GLUCOFIT: A PILOT STUDY EVALUATING A BRIEF ACTION PLANNING INTERVENTION IN INDIVIDUALS WITH PRE-DIABETES AND TYPE 2 DIABETES

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Abstract

There is a need to support physical activity (PA) participation among people with pre-diabetes and type 2 diabetes mellitus (T2DM). The Health Action Process Approach (HAPA) considers post-intentional factors, translating intentions into behaviour. Brief action planning (BAP) improves self-efficacy (SE) and may support PA among people with T2DM within the framework of the HAPA model. **Purpose:** Evaluate the effects of a BAP intervention among people with pre-diabetes and T2DM. **Methods:** Adults with pre-diabetes and T2DM (N=13) completed measures of the HAPA constructs and self-reported PA before and after engaging in 4 weeks of BAP. **Results:** There were significant improvements in maintenance SE (p =.05; d=-.4), and planning (p=.02; d=-1.32) following BAP. **Conclusion:** This pilot study suggests that BAP may be useful to improve HAPA constructs, and maintain PA among people with T2DM. Future research with a larger sample is warranted to further understand BAP as a tool to support PA.

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Introduction

Pre-Diabetes and Type 2 Diabetes

Pre-diabetes is a condition in which blood glucose levels are above normal, usually between 100 and 125 mg/dl (Booth, Roberts, & Laye, 2012), but not high enough to be classified as diabetic (Booth, Roberts, & Laye, 2012; and Colberg et al., 2012), where fasting plasma glucose levels are 7.0 mmol/l (126 mg/dl) or higher (Shaw, Zimmet, McCarty, & de Courten, 2000). Although pre-diabetes is reversible, without the appropriate lifestyle changes, individuals who are pre-diabetic are at greater risk of developing type 2 diabetes mellitus (T2DM), which is non-reversible (Booth, Roberts, & Laye, 2012).

T2DM is a global epidemic that represents a growing threat to the lives of many. In 2014, diabetes affected 422 million adults across the globe (WHO, 2016), with approximately 90-95% of cases being T2DM (Colberg et al., 2010; and WHO, 2016). In Ontario alone, pre-diabetes prevalence reached 2.3 million, while T2DM reached 1.6 million in the year 2016 (CDA, 2016). Characterized by insulin resistance, T2DM results in chronic hyperglycemia (Alberti et al., 1998), or increased blood glucose, and poor glucose regulation. If not managed through medication and lifestyle modification, T2DM often results in various complications and comorbidities including but not limited to organ damage and dysfunction, kidney failure, blindness, nerve damage, heart attack, stroke and premature death (Alberti et al., 1998; Booth, Roberts, & Laye, 2012; Colberg et al., 2010; Williams et al., 2012; and van der Heijden, Pouwer, Romeijnders, & Pop, 2012). The World Health Organization projects that T2DM will be the seventh leading cause of death by the year 2030 (WHO, 2016). The chronic impacts of this disease and its complications have led to both a personal and financial burden, costing the Canadian health care system $3 billion in 2015 (CDA, 2015).

Managing Pre-diabetes and Type 2 Diabetes Through Physical Activity

Often referred to as the "human made" disease, T2DM is mainly caused by poor lifestyle, namely physical inactivity and an unhealthy diet (Anvenell et al., 2004; Lees & Booth, 2004; and Olson & McAuley 2015). In fact, physical inactivity is one of three modifiable lifestyle factors that are the main causes of most chronic diseases including T2DM (Lees & Booth, 2004). Physical activity (PA) plays a crucial role in the management and treatment of T2DM and is necessary to delay and prevent disease onset for individuals who have pre-diabetes (Avenell et al., 2004; Booth, Roberts, & Laye, 2012; Olson & McAuley, 2015; Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2008; Silfee, Petosa, Laurent, Schaub, & Focht, 2016; Tuomilehto et al., 2001; van der Heijden, Pouwer, Romeijnders, & Pop, 2012; and Yang et al., 2014). Studies show that those with pre-diabetes who engage in regular physical activity will reduce their chances of developing diabetes by 47-65% (Hamman et al., 2006; Xiao-Ren Pan et al., 1997).

Indeed, the benefits of PA for individuals with pre-diabetes or T2DM have been confirmed through abundant research. The mechanisms include improving glycemic control (van Dijk & van Loon, 2015) by increasing cellular insulin sensitivity (Dutton et al., 2009) and stimulating blood glucose uptake into skeletal muscles during muscular contraction (Colberg et al., 2010). Regular PA enhances metabolic control and improves overall physical fitness in individuals with T2DM, resulting in reduced secondary complications and improved quality of life (van der Heijden, Pouwer, Romeijnders, & Pop, 2012).

Benefits from both aerobic activity as well as resistance training have been observed in patients with T2DM (Colberg et al., 2010). A recent systematic review and meta-analysis of randomized controlled trials found that although aerobic activity led to greater reductions in body mass index (BMI), aerobic and resistance training were equally effective in reducing

glycated hemoglobin (HbA1c; a measure to detect changes in glucose tolerance) levels in adults (Yang et al., 2014).

Type and Degree of Physical Activity for Pre-Diabetes

Given the evidence to support the role of PA in diabetes prevention and management, the Canadian Diabetes Association recommends that individuals living with pre-diabetes or T2DM engage in at least 150 minutes of moderate- to vigorous-intensity PA per week, which should include both aerobic and resistance training (CDA, 2016; Colberg et al., 2010). Despite the many clear benefits of PA, participation rates are especially low among individuals with T2DM (Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2008; van der Heijden, Pouwer, Romeijnders, & Pop, 2012). It is estimated that only 30% of those with T2DM are physically active, and among those who are active many are not sufficiently active to meet the recommended guidelines (van der Heijden, Pouwer, Romeijnders, & Pop, 2012). A systematic review showed that benefits such as weight loss tend to occur when individuals engage in 150-180 minutes of physical activity per week to manage glucose intolerance (Yates, Khunti, Bull, Gorely, & Davies, 2007). However, benefits leading to disease management are achieved only through long-term engagement in activity (Clark, Hampson, Avery, & Simpson, 2004). Furthermore, while initiating behaviour is important, evidence suggests that adherence to new behaviours such as PA declines following reduction or withdrawal of the PA intervention (Artinian et al., 2010).

Although opportunities for PA such as community-based programs exist for many individuals with pre-diabetes and T2DM, these interventions are not always successful in improving PA behaviours (Plotnikoff, Costigan, Karunaminu, & Lubans 2013). Behavioural interventions for PA tend to differ in their nature, and are often used to try to achieve PA behaviour change in individuals with pre-diabetes and T2DM. A systematic review and meta-

analysis of behavioural interventions found that compared with usual care, behavioural interventions showed a significant increase in objective and self-reported levels of PA (Avery, Flynn, van Wersch, Sniehotta, & Trenell, 2012). However, these increases were not maintained at a 6 and 24 month follow up. Some behavioural interventions may be useful in initiating PA behaviour during the intervention, however, long-term maintenance continues to be an issue. Therefore, interventions need to target factors that support the initiation *and* maintenance of PA among people with pre-diabetes and T2DM. There is a need for research to further understand the development of strategies to support long-term PA maintenance among this population.

Theoretical Approaches to Increasing Physical Activity

In order to create interventions that support PA maintenance, it is important to understand the various factors involved in behaviour change. Many behaviour change theories, such as the Theory of Planned Behaviour (Ajzen, 1991), place an emphasis on intention or motivation as a precursor, antecedent and predictor of behaviour (Sniehotta, 2009). Intention is indeed a strong predictor of behaviour.

However, research has shown intention alone is insufficient to elicit long-term behaviour change in many cases, considering people often do not act according to their intentions due to unforeseen temptations or barriers that may emerge (Schwarzer et al., 2008; and Sniehotta, Scholz, & Schwarzer, 2005). Intentions to achieve a goal do not guarantee achievement or action towards that goal (Gollwitzer & Sheeran, 2006); this gap between intention and behaviour is not uncommon in the PA domain (Godin & Conner, 2008).

The PA intention-behaviour gap was highlighted in a review of epidemiological evidence from six longitudinal PA studies (Godin & Conner, 2008). The review found that among the 62% of individuals with a positive intention for PA, approximately 34% were not active.

Therefore, there is a need to better understand *post-intentional* factors that predict PA behaviour change and maintenance. Behaviour change theories which consider post-intentional factors may be valuable for informing the development of interventions for individuals with pre-diabetes or T2DM, such that intentions are translated into behaviour and PA maintenance is supported.

Health Action Process Approach

The Health Action Process Approach (HAPA; Lippke, Ziegelmann, & Schwarzer, 2005; Schwarzer, Luszczynska, & Lippke 2011; and Schwarzer 2008) is a behaviour change model that aims to bridge the intention-behaviour gap by identifying post-intentional factors that are critical in the behaviour change process. HAPA presents a health behaviour change framework that overcomes the gaps in many other models (Schwarzer, Luszczynska, & Lippke 2011; Schwarzer 2008). As a stage model, the HAPA divides behaviour change into two main phases or stages (Schwarzer, Luszczynska, & Lippke 2011; and Schwarzer 2008): 1) motivational or *pre-intentional* phase and 2) volitional or *post-intentional* stage. A visual representation of the HAPA can be found in Figure 1.

Within the pre-intentional stage, the development of intentions to engage in a behaviour such as PA, are predicted by three factors: outcome expectancies, risk perceptions and task self-efficacy (SE). SE is defined as one's beliefs about his or her capabilities of performing a specific action (Bandura, 1977). Outcome expectancies refer to one's evaluation of the pros and cons of taking on a new behaviour such as PA (Caudroit, Stephan, & Le Scanff, 2011; and Schwarzer, 2008). For example, the belief that participating in PA will improve mood and reduce stress could be an outcome expectancy. Risk perceptions refer to one's beliefs about the likelihood of developing a health problem or further complications of a health problem (Schwarzer, 2008); for example, perceptions of one's chances of becoming obese or developing T2DM. Risk

perceptions are often associated with behaviours to avoid risk and prevent disease. Task SE refers to one's confidence to complete a specific task (Bandura, 1977; Schwarzer, 2008); for example, one's confidence in her ability to perform 30 minutes of aerobic PA twice a week. These three factors operate in concert with one another to build an intention towards a behaviour (Schwarzer, Luszczynska, & Lippke 2011; and Schwarzer, 2008), and individually are insufficient to elicit intention (Caudroit, Stephan, & Le Scanff, 2011, and Schwarzer, 2008).

Once an intention is formed, it must then be translated into action (Schwarzer, Luszczynska, & Lippke 2011; and Schwarzer, 2008). Action must be initiated, planned and maintained using self-management skills and strategies within the post-intentional phase (Norman and Conner, 2005; Schwarzer, 2008). In the post-intentional phase of the HAPA, action control, volitional SE (i.e., maintenance SE and recovery SE), as well as strategic planning such as action and coping planning can help to facilitate the translation from intention to behaviour (Schwarzer, 2008). These are each defined in turn below.

Action control refers to the evaluation and regulation of a behaviour (Schwarzer, 2008). For example, if a person has high action control regarding PA, then it is often on her mind, she is aware of her PA program and engages in behaviours such as monitoring and goal-setting. Maintenance SE represents one's beliefs about her ability to overcome and deal with barriers towards maintaining the desired behaviour (Schwarzer, 2008). This includes personal barriers such as feeling fatigued and environmental or external barriers such as bad weather conditions. Recovery SE addresses one's confidence in dealing with and recovering from failure, lapses or setbacks (Schwarzer, 2008). Strategic planning can include action planning and/or coping planning. Action planning refers to setting an individualized, specific, usually short-term plan to follow through with behaviour (Hagger, & Luszcynska, 2014; and Lorig, Laurent, Plant,

Krishnan, & Ritter, 2013), and setting cues for action (De Bruijin, Rhodes, & Van Osch, 2012). Coping planning refers to planning with consideration for barriers that might occur and plans to overcome such barriers (Schwarzer, 2008). These strategic planning factors act as mediators to overcome the behaviour-intention gap (Schwarzer, 2008). In summary, the post-intentional phase of the HAPA model identifies volitional processes that aim to mediate the intention behaviour gap to support the translation of intentions into behaviour change and maintenance (Schwarzer, 2008).

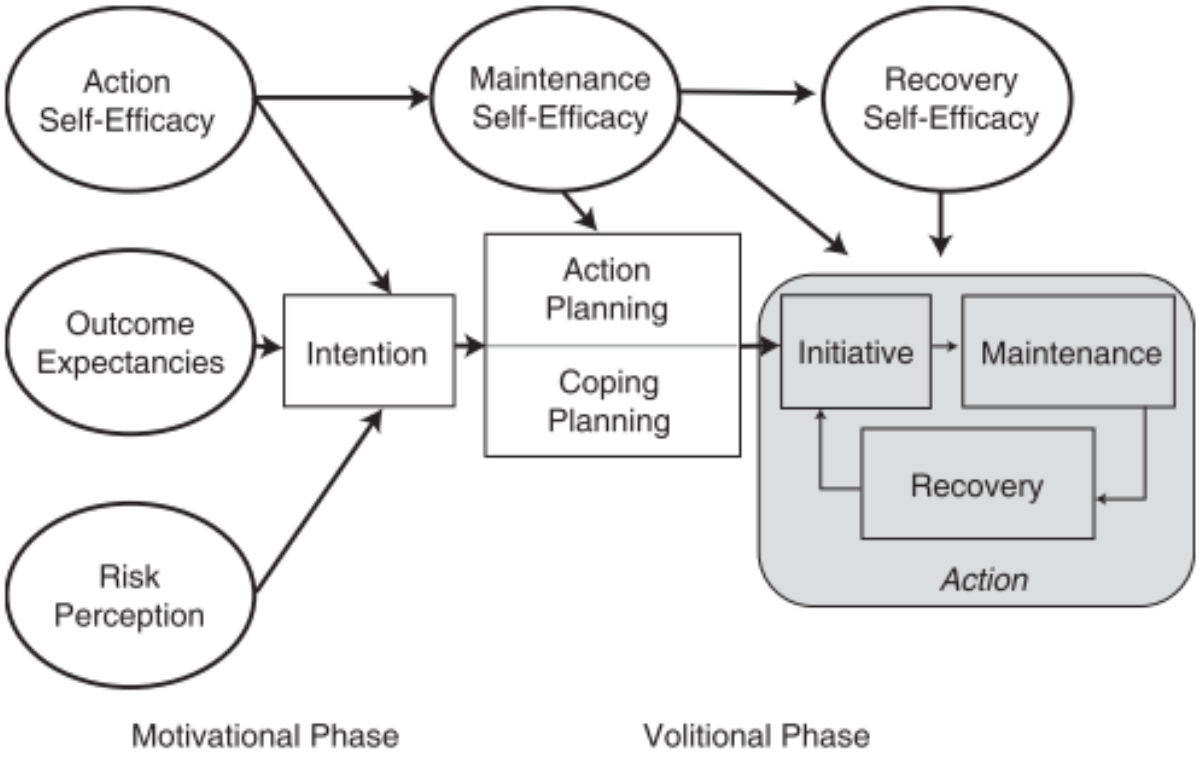

Figure 1. Generic Diagram of the Health Action Process Approach (HAPA) (Schwarzer, 2008). Reproduced with permission from "Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors." by R. Schwarzer, 2008. *Applied Psychology*, *57*(1), 1–29.

The HAPA model can be useful in designing interventions for individuals with chronic diseases such as T2DM. The HAPA allows us to consider individuals within three main groups:

"pre-intenders", "intenders", and "actors" (Lippke, Ziegelmann, & Schwarzer, 2005; Schwarzer, Luszczynska, & Lippke 2011; Schwarzer, 2008). Within the context of PA "pre-intenders" are individuals who are not engaging in PA and do not intend or plan on doing so in the near future (Schwarzer, Luszczynska, & Lippke 2011; Schwarzer, 2008). "Intenders" are identified as individuals who are not engaging in PA, however, have an intention to begin PA in the near future. "Actors" are those who have been physically active and have an intention to continue behaviour maintenance (Schwarzer, Luszczynska, & Lippke 2011; Schwarzer, 2008).

PA interventions can be designed such that they are stage-specific, which can be effective in health behaviour change (Lippke, Ziegelmann, Schwarzer, 2004; Luszczynska, Goc, Scholz, Kowalska, & Knoll, 2011). For example, pre-intenders (i.e. individuals with no intention to change behaviour) would not benefit from interventions such as planning targeting volitional factors (Lippke, Ziegelmann, Schwarzer, 2004; Lippke, Ziegelmann, & Schwarzer, 2005; Luszczynska, Goc, Scholz, Kowalska, & Knoll, 2011). Alternatively, intenders would be unlikely to benefit from interventions targeting outcome expectancies but would benefit more from interventions targeting self-regulatory strategies such as planning (Schwarzer, Luszczynska, & Lippke, 2011). Finally, actors may benefit from interventions such as planning that lead to behaviour maintenance and allow them to prevent and overcome potential lapses (Schwarzer, Lippke, & Luszczynska, 2011).

The HAPA has been successfully applied to research in different populations and targeting different health behaviours, such as breast self-examination (Luszczynska, & Schwarzer, 2003), and seat belt use in adolescents (Schwarzer, Schüz, Ziegelmann, Lippke, Luszczynska, & Scholz, 2007). It has also been applied to PA in cardiac patients (Scholz, Sniehotta, & Schwarzer, 2005; Sniehotta, Scholz, & Schwarzer, 2005), and older adults

(Caudroit, Stephan, & Scanff, 2011). The HAPA has been able to explain behaviour change better than other theories, due to the inclusion of post-intentional factors that address the intention-behaviour gap (Schwarzer, 2008). The HAPA is superior to other theories, as it considers more social cognitive determinants of health behaviours compared to other theories (Lippke & Ziegelmann, 2008). It is useful in helping further understand the behaviour change process in the PA domain, specifically in those with chronic illnesses.

Studies Applying the HAPA Model and Its' Associated Constructs in Pre-Diabetes and Type 2 Diabetes Populations

There is limited research applying the HAPA model to understand PA among people with pre-diabetes and T2DM per se. Two known studies have applied the HAPA to predict healthy eating behaviours (MacPhail, Mullan, Sharpe, MacCann, & Todd, 2014) and walking (Namadian, Presseau, Watson, Bond, & Sniehotta, 2016) in individuals with T2DM. In the latter study, adults with T2DM (N=411) completed questionnaire assessments of their walking habits as well as pre-intentional and post-intentional constructs of HAPA (Namadian, Presseau, Watson, Bond, & Sniehotta, 2016). Post-intentional factors of HAPA were found to be strong correlates of walking. This study did not include any intervention, but used the HAPA model to predict walking.

Furthermore, there is only one known study testing the effects of an intervention targeting a post-intentional HAPA factor to support PA maintenance among people with T2DM (Di Loreto et al., 2003). In this randomized controlled trial, physician counseling was used to target SE, among other factors such as potential obstacles, to promote the adoption and maintenance of PA (Di Loreto, et al., 2003). All participants received a counseling session from a physician, and

those in the intervention group received an additional 30 minutes of counseling for physical activity, and 15-minute follow-up telephone sessions. It was found that participants in the intervention group had significantly lower BMI and HbA1c scores at post-test. These results suggest that there may be value in using counselor-led strategies to implement HAPA constructs to support PA among people with or at risk for T2DM. Such strategies may be particularly important as people with pre-diabetes and T2DM exit supervised PA programs given that they are at risk of relapse at this time. Counselor-led interventions such as action planning that target post-intentional factors may support the maintenance of PA.

Self-Management and Self-Efficacy as Key Components of HAPA

SE is a key component of the HAPA model, and a seemingly critical factor in diabetes management through PA. Research suggests that in order to support PA and disease management, PA interventions should target SE through self-management interventions (Colberg et al., 2010; Dutton et al., 2009; Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2008; and Schwarzer, Luszczynska, & Lippke, 2011) since it has been shown to have a significant relationship with PA (Dutton et al., 2009). A very strong relationship between SE and health behaviour change and maintenance has been observed for health behaviours including smoking, alcohol abuse, weight control, use of contraception and PA (Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986). It is believed that a major barrier and predictor of engaging in PA for those with T2DM is task SE (Dutton et al., 2009; Olson & McAuley, 2015; van der Heijden, Pouwer, Romeijnders, & Pop, 2012), or one's beliefs about his or her capabilities to be physically active. Self-management is an important tool that targets SE and can be used to delay the onset of T2DM and comorbidities (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Silfee, Petosa, Laurent, Schaub, & Focht, 2016). Self-management is defined as the ability to modify behaviour

using strategies such as goal setting, self-monitoring, planning and time management (Bandura, 1991). Patients must learn to manage blood glucose through proper self-regulation which includes management of PA behaviour. Self-management strategies for diabetes is useful in giving patients skills to improve their diabetes control, and has been found to improve glycemic control and health-related quality of life (Funnell et al., 2011). For people with T2DM, self-management is a daily process that requires conscious decisions about management, which can very complex and often difficult for patients (Bodenheimer, Lorig, Holman, & Grumbach, 2002).

Intervention Studies Targeting HAPA Constructs to Increase Physical Activity

Self-regulation techniques such as planning are effective tools to support PA among patients with chronic diseases such as T2DM (Artinian et al., 2010). Furthermore, better self-regulation has been associated with greater SE and PA levels in T2DM populations (Olson & McAuley, 2015; Silfee, Petosa, Laurent, Schaub, & Focht, 2016). For example, a 2-year community-based, peer-led chronic disease management program targeting PA for patients with chronic disease was found to increase SE and PA (Lorig et al., 2001). This program promoted self-management and targeted HAPA constructs by helping patients improve SE toward PA. There is great value in evidence-based strategies to support the development of self-management skills among people with pre-diabetes and T2DM such that PA can be independently maintained.

The importance of SE has been confirmed in a study assessing the efficacy of a behavioral intervention to increase PA levels in older adults with T2DM (Olson & McAuley, 2015). Participants were randomized into an education control group (i.e., diabetes and health education course), or a PA intervention group including walking, group workshops and self-regulation through monitoring behaviour. The intervention was gradual in nature and ran for 8

weeks. Compared to the control condition, participants in the PA intervention group had greater changes in SE for PA. Furthermore, changes in SE and self-regulation over 8 weeks were associated with change in PA at a 4-month follow-up (Olson & McAuley, 2015). These findings highlight the importance of SE for individuals with T2DM, and demonstrate the potential impact of a relatively short-term intervention that supported independent PA maintenance. Maintenance and recovery SE are key components of the HAPA model that are involved in the maintenance of behaviour following initiation. These factors can be targeted through interventions that aim to improve PA maintenance.

Another study demonstrated that a PA intervention with self-regulation components such planning, worked to increase PA levels among patients with T2DM (van der Heijden, Pouwer, Romeijnders, 2012). Planning, such as coping and action planning, is strategy present in HAPA that can be used to reinforce the maintenance of behaviour. In a non-randomized controlled trial, inactive adults with T2DM were recruited and allocated to one of two interventions based on their baseline SE levels. Participants with high baseline SE were assigned to an advice only intervention and participants with low baseline SE were assigned to an intensive intervention. Some participants were assigned to a no-intervention control group. Participants in both intervention groups received a patient-tailored exercise intervention, and the intensive group also received group training guided by a physiotherapist. Both groups set goals and made plans for exercise, and used an exercise journal for self-regulation. PA levels in both intervention groups were found to be higher than the control (van der Heijden, Pouwer, Romeijnders, 2012).

Currently, there have been no studies examining the effects of self-management strategies such as action planning in maintaining PA in individuals with T2DM following a community-based PA program. There is a need for evidence-based interventions based on HAPA to enhance

independent PA maintenance among people with T2DM. Action planning is a good strategy to use based on previous evidence for its ability to target SE and positively impact behaviour change and maintenance.

Action Planning as a Tool for Physical Activity Behaviour Change

Planning as a self-regulatory strategy included in the HAPA model is a key variable in supporting behaviour change and maintenance (Norman & Conner, 2005). Setting an action plan includes identifying the what, when, where, and how of the desired action (Sniehotta, 2009). Part of action planning is setting a goal to complete a certain task for the specified time. Planning has been found to be valuable in supporting behaviour maintenance (Artinian et al., 2010). Furthermore, more proximal plans, and ones that focus on a behaviour (e.g., jogging three times this week) have been more successful in supporting PA compared to plans that are distal and outcome focused (e.g., losing 10 pounds in a month). (Bodenheimer & Handley, 2009; Artinian et al., 2010). Action plans impact standards for action and cues for monitoring behaviour (Sniehotta, Scholz, & Schwarzer, 2005). By making a commitment to future behaviour change, action plans increase SE and increase the likelihood of action (Lorig, Laurent, Plant, Krishnan & Ritter, 2013). Adherence to different health behaviours such as condom use (Abraham et al., 2001), sunscreen use (Jokes, Abraham, Harris, Schulz, & Crispin, 2001), and breast self-examination (Luszczynska, & Schwarzer, 2003) has improved with action planning interventions.

Action planning has been explored extensively in the PA domain (De Bruijn, Rhodes, & Van Osch, 2012; Evers, Klusmann, Ziegelmann, Schwarzer, & Heuser, 2012; Lorig, Laurent, Plant, Krishnan, & Ritter, 2013; Norman & Conner, 2005; Sniehotta, Scholz, & Schwarzer, 2006) and is a significant predictor of PA (Mistry, Sweet, Latimer-Cheung, & Rhodes, 2015).

Action planning has been found to increase PA adherence in both undergraduate students (de Bruijn, Rhodes, & van Osch, 2012), and orthopedic patients in the "intenders" and "actors" stages (Lippke, Ziegelman, & Schwarzer, 2004). Furthermore, action planning interventions have also been used in primary care as a self-management skill for patients with chronic conditions (Handley et al., 2006) and is found to be effective in achieving positive health outcomes (Lorig, Laurent, Plant, Krishnan, & Ritter, 2013). For example, action planning was found to be a significant predictor of snack reduction and fruit consumption in a sample of adults (van Osch et al., 2009) While there is no known research to examine the effectiveness of an action planning intervention to support PA among people with T2DM, overall, the effects of strategic planning on PA has been well demonstrated. A meta-analysis on action planning and coping planning for PA found that action planning had a medium to large effect on PA (Carraro & Gaudreau, 2013). Action planning holds promise as an effective strategy to support PA among people with T2DM. However, further research is necessary to establish the effectiveness and feasibility of various approaches to action planning.

Action Planning Delivery

A study testing the effectiveness of text messages for action planning for PA, found that text messaging affected planning behaviour, which subsequently predicted changes in PA (Mistry, Sweet, Latimer-Cheung, & Rhodes, 2015). Other telephone assisted interventions have been effective in improving PA and glycemic control (Cassimatis & Kavanagh, 2012; Eakrin et al., 2014; Goode et al., 2015; Olson & McAuley, 2015). For example, a randomized controlled trial of an automated telephone intervention aiming to improve diabetes management found that participants receiving phone services had a significant decrease in HbA1c levels at a 6-month follow-up. Although in-person action planning interventions are valuable, telephone-assisted

planning interventions have also been effective in promoting adherence to PA by serving as a regular follow-up to help individuals regulate their behaviour (Evers, Klusmann, Zieglmann, & Schwarzer, 2012). Action planning delivery through telephone can reduce the cost and increase the reach of an intervention compared to in-person planning. This strategy could be valuable to support individuals with T2DM transitioning out of community-based PA programs. While program providers may not be able to sustain in-person action planning support for individuals with T2DM, telephone-assisted planning may be an effective and feasible alternative.

Brief Action Planning

Brief action planning (BAP) is a specific type of action planning developed by the Centre for Collaboration, Motivation and Innovation (CCMI; http://www.centrecmi.ca/learn/brief-action-planning/). It refers to a "highly structured, patient-centered, stepped-care, evidence-informed self-management support technique" (Reims, Gutnick, Davis, & Cole, 2014). BAP is a type of self-management support tool used to assist patients to self-manage behaviours leading to positive health outcomes (Gutnick et al., 2014). Similar to action planning, BAP includes the specifics of an intention or goal such as what, when, where, and how one will perform an action (Gutnick et al., 2014; and Reims, Gutnick, Davis, & Cole, 2014). By facilitating goal setting and action planning, BAP builds SE for long-term chronic disease management (Gutnick et al., 2014; and Reims, Gutnick, Davis, & Cole, 2014).

The practice and use of BAP is patient centered and based in the spirit of Motivational Interviewing (Gutnick et al., 2014; Reims, Gutnick, Davis, & Cole, 2014). Figure 2 displays the BAP process. BAP is comprised of eight clinical competencies, three questions and five skills which the deliverer must incorporate in each session (Reims, Gutnick, Davis, & Cole, 2014). Questions regarding the specificity of the PA plan are asked, and a confidence check is done to

ensure the participant is able to complete their plan. Furthermore, a follow-up call is scheduled with permission from the participant to create accountability and encourage plan completion. Evidence suggests that between 50-70% of those who are asked the first BAP question (i.e., "is there anything you would like to do for your health in the next week or two?") will go on to develop an action plan (Gutnick et al., 2014). If the client agrees to make a plan, further BAP questions are used to make a specific and proximal plan. BAP is known to work better for individuals who are motivated and would like to make a plan (Reims, Gutnick, Davis, & Cole, 2014).

Counselors should receive training and become certified to deliver BAP. The counselor must accept and respect the client's plan and maintain partnership throughout the process (Reims, Gutnick, Davis, & Cole, 2014). The counselor works to elicit a commitment statement from the client for the new plan. Research shows that a commitment statement is a predictor of future behaviour (Reims, Gutnick, Davis, & Cole, 2014). Since the aim of BAP is to increase SE, checking the clients' confidence while planning is an important component of BAP (Bodenheimer & Handley, 2009).

One skill used during BAP to boost confidence and brainstorm ideas is problem solving. Problem solving is a useful tool to help clients navigate through barriers to change (Artinian et al., 2010). A follow-up and new plan is then set up with the client to check-up on the previous plan and create a new one, creating a cycle of BAP.

Evidence suggests that interventions with scheduled follow-ups are generally more effective than single-session interventions (Artinian et al., 2010). Moreover, research has found

that people are more likely to follow through with their plans if they are asked to report back on their progress (Reims, Gutnick, Davis, & Cole, 2014).

Using BAP is an effective way to provide self-management support for individuals with chronic diseases such as diabetes (Gutnick et al., 2014) to help mitigate disease effects and progression through behaviour change. BAP may be a particularly promising approach to supporting independent PA maintenance among people with T2DM transitioning out of community-based PA programs because of its direct impact on maintenance SE and recovery SE. Although BAP can be delivered in person, it is suitable as a telephone-based strategy to support PA, as it is a relatively brief and simple intervention to deliver. A study testing the effectiveness of training peers of those with spinal cord injury to learn BAP found that teaching BAP to promote PA is indeed feasible (Gainforth, Latimer-Cheung, Davis, & Martin Ginis, 2015). BAP can be learned easily and used to promote PA initiation and maintenance in different populations. Thus, BAP is a feasible intervention that may be useful in supporting the maintenance of physical in individuals with prediabetes and T2DM who are exiting a community-based PA program.

As described above, the HAPA model suggests that the use of self-regulation tools can facilitate behaviour change and maintenance (Schwarzer, 2008). BAP is an approach to support the long-term management of diseases such as T2DM by encouraging behaviours such as PA (Gutnick, et al., 2014). BAP is an intervention that is efficient and feasible relative to other counseling approaches. However, there is no known research examining the effectiveness of BAP to support PA in general or specifically among individuals with pre-diabetes and T2DM.

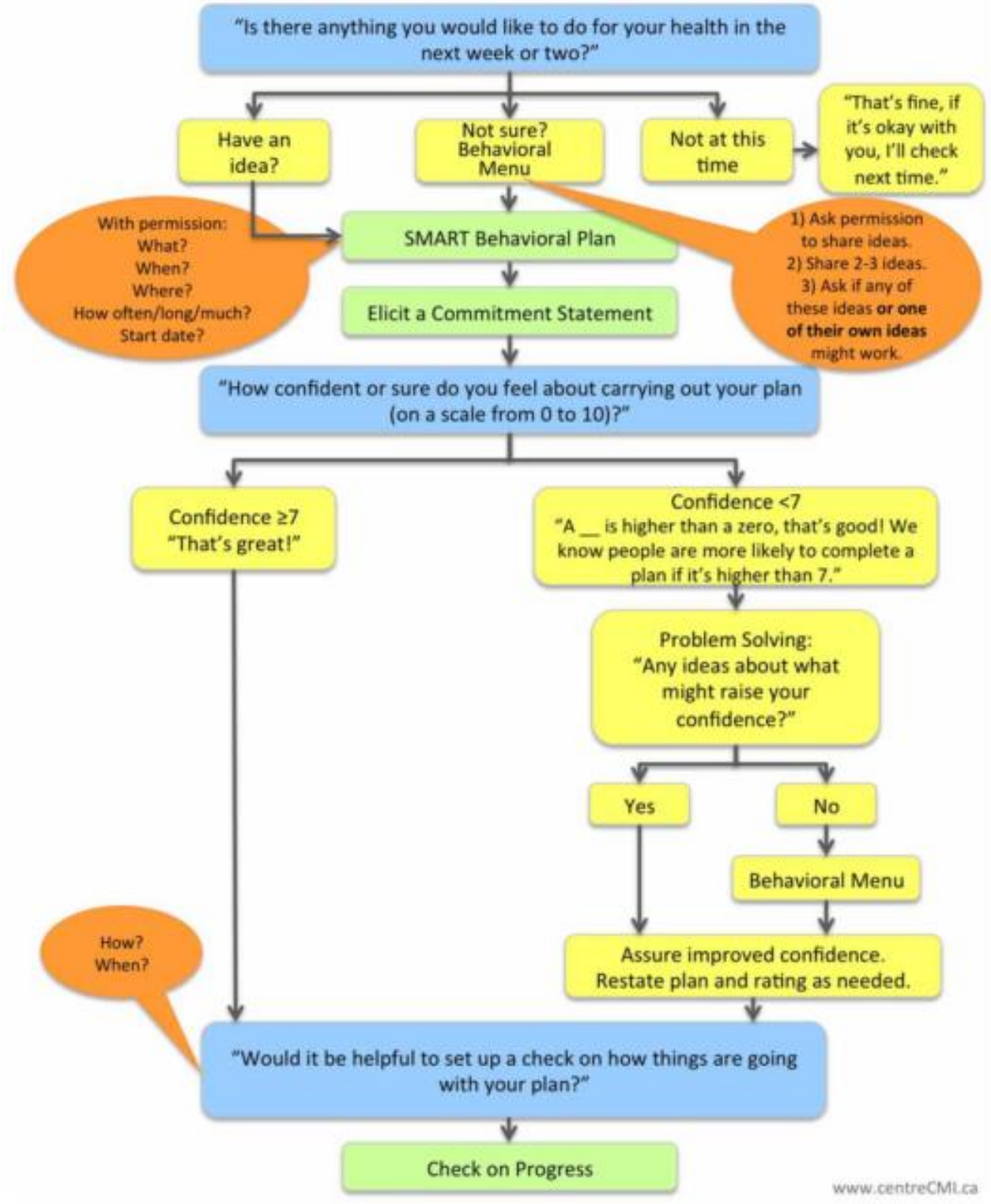

Figure 2. Brief action planning flow chart. (Gutnick et al., 2014). Reproduced with permission from "Brief Action Planning to Facilitate Behavior Change and Support" Gutnick, D., Reims, K., Davis, Gainforth, H., Jay, M., & Cole, S. (2014). *21*(1), 17–29. Retrieved from http://www.jcomjournal.com/brief-action-planning-to-facilitate-behavior-change-and-support-patient-self-management-3/

Purpose

Currently, there have not been any studies evaluating the effectiveness of BAP to support PA among people with pre-diabetes and T2DM. Although many have studied the impact of behavioural interventions on PA in those with T2DM, the role of BAP in supporting the maintenance of PA following a community-based intervention is unknown. Support for maintenance of PA is essential due to the critical role PA plays in the prevention and management of T2DM. Guided by the HAPA model, this pilot study aimed to evaluate the effects of a 4-week BAP intervention on: a) pre- and post-intentional HAPA constructs including intention for PA, intention to plan, task SE, maintenance SE, recovery SE, planning SE, planning and action control, and b) maintenance of PA in people with pre-diabetes and T2DM.

Hypotheses

Hypothesis 1: Intention to plan, task SE, maintenance SE, recovery SE, planning SE, planning and action control will improve following BAP. Intentions for PA are not hypothesized to change following BAP because the participants will have formed intentions for PA prior to participation in the BAP intervention.

Hypothesis 2: PA behaviour that has been established during the community-based PA program will be maintained (will not decrease) over 4 weeks of BAP because participants will already be engaging in regular PA prior to the BAP intervention. The BAP intervention will aim to support PA maintenance upon completion of the community-based PA program.

Methods

Design

Research ethics approval was obtained by the research ethics board at York University. This was a prospective, observational, and non-randomized pilot study with a single group using pre-and-post measurements. All participants received the BAP intervention upon completion of a community-based PA program (i.e., Glucofit). Questionnaires were administered at two time points: pre-BAP/baseline (T1) and post-4-week BAP intervention (T2). Refer to Appendix B for the questionnaires. Figure 3 provides a visual representation for the study design and timeline.

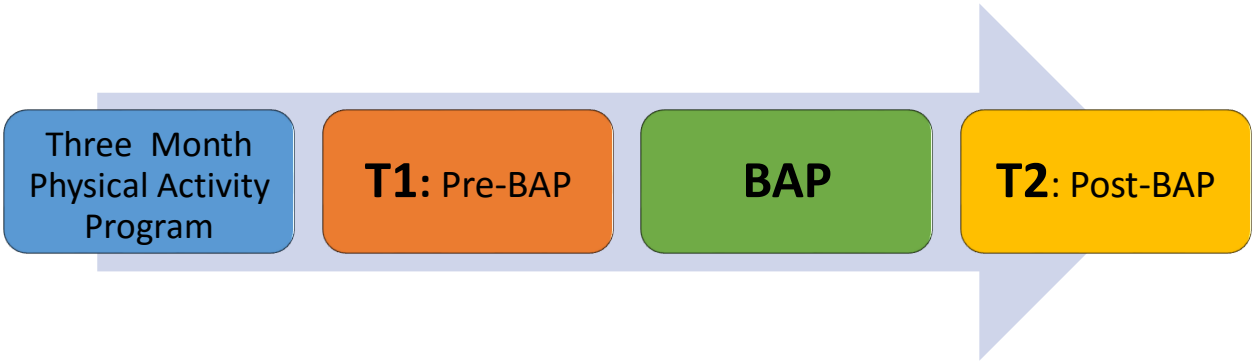

Figure 3. Study Design and Assessment Points.

Setting

The study was an evaluation of a BAP intervention delivered to individuals with pre-diabetes or T2DM. Participants were recruited following completion of *GlucoFit*, which is a community-based PA program offered at the Tait McKenzie facility at York University. The GlucoFit program was delivered in partnership with the Canadian Diabetes Association, the Jane and Finch Family Health Team, the Black Creek Community Health Care Centre, and York University's Campus Recreation Department. All activities took place at the Tait McKenzie Centre. Glucofit consisted of three months of aerobic and resistance training with a certified

personal trainer. Aerobic exercises included light but challenging activities, and resistance training used body weight or light weights, with full body and isolation exercises. Participants engaged in the program twice a week for 3 months, completing a total of 24 sessions. In addition to the personal training, participants had access to a nutritionist at the gym. Although the program ended 3 months post-registration, participants received a free membership at the Tait McKenzie Fitness Centre expiring in December 2017. The free membership was intended to support independent PA maintenance after the conclusion of the formal Glucofit program.

Procedure

Participants were approached as they exited the community-based PA program and invited to participate in the BAP intervention. Participants who did not complete the PA program were not invited to participate as the BAP intervention was designed to specifically support PA maintenance. Prior to completing the baseline questionnaires, participants gave written consent to participate. Participants then scheduled telephone calls on the same day every week for 4 weeks. They were also given a "Checking on My Plan" sheet developed by the CCMI to help participants monitor their plans independently or with the help of a certified BAP counselor. Questionnaires were administered at baseline, participants participated in the BAP intervention, and then completed a questionnaire again following BAP.

Intervention

Following the Glucofit program, consenting participants engaged in a 4-week behavioural BAP intervention with a certified BAP counselor. The lead author and a second researcher were certified by the CCMI to be the BAP counselors for this study and therefore

carried out all BAP calls with participants. Certification was completed over the phone with a representative from the CCMI. The lead author completed three practice sessions before completing a telephone test to become certified. The BAP intervention was intended to support participants in continued, independent PA post-Glucofit. BAP was delivered by telephone once per week for 4 weeks. Each call took approximately 3-10 minutes during which a certified BAP counselor assisted the participant in making a plan to be physically active for the following week. Figure 2 provides a visual representation of a typical BAP session protocol.

The first BAP question was asked to facilitate goal setting and action planning (Reims, Gutnick, Davis, & Cole, 2014). Next, a very specific, proximal and behaviour-focused action plan or goal was set by asking about the what, where, when and how of an action (Reims, Gutnick, Davis, & Cole, 2014). Following the creation of a plan, a commitment statement was elicited from the client. Next, a confidence check was done by asking clients to rate their confidence in completing the plan on a scale from zero to 10 (where zero = not at all confident and 10 = extremely confident). In cases where the participant's confidence was rated less than seven, problem solving was used to adjust the plan and increase confidence (Reims, Gutnick, Davis, & Cole, 2014). In cases where the participant's confidence was rated seven or higher, a follow up call was booked to check-in with the participant and adjust the plan if required (Reims, Gutnick, Davis, & Cole, 2014).

During a follow-up call, the completion, partial completion, and incompletion of plans was evaluated, acknowledged and reassured. Additionally, questions were asked to evoke a new action plan for the following week (Reims, Gutnick, Davis, & Cole, 2014). A follow-up call flow chart is found in Appendix E.

Intervention Deliverers and Training

A first step in supporting BAP fidelity was the certification of two researchers through the CCMI to conduct BAP calls. The certified counselors conducted all BAP calls for the study. Certification took place over the phone with a representative from CCMI. Researchers to be certified took part in three practice runs and one test to ensure proper protocol was followed.

Intervention Fidelity

Fidelity was carefully considered when conducting BAP calls. The CCMI guided the development of a strategy to support and assess fidelity. An adapted CCMI BAP script specific to PA and T2DM (Appendix E) was used by both counselors to support consistency in BAP delivery throughout the study.

To ensure that all participants received the same quality BAP counseling, 25% of BAP calls were tested for fidelity by one of two methods. In the first method, calls were chosen at random to be assessed for fidelity using an online randomizer. The primary method to assess fidelity consisted of evaluation by a second BAP counselor. Permission was requested from the participant to include a second counselor on the call to evaluate the fidelity. Once permission was granted by the participant a second counselor joined the BAP call to silently observe the primary counselor. The second counselor used a checklist provided by the CCMI to ensure that the primary counselor used all appropriate questions and skills as necessary.

When a second BAP counselor was not available to assess fidelity during the call or the participant did not give consent for the second counselor to listen to the call, an alternate method was employed. In these cases, a debriefing of the call took place between the primary and

secondary BAP counselors. During the debrief, the primary counselor detailed the call to the secondary counselor and outlined how the necessary questions and skills were employed to facilitate the BAP. As the secondary counselor listened to the debriefing, he/she used the same checklist to ensure appropriate BAP protocol was followed.

Participants

Participants for the BAP intervention were recruited from the Glucofit PA program which targeted individuals who reported being of a low socio-economic status living in the North York region in Ontario. Inclusion criteria for participants included being ≥18 years of age and being diagnosed with pre-diabetes (i.e., at risk for T2DM) or T2DM. Diagnosis of pre-diabetes (i.e., HbA1c levels between 5.7-6.4) and T2DM (HbA1c levels greater than 6.5) was confirmed through participants' physicians. The exclusion criterion included not knowing how to speak and read English.

The BAP intervention commenced upon completion of the 3 months Glucofit PA program. Considering participants were aware of their negative health status and had been physically active for 3 months as they commenced the BAP intervention, they fit in the post-intentional "intenders" and "actors" categories of the HAPA (Schwarzer, Luszczynska, & Lippke 2011; Schwarzer 2008). Accordingly, these participants were good candidates for the BAP technique, as it is known to work for motivated individuals (Gutnick et al., 2014).

Measures

Sociodemographic and clinical characteristics

Sociodemographic characteristics were assessed to characterize the sample and understand generalizability. These measures included age, gender, occupation/student status, and disease status (i.e., pre-diabetic or type 2 diabetic). Refer to Appendix B, Section A for questions.

HAPA Constructs

Pre- and post-intentional constructs of the HAPA framework were measured at T1 (i.e., pre-BAP) and T2 (i.e., post-BAP). Post-intentional HAPA constructs, including planning, action control, recovery SE and maintenance SE were used as the dependent variables for the first hypothesis.

Intentions for PA

In this study, regular PA was operationalized as 150 minutes of moderate to heavy intensity per week as per guideline recommendations (CDA, 2016; Colberg et al., 2010). Intentions for PA were measured using four items adapted from Schwarzer (2008) on a 7-point Likert scale. For example, participants were asked to rate how true (1= definitely false to 7= definitely true) were the statements: i) I intend to do 30 minutes of moderate to heavy PA at least two days per week over the next month and ii) I will try to engage in regular PA (150 minutes per week) over the next month or 3 months depending on the time of questionnaire. Internal consistency of the scale was alpha= .87. Refer to Appendix B, Section C for these questions.

Intentions to Plan for PA

Intention to plan was measured with one item adapted from Schwarzer (2008). Participants were asked to rate the degree to which the following statement is true: (1= definitely false to 7= definitely true) I intend to make a plan for PA once a week over the next month. Refer to Appendix B, Section C for these questions.

Self-efficacy

As per the HAPA model, 4 types of pre- and post-intentional SE factors were measured: task SE, maintenance SE, recovery SE and planning SE. *Task SE* was measured using a scale that assessed SE for: (a) minutes of moderate intensity aerobic activity, (b) days of moderate-heavy intensity aerobic activity, and (c) days of resistance training. Participants rated their confidence on a 7-point scale (1= not confident at all; 7= completely confident) to engage in the specified minutes and days of PA over the next 4 weeks. For example, "Over the next month, assuming that you were very motivated and had all the resources you need, how confident are you that you could physically do the following amounts of moderate intensity aerobic activity (e.g., bicycling, running, walking, swimming, jogging) without stopping: 10 minutes, 20 minutes, 30 minutes." Total task SE was calculated using the mean of the three sub-categories. The scale for task SE was alpha =0.94. Refer to Appendix B, Section D1 for all items.

Maintenance SE was measured using a 13-item questionnaire. Nine items were taken from a previous tool (Plotnikoff, Blanchard, Hotz, & Rhodes, 2001; Plotnikoff, Lippke, Courneya, Brikett, & Sigal, 2008) and five items were developed and found to be reliable for the T2DM population (Plotnikoff, Lippke, Courneya, Brikett, & Sigal, 2008). Items were measured

on a 5-point scale, (1=not at all confident to 5=extremely confident) to participate in regular PA for the next 4 weeks even when facing a number of barriers (Plotnikoff, Lippke, Courneya, Brikett, & Sigal, 2008). For example, "Assuming you were very motivated, how confident are you that you will participate in regular PA every week over the next month even when you feel tired, or when the weather is bad". The 13 items on this scale had an internal consistency of alpha =.92. Refer to Appendix B, Section D2 for all items.

Recovery SE was measured using a five-item scale to assess the participants' confidence to recover and return to PA after a lapse. Items were adapted from Schwarzer (2008). Questions were rated on a 7-point scale (1= not at all confident to 7 = completely confident). For example, "Over the next month, how confident are you that you can resume regular PA when it is interrupted and you miss PA for a few days?" Internal consistency for this scale was alpha=.94. Refer to Appendix B, Section D3 for these questions.

Planning SE measured using four-items on a 7-point scale (1 = not at all confident to 7 = completely confident). Items were adapted from Schwarzer (2008). For example, "Over the next month how confident are you that you can develop plans to reach your PA goals?" Internal consistency for these questions was alpha =.94. Refer to Appendix B, Section D3 for these questions.

Risk Perceptions for Diabetes

Risk perceptions for diabetes measures participants' beliefs about their likelihood to develop T2DM, or complications associated with TD2M. This was measured using two items rated on a 7-point scale. For example, "My chances of developing diabetes in the future are" (1 =

not strong to 7 = very strong). These questions are adapted from Schwarzer (2008). Internal consistency for risk perceptions for diabetes was alpha =.97. Refer to Appendix B, Section E for these questions.

Risk Perceptions for Obesity

Participants' beliefs about their likelihood to become obese (i.e., a comorbidity of diabetes) was also assessed using two items rated on a 7-point scale. For example, "My chances of becoming obese in the future are" (1 = not strong to 7 = very strong). These questions are adapted from Schwarzer (2008). Internal consistency for risk perceptions for obesity was alpha =.73. Refer to Appendix B, Section E for these questions.

Outcome Expectancies

Outcome expectancies were assessed using seven items on a 5-point scale (1 = strongly disagree to 5 = strongly agree). The items were shown to be reliable in a population of adults with type 1 and T2DM (Plotnikoff, Lippke, Courneya, Brikett, & Sigal, 2008). For example, participants rated their beliefs on how "engaging in PA will reduce tension" or, "improve sleep". Internal consistency for these items was acceptable alpha =.83. Refer to Appendix B, Section F for these questions.

Planning

Planning was measured using a four-item question rated on a 7-point scale (1 = definitely false to 7 = definitely true). These items were previously used to measure planning behaviours in the maintenance of PA in cardiac rehabilitation patients (Sniehotta, Scholz, & Schwarzer, 2005).

For example, “I have made a detailed plan regarding when to participate in PA.” Internal consistency of these items was (α=.97). Refer to Appendix B, Section G for these questions.

Action Control

Action control was measured using a six-item scale where items were rated on a 7-point scale (1 = definitely false to 7 = definitely true). These items were previously used to measure action control in the adoption and maintenance of PA in cardiac rehabilitation patients (Sniehotta, Scholz, & Schwarzer, 2005). Example statements are: “I am constantly aware of my PA program,” and, “I constantly monitor whether I engage in PA often enough.” Internal consistency was found to be (α=.96). Refer to Appendix B, Section G for these questions.

Physical Activity

PA was measured using the Godin Leisure-Time PA (LTPA) questionnaire (Godin, & Shephard, 1997). LTPA is physical activity that is done during one’s leisure time and can include anything from light exercise such as yoga to vigorous-intensity sports. Participants reported their average number of 30-minute bouts of vigorous, moderate and mild PA per week over the last 4 weeks (T2) or 3 months (T1). Mild LTPA includes activities such as yoga, fishing, bowling or golf. Moderate LTPA includes activities such as fast walking, volleyball, and easy swimming. Vigorous LTPA includes activities such as running, vigorous swimming, hockey and soccer. Each type of LTPA was explained to participants with examples in the questionnaire. Total PA was calculated as an average of mild, moderate and vigorous weekly LTPA, and each category was calculated on its own. PA maintenance operationalized by comparing PA levels following the supervised program (T1) to PA levels post-BAP (T2); no significant decrease in PA was

determined to reflect maintenance. Based on the recommendations for PA, minutes of moderate to vigorous PA (MVPA) were also calculated. Refer to Appendix B, Section B for the Godin Leisure Time for PA questionnaire.

Statistical Analyses

Statistical analyses were performed using SPSS version 24 (IBM Corporation, Armonk, NY, USA). BAP fidelity was tested using a dichotomous scale (fidelity present/absent) to rate the degree to which the BAP session adhered to the script and principles of motivational interviewing.

Participant characteristics at baseline were described (i.e., means and standard deviations, frequencies) Pre-intentional HAPA constructs were examined to allow for an understanding of the population entering the BAP program. Values in diabetic and pre-diabetic individuals were examined to understand potential differences between these two populations.

Mean scores for pre-and post-BAP were examined for differences across time. The first hypothesis was tested using a paired t-test to compare values of HAPA constructs across T1 and T2. The second hypothesis was tested using a paired t-test and effect sizes, calculated to explore the magnitude of changes in variables from T1 to T2. Effect sizes were calculated using an online effect size calculator (Becker, 1999; https://www.uccs.edu/~lbecker/), such that a negative effect size represents an increase in any given variable at T2 compared to T1. A small effect size ranges from 0.2-0.49, a medium effect size ranges from 0.5-0.79, and a large effect size is anything ≥0.8 (Aarts, van de Akker, & Winkens, 2014).

Results

Respondent Characteristics

A total of 22 individuals entered in the 3-month Glucofit PA program during September 2016. Of those, nine (40%) participants did not complete the 3 months of training and were therefore ineligible for the current study. Thirteen (59%) individuals completed the training and entered the BAP intervention, and 10 (77%) completed the BAP intervention. Therefore, 13 participants completed the baseline (T1) questionnaire and 10 (45%) participants completed the 4-week intervention and the post-BAP (T2) questionnaire. The three participants who were lost to follow-up throughout the 4-week BAP intervention reported a lack of interest and inability to take calls. Therefore, data from 10 participants were included in the analyses to test the hypotheses.

Among the 10 subjects who completed BAP calls, three calls were made on average, and BAP fidelity was high; 91% of calls followed BAP protocol.

Participant baseline demographic characteristics are displayed in Table 1. Of the participants that entered the BAP intervention, 30% were males, and 70% were females. 40% of participants had pre-diabetes, and 60% had T2DM. The age of participants was (M=60.8, SD=18.5), with 80% of participants being ≥48 years old.

Table 1

Respondent Characteristics

		Participants					
		Completed Intervention		Dropouts		Total	
		N	%	*n*	%	*N*	%
Diabetic Status	Pre-diabetic	4	40.0%	0	0.0%	4	30.8%
	Diabetic	6	60.0%	3	100.0%	9	69.2%
Age	18-27	1	10.0%	0	0.0%	1	7.7%
	28-37	0	0.0%	0	0.0%	0	0.0%
	38-47	1	10.0%	0	0.0%	1	7.7%
	48-57	2	20.0%	0	0.0%	2	15.4%
	58-67	2	20.0%	2	66.7%	4	30.8%
	68-77	3	30.0%	1	33.3%	4	30.8%
	78+	1	10.0%	0	0.0%	1	7.7%
Mean Age	60.8 ±18.5						
Sex	Male	3	30.0%	1	33.3%	4	30.8%
	Female	7	70.0%	2	66.7%	9	69.2%
Occupation	Employed	5	50.0%	1	33.3%	6	46.2%
	Unemployed	0	0.0%	1	33.3%	1	7.7%
	Student	1	10.0%	0	0.0%	1	7.7%
	Retired	4	40.0%	1	33.3%	5	38.5%

N = Sample size

Group differences on all HAPA constructs and PA between those who completed the 4 weeks of BAP (BAPers) (n=10) versus dropouts from the BAP intervention (n=3) were considered. Most variables did not differ between BAPers and dropouts due to low power. A significant difference was found for T1 planning levels between dropouts (M=6.67, SD=.58) and BAPers (M=4, SD=2.66), $t(11)$=-2.95 $p < .05$ (see Table 3). Effect sizes were calculated for all variables, where a negative effect size means dropouts had higher scores than BAPers and vice versa. Large effect sizes were found for intention to plan (d=-1.03), task SE (d=.84), risk perception for obesity (d=-1.46), moderate PA (d=1.1) and vigorous PA (d=-1.1). Moderate effect sizes were found for intentions for PA (d=-.67), planning SE (d=-.78), and mild PA (d=.5). Small effect sizes were observed for maintenance SE (d-=.43), recovery SE (d=-.32), outcome expectancies (d=-.43) and action control (d=-.32). Refer to Table 2 below for these results.

Table 2

Comparison of BAPers and Dropouts' Baseline (T1) HAPA Constructs and PA

	n	*M*	*SD*	*t*	*df*	*p*	Cohen's *d*
Intentions for PA							
BAPers	10	5.30	1.66	-0.86	11	0.41	-0.67
Dropouts	3	6.17	0.76				
Intentions to Plan							
BAPers	10	5.20	2.53	-1.20	11	0.26	-1.03
Dropouts	3	7.00	0.00				
Task SE							
BAPers	10	5.67	1.58	1.21	11	0.25	0.84
Dropouts	3	4.44	1.35				
Risk perception for Diabetes							
BAPers	10	5.95	1.30	0.12	11	0.91	0.07
Dropouts	3	5.83	2.02				
Risk perception for Obesity							
BAPers	10	2.80	1.40	-2.09	11	0.06	-1.46
Dropouts	3	4.67	1.15				
Maintenanace SE							
BAPers	10	3.25	1.09	-0.74	11	0.48	-0.43
Dropouts	3	3.82	1.54				
Planning SE							
BAPers	10	5.15	1.84	-0.42	11	0.69	-0.78
Dropouts	3	5.67	2.10				
Recovery SE							
BAPers	10	5.40	1.82	-0.46	11	0.66	-0.32
Dropouts	3	5.93	1.51				
Outcome Expectancies							

BAPers	10	4.87	0.25	-0.54	11	0.60	-0.43
Dropouts	3	4.95	0.08				
Planning							
BAPers	10	4.00	2.66	-2.95	11	0.01*	-1.38
Dropouts	3	6.67	0.58				
Action Control							
BAPers	10	5.83	1.86	-0.40	11	0.70	-0.32
Dropouts	3	6.28	0.63				
Mild PA							
BAPers	10	110	83.27	0.74	11	0.47	0.50
Dropouts	3	70	75.50				
Moderate PA							
BAPers	10	141	58.4	1.426	11	0.18	1.1
Dropouts	3	90	30				
Vigorous PA							
BAPers	10	33	60.75	-1.288	11	0.22	-1.1
Dropouts	3	80	17.32				
Total PA							
BAPers	10	94.67	31.43	0.70	11	0.50	0.53
Dropouts	3	80	34.6				

*Significant at the 0.05 level (2-tailed) $p<0.05$
n = Sample size
M = Mean
SD = Standard deviation
BAPer = participants who completed BAP intervention
PA = Physical activity
SE = Self-efficacy

Effect of Intervention on Change in HAPA Constructs

Hypothesis 1*: Intention to plan, task SE, maintenance SE, recovery SE, planning SE, planning and action control will improve following BAP. Intentions for PA are not hypothesized to change following BAP because the participants will have formed intentions for PA prior to participation in the BAP intervention.*

Scores at each time point are shown in Table 4. Exploratory inferential statistics were done, and significant differences were observed in maintenance SE $t(9) = -2.28$ $p < .05$ (d=-.40) from T1 (M = 3.25, SD = 1.09) and T2 (M = 3.67, SD = 1.06), as well as T1 (M = 4.00, SD = 2.66) and T2 (M = 6.65, SD = 0.73) planning scores $t(9) = -2.79$, $p < .05$ (d=-1.32) in the expected direction. Also in support of hypothesis 1, there was no change in intentions for PA. Contrary to hypothesis 1, no significant changes were found between T1 and T2 intentions to plan, task SE, recovery and planning SE, or action control. Refer to Table 4 for these results.

Effect sizes were also calculated for these variables. Medium effect sizes were found for changes in intentions for PA (d=-.541), intentions to plan (d=-0.525) and action control (d=-0.523). Furthermore, a small effect size was observed for planning SE (d=-.283). Effect size for task SE (d=-0.155) and recovery SE (-0.011) were negligible. However, these were all in the expected direction, denoting improvement in HAPA constructs from pre- to post-BAP.

Table 3

Comparisons of Mean HAPA Construct Scores from Baseline (T1) to Post-BAP (T2)

	Pair	*M*	*SD*	*T*	*df*	*p*	*Cohen's d*
Intentions for PA							
	T1	5.30	1.66	-1.35	9	0.21	-0.54
	T2	6.02	0.76				
Intentions to Plan							
	T1	5.20	2.53	-1.34	9	0.21	-0.52
	T2	6.20	0.00				
Task SE							
	T1	5.67	1.58	-1.25	9	0.24	-0.15
	T2	5.92	1.35				
Maintenance SE							
	T1	3.25	1.09	-2.28	9	0.04*	-0.40
	T2	3.67	1.06				
Recovery SE							
	T1	5.40	1.82	0.05	9	0.96	-0.01
	T2	5.38	1.66				
Planning SE							
	T1	5.15	1.84	-1.58	9	0.15	-0.28
	T2	5.63	1.53				
Planning							
	T1	4.00	2.66	-2.76	9	0.02*	-1.32
	T2	6.55	0.73				
Action Control							
	T1	5.83	1.86	-1.33	9	0.21	-0.52
	T2	6.55	0.57				

*Significant at the 0.05 level (2-tailed) $p<.05$.
PA = Physical activity
SE = Self-efficacy

Effect of Intervention on Change in Physical Activity

Hypothesis 2. *PA behaviour that has been established during the community-based PA program will be maintained (will not decrease) over 4 weeks of BAP because participants will already be engaging in regular PA prior to the BAP intervention. The BAP intervention will aim to support PA maintenance upon completion of the community-based PA program.*

In support of hypothesis 2, no significant changes were detected from T1 to T2 for total PA or any other level of PA (i.e., mild, moderate, vigorous), suggesting that PA levels did not change significantly following BAP. There were also no significant changes found for any other intensities of PA that were measured. Refer to Table 5 below for these results.

Effect sizes were calculated to explore possible changes that were not detected due to limited power. Negative effect sizes represent an increase in score from T1 to T2, and vice versa. Small effect sizes were found for mild PA (d=-.21). Moderate-to-vigorous PA did not change significantly, however, a small effect size was observed with changes in the negative direction (d=.24). Furthermore, of the 10 participants, only 10% or 1 participant, met the recommended guidelines of ≥ 150 minutes per week. Effect size for total PA was negligible (d=.03). Refer to Table 5 below for these results.

Table 4

Comparisons of Mean PA Scores from Baseline (T1) to Post-BAP (T2) (Minutes per Week)

	Pair	*M*	*SD*	*t*	*df*	*p*	*Cohen's d*
Mild PA							
	T1	110	83.26	-0.52	9	0.62	-0.21
	T2	129	98.03				
Moderate PA							
	T1	141	58.40	1.04	9	0.33	0.15
	T2	129	98.03				
Vigorous PA							
	T1	33	60.75	-1.5	9	0.17	-0.09
	T2	39	67.90				
MVPA							
	T1	87	36.60	0.77	9	0.46	0.24
	T2	75	60				
Total PA							
	T1	94	31.43	0.11	9	0.92	0.03
	T2	93	62.90				

MVPA= Moderate to vigorous physical activity
PA = Physical Activity

Discussion

The purpose of this thesis was to evaluate a pilot BAP (Reims, Gutnick, Davis, & Cole, 2014) intervention in individuals with pre-diabetes and T2DM following a community-based PA program. Guided by HAPA (Schwarzer, 2008), the study considered the effects of BAP on HAPA constructs including intentions, task SE, maintenance SE, recovery SE, planning SE, planning and action control, and PA. To our knowledge, this is the first study to examine the effects of a telephone-based BAP intervention in individuals with pre-diabetes and T2DM following a community-based PA program.

Changes in HAPA Constructs Following BAP

Results from the current study suggest that BAP may have had a positive impact on constructs of the HAPA model. Specifically, participants who engaged in BAP had significant increases in their maintenance SE and planning behaviours. Examination of effect sizes suggests that there were also medium-sized effects for differences in intentions to plan and action control, and small-sized effects for planning SE. All of these trends were in the hypothesized direction such that these variables appeared to be higher post BAP compared to baseline. It is possible that with a larger sample size, these small-medium effects may have been detected as significant changes.

The changes in maintenance SE and planning were in support of the first hypothesis. In a randomized controlled trial, maintenance SE as well as other HAPA constructs were shown to improve following a HAPA based intervention, which included education and action planning among individuals with coronary heart disease (Aliabad et al., 2014). Planning also increased significantly, suggesting that participants were actively engaging in the planning intervention. These results suggest that planning and maintenance SE may affect one another as showed in the

HAPA model illustration (Schwarzer, 2008). Planning can be used as a post-intentional tool to increase post-intentional SE that lead to and reinforce behaviour such as maintenance SE. An increase in maintenance SE may signify that BAP is a good self-management support technique, as it can aid in the improvement of post-intentional constructs that work to support behaviour maintenance.

The intervention may have also supported planning SE demonstrated through trends in improvements in this variable. Action planning has been positively associated with planning SE in individuals with chronic illnesses (Lorig, Laurent, Plant, Krishnan & Ritter, 2013). Planning SE is inherently supportive in using planning as a PA maintenance support technique. Furthermore, in support of hypothesis one, intention to plan had a moderate effect size towards improvement over the BAP period. BAP is designed to serve as a teaching method for supporting individuals to make their own plans. In the current study, the BAP intervention may have been successful in supporting participants' motivation to plan by enhancing intentions and SE for planning. Although intentions do not always lead to behaviour, they move individuals from the pre-intentional phase to the post-intentional phase where they can use volitional skills to support planning initiation and maintenance. In this study, planning initiation was facilitated by the BAP intervention. Since the BAP intervention was short term, intentions to plan are integral for future planning beyond the intervention. The motivation for and facilitation of planning is important, as planning can serve as a possible mediator of the intention-behaviour gap (Sneihotta, Scholz, & Schwarzer, 2004) and predictor of PA (Mistry, Sweet, Latimer-Cheung, & Rhodes, 2015).

Also in support of hypothesis one, there were trends towards improvements in action control following the BAP intervention. Action control is defined as the constant evaluation and regulation of a behaviour (Schwarzer, 2008), in this case, PA. The finding of improved action

control, and the increases in maintenance SE and planning suggest that BAP may have supported participants' self-regulatory abilities to manage their PA behaviour. Since self-regulation for PA is critical to the management of T2DM complications (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Silfee, Petosa, Laurent, Schaub, & Focht, 2016), BAP may provide a simple and feasible way to support PA self-regulation among people with T2DM. Together, these findings suggest that BAP may be useful in improving HAPA factors that influence behaviour maintenance. Self-regulation through BAP may be helpful to promote PA and give individuals who have pre-diabetes or T2DM a tool to help manage and mitigate the disease following a community-based PA program.

Intentions for PA were not hypothesized to increase following BAP, since they are formed prior to engagement in PA behaviour (Schwarzer, 2008). In the current study, participants had already been engaging in PA prior to the BAP intervention and thus it was assumed that intentions had been previously formed. Indeed, given that the participants were regularly engaging in PA through the community-based program before joining the BAP intervention, they were expected to be in the "actors" stage for PA with well-established intentions (Lippke, Zeigleman, & Schwarzer, 2004). Contrary to the hypothesis, intentions for PA showed medium-sized trends towards increases following BAP. It is possible that participants experienced a decrease in intentions at the conclusion of the community-based PA program, which may have been reflected in reduced T1 intention scores. For example, participants may have felt a reduction in motivation to engage in PA without a personal trainer or formal program. BAP targets SE (Gutnick et al., 2014), which is important in the formation of intentions (Schwarzer, 2008). Therefore, the BAP intervention may have supported participants' confidence to engage in PA, which in turn could have contributed to increased motivation reflected in higher intentions

at T2. This finding suggests that BAP may have a positive influence on pre- as well as post-intentional constructs of HAPA, thereby enhancing motivation and strengthening factors that support the maintenance of behaviour. These pilot results suggest that there is value in further research exploring the effectiveness and feasibility of BAP to support HAPA constructs.

Changes in PA Levels Following BAP

In support of hypothesis two, total PA levels were maintained from T1 to T2. There was no significant decrease in total PA and the effect size representing the magnitude of change was negligible. Overall, participants were doing the same number of minutes of total PA following BAP as they were at the conclusion of the community-based program (i.e., pre-BAP). In terms of MVPA, only one participant was engaging in 210 minutes of physical activity per week, more than the recommended 150 minutes set out in PA guidelines. Although BAP may be useful in supporting the maintenance of PA following a community-based program, other strategies may be valuable in support increased PA to meet the PA guidelines for optimal benefit. Programs that provide support for PA to individuals with chronic diseases could consider adding BAP to support participants in long-term maintenance and independent PA upon program completion (Artinian et al., 2010). In addition, strategies to further increase PA levels should be explored.

It is likely that BAP contributed to PA maintenance through support of the HAPA constructs that are posited to support behaviour maintenance. Specifically, BAP may have supported the increase in maintenance SE, action control and planning scores. Further research is necessary to explore a potential causal role of BAP in changing HAPA constructs and PA behaviour.

Despite a lack of significant or meaningful change in total PA, a small effect size was observed for changes in mild PA towards increasing, and MVPA showed trends towards decrease. The trend for mild PA suggests that minutes of mild PA may have increased over the

course of the BAP intervention. This finding was not surprising as it was observed that participants tended to plan for mild PA during the BAP sessions. One factor that may have affected mild PA participation was the patient-centered nature of BAP. BAP evokes a plan from the individual making the plan, which means that the participants led the formation of PA plans (Gutnick et al., 2014). The client-centered nature of BAP may be a strength from a motivational perspective, however, it can also be seen as a draw-back when clients do not want to meet the recommended guidelines for MVPA. Since most clients planned for more mild activities such as walking and yoga, this could have contributed to the decrease in MVPA and low rate of individuals meeting the recommended guidelines. Furthermore, 80% of the sample was above the age of 48, and studies show that PA participation rates tend to decline very steeply with age (Stephens, Jacobs, & White, 1985).

PA maintenance has shown to be particularly difficult for people with T2DM (van der Heijden, Pouwer, Romeijnders, & Pop, 2012). Maintenance of PA can also be very challenging for individuals exiting a structured and supported PA program (Artinian et al., 2010). However, it is challenging to sustain supervised PA programs for individuals and therefore there is value in developing strategies to support independent PA maintenance. The development of intentions alone may not facilitate behaviour change and maintenance (Schwarzer, 2008), however, action planning can be used to trigger post-intentional factors supporting behaviours. An action plan to complete an act is a better predictor of behaviour than intention (Gollwitzer & Sheeran, 2006). Setting goals, making plans and specifying intentions around them could be a way to reduce the intention-behaviour gap that exists (Norman & Conner, 2005). BAP was developed by the CCMI to support self-management among individuals with chronic diseases such as T2DM (Gutnick et al., 2014). Results from this study align with the tenets of HAPA that suggest using action

planning, or BAP, as a self-regulatory skill can support SE to facilitate PA behaviour maintenance (Schwarzer, 2008). Based on these results, BAP has been supported as a self-management technique targeting SE to elicit behaviour change and maintenance. These preliminary findings support subsequent research with larger samples sizes to further understand the effects BAP on PA maintenance and the potential role of post-intentional factors identified in the HAPA.

Acceptability and Delivery of BAP

In this study, BAP was delivered through telephone calls which lasted 3-10 minutes per call. Participants scheduled a weekly day and time to make calls so that they did not miss any sessions. In most cases, participants answered calls, and called back when they were unavailable to take the call at the scheduled time. Although participants engaged in most or all of their available calls (four calls in total per participant), it was unclear whether or not they accepted the process. Each time, the same questions were asked by following the BAP script. However, often with older participants frustration was expressed about these repetitive questions, especially when the answer would be the same for every week. Therefore, participants acceptability of BAP was not always high. Furthermore, it was unclear whether or not participants understood what they were doing. For most sessions, BAP counselors had to re-explain that they were going to make a plan together, and what this plan would look like. BAP counselors suggested that there may be a need for more education around BAP prior to entry into an intervention. Moreover, BAP counselors expressed that due to participants' confusion, it was difficult to elaborate on the BAP purpose and process. Therefore, counselors suggested in-person BAP sessions could have been valuable in enhancing effectiveness of the approach.

Although the BAP process itself may have been confusing for some participants, anecdotal evidence suggests that many individuals valued BAP as a tool to support their PA maintenance. For example, one participant expressed that BAP helped her keep track of her weekly PA schedule, and reach her desired goals. Furthermore, following the 4-week BAP intervention, another participant reported test results for pre-diabetes being negative, and noted that BAP had helped her plan her PA without a personal trainer. Although subjective, these are valuable testimonies as to how BAP may practically influence individuals in the real world.

The BAP intervention was relatively short (i.e., 4 weeks) and low intensity (i.e., one call per week). The results from this study show that BAP may have had some positive outcomes despite the relatively short and low intensity intervention delivery. One might speculate that if the intervention were longer, it may have had lasting effects on the maintenance of PA, as clients would have learned to plan on their own. However, if it were shorter, it is unknown whether or not it would have had the effect it had in this study on the HAPA constructs and PA variables. Thus, behavioural interventions that aim to change and maintain PA behaviours may not need to exceed 4 weeks before having a positive impact.

Who Might Benefit From BAP

Results from this study suggest that further research is necessary regarding for whom BAP may be most beneficial. BAP may benefit some individuals more than others. For example, comparisons were made between dropouts (i.e., those who did not complete the 4-week BAP intervention) and BAPers (i.e, those who completed the 4-week BAP intervention). At baseline, dropouts were significantly more engaged in planning behaviours compared to the BAPers. Examination of effect sizes suggests that this may not be the only difference between the two groups. The difference between dropouts and BAPers in intentions to plan was non-significant

but of a large effect size, with dropouts having higher intentions to plan than BAPers. Similarly, there were medium-sized trends towards higher scores for dropouts in planning SE. Differences in planning-related variables suggest different stages of *planning* behaviour based on the HAPA model. Groups in different stages of behaviour may benefit more or less from various types of interventions. If planning is viewed as a behaviour itself (i.e., rather than a predictor of PA), then individuals may be anywhere along the continuum of the behaviour change stages (pre-intenders, intenders and actors) for planning. It seems as though dropouts had trends towards higher scores for planning-related variables (i.e., intention to plan, and planning SE) suggesting many drop-outs were actually in the "actors" stage of planning prior to entering the BAP intervention. Thus, they may have been more likely to drop out due to their autonomy and competence (Williams et al., 2006) in planning, which made them more comfortable planning alone. Consistent with the findings of higher intentions to plan and planning SE scores, the autonomy of these individuals suggests that they were also more motivated to plan than BAPers upon entering the intervention. Therefore, the dropouts may have determined that the BAP was intervention unnecessary. Furthermore, they may have dropped out from BAP because they decided it was not useful to them if they discontinued PA.

Interestingly, a large effect size was found for task SE (one's confidence in their ability to perform a task), with BAPers having higher baseline SE compared to drop outs. This could suggest that throughout the 3-month PA program, the BAPers may have gained confidence in their ability to engage in regular PA compared to dropouts. Task SE is a strong predictor of intention (Schwarzer, 2008), suggesting that BAPers may have been more motivated than dropouts to continue being physically active following the Glucofit program. Motivation for physical activity, and lower planning behaviours and planning related variables in the BAPers

group may have acted as a driving force for them to engage in the BAP intervention. Interventions like BAP are only beneficial if they are filling a gap to enable-participants to succeed in changing or maintaining the targeted behaviour.

Moreover, small effect sizes showed that dropouts may have had higher scores for maintenance and recovery SE, outcome expectancies, and action control. These effect sizes suggest that had the sample size been larger, there may have been significant differences between the two groups. Dropouts seemed to have important skills such as maintenance, recovery and planning SE, and action control to support their independent PA behaviours. Having these skills may have caused dropouts to feel confident about engaging in PA independently following Glucofit and therefore perceive BAP to be unhelpful. BAPers may have needed to develop or strengthen these skills in order to manage on their own. Therefore, BAP may only be beneficial for a certain group of individuals who need support in improving their post-intentional SE and action control constructs. When creating interventions to support PA it is important to examine each individual's stage of behaviour change (Lippke, Zeigelmann, & Schwarzer, 2004) according to the HAPA model with regards to the target behaviour (PA) and the intervention behaviour itself (planning), so that the intervention may be beneficial for the individual.

This pilot study targeted a small sample of individuals who had just completed a community-based PA program. They had 3 months of supported and supervised PA, and had access to the gym facility until the end of December 2017. Together, these factors could have made PA easier for this group of individuals compared to when they entered the program. BAP, then, may have be particularly helpful for people exiting a supervised program, as it may have

acted as an additional form of support that they could use if they needed something extra to support their maintenance.

Limitations and Future Research Directions

The aim of this study was to explore and evaluate BAP to support HAPA constructs and PA maintenance among individuals with T2DM and pre-diabetes when exiting a community-based PA program. There are some important limitations that warrant consideration in interpreting the results. First, although the study was a pilot project, the small sample size presented a challenge. Dropouts from the PA program and from BAP intervention resulted in a smaller than anticipated sample which limited the power to detect significant effects. Effect sizes were calculated to examine the magnitude of changes that were not detected as significant, possibly due to limited power. However, caution must be used when interpreting these results, due to the low power caused by the small sample size. Further research among larger samples is necessary.

Second, there was no control group in this study. The inclusion of a control group would increase confidence that changes were the direct result of the BAP intervention. Third, a Bonferroni adjustment was not done for t-tests because this would further limit the ability to detect significant findings. A Bonferroni adjustment would have reduced the chances of having a type 1 error. Fourth, there was a sampling bias considering all individuals were people who were already involved in a community-based physical activity program. It is possible that BAP may have had different effects on other individuals who are not part of a community-based program and are working towards PA maintenance. Fifth, there was no follow-up to observe long-term PA maintenance. Exploring long-term maintenance could have given more insight as to how a short-term BAP intervention may affect PA maintenance in individuals exiting a supervised

program. Thus, results from this study must be interpreted with caution and consideration of these limitations.

Future research should use a randomized controlled trial to further explore the effects of BAP on HAPA constructs and PA maintenance. Furthermore, researchers should explore for whom BAP is useful, and consider participants in various HAPA stages for planning behaviour itself. For example, those in the post-intentional stage for planning as a behaviour may benefit less from a planning intervention compared to those in the pre-intentional stage according to the HAPA model. Future research should also aim to understand how to reach individuals who are sedentary and/or are not exiting a supervised PA program. It is unknown whether or not these individuals will benefit from an intervention such as BAP to initiate and maintain PA behaviours. Finally, future studies may benefit from having a long-term follow-up measure to understand the longer-term effects of BAP on PA maintenance.

Conclusions

This thesis was the first known study to evaluate a pilot BAP program in individuals with T2DM and pre-diabetes to maintain PA following a community-based PA program. Results showed that many post-intentional constructs of HAPA improved significantly or showed trends towards improvement following the BAP intervention. Overall, BAP targeted and improved SE scores, which are thought to support the maintenance of PA according to the HAPA. Furthermore, it was found that total PA was maintained, while mild activity levels showed trends towards improvement, and MVPA showed trends towards decreases. BAP may present a relatively simple and feasible approach to support individuals with or at risk for chronic diseases such as T2DM to self-manage and regulate PA. Further research is warranted using larger samples and controlled study designs to further understand the effects of BAP on HAPA constructs and PA.

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Appendices

Appendix A

Glucofit Program Description

The GlucoFit Project is a comprehensive, individualized and innovative approach to the management of type 2 diabetes and pre-diabetes through exercise and behavior change. The project targets adults who are of a lower socioeconomic status and ethnic background living in the North York community. The project is delivered in partnership with the Canadian Diabetes Association and York University's Campus Recreation Department. All program activities will take place at the Tait McKenzie Centre at York University's Keele Campus. All program participants will receive an initial and post-program assessment. They will receive 3-months of supervised workouts which will be delivered by the student fitness staff of York University's Campus Recreation team. In addition to the supervised exercise sessions participants, will also receive motivational interviewing and behavior change counseling from certified action planning counselors. Once participants exit the program they will have a year membership to the Tait McKenzie Fitness Centre. Each participant will receive a Tractivity Sensor, which is a wearable technology device that monitors participant activity levels. These devices will help encourage and support an active and healthy lifestyle. They will serve as a motivational tool and opportunity to engage with other participants through friendly competitions set up by York University Campus Recreation staff. This technology offers a sustainable approach to positive behavior change as participants will remain engaged post-program completion through Tractivity's user-friendly website.

This project offers educational services for type 2 diabetes and addresses clinical issues related to the disease. The GlucoFit Project differentiates itself from other existing projects by its comprehensive and individualized approach to managing type 2 diabetes and pre-diabetes through exercise and behaviour change. Each GlucoFit Project participant will receive the following:

Initial, Progression and Final Assessment (body composition and girth measurements)

3-months of Personal Training (2 sessions per week)

- Body weight or light weighted resistance training
- Light but challenging aerobic exercise
- Exercises will be full body or muscle isolation exercises

Tractivity Sensor (wearable technology device)

Nutrition Assessment: one- hour consultation over Skype or phone is an option in case they are unable to meet in person

Brief Action Planning:

- 3-10 minute phone sessions per week

- A structured way of interacting with individuals interested in making a concrete action plan for some aspect of their health.
- Structured around 3 main questions:
    - **Question 1 elicits ideas for change:** "Is there anything you would like to do for your health in the next week or two?"
        - When? Where? How often/long/much? When would you like to start?
    - **Question 2 evaluates confidence:** "I wonder how confident you feel about carrying out your plan. Considering a scale of 0 to 10, where '0' means you are not at all confident or sure and '10' means you are very confident or very sure, how confident are you about completing your plan?"
    - **Question 3 arranges follow-up or accountability:** "Would it be useful to set up a check on how it is going with your plan?"

Appendix B

Questionnaires

T1 Questionnaire

SECTION A: DEMOGRAPHICS

What is your gender? Male Female Transgender Prefer not to Answer

What is your age? _____ years

What is your occupation? _____

If you are a student,
what year are you in? _____

What program are you in? _____

SECTION B: PHYSICAL ACTIVITY MEASURE (GODIN LTPA QUESTIONNAIRE)

For this next section, we would like you to recall your average weekly physical activity (PA) done during a typical week during the past three months. When answering these questions please:

- Consider your average weekly physical activity.
- Note that the main difference between the three categories is the intensity of the activity.

a) VIGOROUS EXERCISE (your heart beats rapidly):

(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, skating)

Average number of 30-minute bouts per week: _____

b) MODERATE EXERCISE (not exhausting):
(e.g., fast walking, weight-training, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, dancing)

Average number of 30-minute bouts per week: _____

c) MILD EXERCISE (minimal effort):
(e.g., yoga, archery, fishing, bowling, horseshoes, golf, snowmobiling, easy walking)

Average number of 30-minute bouts per week: _____

SECTION C: INTENTIONS

This next section involves your intention to participate in regular physical activity. For the purpose of this questionnaire we are defining regular physical activity as any physical activity you are doing with purpose for exercise (e.g., going to the gym, going for a walk or riding a bicycle).

To what extent is the following statement true for you: I will try to do 150 minutes of moderate to heavy physical activity per week over the next month.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement true: I intend to do 30 minutes of moderate to heavy physical activity at least 2 days per week over the next month.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement true for you: I will try to do 30 minutes of physical activity at least 2 days per week over the next month.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement likely: I intend to do at least 150 minutes of physical activity per week over the next month.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement true: I intend to make a plan for physical activity once a week over the next month

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

SECTION D: SELF-EFFICACY MEASURES

Now we are going to ask you some questions about your confidence to participate in Regular Physical Activity under various conditions. Regular Physical Activity means at least 150 minutes of moderate to heavy intensity per week.
For these questions, please rate your confidence on a scale of 1-7 where:

1 = not at all confident 4 = moderately confident 7 = completely confident

SECTION D1: TASK SELF-EFFICACY

Over the next month, assuming that you were very motivated and had all the resource you need, how confident are you that you could physically do the following amounts of moderate intensity aerobic activity (bicycling, running, walking, swimming, jogging) without stopping:

	Not at all Confident			Moderately Confident			Completely Confident
	1	2	3	4	5	6	7
(a) 10 minutes	☐	☐	☐	☐	☐	☐	☐
(b) 20 minutes	☐	☐	☐	☐	☐	☐	☐
(c) 30 minutes	☐	☐	☐	☐	☐	☐	☐

Assuming that you were very motivated, over the next month, how confident are you that you can fit 30 min of moderate-heavy PA into your weekly schedule:

	Not at all Confident			Moderately Confident			Completely Confident
	1	2	3	4	5	6	7
(a) Once per week	☐	☐	☐	☐	☐	☐	☐
(d) Twice per week	☐	☐	☐	☐	☐	☐	☐
(e) Three times per week	☐	☐	☐	☐	☐	☐	☐
(f) More than three times per week	☐	☐	☐	☐	☐	☐	☐

Over the next month, assuming you were very motivated and had all the resources you need, such as specialized equipment or an assistant, how confident are you that you could physically do the following amounts of strength training (e.g. bench press, squats, bicep curls, push ups) activity without stopping:

	Not at all Confident			Moderately Confident			Completely Confident
	1	2	3	4	5	6	7
(a) One day per week	☐	☐	☐	☐	☐	☐	☐
(g) Two days per week	☐	☐	☐	☐	☐	☐	☐
(h) Three days per week	☐	☐	☐	☐	☐	☐	☐

SECTION D2: MAINTENANCE SELF-EFFICACY

Assuming you were very motivated, how <u>confident</u> are you that you will participate in regular PA every week over the next 3 months even when:

	Not at all Confident	Extremely Confident

	1	2	3	4	5
(a) you feel tired or fatigued	☐	☐	☐	☐	☐
(b) you get busy or have limited time	☐	☐	☐	☐	☐
(c) you have transportation problems	☐	☐	☐	☐	☐
(d) you have pain or soreness	☐	☐	☐	☐	☐
(e) the weather is very bad	☐	☐	☐	☐	☐
(f) you are doing it by yourself	☐	☐	☐	☐	☐
(g) you are in a bad mood/ feeling depressed	☐	☐	☐	☐	☐
(h) it becomes boring	☐	☐	☐	☐	☐
(i) you have to get up early even on weekends	☐	☐	☐	☐	☐
(j) you have diabetes-related complications	☐	☐	☐	☐	☐
(k) you become a little ill	☐	☐	☐	☐	☐
(l) you have to find different activities due to diabetes complications	☐	☐	☐	☐	☐
(m) you have to let others know that you have diabetes	☐	☐	☐	☐	☐

SECTION D3: RECOVERY AND PLANNING SELF-EFFICACY

Over the next month, how confident are you that you can:

	Not at all Confident 1	2	3	Moderately Confident 4	5	6	Completely Confident 7
(a) Anticipate problems that might interfere with your physical activity schedule.	☐	☐	☐	☐	☐	☐	☐
(b) Develop solutions to cope with potential barriers that can interfere with your physical acitivity.	☐	☐	☐	☐	☐	☐	☐
(c) Resume regular physical activity when it's interrupted and you miss physical activity for a few <u>days</u>.	☐	☐	☐	☐	☐	☐	☐
(d) Resume regular physical activity when it's interrupted and you miss physical activity for a few <u>weeks</u>.	☐	☐	☐	☐	☐	☐	☐
(e) Identify key factors that trigger lapses in your physical activity program.	☐	☐	☐	☐	☐	☐	☐
(f) Accept lapses in your physical activity normal.	☐	☐	☐	☐	☐	☐	☐ **program as**
(g) View lapses in your physical activity challenges to overcome rather than	☐	☐	☐	☐	☐	☐	☐ **program as failures.**
(h) Set realistic goals for increasing your activity.	☐	☐	☐	☐	☐	☐	☐ **physical**
(i) Develop plans to reach your activity goals.	☐	☐	☐	☐	☐	☐	☐ **physical**

SECTION E: RISK PERCEPTIONS

This next section involves your health status and likelihood to develop diabetes and/or obesity in the future. Answer the questions based on what what you believe is true.

(a) My chances of developing diabetes in the future are

Not Strong	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very Strong

(b) I am unlikely to develop diabetes in the future

Strongly Agree	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Strongly Disagree

(c) My chances of becoming obese in the future are

Not Strong	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very Strong

(d) I am unlikely to become obese in the future

Strongly Agree	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Strongly Disagree

SECTION F: OUTCOME EXPECTANCIES

"To what do you agree with the following statements?"

Participating in regular physical activity over the next month will:

	Strongly Agree 1	2	3	4	Strongly Disagree 5
(a) reduce tension or help manage stress	☐	☐	☐	☐	☐
(b) make me feel more confident about my health	☐	☐	☐	☐	☐
(c) help me sleep better	☐	☐	☐	☐	☐
(d) give me a more positive outlook	☐	☐	☐	☐	☐
(e) help control weight	☐	☐	☐	☐	☐
(f) decrease the chances of having diabetes complications	☐	☐	☐	☐	☐
(g) help control glucose levels	☐	☐	☐	☐	☐

SECTION G: PLANNING AND ACTION CONTROL

"To what extent are the following statements true for you?"

(a) I have made a detailed plan regarding <u>when</u> to participate in physical activity

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(b) I have made a detailed plan regarding <u>where</u> to participate in physical activity

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(c) I have made a detailed plan regarding <u>what types of</u> physical activity <u>to do</u>

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(d) I have made a detailed plan regarding <u>how often</u> to participate in physical activity

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(e) I constantly monitor whether I engage in physical activity often enough

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(a) (f) I am careful to ensure that I am active for at least 30 minutes at a moderate to heavy intensity, each time I engage in physical activity

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(g) My physical activity program is often on my mind

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(h) I am constantly aware of my physical activity program

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(a) (i) I really try to engage in regular physical activity (150 min per week)

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(j) I try my best to meet my own standards for being physically active

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely

False 1 2 3 4 5 6 7 True

Thank you for completing this survey! ☺

T2 Questionnaire

Date:_____

Participant ID Code:_____

SECTION A:

For this section, we would like you to recall your average weekly physical activity (PA) done during a typical week during the past month. When answering these questions please:

- Consider your average weekly physical activity.
- Note that the main difference between the three categories is the intensity of the activity.

a) VIGOROUS EXERCISE (your heart beats rapidly):

(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, skating)

Average number of 30-minute bouts per week: _____

b) MODERATE EXERCISE (not exhausting):
(e.g., fast walking, weight-training, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, dancing)

Average number of 30-minute bouts per week: _____

c) MILD EXERCISE (minimal effort):
(e.g., yoga, archery, fishing, bowling, horseshoes, golf, snowmobiling, easy walking)

Average number of 30-minute bouts per week: _____

This next section involves your intention to participate in regular physical activity. For the purpose of this questionnaire we are defining regular physical activity as any physical activity

you are doing with purpose for exercise (e.g., going to the gym, going for a walk or riding a bicycle).

To what extent is the following statement true for you: I will try to do 150 minutes of moderate to heavy physical activity per week over the next three months.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement true: I intend to do 30 minutes of moderate to heavy physical activity at least 2 days per week over the next three months.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement true for you: I will try to do 30 minutes of physical activity at least 2 days per week over the next three months.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement likely: I intend to do at least 150 minutes of physical activity per week over the next three months.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

To what extent is the following statement true: I intend to make a plan for physical activity once a week over the next three months.

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

Now we are going to ask you some questions about your confidence to participate in Regular Physical Activity under various conditions. Regular Physical Activity means at least 150 minutes of moderate to heavy intensity per week.
For these questions, please rate your confidence on a scale of 1-7 where:

1 = not at all confident 4 = moderately confident 7 = completely confident

Over the next month, assuming that you were very motivated and had all the resource you need, how confident are you that you could physically do the following amounts of

moderate intensity aerobic activity (bicycling, running, walking, swimming, jogging) without stopping:

	Not at all Confident					Moderately Confident	Completely Confident
	1	2	3	4	5	6	7
(a) 10 minutes	☐	☐	☐	☐	☐	☐	☐
(i) 20 minutes	☐	☐	☐	☐	☐	☐	☐
(j) 30 minutes	☐	☐	☐	☐	☐	☐	☐

Over the next three months, assuming you were very motivated and had all the resources you need, such as specialized equipment or an assistant, how confident are you that you could physically do the following amounts of strength training (e.g. bench press, squats, bicep curls, push ups) activity without stopping:

	Not at all Confident					Moderately Confident	Completely Confident
	1	2	3	4	5	6	7
(a) One day per week	☐	☐	☐	☐	☐	☐	☐
(k) Two days per week	☐	☐	☐	☐	☐	☐	☐
(l) Three days per week	☐	☐	☐	☐	☐	☐	☐

Assuming that you were very motivated, over the next three months, how confident are you that you can fit 30 min of moderate-heavy PA into your weekly schedule:

	Not at all Confident					Moderately Confident	Completely Confident
	1	2	3	4	5	6	7
(a) Once per week	☐	☐	☐	☐	☐	☐	☐
(m)Twice per week	☐	☐	☐	☐	☐	☐	☐
(n) Three times per week	☐	☐	☐	☐	☐	☐	☐
(o) More than three times per week	☐	☐	☐	☐	☐	☐	☐

Assuming you were very motivated, how <u>confident</u> are you that you will participate in regular PA every week over the next three months even when:

	Not at all Confident				Extremely Confident
	1	2	3	4	5
(a) you feel tired or fatigued	☐	☐	☐	☐	☐
(b) you get busy or have limited time	☐	☐	☐	☐	☐
(c) you have transportation problems	☐	☐	☐	☐	☐
(d) you have pain or soreness	☐	☐	☐	☐	☐
(e) the weather is very bad	☐	☐	☐	☐	☐
(f) you are doing it by yourself	☐	☐	☐	☐	☐

(g) you are in a bad mood/ feeling depressed	☐	☐	☐	☐	☐
(h) it becomes boring	☐	☐	☐	☐	☐
(i) you have to get up early even on weekends	☐	☐	☐	☐	☐
(j) you have diabetes-related complications	☐	☐	☐	☐	☐
(k) you become a little ill	☐	☐	☐	☐	☐
(l) you have to find different activities due to diabetes complications	☐	☐	☐	☐	☐
(m) you have to let others know that you have diabetes	☐	☐	☐	☐	☐

Over the next three months, how confident are you that you can:

	Not at all Confident 1	2	3	4	5	6	Completely Confident 7
(a) Anticipate problems that might interfere with your physical activity schedule.	☐	☐	☐	☐	☐	☐	☐
(b) Develop solutions to cope with potential barriers that can interfere with your PA	☐	☐	☐	☐	☐	☐	☐
(c) Resume regular physical activity when it's interrupted and you miss exercising for a few <u>days</u>.	☐	☐	☐	☐	☐	☐	☐
(d) Resume regular physical activity when it's interrupted and you miss exercising for a few <u>weeks</u>.	☐	☐	☐	☐	☐	☐	☐
(e) Identify key factors that trigger lapses in your physical activity program.	☐	☐	☐	☐	☐	☐	☐
(f) Accept lapses in your physical activity program as normal.	☐	☐	☐	☐	☐	☐	☐
(g) View lapses in your physical activity program as challenges to overcome rather than failures.	☐	☐	☐	☐	☐	☐	☐
(h) Set realistic goals for increasing your exercise.	☐	☐	☐	☐	☐	☐	☐
(i) Develop plans to reach your exercise goals.	☐	☐	☐	☐	☐	☐	☐

This next section involves your health status and likelihood to develop diabetes and/or obesity in the future. Answer the questions based on what you believe is true.

(e) My chances of developing diabetes in the future are

Not Strong	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very Strong

(f) I am unlikely to develop diabetes in the future

Strongly	☐	☐	☐	☐	☐	☐	☐	Strongly

Agree	1	2	3	4	5	6	7	Disagree

(g) My chances of becoming obese in the future are

Not	☐	☐	☐	☐	☐	☐	☐	Very
Strong	1	2	3	4	5	6	7	Strong

(h) I am unlikely to become obese in the future

Strongly	☐	☐	☐	☐	☐	☐	☐	Strongly
Agree	1	2	3	4	5	6	7	Disagree

"To what do you agree with the following statements?"

Participating in regular PA over the next three months will:

	Strongly Agree 1	2	3	4	Strongly Disagree 5
(a) reduce tension or help manage stress	☐	☐	☐	☐	☐
(b) make me feel more confident about my health	☐	☐	☐	☐	☐
(c) help me sleep better	☐	☐	☐	☐	☐
(d) give me a more positive outlook	☐	☐	☐	☐	☐
(e) help control weight	☐	☐	☐	☐	☐
(f) decrease the chances of having diabetes complications	☐	☐	☐	☐	☐
(g) help control glucose levels	☐	☐	☐	☐	☐

"To what extent are the following statements true for you?"

(a) I have made a detailed plan regarding <u>when</u> to participate in PA

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(b) I have made a detailed plan regarding <u>where</u> to participate in PA

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(c) I have made a detailed plan regarding <u>what types of PA to do</u>

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(d) I have made a detailed plan regarding <u>how often</u> to participate in PA

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(e) I constantly monitor whether I engage in PA often enough

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(f) I am careful to ensure that I am active for at least 30 minutes at a moderate to heavy intensity, each time I engage in PA

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(g) My physical activity program is often on my mind

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(h) I am constantly aware of my physical activity program

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(i) I really try to engage in regular PA (150 min per week)

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

(j) I try my best to meet my own standards for being physically active

Definitely	☐	☐	☐	☐	☐	☐	☐	Definitely
False	1	2	3	4	5	6	7	True

Thank you for completing this survey! ☺

Appendix C

Consent Form

Date: August 10, 2016

Study Name: Glucofit: An evaluation of a community-based exercise program for individuals at risk for type two diabetes.

Purpose of the Research: We would like to evaluate your experience with the Glucofit program based out of York University. We are interested in your thoughts and feelings regarding physical activity, as well as changes in behaviour or fitness that you may experience.

What You Will Be Asked to Do in the Research Project: We would like to evaluate your experience with the program by having you complete a series of questionnaires. Specifically, we would like you to complete four questionnaires: 1) before you begin the Glucofit program, 2) at the end of the three-month program at Tait McKenzie Fitness Centre, 3) at the end of the one month telephone counseling, and 4) three months after the telephone counseling is complete. With your permission, the telephone counseling sessions will be listened to by a second counselor on the line. The first two questionnaires can be done in person when you are visiting the Tait McKenzie centre. The second two questionnaires can be completed online or over the telephone.

As part of the Glucofit program, you will receive a Tractivity Sensor, which is a wearable device that monitors physical activity levels. We will collect the data from the Tractivity sensor to use for research purposes.

Personal trainers will also take measures of body composition throughout the program. This includes measuring things like your weight and waist circumference. With your permission, we will have access to these data for research purposes.

Risks and Discomforts: We do not foresee any risks or discomfort from your participation in the research.

Benefits of the Research and Benefits to You: There are no known benefits to your participation in the research project.

Voluntary Participation: Your participation in the research study is completely voluntary. You do not have to participate in the research project to continue participating in the Glucofit program. If you decide to participate in the research project and change your mind then you may stop participating at any time. Your decision will not influence the nature of your relationship with York University or the other research institutions either now, or in the future.

Withdrawal from the Study: You can stop participating in the study at any time, for any reason. You may also refuse to answer any questions that you do not wish to answer. Your decision to stop participating, or to refuse to answer questions, will not affect your relationship with the researchers, York University, or any other group associated with this project. In the event you withdraw from the study, all data collected by the researchers will be immediately destroyed wherever possible.

Confidentiality: All information you supply during the research will be held in confidence. Your name will not appear in any report or publication of the research. All data will be transcribed using ID numbers that will be assigned to each participant. The activity and body composition data received from the Glucofit program will not include your name or any identifiers. Hard copy data will be stored in a locked filing cabinet in Dr. Bassett-Gunter's research lab. All electronic data will be safely stored on a password protected computer, which will be locked in Dr.

Bassett-Gunter's research lab. The data will be stored for a period of approximately seven years after data publication and will then be destroyed. Confidentiality will be provided to the fullest extent possible by law.

Legal Rights and Signatures: I_____, consent to my participation in the research project "Glucofit: An evaluation of a community-based exercise program for individuals at risk for type two diabetes." conducted by *Dr. Rebecca Bassett-Gunter*. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Signature_____ **Date**_____
Participant

Signature_____ **Date**_____
Principal Investigator

Appendix D

Brief Action Planning Script

Question 1:

- "Is there anything you would like to do to help you exercise in the next week?"
- "Is there something you would like to do to be more physically active in the next week?"
- "Are there any physical activities you would like to do to help manage your diabetes/risk of diabetes in the next week?"

Response:

"many people find it helpful to get more specific about their plan, is that ok with you?"

1. Have an idea → SMART Behaviour Plan
    a. Ask what, when, where, how much, etc.
    b. Make sure the plan is very specific, ask if they know the how's where's and when's of the plan
    c. Respect the clients plan

2. Not sure → Behavioural Menu.
    a. Ask permission to share ideas
        i. "Is it ok if I share some ideas from others who are working on something similar?"
    b. If yes, hare **2-3** ideas
    c. Ask if one of these ideas or one of their own might work.
        i. "Maybe one of these would be of interest to you or maybe you have thought of something while we have been talking?"
        ii. If yes, proceed to SMART Behaviour Plan

Ideas: Use ideas from GlucoFit LiveWell Programming Manual, walk, jog, run

3. Not at this time → Ask "Ok, may I ask why you would not like to do anything?"
    a. Ask for permission to check in next week/book another appointment (Question 3)

Elicit a Commitment Statement: "Just so I'm clear about your plan, can you repeat it to me?"

Question 2: "How confident or sure do you feel about carrying out your plan on a scale of 0-10?"

Response:

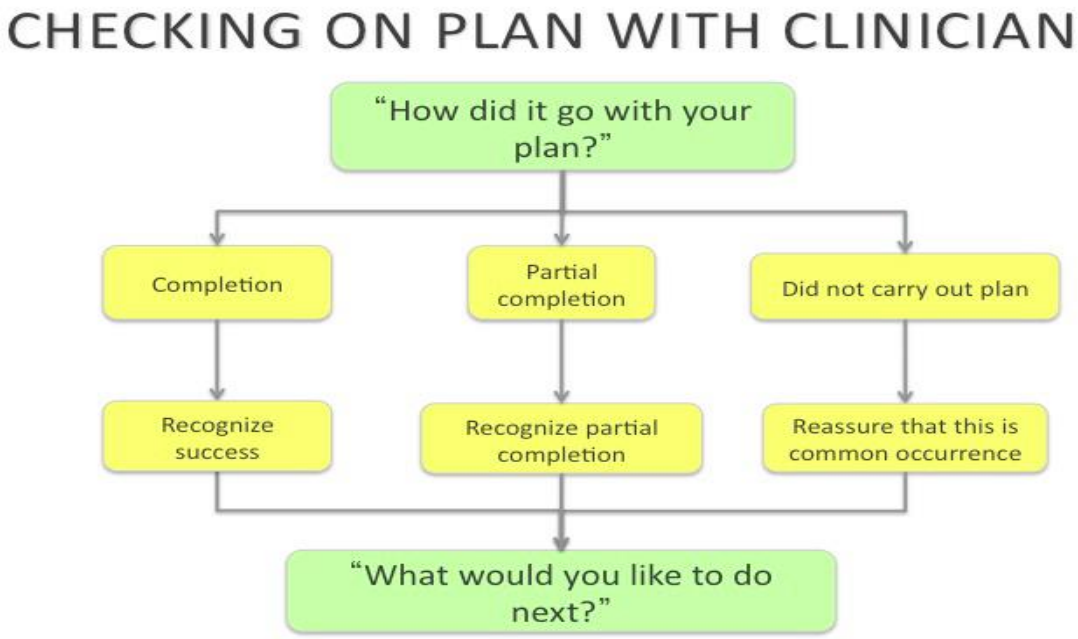
1. Confidence >/= 7 → Encourage/Praise and proceed to question three
2. Confidence < 7 → Problem Solving
    a. Reassure the client that the number mentioned is better than 0
    b. "We know people are more likely to complete a plan if it's 7 or higher"
    c. Ask "Any ideas about what might raise your confidence?"
    d. Ask "How can you modify your plan to raise your confidence?"
    e. Re-elicit commitment statement

f. Ask again about confidence
    i. If =/>7 proceed to question → 3

Question 3: "Would it be helpful to set up a check with myself or someone else next week on how things are going with your plan? Would that work for you?"

- If Yes → How? When? With Who?
- They can do this with you, family member, or friend
- If they are not checking in with **you**, ask if they would like to schedule another session with you
- **If response is no**, ask "just out of curiosity, may I ask why you don't think it would be helpful?" → record reasons

Check on Progress:



→ Recycle into next BAP session

Appendix E

Checking on My Plan Sheet

CHECKING ON MY PLAN

21 March 2016

Your plan may go perfectly or it may not, which is normal when people try new things.

My plan is: (Example: Go a 30 minute walk on Monday, Wednesday and Friday at 9 am)

_____

My goal is: (Example: Be a good example for my kids)

_____

Choose how to check in. Use the questions on the other side as a guide:

a. **Do-it-yourself check-in:**
Make an appointment with yourself to look at how it went

b. **Check-in with someone else:**
You can check in with someone else. They can:
- help you find new ideas
- just listen or offer support
- not give advice
- let **you** decide what will work for you

A check-in helps you learn what worked, what didn't and what you want to do next!

My plan to check-in:

To support myself to complete and learn from my plan I will check in with:

- Myself. I will sit down on the _____ at_____ and _____.
- Someone else. We will check in by _____ (phone, text, in person.) on the _____ at _____.

It's about learning:

Your plan may go perfectly or not, there will still be things to learn.
You may learn:

- What you like and what you don't
- What makes sense for you and what does not!

Check-in Question Guide

Remember, checking on the plan isn't about finding success or failure, its about learning. You didn't fail if you learned something! If your plan went well, celebrate!

The Question	My Experience
How did it go with your plan?	
What did you learn? - what makes a plan work for you - how to make a plan - times of day that work or don't - something you like or don't like - something else	
What do you want to do next? - make a new plan - keep this one - change this one - take a break - do anything else you want	**Next I want to:**
If you are going to make another plan write it here! **My new plan:** What? When? How Much? How Far? How Long? Start Date?	
- How sure are you that you can complete your plan? - What would make you more confident? - Re-write your plan if needed	

Appendix F

Brief Action Planning Certificate

Appendix G

Abbreviations

1. BAP: Brief Action Planning
2. BAPers: Particpants who Completed BAP Intervention
3. BMI: Body Mass Index
4. CCMI: Centre for Collaboration, Motivation and Innovation
5. HAPA: Health Action Process Approach
6. HbA1c: Glycated Hemoglobin
7. LTPA: Leisure Time Physical Activity
8. MVPA: Moderate to Vigorous Physical Activity
9. PA: Physical Activity
10. T1: Time Point 1 (baseline)
11. T2: Time Point 2 (post-BAP)
12. T2DM: Type 2 Diabetes Mellitus