) aims to clarify and distinguish affect-related constructs (Stevens et al., 2020). The AHBF proposes affective determinants of PA can be categorized into affective response to PA (e.g., feelings in response to PA); incidental affect (e.g., feelings throughout the day but unrelated to PA); affect processing (e.g., affective judgments); and affectively charged motivation (e.g., hedonic motivation). Research to date has largely focused on affective response and affective processing (Stevens et al., 2020; Williams et al., 2019). Notably, there is a paucity of research targeting factors such as the regulation of

incidental affect (e.g., effects of job-related stress on PA engagement) to assist the translation of intentions into behaviour. To this end, intervention upon moderators of the affect-behavior link (affect regulation) has been identified as an important area for future direction (Williams et al., 2019). While emotion regulation is accounted for within M-PAC's regulatory processes, strategies to regulate affect are underdeveloped and targeting affect regulation explicitly has received little research attention. Thus, incorporating regulatory strategies to mitigate the effect of difficult emotions or stress (i.e., incidental affect) on PA is both novel and warranted.

A focus on closing the intention-behavior gap through emotion regulation of incidental affect may be best achieved by observing the principles of Acceptance and Commitment Therapy (ACT; Hayes, 2004; Hayes, Strosahl, & Wilson, 1999). ACT is rooted in clinical psychology but has been gaining momentum for health behaviour change (Zhang et al., 2018). ACT aims to promote health behaviour via a model of psychological flexibility wherein individuals are committed to behaviour congruent with deeply held values, even in the face of psychological barriers such as difficult emotions. Put simply, psychological flexibility can help individuals engage in a valued target behaviour (e.g., increased PA) despite difficult thoughts or emotions (e.g., I'm too stressed) (Pears & Sutton, 2020). In short, ACT does not aim to change internal experiences, but aims to foster acceptance and mindful awareness skills to increase behavioural regulation and value-congruent acts. ACT offers an attractive approach for regulating incidental affect such as the job-related stress experienced by ECPs. While there is preliminary evidence to suggest ACT-based intervention may have efficacy in increasing PA (Butryn et al., 2011; Moffitt & Mohr, 2015; Pears & Sutton, 2020), sustained research is warranted to explore the suitability of such an approach for incidental affect regulation and in the context of early career professionals.

Taken together, there is a strong rationale for exploring the viability of a web-based intervention, grounded in M-PAC and informed by ACT to target incidental affect and promote PA among ECPs. As per the ORBIT framework for developing behavioural treatments (Czajkowski et al., 2015), testing the feasibility of the intervention for this population could constitute the necessary chain of evidence needed to signal an efficacy trial of this scalable intervention with the eventual possibility of dissemination into practice or policy. Thus, establishing the feasibility of this type of intervention among this demographic is a worthy line of inquiry.

2.2.2 Objectives

The purpose of this research is to investigate the feasibility and acceptability of an online intervention integrating the M-PAC framework as well as ACT principles targeting affect regulation to promote physical activity among early career professionals. More specifically, the study objectives are to 1) determine feasibility (recruitment, retention, adherence) and acceptability (satisfaction) and 2) explore the effects of the intervention on MVPA, emotion regulation, M-PAC constructs, and ACT-related constructs such as applied acceptance and mindfulness.

2.2.3 Hypotheses

Based on previous research (Cox & Rhodes, 2020; Hollman et al., 2022; Husband, Wharf-Higgins, & Rhodes, 2019; Willms, 2021), my primary hypotheses were 1) the study would result in acceptable recruitment (at least 6 participants per month; >30% rate), retention rates (>70%), and engagement (>60%), while adherence would wane over time and 2) participants would have high ratings on two questionnaires concerning evaluation and satisfaction (mean scores of ≥2.5 and ≥3 respectively) and >80% would report preferable

acceptability and satisfaction while qualitative feedback may indicate room for program refinement. My secondary hypotheses were that the intervention group would demonstrate improved MVPA, M-PAC constructs, and ACT constructs relative to baseline and in comparison to a control group.

2.3 Methods

2.3.1 Study Design

This mixed-methods feasibility trial employed a convergent design, whereby quantitative and qualitative data were complementary and integrated during analysis (Pluye & Hong, 2014). This study followed the Consolidated Standards of Reporting Trials (CONSORT) guidelines for feasibility trials (Eldridge et al., 2016) and integrated recommendations from the Obesity Related Behavioral Intervention Trials (ORBIT) model for early phase research (Czajkowski et al., 2015). Primary outcomes concerned key feasibility outcomes to provide guidance about whether to proceed to a full trial. Secondary outcomes explored changes and effect to provide guidance about intervention fidelity and promise for impact (i.e., plausibility).

The study was an open parallel feasibility randomized controlled trial with two arms and two measurement occasions (pre- and post-intervention at the primary study end-point at 7 weeks). The arms included an intervention condition and a wait-list control condition. Given the nature of the conditions, participants were aware of their allocation and thus the study was unblinded. Randomization used a mixed block design executed in Microsoft Excel. The randomization sequence was concealed from the primary researcher until after baseline assessment.

2.3.2 Ethics

Ethics approval for this study was obtained through the Human Research Ethics Board at the University of Victoria (protocol number 20-0412) originally approved in April of 2021. The trial is registered with the Protocol Registration and Results System (PRS), Trial Number Register NCT05557071.

2.3.3 Eligibility Criteria

Inclusion criteria included adults aged 25-44 currently employed at least part-time in a desk-based job, not meeting the Canadian Physical Activity Guidelines of 150 minutes of MVPA per week (Ross et al., 2020), and reporting no contraindications to safely increase physical activity (assessed via the Get Active Questionnaire; (CSEP, 2017). To be considered eligible, participants were also required to speak English, live in Canada, and have access to a device and the internet to support the e-health application.

2.3.4 Procedure

Participants were recruited entirely online through a number of avenues. Recruitment was conducted primarily on social media. Specifically, Facebook and Instagram were leveraged through a lab account by way of regular paid and targeted advertisements, posting to newsfeed and stories, and manual sharing to existing applicable interest groups (e.g., young professional networks across Canada). Additionally, promotional material was posted to LinkedIn and Twitter. A faculty newsletter was also leveraged to disseminate brief study information. The university alumni association was also contacted to share study details to their social media channels. Finally, snowball recruitment occurred whereby several participants shared the study flyer with their networks. Recruitment took place on a rolling basis from February 18 to June 14, 2022.

Potential participants demonstrated interest through contacting the researcher. The researcher provided study details and requested a virtual meeting over videoconference (i.e., Zoom) to screen for eligibility, confirm details, and answer any questions about the protocol (please refer to Appendix A for emails and voice scripts). If the individual met all the eligibility criteria and wished to proceed, informed consent took place (see Appendix B for Participant Consent Form). Once the participant signed and returned the consent form, they were provided information to complete the baseline questionnaire. Following the baseline assessment, participants were randomized to the intervention group or the waitlist control group. Participants in the intervention condition were provided with login credentials and received immediate access to the online portal. They were advised to complete the six weekly lessons and implement the strategies introduced. Automated emails were sent weekly notifying participants when a new lesson was available. At three weeks, participants were invited to partake in a mini check-in over videoconference to discuss online platform usage, any changes to physical activity, and questions. After the 6-week intervention period, participants completed a follow-up questionnaire and were then invited to participate in a semi-structured exit interview about their experiences in the study.

2.3.5 Comparator Group

This study uses a waitlist control group; therefore, participants randomized to the control condition were advised they would receive a follow-up questionnaire in 6 weeks-time and informed they could access the intervention following study completion. After questionnaire completion, waitlist participants' involvement was considered complete, but they could gain access to the intervention if they wished. Website analytics were not accessed for those in the waitlist control group.

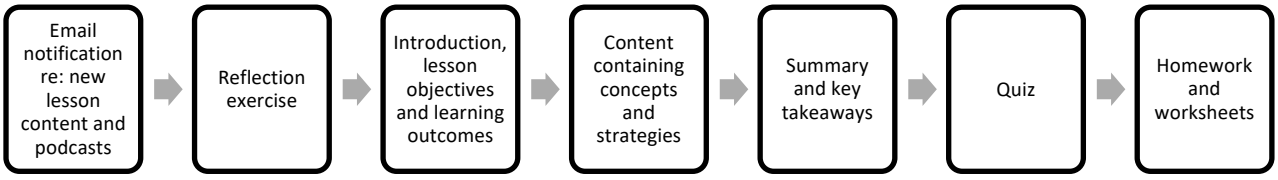
2.3.6 Intervention

The original web-based intervention was designed to promote PA among adults by leveraging the M-PAC framework, and an outline of its content and features is described elsewhere (e.g., Cox & Rhodes, 2020; Hollman, Sui, & Rhodes, 2022; Liu et al., 2019). For this study, elements of the base intervention were reorganized in order to shorten the program from 10 weeks in length to 6 weeks. The content was also tailored for early career professionals by ensuring the examples were pertinent and the images and explanations were appropriate and relatable.

The 6-week asynchronous intervention introduced online educational and interactive modules by notifying participants via email when new content was available. The platform allowed for each lesson to be self-guided, taking approximately 30-60 minutes to complete. Lessons included a prompt to review progress, educational text, videos, weekly quizzes, space for reflection, homework assignments, worksheets and a supplemental mini podcast to complement the concepts presented in the lesson (see Figure 1 for the structure and flow of the lesson; see Appendix C for screenshots of the platform design and Appendix D for weekly worksheets). The content was informed by the scientific literature and underpinned by theory. The modules included references and links to original sources and provided additional tools in a resource section.

Figure 1

Lesson Structure and Flow



The adapted intervention remained grounded in M-PAC: it included one lesson designed to strengthen the reflective processes associated with intention formation, five lessons to strengthen regulatory processes, and had one lessons indirectly related to a reflexive process, namely identity formation. Importantly, the base intervention was iterated upon to include emotion regulation strategies and a number of ACT-informed principles, practices, and tactics to assist with regulating and thus mitigating the effect of incidental affect on physical activity engagement. See Table 2 for an outline of the program, including lesson titles, content, the associated M-PAC process (Rhodes, 2017b), ACT construct(s) (Hayes et al., 1999) and behaviour change techniques (BCTs; Michie et al., 2013).

Table 2

Outline of the Online Platform Intervention Lesson Content Linked to Theoretical Process and Behaviour Change Techniques (BCTs)

Lesson	Title	Content	Corresponding M-PAC Process	BCT* (or ACT construct**)
1	Introduction to the program: physical activity basics	• Info about benefits (tailored to population) • Physical activity guidelines • Capability • Opportunity	Initiating reflective processes	5.1 - Information about health consequences 5.6 Information about emotional consequences

		• Enjoyment		12.1 Restructuring the physical environment
2	ACT for physical activity: values and committed action	• Description of incidental affect • Introduction to ACT • Define valued ends • Overview committed Action (goal setting and planning)	Regulatory	N/A - Values 1.9 – Commitment 1.1 - Goal setting (behaviour) 1.4 Action planning
3	How to deal with negative emotions	• Info about psychological demands • Affect circumplex • Overview mindfulness • Define acceptance • How to reduce the impact of negative emotions	Regulatory	N/A - Contact with the present moment/ Mindfulness N/A - Acceptance 11.2 - Reduce negative emotions N/A - Self-as-context N/A - Defusion N/A - Reappraisal
4	Planning for challenging moments	• Implementation intentions • Problem solving • Self-compassion	Regulatory	1.4 - Action planning 1.2 - Problem solving
5	Level up your mindfulness and acceptance	• Visualization • Mental toughness • Self-talk	Regulatory	15.2 - Mental rehearsal of successful performance 15.4 – Self-talk
6	Bringing it all together	• Recap	Reflective, regulatory	All the above

Note. PA = physical activity, BCT = behaviour change technique *Numbers correspond to the BCT Taxonomy as defined by Michie et al., (2013) **ACT techniques are not mapped to the behaviour change taxonomy

The podcast component was designed to complement the ideas presented in the weekly modules. To keep this part of the intervention accessible and digestible, there were two short (3

to 5 minutes in length) podcasts for each week for a total of 12 episodes. They described how the tactics presented in the weekly lesson could be applied to help with physical activity initiation in challenging moments. As such, they could be used on-the-go and potentially in moments of need. Podcast episodes were linked within the weekly email notifying participants about the release of new content. See Table 3 for an outline of podcast content.

Table 3

Outline of Podcast Content and the Associated Behaviour Change Techniques and Strategies

Week	Episode Title	Content	BCT, Emotion Regulation Strategy, or ACT process
1	• How does physical activity benefit you? • The importance of your environment and enjoyment	• Physical and mental benefits • Restructuring environment and how to foster fun	• Information about health and emotional consequences (BCT 5.1 & 5.6) • Restructuring environment (BCT 12.1)
2	• The choice point: physical activity or bust? • Feeling unmotivated? Let your values guide your behaviour	• Compass analogy, valued directions • Value mantra, commitment statement	• Values Clarification • Values, committed actio
3	• A mindfulness exercise to notice and accept feelings • Watch your thinking and shift your perspective	• Deep breathing, noticing feelings, making room for emotions • Observing thoughts, clouds exercise, hooking and unhooking; Normalizing negative emotions	• Contact with the present moment and acceptance • Defusion, self-as-context • Reappraisal

4	• Planning for the challenging moments • What to do when you're not feeling it: avoid all-or-nothing thinking	• Identify problems/barriers and create if-then plans • Self-compassion, all-or-nothing thinking, adjusting intensity/duration	• Implementation intentions (BCT 1.4 Action Planning) • Problem solving (BCT 1.2)
5	• Envisioning success • Self-talk to foster mental toughness	• Visualization exercise • Self-talk example and instruction	• Visualization (15.2 - Mental rehearsal of successful performance) • Self-talk (BCT 15.4)
6	• Psychological flexibility • You've got this!	• Recap all strategies, discuss psychological flexibility • Be present, open up, do what matters - ACT	• All ACT processes • All ACT processes

Note. ACT = Acceptance and Commitment Therapy. BCT = Behaviour Change Technique. Numbers reported are based on the Michie et al., (2013) Taxonomy.

2.4 Outcome Measures

2.4.1 Demographics

Basic demographics were collected, including age, gender, education, employment status, household income, years since entering the workforce, hours per week worked, province or territory of residence, height and weight.

2.4.2 Primary Outcomes: Feasibility Measures

Recruitment rate. Recruitment was calculated by dividing the number of participants who enrolled in the study (i.e., provided informed consent) by the number of participants who expressed interest. To determine the average number of recruits per month, total recruits was divided by the number of recruitment months. The screening to enrolment ratio was calculated

by dividing the number of individuals who attended the eligibility meeting by the number of participants that enrolled in the study (Willms, Rhodes, & Liu, 2022).

Retention. Retention was calculated by dividing the number of participants that completed the follow-up questionnaire by the number of participants who completed the baseline questionnaire.

Engagement and adherence. Website usage was collected through the intervention portal. Engagement was assessed by calculating averaged total logins over the 6-week period, average pages viewed, weekly minutes spent on the web-intervention, and percentage of participants who viewed each lesson. Podcast engagement was assessed by usage metrics collected through the platform provider, namely by the number of listens per episode as well as through a questionnaire item 'how often did you listen to the weekly mini podcasts' with available responses ranging from never to almost always.

Satisfaction and acceptability. Study satisfaction was evaluated at the final measurement occasion with two questionnaires, adapted from previous research. Evaluation of study methods included items such as 'did you find the information provided in the lessons interesting' and 'did you use the tools and strategies provided' with available responses on a 4-point scale (1=least satisfied; 4=most satisfied) (Husband et al., 2019). The satisfaction questionnaire was on a 5-point scale and included items such as 'I enjoyed being a part of the research study' and 'the topics for each lesson were useful and relevant' (Cox & Rhodes, 2020). Acceptability of the intervention components and the associated procedures was also explored post-intervention through semi-structured interviews that were conducted virtually. The end-of-trial interviews provided in-depth program evaluation data to assist with understanding the impact and to facilitate refinement. Interview questions can be found in Appendix E.

2.4.3 Secondary Outcomes

Self-reported physical activity. Physical activity participation was assessed via the Godin Leisure Time Exercise Questionnaire (GLTEQ) which has demonstrated acceptable validity and reliability (Godin & Shephard, 1985). This questionnaire is open-ended in nature, with three questions relating to the bouts and frequency of light, moderate, and vigorous intensity PA. Weekly MVPA was then estimated by multiplying frequency by duration and summing moderate- and vigorous-intensity minutes.

M-PAC constructs. M-PAC constructs were framed for engaging in regular PA, operationalized as "achieving at least 150 minutes a week of MVPA". Instruments employed in previous research were used to assess M-PAC constructs including decisional intention (Courneya, 1994), instrumental and affective attitude (Rhodes & Courneya, 2003), perceived capability and opportunity (Burrell, Allan, Williams, & Johnston, 2018; Rhodes, Blanchard, & Matheson, 2006), self-regulation (Sniehotta, Schwarzer, Scholz, & Schüz, 2005), identity (Anderson & Cychosz, 1994; Sparks & Shepherd, 1992; Wilson & Muon, 2008), and habit (Gardner, Abraham, Lally, & de Bruijn, 2012).

Perceived Job Stress. Perceived stress was assessed using a single item measure of global job stressfulness (Houdmont et al., 2019). The item stated, "in general, how do you find your job?" with available responses ranging from 1 (not at all stressful) to 5 (extremely stressful).

Applied Mindfulness. Applied mindfulness was measured using a selection of items from the validated Applied Mindfulness Process Scale (AMPS) which was designed to evaluate mindfulness-based interventions (Li, Black, & Garland, 2016). Specifically, 5 items related to the factor of negative emotion regulation were used. These items reflected the use of mindfulness

to cope and tapped into the degree to which mindfulness was used to calm emotional upset. Response options ranged from 1 (never) to 5 (almost always) with higher scores indicated more frequent use of applied mindfulness.

ACT constructs. Previously validated questionnaires were adapted to assess ACT constructs such as acceptance and action, valued living, and PA acceptance. Two items from the Acceptance and Action Questionnaire-II (Bond et al., 2011) were adapted to "emotions cause problems for my physical activity behaviour" and "worries get in the way of my physical activity success". These items were rated on a 7-point Likert scale (1=never true to 7=always true). Lower scores indicated greater levels of psychological flexibility. Two items were adapted from the Valued Living Questionnaire (Wilson, Sandoz, Kitchens, & Roberts, 2010). A previously validated Physical Activity Acceptance Questionnaire (PAAQ) which has demonstrated high internal reliability (Butryn et al., 2015) was used to assess behavioural commitment and cognitive acceptance towards PA. The seven PAAQ items were rated on a 7-point Likert scale with responses ranging from 1 (never true) to 7 (always true).

Internal consistency was acceptable for most secondary outcome measures at baseline and follow-up. Please refer to Table 4 for reliability scores (Cronbach's Alpha) for measures of M-PAC constructs and ACT-related constructs. Internal consistency for the valued living composite was good ($\alpha = 0.86$) for the first and second administrations. However, because the Valued Living Questionnaires is an index composite of two scales, assessing reliability in this form is not necessarily appropriate as it is more of a formative measure (Coltman, Devinney, Midgley, & Venaik, 2008).

Table 4

Reliability Estimates for Secondary Outcome Measures

	Items	Baseline α	Follow-up α
Decisional intention	1	N/A	N/A
Instrumental attitudes	2	0.90	0.72
Affective attitude	2	0.96	0.87
Perceived capability	2	0.86	0.72
Perceived opportunity	2	0.73	0.86
Behavioural regulation	4	0.70	0.90
Emotion regulation	3	0.90	0.93
Identity	4	0.83	0.96
Habit	4	0.93	0.92
Perceived stress	1	N/A	N/A
Mindfulness	5	0.94	0.94
Acceptance and Action	2	0.51	0.83

2.5 Analysis

The primary outcomes related to the feasibility of the intervention were primarily descriptive and compared against progression criteria that were adapted from previous research and set a priori (Cox & Rhodes, 2020; Hollman et al., 2022; Willms, 2021).

Qualitative data sought to explore the impact and acceptability of intervention components and study procedures. The qualitative analysis procedure was oriented by a research question and anchored to the quantitative analysis. Qualitative data from the semi-structured exit interviews was analyzed using thematic analysis (Braun & Clarke, 2006) to identify patterns amongst participants in the intervention condition (i.e., overall positive/negative comments and suggestions for change). Interviews were audio recorded, transcribed verbatim, and analyzed using NVivo 12 (QSR International Pty Ltd, 2018). Analysis followed Braun and Clarke's (2006) recommended six steps for thematic analysis. The researcher read through the transcripts for familiarization and subsequently developed an initial coding framework. Upon reviewing and

coding the transcripts, the researcher collated codes into potential themes which were subsequently reviewed, defined, and named. Ultimately, through iterative analysis, a set of themes was developed that reflected the overall story of the entire data set. Vivid examples were extracted which related back to the research question and offered a compelling illustration of participant experiences.

Website usage was analyzed using tracking data collected on the admin portal of the intervention platform. Microsoft Excel for Mac version 16.29 was used to analyze frequency counts, means, and standard deviations for engagement metrics such as number of logins, percentage of core lesson pages viewed, and time spent on the intervention. Adherence was analyzed using frequency of lesson completion. Podcast engagement used analyzed using frequency counts from the host platform, as well as self-report measures.

Quantitative data for the secondary outcome measures were analyzed using Microsoft Excel version 16.29 for Mac and R version 3.6.1 (R Core Team, 2017). The percentage of individuals with positive change in self-reported MVPA, M-PAC constructs, and ACT constructs was calculated. R software was then used to test whether the data for the secondary outcomes of interest met the assumptions for mixed-design analysis of covariance (ANCOVA). Preliminary analyses were conducted to establish whether the data was normally distributed and free from outliers. To control for baseline measures, ANCOVA was used and effect sizes were calculated, namely partial eta squared (η^2) values. Laken's (2013) recommendations for effect sizes were applied: an $\eta 2p = 0.01$ indicated a small effect, $\eta 2p = 0.06$ indicated a medium effect, and $\eta 2p = 0.14$ indicated a large effect. Missing data was handled using listwise deletion. Descriptive statistics, percentage improved, and effect sizes are presented in Table 13 (MVPA, Emotion Regulation, and M-PAC constructs) and Table 14 (ACT-related constructs).

2.6 Results

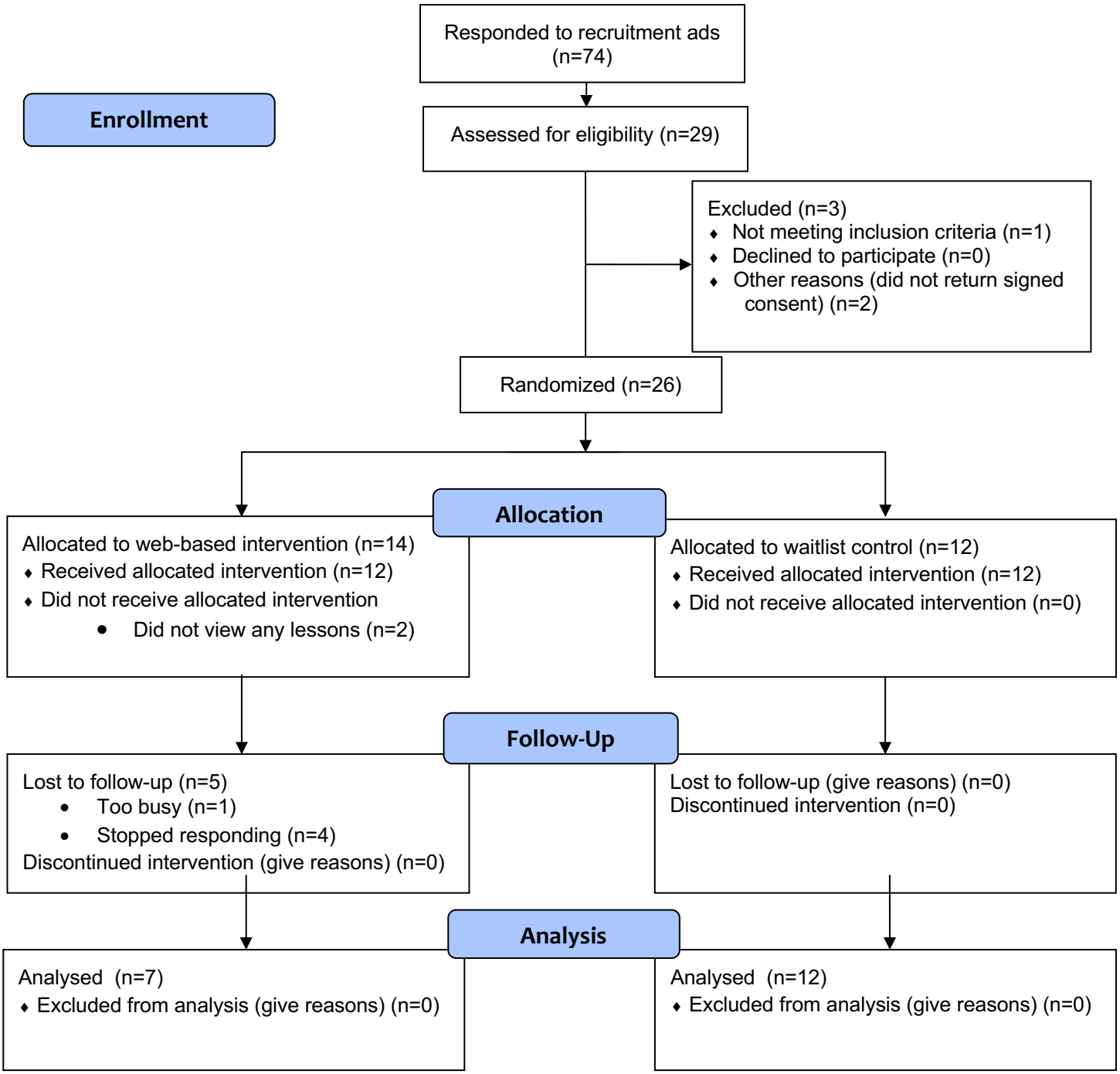
2.6.1 Participant Flow

A total of 74 adults responded to recruitment advertisements and expressed an interest to participate in the study by emailing the Research Coordinator. Of those, 29 were assessed for eligibility after which point three were excluded, because either they did not meet the inclusion criteria (n=1) or did not return the consent form (n=2) (see Figure 2). The participants completed baseline measures and then were randomized and allocated to the intervention group (n=14) or control group (n=12).

For the intervention condition, two participants never logged in to the platform and therefore did not see any lessons or receive the intervention. An additional five participants were lost to follow up, due to dropping out because of being too busy (n=1) or ceasing to respond to email communications (n=4). All participants allocated to the control group (n=12; 100%) completed all the study measures.

Figure 2

CONSORT Flow Diagram of Enrolment, Allocation, Follow-Up, and Analysis



2.6.2 Baseline Characteristics

Baseline demographics are presented in Table 6. The mean age for participants was 35.72 (SD = 5.71, age range 25-42) and the majority of participants were female (21/26, 81%). Sex was unevenly distributed among the conditions: all five males (100%) were allocated to the waitlist control group. The sample was largely Caucasian/white (73%); however, there were a number of other ethnic or cultural origins represented, namely five participants were a visible minority and one was Indigenous. Nearly all participants (25/26, 96%) had at least some college or university education, while 35% (9/26) had a professional or graduate degree. Over half (16/26, 62%) reported a gross household income of $75,000 or more. Most (18/26, 69%) were employed full-time (defined as working 35 hours per week or more) and participants reported working 37.36 hours per week (SD = 13.01). There was a broad range of occupations represented. Sample job titles included Advisor, Analyst, Bookkeeper, IT Manager, Program Coordinator, and Researcher, On average, participants reported 5.56 years (SD = 4.92) since entering the workforce in their current profession. The majority of participants (16/26, 61%) were married or living with a partner. Half of participants reported being a parent. Nearly two thirds (16/26, 62%) were from British Columbia, however there was representation from a total of seven Provinces and one Territory. Baseline physical activity and emotion regulation can be found in Table 5.

Table 5

Baseline Characteristics for Key Secondary Outcomes of Interest

	Intervention (n=14)	Control (n=12)	All (n=26)
MVPA	44.29 (42.52)	52.25 (51.08)	47.5 (45.83)
Emotion Regulation	5.86 (3.44)	5.42 (3.73)	5.65 (3.51)

Table 6

Baseline Characteristics of Participants

Characteristic	Overall (n=26)	Control (n=12)	Intervention (n=14)
Age	35.72 ± 5.71	35.25 ± 5.99	36.15 ± 5.65
Sex			
Male	5 (19%)	5 (42%)	0
Female	21 (81%)	7 (58%)	14 (100%)
Ethnicity			
Caucasian	19 (73%)	7 (58%)	12 (86%)
Black	1 (4%)	0	1 (7%)
Filipino	1 (4%)	1 (8%)	0
Inuit	1 (4%)	1 (8%)	0
Japanese	1 (4%)	0	1 (7%)
Latin American	1 (4%)	1 (8%)	0
Mixed Race	2 (8%)	2 (17%)	0
Education			
High school diploma	1 (4%)	0	1 (7%)
Vocational school or some college	4 (15%)	2 (17%)	2 (14%)
College or university undergraduate degree	12 (46%)	4 (33%)	8 (57%)
Professional or graduate degree	9 (35%)	6 (50%)	3 (21%)
Marital Status			
Common-law	5 (19%)	2 (17%)	3 (21%)
Divorced/separated	1 (4%)	0	1 (7%)
Married	11 (42%)	5 (42%)	6 (43%)
Single	9 (35%)	5 (42%)	4 (29%)
Parent	13 (50%)	7 (58%)	6 (43%)
1 child	4 (15%)	3 (25%)	1 (7%)
2 or more children	9 (35%)	4 (33%)	5 (36%)
Household annual income			
$35,000 or less	2 (8%)	1 (8%)	1 (7%)
$35,001 to $50,000	3 (12%)	1 (8%)	2 (14%)
$50,001 to $75,000	4 (15%)	2 (17%)	2 (14%)
$75,001 to $100,000	6 (23%)	2 (17%)	4 (29%)
$100,001 to $150,000	8 (31%)	4 (33%)	4 (29%)
$150,001 to $200,000	1 (4%)	0	1 (7%)
More than $200,000	1 (4%)	0	1 (7%)
Choose not to respond	1 (4%)	1 (8%)	0
Employment status			
Employed full-time (35 hrs/wk or more)	18 (69%)	10 (83%)	8 (57%)
Employed part-time (less than 35 hrs/wk)	6 (23%)	2 (17%)	4 (29%)
Self-employed or freelance (variable hours)	2 (8%)	0	2 (14%)
Years since entering the workforce	5.56 ± 4.92	5.33 ± 4.52	5.77 ± 5.43
Self-reported hours per week worked	37.36 ± 13.01	40.92 ± 12.26	34.32 ± 13.31

Province or territory			
Alberta	3 (12%)	2 (17%)	1 (7%)
British Columbia	16 (62%)	8 (67%)	8 (57%)
Manitoba	1 (4%)	0	1 (7%)
Newfoundland and Labrador	1 (4%)	0	1 (7%)
Northwest Territories	2 (8%)	1 (8%)	1 (7%)
Nova Scotia	1 (4%)	0	1 (7%)
Ontario	1 (4%)	0	1 (7%)
Quebec	1 (4%)	1 (8%)	0
Height (cms)	168.14 ± 8.15	168.59 ± 10.36	167.79 ± 6.30
Weight (kgs)	96.58 ± 32.80	94.41 ± 31.83	98.29 ± 34.64

2.6.3 Primary Feasibility Outcomes

Recruitment and retention

The recruitment rate was 35%. Recruitment took place over a 16-week period. There was an average of 6 recruits per month. The majority of participants were recruited via Facebook or Instagram (n=23) with snowball referral (n=2) and the faculty newsletter (n=1) also yielding recruits. The screening to enrolment ratio was 90%. Throughout the course of the study, there was a 73% retention rate, with 19 of 26 randomized participants completing the follow-up questionnaire and the exit interview. Of the 7 who did not complete the study, all (100%) were allocated to the intervention condition.

Engagement and adherence

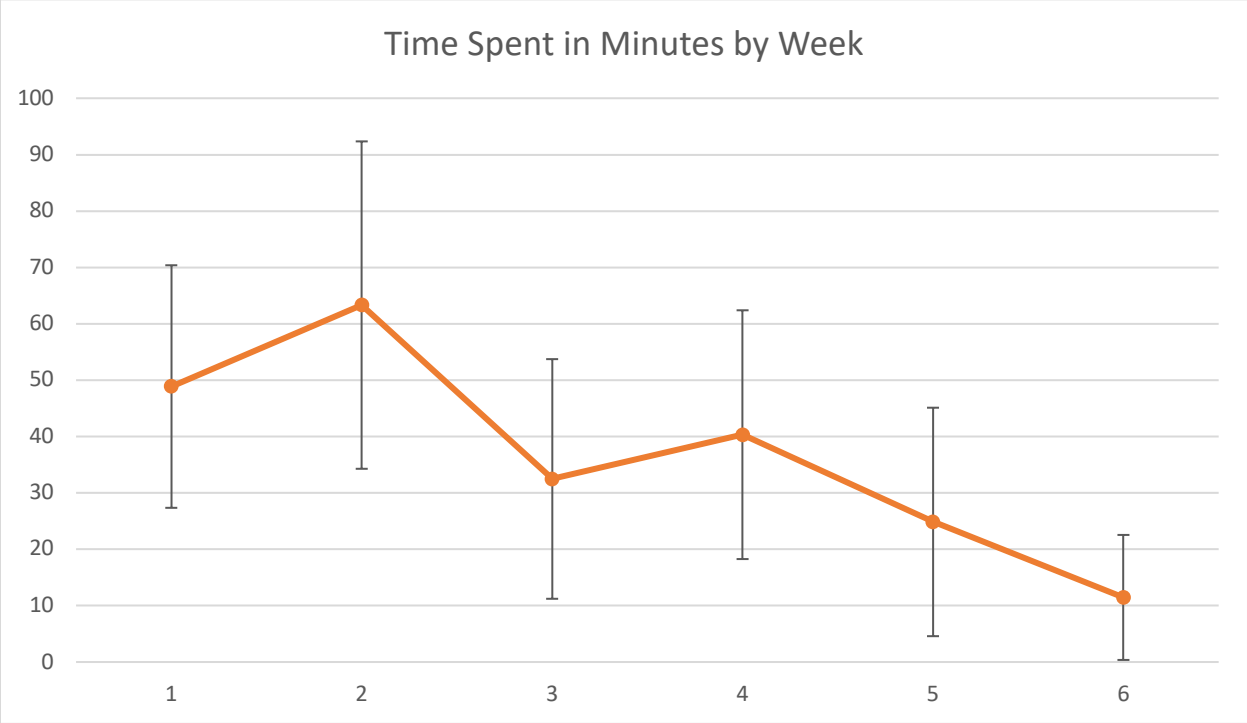
Engagement was analyzed for the intervention group (n=14) only. Over 6 weeks, participants logged in 4.57 (SD = 3.30) times and accessed 63% (SD = 13.29) of the core lesson pages (M = 21.43 of 34 lesson pages). On average, participants spent 31.6 minutes (SD = 18.25) on the web-based intervention per week, ranging from 63.3 minutes (Lesson 2) to 11.4 minutes (Lesson 6). Of the seven participants who completed all the study measures, 71% (5/7) viewed all six of the lessons. Participants who completed all measures logged in 7 times (SD = 2.52) and visited 86% (SD = 21.32) of the core lesson pages (M = 29.29 of 34 lesson pages). On average,

those who completed the study spent an average of 58.90 minutes per week (SD = 9.03), ranging from 91.63 minutes (Lesson 2) to 24.90 minutes (Lesson 6).

Time spent on the web intervention by week for the intervention condition (n=14) is shown in Figure 3. In terms of the number of opened modules, 6 participants (42%) opened all six lessons, 8 participants (57%) opened four or more lessons, 12 participants (86%) opened 2 or more lessons, while 2 participants (14%) did not open any lessons. Usage metrics denoting percentage of lessons viewed are presented in Table 7.

Figure 3

Minutes Spent on Web Intervention by Weekly Intervals



Note. Error bars represent 95% confidence intervals.

Table 7

Percentage of Lessons Viewed by Participant

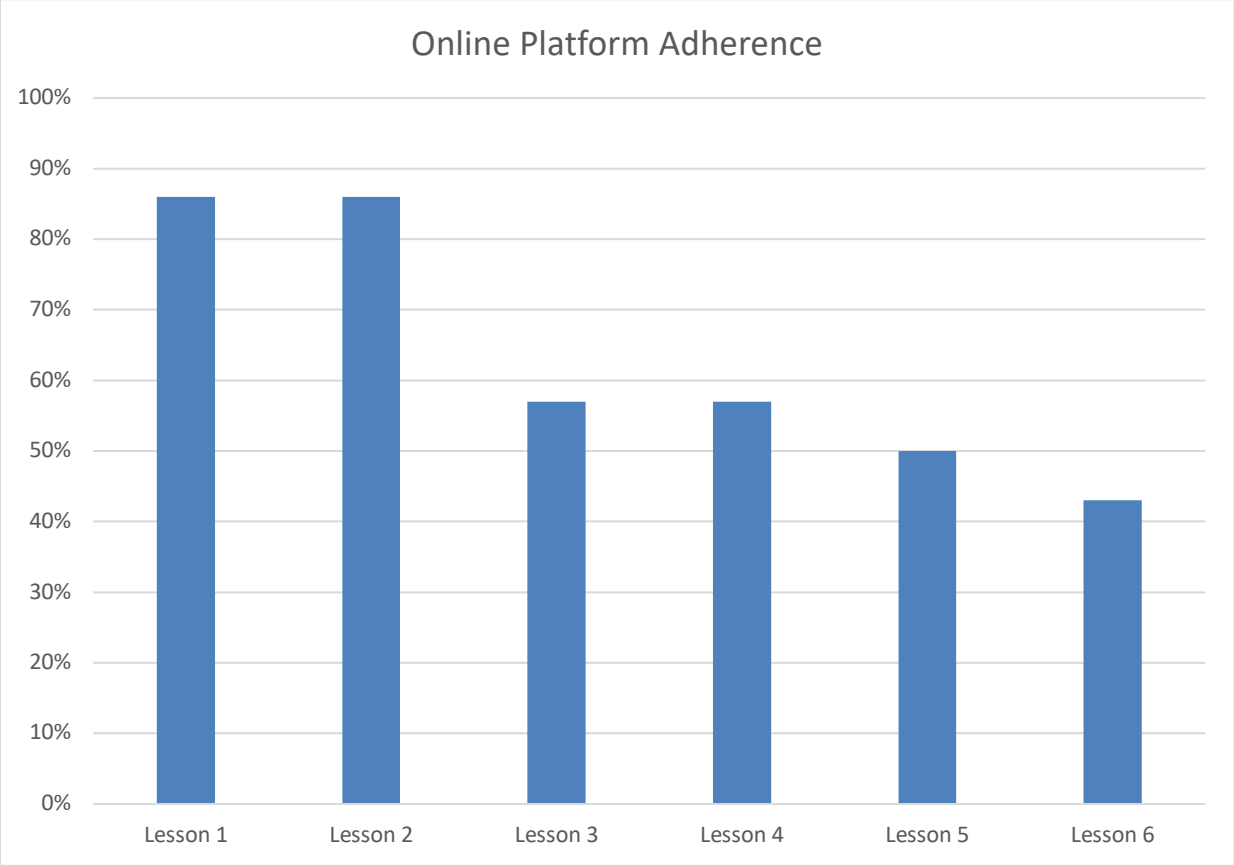
Number of lessons viewed	Percentage of lessons viewed	Intervention condition (n=14) n (%)
6 of 6	100%	6 (42%)

5 of 6	83%	1 (7%)
4 of 6	67%	1 (7%)
3 of 6	50%	-
2 of 6	33%	4 (29%)
1 of 6	17%	-
0 of 6	0%	2 (14%)

Total usage by lesson for the intervention condition included 86% (12/14) of participants who accessed Lesson 1, 86% (12/14) of participants who accessed Lesson 2, 57% (8/14) of participants who accessed Lesson 3, 57% (8/14) of participants who accessed Lesson 4, 50% 7/14) of participants who accessed Lesson 5, and 43% (6/14) of participants who accessed Lesson 6. Usage by lesson is presented in Figure 4.

Figure 4

Online Platform Adherence

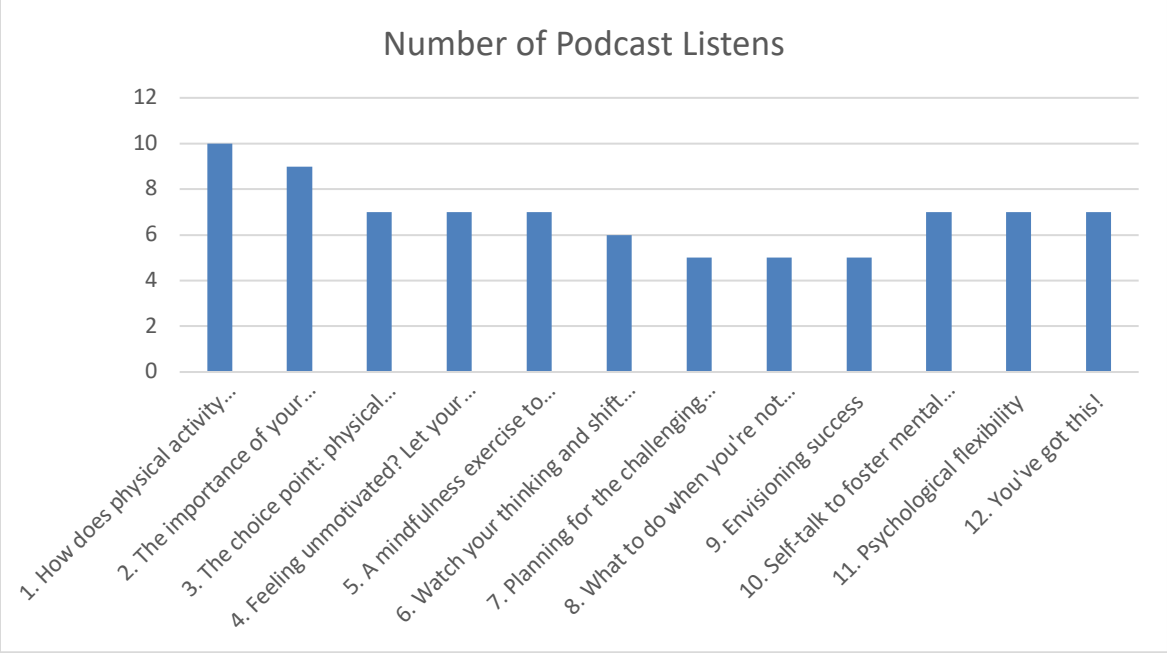


Note. Percentage of participants allocated to the intervention who opened lesson

Engagement in the podcast component was analyzed by the number of listens, as measured objectively by the podcast platform (see Figure 5). On the follow-up questionnaire for those allocated to the intervention condition, participants' responses ranged from never (n=2) to almost always (n=1). The majority of participants reported listening to the weekly podcasts at least sometimes (5/7, 71%) and most (5/7, 71%) also reported applying the podcast concepts to help follow through on physical activity intentions. See Table 8 for a breakdown of podcast engagement and adherence results from the questionnaire.

Figure 5

Podcast Listens by Episode



Note. Counts represent objective number of listens per episode as reported by host platform

Table 8

Podcast Usage Questionnaire Results

Item and response options	Intervention Condition (n=7)
How often did you listen to the weekly mini podcasts?	

Never	2 (29%)
Rarely	1 (14%)
Sometimes	2 (29%)
Often	2 (29%)
Almost always	1 (14%)
Were you able to apply the concepts from the mini podcasts to help with physical activity follow through?	
Never	2 (29%)
Rarely	0
Sometimes	2 (29%)
Often	2 (29%)
Almost always	1 (14%)

Satisfaction and acceptability

For the questionnaire pertaining to the evaluation of lesson content, the mean aggregate score was >2.5 out of a possible 4 (M = 2.68, SD = 0.66, α = 0.87). For the questionnaire pertaining to overall study experience and satisfaction with the online platform (5-point scale), the mean score was >4 (M = 4.07, SD = 0.43, α = 0.74). For both questionnaires, 100% of respondents (n=7) reported neutral or positive acceptability and satisfaction, which translates to 0% of respondents reporting dissatisfaction. See Table 9 for mean scores across items for each questionnaire respectively. For the first questionnaire, two items had mean scores below 2.5: one was regarding the extent to which the participant learned new things, and one item was regarding the extent to which the participant perceived that the strategies presented helped to increase physical activity levels. For the second questionnaire, none of the items had a mean below 4.

Table 9

Satisfaction and Evaluation Questionnaire Results

Evaluation items pertaining to lesson content	**Mean (SD)**	**Scored 2 or above n (%)**	**Scored 3 or above n (%)**
Found the information interesting	2.85 (0.69)	7 (100%)	5 (71%)
Learned new things	2.42 (0.79)	7 (100%)	2 (29%)

Used the tools and strategies provided	3 (0.82)	7 (100%)	5 (71%)
Strategies helped to increase physical activity levels	2.43 (0.79)	7 (100%)	2 (29%)
Satisfaction items pertaining to study and online platform	**Mean (SD)**	**Scored 3 or above n (%)**	**Scored 4 or above n (%)**
Enjoyed being part of the study	4.14 (0.69)	7 (100%)	6 (86%)
Topics were relevant and useful	4.14 (0.37)	7 (100%)	7 (100%)
Would recommend the online platform to others	4.00 (0.58)	7 (100%)	6 (86%)
Increased physical activity because of study	4 (0.57)	7 (100%)	6 (86%)

Intervention Satisfaction and Acceptability: Qualitative Evaluation

A total of 7 participants from the intervention group completed the semi-structured interview at follow-up. Comments were largely positive towards the intervention and procedure; however, most (6/7) participants had at least one recommendation for improving or refining the intervention or procedures. A summary of results incorporating exemplary quotes from the exit interviews is available in Table 10. Common themes were organized under the categories of positive comments and recommendations for improvements.

Table 10

Summary of Results from Exit Interview Exploring Participant Feedback

Interview Question	Valence	Sample quotes and participant number
Tell me how you felt about the study?	6/7 Positive 1/7 Neutral	*"Overall I really enjoyed being part of the study. I would say that it did help me to increase my physical activity over the past six weeks."* [1] *"I enjoyed doing it - I like how it was set up with the lessons, I thought that was good I wasn't getting a ton of information all at once, I was getting it in little pieces which I found helpful."* [24]
Did you listen to the mini podcasts? If so, were they useful? If not, how come?	4/7 Listened Sometimes 3/7 Did not listen	*"Yeah I listened to a few of those -- just really motivating. I really liked how they weren't super long or anything like that or the ones I listened to, I really liked how you could listen to them on the go a bit."* [11] *"I did not use the mini podcasts, because honestly, I forgot about them."* [21]

Did you find the information that we provided interesting or informative?	7/7 Positive	*"I think it was practical, so I appreciated all of it*." [5] "*It was a lot of good, useful information and it was like I said really well laid out. You chose some really good topics, so it kept the person like me engaged so ya I really liked it."* [11]
Have you been able to incorporate the strategies provided in the lessons and podcasts?	7/7 found at least one strategy helpful or relevant	*"The conversation around having the emotion and feeling that emotion and then continuing to go on with your day was super powerful."* [5] *"That was probably my favourite part with kind of the ACT skills specifically."* [21]
What would you change about the study?	1/7 No changes 6/7 had suggestions including addressing minor issues, adjustments to delivery of content, ideas for stronger engagement	*"integrating the homework into the actual platform might be helpful for some people."* [1] *"So maybe that piece was missing a little bit for me just having more of a video of step-by-step what the lesson was about."* [24]

Positive comments. Most participants (6/7) liked the intervention, using words such as 'enjoyed', 'loved', 'great', 'pleased' and citing enjoyment, fun, new tools, and new mindsets. There was also consistent feedback on the intervention content, namely six participants reported the information and strategies presented was perceived as helpful, and the majority (5/7 of participants) reported using at least one strategy. Most of participants (5/7) cited ACT-related strategies (e.g., acceptance, values, mindfulness) and two participants cited regulatory strategies (goal setting and planning). Three of seven participants discussed their physical activity behaviour and stated the intervention helped to increase their physical activity. In terms of the design and delivery of the intervention, four participants liked the layout and three participants felt the topics were broken down in a way that was not overwhelming. Three participants enjoyed how the lessons built on each other. One participant remarked 'I really really really like the format that you chose. As the journey was going it was opening the right doors at the right

times, so it was really helpful'. Two participants referenced the homework and worksheets useful for solidifying ideas. Common themes related to positive feedback are presented in Table 11.

Table 11

Sample Quotations of Feedback from Intervention Group

Positive Comments	Components (Number of respondents)	Example Quotes [Participant ID]
Gratification and Enjoyment	• Enjoyed (3) • Fun (2) • New mindset (2) • New tools (2) • Motivating (1)	*"Overall I really enjoyed being part of the study."* [1] *"I think it was great. Yeah! I really enjoyed it, I thought it was fun, I got a bunch of tools so…yay."* [5] *"I had a lot of fun doing it and it was a great motivator and it got me going."* [11] *"Overall I felt pretty good about this study. I felt like it was like relatively helpful and helpful way to look at things."* [21] *"I liked that it was some new stuff and new ways to think about things."* [23] *"I was pleased with everything."* [24]
Intervention Content: Information and Strategies	• Helpful (6) • ACT-related strategies (e.g., value-based living, acceptance, mindfulness) (5) • Goals and planning (2)	*"The information was really, really helpful, and in particular um, kind of trying to make compromises for times when you can't necessarily do the entire exercise planned that you wanted to do that day but you know, something may have happened, you may be tired you might not be feeling well, whatever the case might be. […] I also found the mindfulness content was helpful as well."* [1] *"I think that the if-then moments stood out to me as being the most helpful and this idea of accepting kind of where you're at."* [5] *"I think it makes so much sense, especially skills like the choice point and using that with exercise and thinking like, you know is this thought or this action helping me of the life that I want to live, especially with exercise."* [21] *"Everything was pretty relevant. Because it's stuff I've struggled with, right? It's easy to put things off when you're just not feeling it."* [23] *"[…] the stuff about being mindful, finding your 'why' - I did think about that beyond just reading about it in my lessons. I did have moments where I could be like you could either do XYZ which is not really helpful or beneficial to get to what you actually want to do."* [23]

		"I thought the parts psychologically with motivation, like when you're dealing with stress how you can still incorporate exercise into your schedule and I found that very helpful even though I already knew a lot of that material it was still that good reminder again that I found helpful. I really didn't find anything unhelpful really." [24]
Physical activity behaviour	• Increased PA (3)	*"I would say that it did help me to increase my physical activity over the past six weeks." [1]* *"I've done a lot more walking and yoga kind of stuff. I've done a bit of weights and things like that." [24]*
Intervention design and delivery	• Acceptable layout or presentation (4) • Lessons built on each other (3) • Not overwhelming (3) • Liked homework (2)	*"Loved the images which I thought was a great way to break things up. […] I like my homework so I loved the worksheets which I thought was really great and a way to solidify them and I like the weekly reminders right that it was time for progress and how the weeks built on each other so second week I had to do some reflection on first week and um that was that was really great. Yeah, I enjoyed it.*" [5] *"I think the way you laid it out […] they kind of led into each other so that was really nice. It created an "I want more" so that was really perfect. I really really really like the format that you chose. As the journey was going it was opening the right doors at the right times, so it was really helpful."* [11] *"I did like the way it was put together and that it was sort of presented in a building blocks approach. First do this then do this and then put them all together as you're going."* [14] *"Yeah it was nice too in that it wasn't a bunch of information that was all in your face like, centered topic by topic so you weren't overwhelmed with the information."* [14]

Recommendations for Improvement. One participant did not think anything should be changed, saying 'everything was perfect'. The remaining participants had suggestions or constructive feedback, although there was little overlap on recommendations. Nonetheless, comments were themed around adjustments to the delivery of content, ideas for strengthening engagement, addressing minor issues or glitches, increasing podcast awareness, and changes to

procedure. Several participated noted a lapse in email reminders as a common challenge. A desire for more video-based content was shared by two participants. Common themes related to recommendations for improvement are presented in Table 12.

Table 12

Sample Quotations of Constructive Feedback

Recommendations for Improvement	Components (Number of respondents)	Example quotes [Participant ID]
Adjustments to delivery of content	• More video content (2) • Chunking information (1) • Embed homework into platform (1) • Plain language (1)	*"At the end of the day when I was doing it, I was so tired I would have really just appreciated simpler language."* [1] *"So, the first thing I would do if you're going to keep it the way it is to build the text more so you are utilizing italicized and bold and different fonts and breaking it up so it's a few sentences at a time, so it's more digestible."* [5] *"I may have wanted just some more video because I find I'm more of a visual learner as opposed to always just reading."* [24]
Ideas for stronger engagement	• More interactivity (1) • Incorporate rewards or prizes (1) • Gamification or challenges (1) • More check-ins from the researcher (1)	*"I found the Platform like a little bit dry like I feel like it could have been maybe a little bit more like jazzed up."* [1] *"But making it fun or making the opportunity for a big payout or reward or some kind of satisfaction is fun. Every time you do the homework upload it and we'll give you whatever. I think that would be super fun."* [5]
Minor issues or bugs	• More space to input text (1) • Hyperlinks open in new window (1) • Video was not working (1) • Lessons inaccurately marked complete (1) • Email reminders stopped arriving (2)	*"The text boxes where the platform would ask you to reflect on some things, it really didn't give you enough space to answer all the questions that were there."* [1] *"Small thing but making sure all the hyperlinks open up in a new webpage window."* [5] *"I stopped getting the messages part way through the study."* [14] *"Say if I was partway through a lesson it would say that I'd completed even though I hadn't got through it all."* [23]

Podcasts	• Forgot (3) • Out of order (1) • Wasn't aware (1)	*"I didn't actually know that I needed to do that until the end and I don't know how I missed it."* [5] *"I did not use the mini podcasts, because honestly, I forgot about them."* [21]
Procedures	• Wished it was longer (2)	*"I might have liked it if it was a bit longer."* [1]

2.6.4 Secondary Outcomes

Data treatment. MVPA violated the normality assumption. After winsorizing extreme MVPA outliers by recoding for the next closest value (Tabachnick & Fidell, 2007), skew and kurtosis were acceptable (<2 and <1 respectively) and thus the data was not transformed prior to further assumption analyses. All secondary outcome data had non-significant results from Levene's Test and therefore met the assumption for homogeneity of variance (Field, Miles, & Field, 2012).

Self-reported MVPA. Self-report data for MVPA and other secondary outcomes is outlined in Table 13. Weekly MVPA minutes showed a large intervention effect relative to control (164.29; SD=52.87; $p < 0.01$; $\eta_p^2 = 0.53$). A greater percentage increased in MVPA in the intervention group (100%) as compared to the control group (58%). The intervention group also showed a greater percentage of participants improving to meet MVPA guidelines (43%) compared to the control group (17%).

Emotion Regulation. Emotion regulation showed a large intervention effect relative to control ($p = < 0.01$; $\eta_p^2 = 0.42$). A greater percentage increased in emotion regulation at follow-up in the intervention group (86%) as compared to the control group (67%).

M-PAC Constructs. In terms of M-PAC constructs, the greatest effect sizes were observed for regulatory behaviours ($p = < 0.01$; $\eta_p^2 = 0.48$), affective attitude ($p = 0.03$; $\eta_p^2 = 0.26$) and identity ($p = 0.17$; $\eta_p^2 = 0.11$) relative to the control group. A medium size effect was

observed for perceived capability (p = 0.24; η_p^2 = 0.08). Small effects were shown for habit (p = 0.35; η_p^2 = 0.05), instrumental attitude (p = 0.52; η_p^2 = 0.03), and perceived opportunity (p = 0.70; η_p^2 = 0.01) relative to control. A greater percentage of participants in the intervention group vs. control improved in outcomes of affective attitude, instrumental attitude, regulatory behaviours, and identity.

Table 13

Changes in Secondary Outcomes of MVPA, Emotion Regulation, and M-PAC Constructs

	Baseline Mean (SD)	Poststudy Mean (SD)	*n* Improved (%)	p-value (p=)	Partial Eta Squared (η_p^2)
MVPA					
Control	51.25 (51.08)	73.83 (56.90)	7/12 (58%)	<.01	0.53
Intervention	44.29 (42.51)	164.29 (52.87)	7/7 (100%)		
Emotion Regulation					
Control	5.42 (3.73)	7.67 (2.42)	8/12 (67%)	<.01	0.42
Intervention	5.86 (3.44)	11.29 (2.21)	6/7 (86%)		
Affective Attitude					
Control	9.58 (3.65)	9.42 (3.34)	3/12 (25%)	0.03	0.26
Intervention	10.14 (3.28)	12 (2.0)	4/7 (57%)		
Instrumental Attitude					
Control	13.27 (1.35)	12.46 (1.98)	1/12 (17%)	0.53	0.03
Intervention	13.21 (1.48)	12.71 (1.70)	2/7 (29%)		
Perceived Capability					
Control	7.33 (1.82)	8 (1.21)	5/12 (42%)	0.24	0.08
Intervention	8.71 (1.27)	9 (1.00)	2/7 (29%)		
Perceived Opportunity					
Control	8.25 (1.36)	8.00 (1.60)	4/12 (33%)	0.70	0.01
Intervention	8.43 (1.22)	8.29 (1.50)	1/7 (8%)		
Regulatory Behaviours					
Control	8.17 (3.16)	7.75 (3.55)	4/12 (33%)	<.01	0.48
Intervention	8.00 (3.66)	14.43 (3.15)	7/7 (100%)		
Habit					
Control	5.92 (3.20)	6.25 (3.19)	3/12 (25%)	0.35	0.05
Intervention	7.14 (4.20)	7.86 (2.54)	0/7 (0%)		
Identity					
Control	5.50 (3.00)	5.42 (3.00)	2/12 (17%)	0.17	0.11
Intervention	7.07 (2.64)	9.14 (2.41)	2/7 (29%)		

Note. Partial η2 effect sizes were small (η2 p = 0.01), medium (η2 p = 0.06), and large (η2 p=0.14) (Lakens, 2013).

ACT-related constructs. Changes in ACT-related secondary outcomes are presented in Table 14. Compared to the control group, the greatest effect sizes were observed for mindfulness (p = <.01; η_p^2 = 0.47) and valued living (p = 0.06; η_p^2 = 0.20). Acceptance and action observed a medium effect (p = 0.28; η_p^2 = 0.07) while PA acceptance showed a small effect size (p = 0.48; η_p^2 = 0.03) relative to the control group. Perceived stress showed a potentially trivial effect size (p = 0.44; η_p^2 = 0.00). Participants in the intervention condition showed a greater percentage of improvement in several ACT-related constructs, including valued living, and applied mindfulness. A greater percentage of improvement was not observed for acceptance and action, perceived stress nor PA acceptance.

Table 14

Changes in Secondary Outcomes of Perceived Stress and ACT-related Constructs

	Baseline Mean (SD)	Poststudy Mean (SD)	n Improved (%)	p-value (p=)	Partial Eta Squared
Perceived Stress					
Control	2.83 (1.11)	3.08 (1.24)	2/12 (17%)	0.44	<0.001
Intervention	2.79 (0.70)	3.00 (1.00)	0/7 (0%)		
Acceptance and Action					
Control	8.08 (2.71)	8.83 (2.55)	4/12 (33%)	0.28	0.07
Intervention	7.71 (2.79)	7.71 (1.38)	3/7 (43%)		
PA Acceptance					
Control	30.42 (4.10)	29.83 (4.43)	4/12 (33%)	0.48	0.03
Intervention	27.71 (6.22)	27.28 (3.95)	2/7 (29%)		
Valued Living					
Control	7.58 (3.82)	7.08 (3.90)	3/12 (25%)	0.06	0.20
Intervention	10.79 (4.51)	13.42 (3.36)	4/7 (57%)		
Applied Mindfulness					
Control	14.25 (5.61)	13 (4.73)	3/12 (25%)	<.01	0.47
Intervention	15.00 (5.08)	18 (2.08)	5/7 (71%)		

Note. Partial η2 effect sizes were small (η2 p = 0.01), medium (η2 p = 0.06), and large (η2 p=0.14) (Lakens, 2013).

2.7 Discussion

Desk-based professionals are at-risk of inactivity (e.g., Kirk & Rhodes, 2012; Smith et al., 2016) and stress or other negative moods or emotions resulting from competing demands may be one reason this group fails to enact positive intentions (e.g., Almeida et al., 2020; Ruissen et al., 2022). An intervention which is accessible and convenient (i.e., web-based), bridges the gap between intentions and action (i.e., leverages M-PAC), and also accounts for incidental affect regulation (via ACT strategies) represents a novel and timely approach. Indeed, the understanding of affective determinants of PA is burgeoning, and yet, targeting incidental affect has received little research attention (Stevens et al., 2020). To my knowledge, this is the first study to use an action control theory to target incidental affect regulation among the at-risk population of desk-based professionals. Further, while an online platform consisting of weekly modules has been feasible among other populations (Hollman et al., 2022; Liu et al., 2019), it is important to test the practicability of the intervention content and delivery among ECPs. Establishing the credibility of a novel intervention is an important first step before proceeding to a full-scale test of efficacy via an RCT (Czajkowski et al., 2015).

The main objective of this study was to examine the feasibility and acceptability of a 6-week eHealth intervention grounded in M-PAC and incorporating ACT principles to target incidental affect regulation and promote PA among ECPs. Primary outcomes of interest included recruitment, retention, engagement, and acceptability. Additional aims included exploring effect sizes for secondary outcomes of interest including PA, emotion regulation, M-PAC constructs and ACT-related constructs. Ultimately, this study sought to elucidate whether the intervention showed viability and promise for mitigating the influence of incidental affect on physical activity behaviour before testing through a full trial.

Primary Outcome Measures

Per the CONSORT guidelines for feasibility studies, the fundamental aim of feasibility studies is to shed light on whether to proceed to a full-scale trial (Eldridge et al., 2016). The primary outcomes of recruitment, retention, engagement, satisfaction, and acceptability observed herein met pre-determined progression criteria. It follows that the set of feasibility indicators provides strong support for extending this work into a definitive test of effectiveness. However, the findings revealed several areas for improvement and optimization.

I hypothesized recruitment would be acceptable, with at least 6 participants enrolling per month and a recruitment rate of over 30%. These predetermined progression criteria were established based on prior research that was six-weeks in length (Husband et al., 2019) and had similar methods (Hollman et al., 2022). As hypothesized, the recruitment rate was 35% and there was an average of six recruits per month and thus recruitment can be deemed successful. Cox and Rhodes (2020) calculated 6 recruits per month by using a clinically significant milestone (30 minute change in MVPA) and an approximate effect size (d = 0.35) to estimate the minimum participants per group (65) for a two-armed trial spanning two years. By meeting these pre-calculated criteria, it can be concluded with confidence that recruitment for a definitive RCT would be viable. Notably, for the present study I recruited a part-time basis. It is conceivable that with more dedicated resources the number of recruits would increase by at least 20-30% conservatively (i.e., 1-2 additional participants per month). Recruitment is an important consideration because one common reason clinical trials are terminated early is due to challenges enrolling an adequate number of participants (Williams, Tse, DiPiazza, & Zarin, 2015). Powell and colleagues (2021) suggest that the pool for eligible and enthusiastic participants can diminish over the course of the study. One advantage for this study was its remote nature which came with

the ability to recruit Canada-wide, and therefore it stands to reason that the eligibility pool is substantial. Social media advertising also proved reasonably successful for this population. Specifically, organic and paid advertising via Facebook and Instagram was most effective and accounted for 88% of recruits. Channels such as Twitter and LinkedIn were less relied upon and could be better leveraged in a future RCT. Furthermore, additional strategies to appeal to early career professionals such as marketing tactics or optimized message framing could be adopted to reach busy professionals.

I hypothesized that the retention rate would be over 70%. The retention rate was 73%, which is satisfactory and consistent with the eHealth literature which often reports high dropout and attrition rates (Liu et al., 2013; Meyerowitz-Katz et al., 2020). Although the retention can be deemed sufficient, it was slightly lower than the range (80-100%) that has been suggested for being indicative of a strong trial (Jackson &Waters, 2005). It is also worth noting that all of the participants who were lost to follow up were in the intervention condition. This suggests that the waitlisted control group helped bolster lower attrition and gaining access to the platform served as an effective incentive. Conversely, the unequal attrition (n=7) in the intervention condition may signal the commitment may not be viable for busy professionals. However, while increased attrition in the intervention condition is slightly concerning, this rate is in line with many studies which employ an internet-based delivery format. For example, in a review of internet-based interventions, Joseph and colleagues (2014) found attrition was common and ranged from 0% to 69%. In response to this challenge, strategies to encourage adherence have been suggested including enhanced engagement, frequent updates, and increased contact (Joseph et al., 2014). Proactive email reminders have also been found to improve effectiveness of web-based

interventions (Liu et al., 2018). It is advisable to incorporate these proactive strategies to mitigate attrition and bolster intervention adherence.

In terms of engagement, I hypothesized that it would be over 60%. Participants accessed 63% of the core lesson pages thereby meeting the progression criteria. Additional metrics leveraging website usage analytics reinforced the conclusion of adequate engagement. Namely, website usage data was analyzed to explore the level of interaction with the materials. The number of logins (4.57) and time spent on the platform per week (31.6 minutes) was reasonable but had substantial variability among participants. This usage is in line with other tests of the web-intervention (Hollman et al., 2022). Notably, usage was considerably higher among participants who completed all study measures. On average, those who completed the study logged in 7 times, spent 58.9 minutes per week on the platform, and visited 86% of the core lesson pages. The majority of participants reported listening to the podcast supplements at least sometimes as well as employing the strategies from the podcasts. This was reflected in the data for objective number of listens per episode. Collectively, these indicators suggest engagement and adherence with the intervention content can be deemed acceptable.

I also hypothesized that adherence to the behavioural intervention would decrease over the course of the six-week intervention. As hypothesized, the initial level of engagement was not maintained over time and showed a steady decline, a finding that is reflected in previous research (Hollman et al., 2022; Willms, 2021). Engagement which wanes over time is a common issue in web-based interventions and particularly problematic because it can lead to poor effectiveness (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012). Accordingly, persuasive technology and design have been suggested as one way to remedy poor adherence (Kelders et al., 2012). Digital health interventions may also benefit from applying insights from behavioural economics

to encourage engagement with the intervention through the use of nudges. For example, nudges (e.g., reminders, feedback, and planning prompts) have shown positive effects in domains such as the self-management of chronic disease (Möllenkamp, Zeppernick, & Schreyögg, 2019). Building upon this, future versions of this trial could use timely and attractive reminders to prompt participants when they are most receptive (e.g., at the start of the week) (Behavioural Insights Team, 2014). Adding elements of gamification to the intervention represents another strategy to promote adherence given this method has been shown to enhance user engagement (Koivisto & Hamari, 2019). Given engagement is associated with PA intervention outcomes (Smith & Liu, 2020), it would be prudent to adopt the aforementioned tactics in future iterations of the trial in order to maximize participant engagement.

In terms of satisfaction, I hypothesized that scores would have high ratings on two questionnaires (means of over 2.5/4 and 4/5). Additionally, I hypothesized that over 80% would qualitatively report favourable satisfaction and acceptability. This hypothesis was supported as both quantitative and qualitative data was positive overall. Specifically, scores on the satisfaction measures were above the aforementioned cut off criteria. Perhaps most importantly, none of the participants reported dissatisfaction on quantitative measures. Feedback from the interviews was largely affirmative and complimentary. Most participants found the intervention helpful and enjoyed the content, design, and delivery of the information.

In line with expectations concerning room for refinement, participants also had a number of suggestions for improvement. One shared challenge that emerged was an issue with the automated email reminders. It is plausible this issue had an impact on retention and may have been a contributor to the attrition observed. A future RCT would need to ensure email reminders are being received by participants and might consider using text reminders as text message

interventions have been shown to be effective (Smith, Duque, Huffman, Healy, & Celano, 2020). Another noteworthy theme that emerged was the lack of awareness around the podcast episodes. In turn, making the podcasts more prominent and salient through timely reminders may assist with increasing their usage. Additional comments were around adjustments to the delivery of the intervention (e.g., more video content), ideas for strengthening engagement (e.g., using challenges and prizes), and addressing minor technical issues on the platform. Interestingly, the suggestion about prizes is aligned with previous literature and well-positioned to support the aim of increasing engagement and adherence. For example, one study found support for using a regret lottery to improve adherence to an intensive mHealth self-monitoring protocol requiring ecological momentary assessments and accelerometer use (Husain et al., 2019). Others have found that even small financial incentives can promote adherence to a web-based PA intervention (Wurst, Maliezefski, Ramsenthaler, Brame, & Fuchs, 2020). Future versions of the web-intervention could integrate these proposed improvements in order to maximize the chances of impact.

Secondary Outcome Measures

The present study observed the principles of CONSORT guidelines for feasibility trials and therefore did not include formal hypothesis testing for effectiveness due to being underpowered (Eldridge et al., 2016). Indeed, due to the preliminary nature of this study, participant outcomes are considered secondary and inferential analyses should be interpreted with caution given the inadequate power. However, multiple authors argue that obtaining information surrounding promise for impact is crucial prior to scaling up a trial (Beets, von Klinggraeff, Weaver, Armstrong, & Burkart, 2021; Czajkowski et al., 2015). As such, the present study examined whether targeted outcomes showed movement in the intended direction.

Therefore, it was hypothesized that secondary outcomes of MVPA, M-PAC constructs, and ACT-related constructs would show improvements relative to baseline and in comparison to control. This hypothesis was generally supported and findings were in-line with M-PAC theory (Rhodes, 2017).

As hypothesized, the secondary outcome of self-report MVPA showed a large effect size in increasing PA and may have been changing in the hypothesized direction in response to the intervention. Further, MVPA for the intervention group increased substantially relative to baseline. Specifically, mean weekly MVPA increased by no less than 120 minutes among intervention participants and all 7 participants improved. The ORBIT framework recommends studies which are considered Phase IIb demonstrate a clinically significant signal as compared to a control group. It can be argued that an increase in one day per week of PA (i.e., 30 minutes) infers meaningful health benefits and thus constitutes a conservative clinically significant milestone. This milestone was surpassed by a great deal. It follows that by this standard, there is overwhelming support to move to an efficacy trial. Analysis of individual improvements also showed that a greater percentage of participants in the intervention condition increased their PA (7/7; 100%) as compared to the control condition. These PA results are promising and offer preliminary evidence for the impact of the intervention; however, these findings must be interpreted with caution. In particular, self-reported MVPA may be subject to recall and social desirability biases (Prince et al., 2008). A future RCT might consider including objective measurement of PA in order to firmly establish the effect of the intervention on PA behaviour.

As hypothesized, there was a large effect size and positive change for emotion regulation in the intervention group compared to the waitlist control group. The secondary outcome of emotion regulation serves as a particularly important manipulation check. To this end, the

increase in emotion regulation among intervention participants signals a preliminary effect on the primary independent variable of interest. Although it must be interpreted with caution given the particularly small number of respondents at follow-up (n=7), the improvement in emotion regulation signals that the intervention affected participants as intended and the construct is malleable. This finding has implications for theory, namely affective factors warrant inclusion in behaviour change theory. In terms of practice implications, these findings suggest that intervening upon emotion regulation may have promise for promoting PA engagement. These inferences are consistent with recommendations for future directions surrounding the affective determinants of physical activity (Stevens et al., 2020; Williams et al., 2019). However, it must be noted that the measure of emotion regulation was based on recall and thus may be subject to bias. If a definitive trial proceeds and emotion regulation becomes an efficacy-based outcome of interest, it may be prudent to leverage a more rigorous measurement method such as ecological momentary assessment (EMA) as a truer and more accurate test of changes in the ability to regulate incidental affect.

I hypothesized that M-PAC constructs would show improvement. There was some support for this hypothesis as select M-PAC constructs demonstrated positive trends. Namely, large effect sizes for increasing regulatory behaviours, affective attitude and identity were observed in the experimental group as compared to the control group. Perceived capability showed a medium effect size. Small effects were also observed for habit, instrumental attitude, and perceived opportunity. It should be noted that the intervention, while grounded in M-PAC, did not include content targeting the full battery of proposed constructs. The intervention was focused on targeting reflective processes and regulatory processes. The findings are interesting, as the greatest effects were observed for constructs that were given a particular emphasis in the

intervention content. Namely, the intervention was largely focused on fostering behavioural follow-through, and this is reflected in the large effect sizes for behavioural regulation. Smaller changes were observed for reflective processes such as instrumental attitude, for which there was limited relevant content. Because participants should have been intenders, focusing on regulation to support initial behavioural changes is in line with the M-PAC approach and previous research (Rhodes et al., 2021). Reflexive processes were not a particular focus and the intervention did not include BCTs relevant for habit formation. This is reflected in the small effect size for habit. Conversely, many of the ACT-based strategies are consistent with proposed identity formation BCTs (e.g., valued self-identity, framing/reframing) and thus may have in turn strengthened a PA identity. To this end, it has been suggested that exercises which clarify values may build self-identification with PA (Stevens & Bryan, 2015). In sum, these findings act as an additional manipulation check and signal intervention fidelity given the targeted M-PAC constructs increased. These findings are similar to other feasibility trials which have demonstrated the utility of the M-PAC and action control variables (Hollman et al., 2022; Lim, Wharf Higgins, & Rhodes, 2021) and contribute to a growing evidence base supporting the application of M-PAC (Rhodes et al., 2021). Taken together, the evidence concerning changes for M-PAC outcomes can be interpreted as promising; however, the current study was not powered to detect significance in these secondary outcomes. As such, a full scale randomized controlled trial would be needed to make conclusions about the intervention's effectiveness on influencing M-PAC variables. A future trial might also consider integrating the full suite of M-PAC constructs within the intervention. If a definitive RCT were to target all M-PAC constructs, including reflexive processes (e.g., identity and habit), it would be prudent to adopt a longer timeline and adjust the

cadence of content delivery over a longer period. In such case, booster sessions could be integrated as a strategy for maintaining intervention-induced behaviour change over time.

There was some support for the hypothesis concerning improvements in ACT-related processes. Specifically, the ACT-related constructs of valued living and mindfulness showed large effects and may have been changing in the hypothesized direction due to the intervention. Acceptance and action measures also showed a medium effect. Again, these outcomes suggest intervention fidelity. Taken together, the ACT-related results are promising, but must be interpreted with caution due to the small sample size. Nonetheless, these positive trends represent a noteworthy contribution to the field as to my knowledge this is the first intervention to target incidental affect regulation using strategies rooted in ACT. A full-scale test is worthwhile as it would allow for firm conclusions surrounding the effectiveness of the intervention on ACT variables.

Summary and future directions

Consistent with recommendations around key criteria for extending behavioural interventions to effectiveness testing (Powell et al., 2021)**,** this study demonstrated sound credibility (i.e., grounded in theory and systematic development), plausibility (i.e., clinically significant benefit), and feasibility (i.e., recruitment and retention). Considering the strong use of theory, promising evidence for the potential impact of the intervention on emotion regulation, PA, M-PAC and ACT variables, as well as solid feasibility outcomes, the findings described herein strongly support the recommendation for a definitive test by way of a full-scale RCT.

With respect to credibility, the intervention was informed by an M-PAC lens and had a particular emphasis on fostering behavioural follow-through. The findings herein provide further support for the utility of M-PAC and contribute to a limited evidence base surrounding the role

of incidental affect regulation. M-PAC proposes that affect can disrupt action control, and enquiry into approaches to regulate affect and enable behavioural follow-through are needed. Notably, while emotion regulation is proposed as a BCT to support follow-through within M-PAC, research into strategies to assist with regulating affect is scant. In fact, the existing version of the behaviour change taxonomy (Michie et al., 2013) only has one relevant BCT for emotion regulation as compared to an abundance of tactics for behavioural regulation more broadly (e.g., action planning, problem-solving, self-monitoring etc.). This research suggests ACT processes could be considered 'active ingredients' to assist with emotion regulation and could potentially be mapped as behaviour change strategies to align with relevant theoretical concepts.

This research is also well-positioned in the affective science literature (Stevens et al., 2020) and fills a gap related to targeting incidental affect regulation to assist with the translation of intentions into PA behaviour. This research contributes to the field by developing strategies to explicitly target incidental affect. While the effect sizes must be interpreted with caution due to the small sample, positive improvements in emotion regulation and PA were observed. These findings signal plausibility and suggest further investigation into how the proposed techniques mitigate the effect of negative incidental affect is warranted. Although preliminary, the findings herein provide support for recommendations to intervene upon the affect-behaviour link and integrate affective factors into existing theories (Stevens et al., 2020; Williams et al., 2019).

This research departs from previous applications of ACT for PA promotion, as prior studies employing acceptance-based strategies were largely focused on using ACT principles to overcome unpleasant feelings associated with PA or tolerate discomfort during PA (Butryn et al., 2011; Kangasniemi et al., 2014; Moffitt & Mohr, 2015). To date, applying ACT explicitly for incidental affect regulation remains unexplored. Therefore, targeting emotion regulation through

ACT principles and processes warrants research attention. Indeed, ACT is potentially powerful for this population given its psychological flexibility model is ideally suited to assist with competing needs and life domains. The upward movement for ACT constructs suggests the intervention may be effective for developing ACT-based skills for psychological flexibility and it is plausible these changes could influence PA follow-through. For this reason, sustained research is warranted, and it would be worthwhile to establish intervention effectiveness via a full-scale RCT. This is aligned with recommendations from Zhang and colleagues (2018) who emphasized the urgent need for empirical evidence for ACT by way of RCTs. Further, this ACT intervention is unique insofar as it used a particularly cutting-edge delivery format which is both cost-effective and has great potential for reach.

This study took the approach of providing a vast array of tactics, which is akin to providing participants with multiple tools for their tool belt. Rhodes and colleagues (2021) suggest that a repertoire of counter-measures for action control is more successful than any specific tactic. It would be difficult to parse the effects of each strategy as there is likely considerable overlap among the underlying mechanisms. In terms of future directions, focused testing into the impact of included interventions strategies such as self-talk, self-compassion, visualization, and mental toughness might be beneficial.

Finally, one innovative feature of the intervention was its use of podcasts to communicate behaviour change information. Podcast interventions represent a convenient, practical, and scalable mode of delivery that is a compelling avenue for PA promotion. However, the podcasts in this study were framed as a supplement to the online modules and thus likely not a prominent feature of the intervention. Testing the effectiveness of an entirely podcast-based intervention for PA promotion may be a fruitful future area of study.

2.8 Limitations

Despite the strong feasibility outcomes observed, this study must be considered within the context of its limitations. First, the randomization was unsuccessful, in that all the males were allocated to the waitlist control group. It is possible people identifying as male may respond differently to the materials and methods. Subsequently, the feasibility and acceptability of the intervention among men is unknown. In turn, future randomization could be stratified based on sex. With respect to the makeup of the sample, the majority of the participants were female (81%), however this is balanced by a distribution for ethnicities and education levels. There was also not equal representation from Canadian provinces and territories, with the majority (62%) of the participants residing in British Columbia. These considerations surrounding the sample may limit the generalizability of the program.

With respect to the qualitative component, it should be noted that the semi-structured interviews were conducted by the main researcher which may have introduced bias, and participants may have been less likely to raise negative issues. Indeed, if participants viewed the researcher as closely aligned with the delivery of the intervention, they may have been less likely to offer honest criticisms. For this reason, employing teams for the qualitative interview component of a feasibility study has been recommended to maximize possibilities for optimization (O'Cathain et al., 2015). Nonetheless, the interviews did identify opportunities for modification and refinement that were not captured by the quantitative data.

Additionally, while there were strong indicators for satisfaction and acceptability, the intervention condition did observe relatively high attrition. It may be that those lost to follow-up had largely different responses and satisfaction levels. Ideally, qualitative research would explore the reasons why participants did not continue with the study (Powell et al., 2021). However,

observing this recommendation is somewhat challenging from a pragmatic perspective as it can be difficult to interview participants who are lost to follow-up. Data was also collected during the COVID-19 pandemic; however, it is not fully understood how this may have impacted participation. For many, the pandemic introduced new stressors in various domains of life. During the spring and summer months of 2022, public health guidelines were shifting, and restrictions were easing which may have allowed for some normal activities to resume. While the role of the pandemic on study participation is unclear, it is possible these circumstances may have influenced opportunities for PA, engagement with the study, and participant attrition.

In terms of limitations related to secondary outcomes, this study had a small sample size and therefore statistical analyses should be interpreted with caution due to instability. Indeed, given the very small sample, even effect sizes may be compromised. As such, the effect sizes observed herein should be considered markers of plausibility for a future trial and not as efficacious in their own right.

2.9 Conclusion

The recruitment, retention, and engagement rates were adequate while satisfaction was favourable, suggesting a full-scale randomized controlled trial is feasible with minor modifications such as adjusting the delivery of the content (e.g., more video), strengthening engagement (e.g., build in rewards or gamification), addressing minor technical issues (e.g., ensure participants receive email reminders), and improving podcast awareness (e.g., make episodes more salient). Secondary outcomes showed movement in the hypothesized direction suggesting intervention fidelity. These positive trends are promising but a full trial would be needed to investigate effectiveness. For a definitive RCT, more robust measures should be considered, as well a longer timeline and booster sessions. Taken together, these findings support

the recommendation that a full-scale randomized controlled trial is warranted to establish whether the intervention meaningfully increases affect regulation and PA.

Chapter 3: General Conclusions

The main objectives of this thesis were to 1) develop a novel and innovative intervention which accounts for action control and targets incidental affect and 2) to determine the feasibility of a six-week digital health trial. This section summarizes the findings, highlights contributions to the field, and describes possible future directions.

3.2 Positioning the Thesis

Historically, affective factors were left out of the dominant theoretical models for health behaviour change (Stevens et al., 2020). However, a burgeoning body of evidence focusing on affective correlates suggests affect-related constructs may be contributing to intention-behaviour discordance (Stevens et al., 2020). This research is well-situated within the rapidly growing literature on the affective determinants of PA. In particular, the literature on incidental affect is currently small but growing. The present study addressed gaps in the literature such as the lack of direct intervention upon the affect-behaviour link (Sheeran, Gollwitzer, & Oettingen, 2018). Further, there is a paucity of interventions and BCTs targeting incidental affect regulation and thus this research represents a worthwhile contribution to the field. Further, theories that account for action control, such as M-PAC (Rhodes, 2017), are needed to effectively promote PA, and ACT has also shown promise for health promotion (Pears & Sutton, 2020; Zhang et al., 2018). For these reasons, testing the feasibility of an affect regulation among at-risk populations is a worthy line of inquiry.

This research is also particularly timely in the context of COVID-19. Evidence suggests the pandemic contributed to increased sedentary behaviour, and decreased PA (Fukushima et al., 2021; Wilms, Schröder, Reer, & Scheit, 2022). There is also evidence to suggest adverse effects of COVID-19-related measures on young adults aged 18-30, namely a substantial increase in

mental health concerns including increased stress in British Columbia and across Canada (Samji et al., 2021). It follows that encouraging health-promoting behaviours such as PA is one area for action that has been identified, which can be achieved through increased evidence-based information to promote healthy habits and support mental and emotional well-being (Samji et al., 2021). This scalable intervention is well-positioned to support this aim, as it provides tangible tools to cope with stress and challenging moods in order to promote the uptake of physical activity. Interestingly, there is research underway to explore ACT among individuals with depression (LaRowe et al., 2022). It follows that ACT principles represent a timely and promising approach for health promotion given the increasing prevalence of mental health concerns.

3.3 Study Manuscript

Results from randomized controlled feasibility trial suggest that a six-week web-based intervention grounded in M-PAC and informed by ACT is feasible among early career professionals. Recruitment, retention, and engagement were acceptable while follow-up interviews yield positive feedback overall with minor suggestions for improvement. Participants in the intervention condition trended towards improved PA, emotion regulation, and select M-PAC and ACT constructs. Changes required before proceeding to a full trial are minor. Notable modifications worth addressing include strengthening engagement (e.g., build in rewards or gamification) and addressing minor technical issues to ensure participants receive email reminders and are aware of the podcast episodes.

3.4 Situating the Results in the Literature

The feasibility study adds to a building evidence base for the utility and validity of M-PAC (Rhodes, La, Quinlan, & Grant, 2021). There are noteworthy implications for research

stemming from this thesis. Namely, because emotion regulation showed movement in the right direction, the intervention warrants further investigation. Sustained research is needed to establish whether intervening upon incidental affect regulation influences PA behaviour.

3.5 Strengths and Limitations

Apart from the novelty of the approach described herein, a major strength of this research is the use of mixed methodology. The feasibility trial incorporated qualitative and quantitative data to allow for a well-rounded understanding of the impact and practicality of the intervention (Sparkes, 2015).

This research has several limitations. The intervention contained a suite of strategies to foster the regulation of incidental affect. This research only addresses the satisfaction with the techniques, but future research is required to disentangle the effects of the respective strategies to elucidate what works for improving emotion regulation. Other limitations include a small sample size which meant the feasibility study was insufficiently powered to detect significance. The makeup of the sample may limit generalizability. Another important limitation is the lack of objective physical activity data and incidental affect data. Lastly, because I conducted the semi-structured interviews my opinions and biases may have impacted the results of the qualitative research.

3.6 Future Directions

A full-scale RCT is recommended as a direct extension of this work. An efficacy trial would allow for conclusions to be drawn surrounding the effectiveness of M-PAC and ACT on promoting PA behaviour and incidental affect regulation. Before proceeding with a full trial, it is important to incorporate minor modifications to the platform and methods as described in the feasibility study.

There are several research avenues that would be worthwhile to pursue which build on this research. The intervention discussed herein incorporated a suite of techniques that are underpinned by a theory designed to assist with action control adoption and maintenance. Given this "kitchen sink" approach, it is not possible to determine which techniques or strategies were most effective for action control. Future research might benefit from isolating the impact of strategies designed to overcome challenges with incidental affect as there would be implications for theory and intervention.

Generally, sustained research targeting affective determinants of PA is needed given these factors were omitted from theory and intervention until recently. Just-in-time interventions are also well-positioned to respond to the challenges resulting from negative incidental affect by providing tactics and nudges in moments of need. Future research may also consider incorporating a measurement protocol leveraging ecological momentary assessment. This would allow for granular measurement and would facilitate a nuanced understanding about how the proposed affect regulation strategies influence behaviour.

Another interesting future direction might examine the role of mental toughness on behavioural follow-through and may draw on relevant work on how to cultivate grit and behavioural persistence. Finally, future PA promotion research may benefit from testing an entirely podcast-based intervention given this delivery method is untapped and has great potential for reach and promise for population health.

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Appendix A – Email and Voice Scripts

Email Script

Dear _____,

My name is Stina Grant and I am a graduate student at the University of Victoria in the Behavioural Medicine Laboratory. Thank you for reaching out regarding the web-based physical activity study for early career professionals.

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

Who is eligible?

- Individuals 25-44 who are working at least part-time in a desk-based occupation.
- You must not be meeting current physical activity guidelines (150 minutes per week of moderate to vigorous physical activity)
- You must have access to the internet and a device to support the web-based platform and a smartphone to access podcasts on-the-go

What is involved?

- Baseline measures consist of an online questionnaire followed by randomization to the web-based intervention or the waitlist control group (those in the control group will gain access to the platform after 6 weeks)
- Weeks 1 through 6 you will work through the online materials and listen to short audio podcast supplements
- After week 6, you will be sent a follow up questionnaire
- We will request an exit interview conducted over video conference (i.e., Zoom)

The total time commitment for this study is approximately 4 hours (independent of any time spent being physically active). I have attached the consent form with more detailed information. Please let me know if you have any questions.

The next step in the enrolment process is a short call to ask a few questions to confirm your eligibility. If you are interested in participating, please let me know your availability and I will provide a Zoom link.

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

Sincerely,

Stina Grant
MSc Candidate
Behavioural Medicine Lab
University of Victoria
sjgrant@uvic.ca

Voice Script

Introduction:

Hello, my name is Stina Grant and I am a graduate student conducting research at the University of Victoria. Thank you for your interest in the web-based physical activity study for early career professionals.

This study will be taking place remotely through the University of Victoria's Behavioural Medicine Laboratory. The study is examining the feasibility of a web-based behaviour change intervention to promote physical activity among professionals.

It is completely up to you whether you would like to take part. Would you be interested in hearing more about this?

If YES,

I'd like to do next is ask you a few questions to confirm your eligibility for this study as well as confirm your ability to participate in physical activity, is that ok with you?

MUST ANSWER YES: VERBAL STUDY CONSENT

Eligibility Questions:

1. Can I confirm that you are between 25-44 and working at least part-time in a desk-based occupation?

Must answer YES

2. Do you currently take part in **less** than 150 minutes of moderate to vigorous activity each week?

Must answer YES

3. Would you be willing to complete 2 questionnaires and weekly web-based lessons over 6 weeks?

Must answer YES

4. Do you have reliable internet access, a device to access the web-based platform and/or a smartphone?

Must answer YES

➔ FOLLOW UP: DOES THIS PERSON HAVE AN EMAIL ACCOUNT WITH REGULAR ACCESS? MUST ANSWER YES

Heath Screening questions:

As a final step to confirm your eligibility, I'd like to go through a few questions about your health to check if there are any complications that could limit your participation in this study.

Must complete Get Active Questionnaire (GAQ+). To be eligible, there must be no contraindications to getting more active. If an individual answers "yes" to any of the GAQ screening questions on page 1, they will be ineligible to proceed. If an individual does not answer "yes" to any of the questions on page 1, they will be deemed eligible**.*

***If ineligible:**

Sorry, unfortunately you need to meet all of these criteria in order to be eligible for the study. We thank you for your interest!

****If eligible:**

Thank you again for your interest in the study and you are eligible to participate!

The next steps are to confirm your contact information and get your signature on the consent form and the Get Active Questionnaire (GAQ).

Contact information, Informed Consent, GAQ

If I could first confirm your contact information (name, e-mail and phone number) ____.

Please note, this contact information is secure and will be kept confidential. It will ONLY be used to follow up with you to discuss the next steps with regards to this study.

We can go through the consent form together now and I can answer any questions you may have.

***Go through informed consent procedure answer any questions.**

Please e-sign and return the consent form along with the GAQ at your earliest convenience.

Baseline Questionnaire

Once I receive your electronically signed consent form I will send you a link to the baseline survey. The informed consent information will be repeated – if you agree to the terms your consent is implied by continuing with the survey.

Should you choose to complete the survey after reading through the informed consent information, your ID number is XX.

Conclusion

Thank for your time and please feel free to contact us with any questions. I will be following up over email with information regarding next steps.

Appendix B – Consent Form

University of Victoria

Participant Consent Form

"Increasing Physical Activity Among Early Career Professionals: A Feasibility Trial of an Online Intervention"

You are invited to participate in a study entitled **"Increasing Physical Activity Among Early Career Professionals: A Feasibility Trial of an Online Intervention"** that is being conducted through the Behavioural Medicine Lab by Stina Grant, a graduate student in the School of Exercise Science, Physical & Health Education at the University of Victoria. As a graduate student, Stina is required to conduct research as part of the requirements for a MSc degree in Kinesiology. You may contact her if you have further questions by email at sjgrant@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

Research of this type is important because Canadian adults are not physically active enough to achieve known health benefits. Specifically, regular physical activity can prevent chronic disease such as cardiovascular disease, some cancers, diabetes, and depression. However, only 15% of the population meets recommended physical activity guidelines. Therefore, physical activity promotion remains a public health priority. Early career professionals are at-risk for inactivity and are therefore a critical target demographic. Given the stress, demands, and time constraints that come with shifting to the workforce, it can be difficult to follow through on physical activity intentions. This study will examine the impact and practicality of a cost-effective and accessible online intervention. This research is important because it will increase our knowledge on ways to effectively intervene upon motivation to increase physical activity participation for this population group.

Purpose of this Project

In this study, we are aiming to establish whether it is worthwhile to implement the intervention on a larger scale. We will examine acceptability, enjoyment, recruitment rates, drop-out rates, and website 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 online lessons, 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. Are aged 25-44
2. Are currently employed part-time or full-time in a desk-based occupation
3. Are not meeting physical activity guidelines (150 minutes of moderate-to-vigorous physical activity/week)
4. Have access to the internet and a device that can access the web-based program and podcast supplements

What is Involved

If you consent to voluntarily participate in this research, you will e-sign the consent form, gain access to a web-based baseline questionnaire, 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**.** Both groups will complete the baseline questionnaire, and if you are selected to be in the intervention condition of this study you will be given a unique login for our online program. This is a self-guided, 6-week program that you will complete on your own time, in any location that has internet access. Those in the intervention group will also gain access to mini podcast-style audio clips to use on-the-go. Then, a mini check-in will take place over videoconference (i.e., Zoom) at the midway point. For the intervention group only, we will collect data on website analytics. Specifically, we will be interested in the amount of time participants spend on online platform and the lessons. Once you have completed the 6-week program, you will fill out a follow-up questionnaire, and be invited to participate in an exit interview**.** The interview will be audio recorded and a transcription will be made. If you are placed are in the waitlist condition of this study, after 6 weeks you will be invited to complete the follow up questionnaire. After questionnaire completion, your involvement in the study can be considered complete, however, if you wish you may gain access to the online materials for 6 weeks. For those in the waitlist condition we will not access any website analytic data. If you are in waitlist condition, you will still complete the baseline questionnaire as well as the follow up questionnaire.

Inconvenience

Participation in this study may cause you minor inconvenience. There is an approximate 4-hour total time commitment for this study if you are randomized to the intervention condition. This time will be spent completing the baseline and follow-up questionnaires and completing the online content. If you are placed on the waitlist control group, there is an approximate 1.5 hour time commitment, for the baseline and follow up questionnaires.

Risks

Risks associated with physical activity participation include 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 physical activity, and potential increased physical activity participation as a result which may elicit health benefits. In addition, this research may increase knowledge on techniques to overcome work-related stress in order to increase physical activity. Finally, this research may have societal benefits if the intervention is eventually disseminated into practice or policy.

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 we will ask if the data you have provided may still be used. If you agree, your data will be

used in the final analysis. If you do not, your data will be withdrawn and immediately erased or destroyed.

On-going Consent
Ongoing consent will be implied when you participate in the remainder of the study. This will be confirmed when you complete the online questionnaire. If you are randomized to the intervention condition, you will have a mini check in at the halfway point with the project coordinator. They will verbally affirm your ongoing consent to participate at this time.

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 Laboratory. 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 Laboratory 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.

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the form of thesis presentations, published articles, social media (i.e. on the Behavioural Medicine Lab Facebook, Instagram, and website), conference presentations, and online. The resulting research thesis/results will be posted publicly on the UVic Library's website "UVic Space."

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 Stina Grant at sjgrant@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*

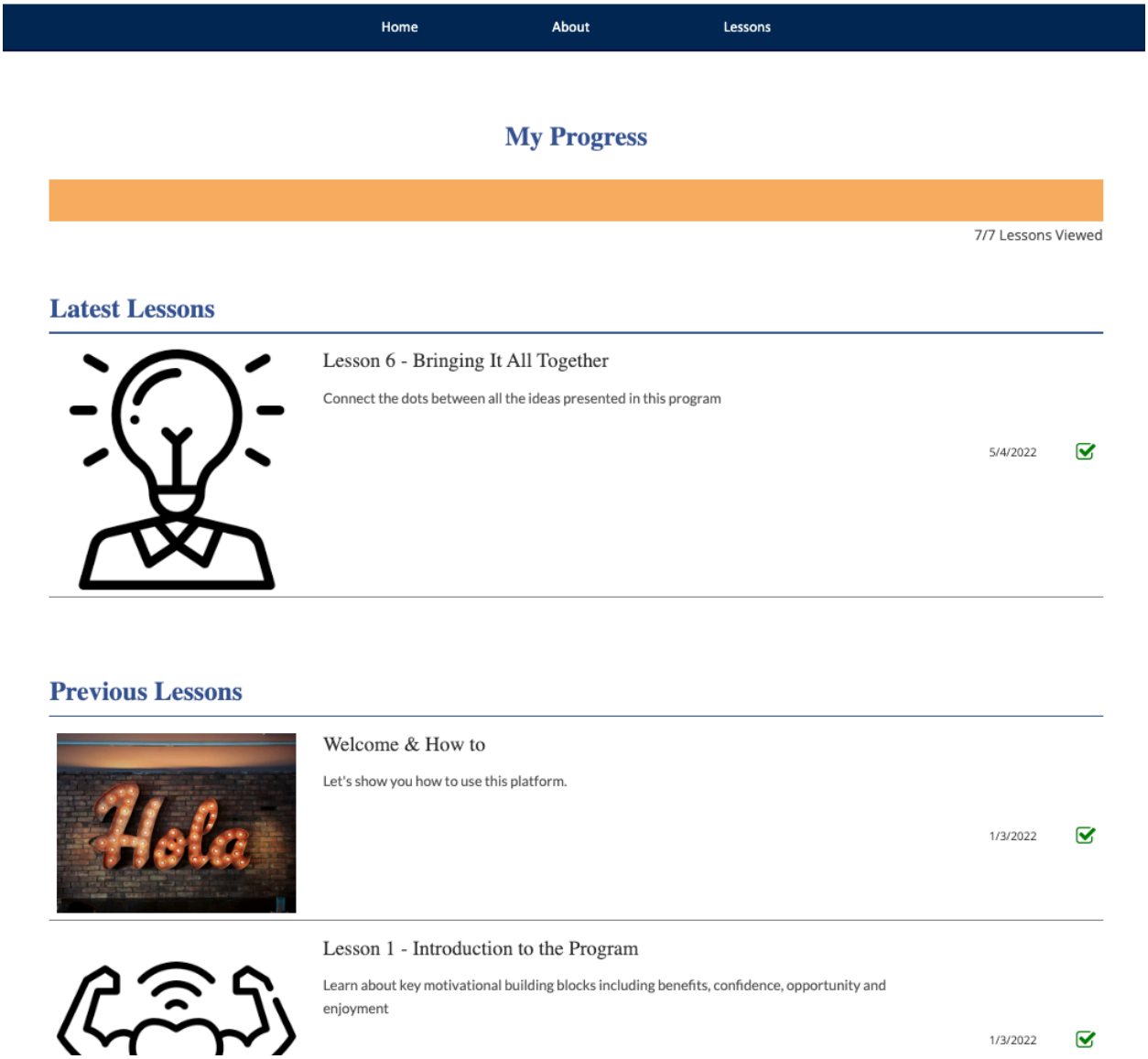
A copy of this consent will be left with you, and a copy will be taken by the researcher.

Please sign one copy for the researchers and sign and keep one copy for your records

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

Stina Grant, MSc Candidate
(250) 532-3934
sjgrant@uvic.ca

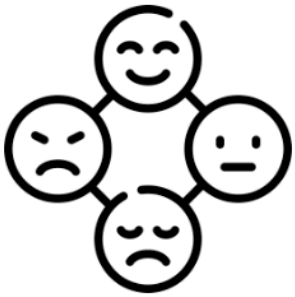
Appendix C – Screenshots Showcasing Online Platform Design and Delivery



Lesson 2 - ACT for Physical Activity: Values and Committed Action

Learn about acceptance and commitment training (ACT) to assist with physical activity follow through

8/3/2022



Lesson 3 - How to Deal with Negative Emotions

Learn about strategies to reduce the impact of negative emotions

15/3/2022

Lesson 4 - Planning for Challenging Moments

Learn how to plan for what to do in the face of difficult moods or emotions

22/3/2022

Lesson 5 - Level Up Your Mindfulness and Acceptance

Learn about additional techniques for physical activity follow-through

29/3/2022

Lesson 1 - Introduction to the Program

Page 1

Welcome to the first week of your physical activity program! If you're reading this, you are a busy professional with good intentions of getting more physically active. However, given the stress that likely comes with a demanding career, you might find it difficult to consistently follow through on your intentions to be physically active. Recent research suggests that stress of the day can indeed impact our ability to follow through with our physical activity[1]. This program is designed with these considerations in mind. We look forward to providing you with tools and tactics to overcome challenging emotions and moods in order to effectively deal with the moments you just don't feel like exercising.

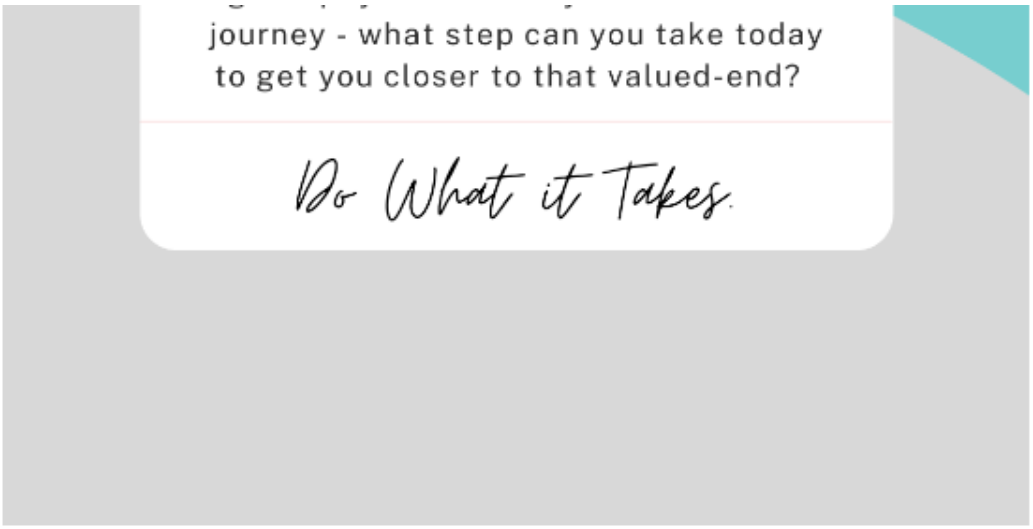
Lesson 2 - ACT for Physical Activity: Values and Committed Action

Page 1

Reflect on your week

Last week you were tasked with some homework. Specifically, you were asked to reflect on your physical activity. What benefits did you experience? Where do you stand in terms of guidelines?

We also asked you to build your confidence, make your environment conducive to being active, and maximize enjoyment. In the space below, write about your homework assignment. Were you successful in these departments? Which areas might you keep working on?



Lesson 2 Quiz

Test your understanding with this short quiz!

Start Quiz

Homework

Your homework for this week is to come up with your own values mantra. In situations when you are feeling low, what can you repeat in order to act in line with your active living values?

We also ask that you come up with a specific physical activity goal and do some planning to work towards it. Then, write a statement about your commitment to physical activity.

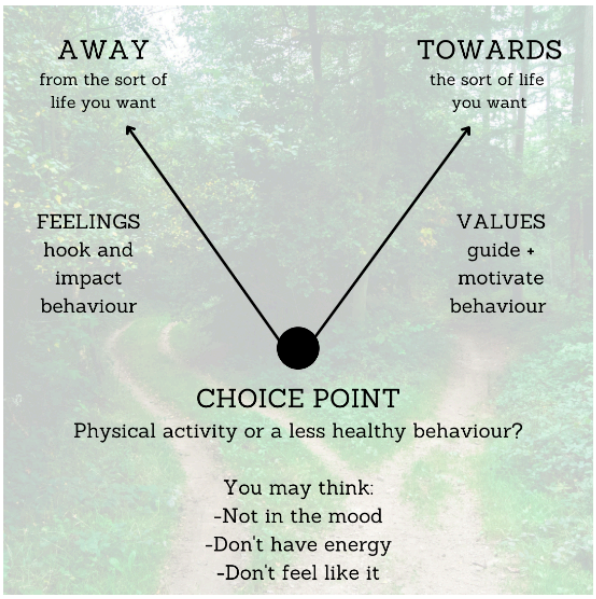
Use the resources below to accomplish these tasks.

Lesson 2 Worksheet (PDF)

Lesson 2 - ACT for Physical Activity: Values and Committed Action

The choice point

ACT helps us move TOWARDS our values rather than AWAY from them. Think of the moments when you're choosing between physical activity and a less healthy behaviour such as an extra hour of work or the couch. This is a choice point: do you want to move towards your values or away from them? The image below depicts this choice point. Moods and emotions can hook you and move you away from the sort of life you want to lead, whereas values can guide and motivate your behaviour so you live in line with the type of life you want to lead.



Mixing up being not motivated with being not in the mood

Our values can help to motivate us even when we don't feel like it. Watch the following video to understand how values can guide our behaviour:

Given the importance values have in motivating us, we encourage you to identify why achieving regular physical activity matters to you. For example, you may value physical activity for reasons such as the following:

- It impacts your health and well-being.
- It boosts your mood and improves your energy and vitality.
- It improves your ability to show up for your loved ones.
- It makes you feel confident and strong and ready to chase your dreams.
- It plays in your family life, social life, or sense of belonging in the community.

Think about why physical activity is important to you and you alone. How does regular physical activity make your life fuller, richer, and more meaningful?

Appendix D – Weekly Worksheets

Worksheet – Reflecting on your Physical Activity and Building Confidence, Opportunity, and Enjoyment

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 you

-Focus on making physical activity a positive experience to build your competence

Brainstorm some ways you can start off slow and make the behaviour simple:

-

-

-

OPPORTUNITY & ENVIRONMENT

This exercise will help you make the most of your environment and build your opportunity to engage in physical activity. Use the prompts in the boxes below to reflect and brainstorm.

What aspects of your neighbourhood can you make use of? Think paths, parks, stairs, or cycling.

-
-
-

What are some “grab and go” activities that you can have on hand to make your physical activity convenient and accessible? Think Frisbee, pickle ball etc.

-
-
-

How can you adjust your home set up so you have an area to work out? What equipment might you get?

-
-
-

What are some pre-planned activities you can think of for certain blocks of time?	
-10 minutes (e.g., walk around the block or quick HIIT workout):	-30 minutes (e.g., jog in your neighbourhood or YouTube workout):
-60 minutes (e.g., Gym session or bike ride):	-90 minutes (e.g., hike or yoga class):

ENJOYMENT

This self-reflection and planning tool aims to assist you in recognizing the pleasure that physical activity provides you with, and encourages to you to brainstorm ways to make physical activity more enjoyable for yourself.

Step 1: Reflect and write down the reasons why physical activity is enjoyable

Step 2: In the "Locations" box, list some fun or nice places where you would like by physically active, and where you would derive added enjoyment from.

Step 3: In the "Social Experiences" box, list some events or activities where you can be physically active, and where you can benefit from social opportunities involved.

Step 4: In the "Others" box, list other considerations/features you would incorporate or are important to you, and which you think would make physical activity more enjoyable for you.

Step 5: Incorporate these ideas and strategies into your plans for physical activity over the next week.

Reasons:

Locations:

Social Experiences:

Other:

BENEFITS

Use the table below to track your physical activity and note any benefits you experience. At the end of the week, consider where you stand in terms of physical activity guidelines. Are you on your way to 150 minutes of moderate to vigorous physical activity per week?

Day of the week	Type and duration of physical activity	Benefits
Sunday		
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		

Worksheet – Values, Commitment, Goal Setting, and Planning

VALUES

This exercise will assist with developing values which define why physical activity is important to you. Clarifying your values surrounding physical activity can help motivate you even when you don't feel like engaging in physical activity.

Why does engaging in regular physical activity matter to you? What truly matters to you in the big picture and what role does physical activity play in that? In the space below, identify your valued-ends:

- *E.g., Physical activity gives me the energy and vitality to show up for my loved ones*

-

-

-

In the space below, create a value mantra that you can repeat to yourself in moments where you are not feeling motivated to exercise.

Physical activity is truly important to me because

_____

_____.

COMMITMENT

In the space below, create a commitment statement to guide your physical activity behaviour. Date the statement and have it witnessed by a friend or family member if possible!

I am strongly committed to my value of

_____

and therefore, I am committed to achieving at least

_____

minutes of physical activity per week.

_____ _____

Date *Witness*

Remember, committed action is all about doing the work to see this statement through. It will require some effort including goal setting, planning, and taking the steps required to live in line with your values.

GOAL SETTING

Goal setting is extremely important when it comes to becoming more active. It is important that your goal is specific and sufficiently difficult. This exercise will walk you through the SMART goal framework to assist with creating an explicit and achievable goal.

Specific – what exactly are you going to do? (e.g., going for a 30 minute run in my neighbourhood on Monday and Wednesday evenings 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 helps put me in a better mood and makes me feel inspired)

-

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.

-

PLANNING

Sometimes becoming more active can be challenging. If you feel this way, you are not alone!

One way to make it easier to get started is by making a physical activity plan. This exercise will take you through the steps to make your own plan.

Think about WHAT, WHERE, WHEN, and HOW you will be active.

Read the questions below and write your answers in the spaces provided.
An example answer for each question has been provided.

WHAT type of physical activities do you want to do? E.g., Go for a walk after dinner.

WHERE would you do these physical activities? E.g., On the chip trail around the golf course near my house.

WHEN can you be physically active? E.g., After dinner on Tuesday and Thursday Evenings.

HOW can you do the physical activity? E.g., I will walk over to the chip trail which is 5 minutes away from my house

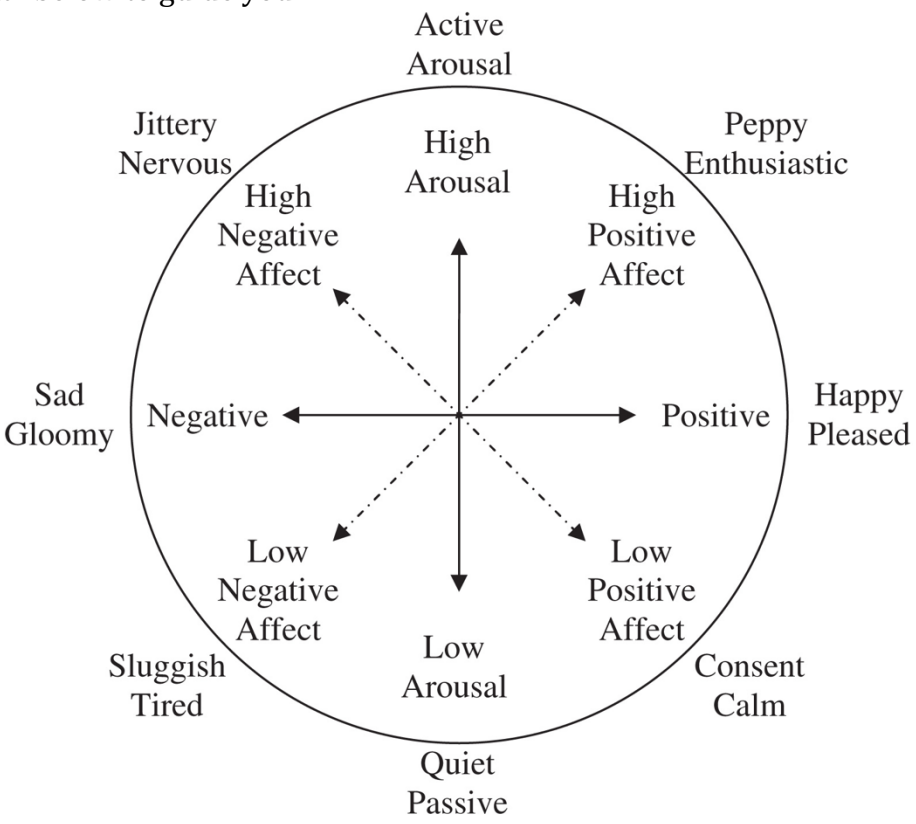
***Note:** Everyone likes to plan differently! Be creative and use what works for you. Whether that be a smart phone, an online computer calendar, or a day planner, make it work for you.

Worksheet – Emotions, Mindfulness, Acceptance

EMOTIONS AND PHYSICAL ACTIVITY

Emotions such as job-related stress can impact physical activity engagement. By recognizing and understanding how your emotions feel, you can start to name them throughout the day which is an important skill for mindfulness and acceptance.

Use the table below to identify three emotions you commonly experience as an early career professional. Recognize and note how they typically impact your physical activity levels. Use the visual below to guide you.



Emotion	Is it positive or negative?	Is stimulation low or high?	How does this emotion typically impact your physical activity engagement?

MINDFULNESS

Mindfulness allows you to become aware of your unpleasant thoughts and emotions so you have more choice in how you handle them. Simply put, mindfulness allows you to get present, notice, and acknowledge what is happening. This centering is critical for being able to adhere to your physical activity values and goals.

Using the ACE formula and instructions to get present, use the below to guide you through an ACE practice. Ideally, this can be used in moments of need when you're stuck in an unpleasant feeling or emotion and don't feel like exercising.

Dropping anchor process	**A** **Acknowledge thoughts and feelings.**	**C** **Come back into your body.**	**E** **Engage with the world.**
Instructions	Silently and kindly acknowledge whatever is 'showing up' inside you: thoughts, feelings, emotions. Take the stance of a curious scientist, observing what's going on in your inner world.	Come back into and connect with your physical body. Find your own way of doing this. Methods include slowly breathing, stretching, pushing your feet into the floor.	Get a sense of where you are and refocus your attention on the activity you are doing or would like to do. Engage your senses on what's right here, right now. What do you see, hear? Initiate your desired behaviour.
Time 1 Notes	*What did you notice?*	*How did get out of your head and into your body?*	*Were you able to engage in physical activity?*
Time 2 Notes	*What did you notice?*	*How did you get out of your head and into your body?*	*Were you able to engage in physical activity?*

ACCEPTANCE

In Acceptance and Commitment Training, acceptance means letting your negative emotions exist without trying to deny them or change them. By making space for our emotions, we can act in line with our values rather than letting emotions rule our behaviour. We can have unpleasant emotions and still engage in physical activity.

In the spaces below, practice accepting your emotions by using the NAME framework: notice your inner world, acknowledge what you are feeling, make room for what you are feeling, expand your awareness.

Fill in the blanks:

I am feeling

_____

it's

_____ (pleasant or unpleasant?)

I have room for it.

I accept it, and it needn't influence my physical activity behaviour.

Worksheet – If-Then Plans, Avoiding All-Or-Nothing Thinking, Self-Compassion

IMPLEMENTATION INTENTIONS

Use the spaces below to develop if-then plans. Research has shown if we identify challenging scenarios and have a plan for what to do in the face of that situation, we are more likely to turn our intentions into actions. Follow the instructions below to fill in the table.

In the first column, identify three situations in which initiating physical activity might be difficult, focusing on the instances you might feel unmotivated or not in the mood to exercise.

In the second column, specify exactly what you will do in that situation. Don't forget the ACT strategies for dealing with emotions: be mindful and aware, notice your thinking and accept your feelings, and do what matters.

If…	**Then…**
I arrive home stressed from a busy day at work…	*I will take 3 deep breaths to ground and reconnect with my values and enact my physical activity intention.*

AVOIDING ALL-OR-NOTHING THINKING

Often people get stuck in all-or-nothing thinking when it comes to exercise. In the face of low moods or challenging emotions, it's common to abandon physical activity plans altogether. Coming up with accessible alternatives can help avoid this type of thinking.

Use the prompts in the table below to brainstorm how you could meet yourself where you are at and get some physical activity that is less intense or shorter.

Originally planned activity	**Alternate activity with adjusted intensity**	**Alternate activity with adjusted duration**
Example: 5km run	*Example: Walk of similar duration*	*Example: Quick yoga mat exercises*

SELF-COMPASSION

Practicing self-compassion can help deal effectively deal with physical activity setbacks.

In the table below, fill in three instances in the past in which you've struggled with your physical activity goals as well as the judgement you made about your setback. Think about what your inner critic said when you struggled to see your intentions through.

Fact	**Judgement**
Example: I didn't exercise this week.	*I'm never going to succeed in being active.*
1.	
2.	
3.	

Using the fact statements you identified above, write a response that's more self-compassionate than your initial judgement. Think about how a friend might rephrase the judgemental thought or how you might rephrase it if a friend told you they had that critical thought.

Fact	**Compassionate Response**
Example: I didn't exercise this week.	*I've had lots on my plate and many competing demands. I can always reset and start again.*
1.	
2.	
3.	

Worksheet – Self-Talk, Visualization, Mental Toughness

SELF-TALK

All day long, we have inner speech that's known as self-talk. Honing our ability to speak to ourselves in a positive and reaffirming way can help us respond to life events in a desirable way. Positive self-talk is a skill that can be learned and can help impact your physical activity behaviour.

Use the first column to brainstorm situations in which you might be tempted to choose work or the couch over your valued physical activity intention. Next, come up with a speech you can give yourself in that moment.

Choice point situation	**Reaffirming inner dialogue script**
Example: Putting in an extra hour of work versus going for a walk around the block	*Example: I'm feeling overwhelmed by the volume of work I have to do, but I know I will get through it. I think what would serve me best in this moment is the walk I'd planned. Getting in some physical activity is more in line with the life I want to lead.*

VISUALIZATION

Visualization is the process of using mental imagery to imagine moving through scenarios. Visualization can be a tool to practice in your mind's eye what you might do when something goes wrong. Envisioning your actions will help you know what to do when the moment presents itself.

Use the instructions below to fill in the table.

1. Brainstorm 1-2 situations where you commonly struggle with initiating physical activity.
2. Close your eyes and practice visualizing what you might do in that situation in order to follow through on your physical activity intentions. After you've done so, describe what the "movie" in your mind looked like. What did you do to deal with the challenge and get active?

Situation in which initiating physical activity is challenging	**Description of mental imagery of dealing with the scenario**
Example: I have a deadline approaching and I'm feeling stressed. I planned to go for a run after work but instead I'm contemplating grabbing some coffee and working longer.	*In the movie in my mind, I imagine myself checking the time and realizing I should be done for the day. I can see myself looking stressed. Next I close my eyes and take 3 deep breaths. I can tell I look calmer and more collected after doing so. I put my things away and proceed to grab my bag. I take out my sneakers and put them on to go for a walk. I see myself walking out the door to my office and moving my body.*

MENTAL TOUGHNESS

Mental toughness is a skill that can be honed to help you persevere through challenging situations. As such, it can help you push through tough moments to realize your physical activity goals.

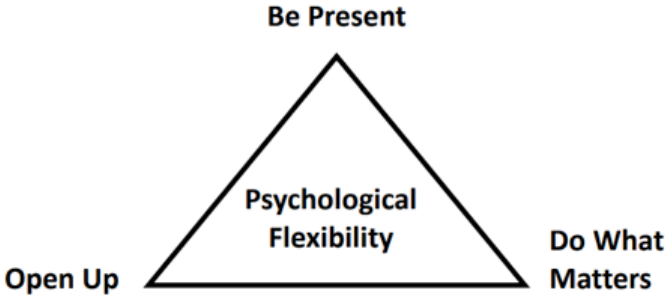
In the table below, use the prompts to brainstorm ways to cultivate mental toughness. HINT: self-talk, visualization, and self-compassion might come in handy here.

Elements of Mental Toughness
Flexibility How can you adjust when things don't go as planned or you have a bad day? -
Strength How might you dig deep when you want to follow through on your physical activity intentions? -
Resilience When you experience adversity how might you bounce back? -

Worksheet – Psychological Flexibility

PSYCHOLOGICAL FLEXIBILITY

Cultivating psychological flexibility enables you to contact the present moment in order to follow through with physical activity. Psychological flexibility is made up of three components, shown in the triangle and described below. Use this tool below track your progress by scoring your psychological flexibility.



Opening Up	**Being Present**	**Doing What Matters**
Able to separate, unhook, detach from thoughts and feelings? Able to open up & make room for thoughts and feelings, and allow them to freely flow?	Able to engage fully in here-and-now experience? Ability for task-focused attention? Aware of own thoughts and feelings? Able to take perspective on self and self-story?	Able to be clear about & connected with physical activity values? Able to take and sustain values-guided action? Able to set goals? Sufficient skills to achieve goals?

In the space below, score yourself for your ability in each of the three domains. Building these skills will assist you with consistently following through on your physical activity intentions.

Today's Scores, 0-10: 0 = low strength and 10 = high strength		
Opening up:	Being present:	Doing what matters:

TACTICS IN YOUR TOOLBOX

In the space below, list the extent to which each strategy helped you engage in physical activity. Refer back to this list if you ever need a refresher for strategies that will help you be more active.

Strategy	Usefulness 0=Ineffective; 5=Very effective
Reviewing the benefits of physical activity	
Building Confidence	
Building Opportunity	
Fostering Enjoyment	
Value Clarification	
Goal Setting	
Planning	
Commitment	
Mindfulness	
Acceptance	
Observing thoughts or feelings	
Reframing negative emotions as normal	
If-then plans	
Avoiding all-or-nothing thinking	
Self-compassion to deal with setbacks	
Self-talk	
Visualization	
Mental toughness	
Psychological flexibility	

Appendix E - Semi-structured 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 listen to the mini podcasts? If so, were they useful? If not, how come?
3) Did you find the information that we provided interesting or informative? Probe: What did you find most useful? Least useful?
4) Have you been able to incorporate the strategies provided in the lessons and podcasts? 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?