TEXT2PLAN: TESTING THE EFFECTIVENESS OF TAILORED TEXT MESSAGES FOR PROMOTING PLANNING FOR PHYSICAL ACTIVITY

by

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Abstract

Text messages can encourage people to carry out their plans, but it is unknown if text messages can encourage people to *form* plans. The primary objective of our study was to determine whether text messages could promote physical activity plan formation. We determined if text messages about planning increased planning more than text messages about physical activity. We examined whether messages tailored to suit the individual message recipient were especially effective in encouraging planning. Furthermore, we determined if planning was maintained over time. The secondary objective of the study was to determine whether text messages about planning could promote physical activity and strengthen the physical activity intention-behaviour relationship. Participants were inactive adults (*n* = 239, *M* age = 30.7 ± 4.8 yrs) with access to email and text messaging. Participants received generic messages about physical activity, generic messages about planning, or tailored messages about planning. Each week for two months, participants were emailed a tool to plan their physical activity. Whether participants used this tool was assessed at baseline (T0), after one month of receiving text messages (T1) and after an additional month without text messages (T2). There were no differences in planning between groups that received messages about planning or physical activity at T1 or T2, *p*s > .05. More participants who received tailored text messages about planning made at least one plan by T1 than participants who received generic messages about planning, $\chi^2(1) = 3.889, p < .05$. This difference did not persist at T2, *p* > .05. For all groups, planning was maintained from T0 to T1, *p*s > .05, but decreased from T1 to T2, McNemars $\chi^2(1) = 17.455, p < .001$. Physical activity increased over the intervention, *p*s < .05, but there were no differences in physical activity between groups over time, *p*s > .05. The strength of the intention-behaviour relationship did not differ between participants who planned and those who did not, *p* > .05. There seems to be little advantage to sending messages about planning relative to messages about physical activity for
persuading planning behaviour. Regardless of content of the messages, planning may not be sustained over time.

Keywords: physical activity, intentions, planning, tailored, text messages
Co-Authorship

This thesis presents the original work of Chetan Mistry in collaboration with his supervisor, Dr. Amy Latimer-Cheung. Chetan Mistry was responsible for developing the research question, conducting background research, designing the study, collecting data, leading the statistical analysis, interpreting the results, and writing the thesis. Dr. Latimer-Cheung assisted with development of the research question and the design of the study, the interpretation of the results and the content of the thesis. Dr. Latimer-Cheung and Dr. Shane Sweet provided guidance on the statistical analysis.
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List of Abbreviations

TPB = Theory of Planned Behaviour
ELM = Elaboration Likelihood Model
CWTA = Canadian Wireless Telecommunications Association
GPA = Generic, Physical Activity
GPL = Generic, Planning
TPL = Tailored, Planning
T0 = Baseline
T1 = 1-month follow up
T2 = 2-month follow up
Chapter 1

Introduction

1.1 Overview

Only 15% of Canadian adults accumulate the recommended amount of physical activity (Colley et al., 2011). Efforts must be taken to understand why this group adults are not meeting the recommended guideline. Many adults have positive intentions to be active (Hagger, Chatzisarantis, & Biddle, 2002), but often fail to translate their intentions into behaviour (Rhodes & Dickau, 2012). Planning can help turn physical activity intentions into behaviour. There is compelling evidence that forming plans can lead to behaviour change. However, there is no research examining if and how individuals form plans for physical activity. Preliminary evidence suggests generic messages can promote plan formation (Sweet, submitted). Researchers have yet to test different types of messages to promote plan formation.

Tailored messages are one potential messaging strategy that warrants further investigation (Latimer, Brawley, & Bassett, 2010). Tailored messages are developed for a specific individual, are personally relevant and can lead to behaviour change. Mounting evidence suggests tailored messages are more likely to change behaviour than generic messages (Lustria, Cortese, Noar, & Glueckauf, 2009; Noar, Benac, & Harris, 2007). In the past, tailoring messages was expensive and time-consuming to deliver. Fortunately, the advancement of mobile technology has dramatically reduced the financial and technological barriers associated with tailoring messages (Fanning, Mullen, & McAuley, 2012). Text messages have quickly become a preferred mode of communication. Text messages are being used increasingly to encourage health promotion and disease prevention behaviours (Cole-Lewis & Kershaw, 2010). Preliminary evidence on text messaging and physical activity is promising (Fanning et al., 2012). Text messages can promote
physical activity plan execution (Prestwich, Perugini & Hurling, 2010), but it is unknown if they can promote plan formation.

1.2 Objectives and Hypotheses

1.2.1 Purpose

The purpose of the present study was to determine whether text messages could be used to promote physical activity plan formation. We determined if receiving text messages about planning enhanced planning behaviour. Second, we determined if tailored messages about planning enhanced planning behaviour more so than generic planning messages. The secondary objective was to determine if planning messages enhanced physical activity above messages about physical activity, and if tailored planning messages enhanced physical activity above generic planning messages. Finally, we determined if planning strengthened the physical activity, intention-behaviour relationship.

1.2.2 Hypotheses

H1a. We expected messages about planning to enhance planning more than messages about physical activity. We also expected tailored messages about planning to enhance planning more than generic messages about planning.

H1b. We expected participants who received tailored messages about planning to maintain planning over time. We expected participants who received generic messages about planning or physical activity to decrease planning over time.

H2. We expected messages about planning to enhance physical activity more than messages about physical activity. We also expected tailored messages about planning to enhance physical activity more than generic messages about planning.

H3. We expected planning to strengthen the physical activity intention-behaviour relationship.
2.1 Physical Activity

The leading causes of mortality in Canada include cancer, heart disease and diabetes (Statistics_Canada_B, 2012). Engaging in regular physical activity can reduce the risk of certain cancers, cardiovascular disease, diabetes and premature death (Warburton, Nicol, & Bredin, 2006). The Canadian physical activity guidelines recommend that adults accumulate at least 150 minutes of moderate to vigorous physical activity per week in bouts of 10 minutes or more and strength train at least two times per week (Tremblay et al., 2011; Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010). However, only 15% of Canadian adults accumulate the recommended amount of physical activity (Colley et al., 2011). Efforts must be taken to understand why adults are not meeting the recommended guideline.

2.2 Theory of Planned Behaviour

Theory can be applied to understand physical activity behaviour. Studies applying health behaviour theory have investigated the relationship between physical activity intentions and subsequent behaviour (Hagger et al., 2002). The theory of planned behaviour (TPB) has been used to understand how attitudes, subjective norms and perceived behavioural control predict one’s intention to perform behaviour, and in turn, how intentions and perceived behavioural control can predict behaviour (Ajzen, 1991). Affective attitudes are one’s positive or negative evaluations of the target behaviour and instrumental attitudes are beliefs about the outcomes that can result from engaging in the behaviour. Subjective norms are the perceived pressures placed on one by significant others to engage in the behaviour. Perceived behavioural control represents one’s belief in his/her ability to engage in the behaviour and overcome factors that may hinder their performance.
2.2.1 Intentions

Intentions are motivational factors that influence behaviour and are a measure of how much an individual is willing to work to perform the behaviour (Ajzen, 1991). The TPB positions intentions as a direct predictor of behavioural performance along with perceived behavioural control. Intentions have been studied within a TPB framework to understand health behaviours, including physical activity (Hagger et al., 2002; Sheeran, 2002). A meta-analysis of meta-analyses applying the TPB to health found intentions to account for 28% of the variance in health behaviour (Sheeran, 2002). Hagger et al. (2002) summarized the results of 72 studies that applied the TPB to understand exercise behaviour specifically. The TPB proved useful for predicting exercise behaviour, as intentions explained 15.7% of the variance in behaviour.

Given the extensive research and media attention on the benefits of physical activity for health, many adults form intentions to be active. For example, adults in the Hagger et al. (2002) meta-analysis formed strong intentions to be physically active. However, forming strong intentions does not guarantee that intentions will be translated into behaviour. The term ‘intention-behaviour gap’ describes a situation when individuals fail to translate their intentions into behaviour, creating a hypothetical ‘gap’ between the two constructs. Unfortunately, the ‘intention-behaviour gap’ is a common within the domain of physical activity (Rhodes & Dickau, 2012). Researchers have aimed to address reasons for the physical activity ‘intention-behaviour gap’. Two explanations are presented below.

2.3 Intention-Behaviour Gap

2.3.1 Activation

Intentions must be sufficiently activated to result in behaviour (Conner & Norman, 2005). Intention activation refers to the memory to perform an action in the future (Goschke & Kuhl, 1993). For any particular time or context, individuals are likely to have multiple and conflicting goals. Intentions that are sufficiently activated in lieu of conflicting demands are more likely to be
translated into behaviour. Intention activation has been tested empirically (Webb & Sheeran, 2004; Webb & Sheeran, 2008).

Researchers tested whether plans improved participants’ memory to execute an intention in a situation where detection was particularly difficult (Webb & Sheeran, 2004). Participants were given a paragraph of text and asked to form an intention to count the number of times the letter ‘F’ appeared in the text. Participants were randomly assigned to a planning or control group. Those in the planning group formed a plan for counting Fs (i.e. ‘As soon as I see the letter F, I will add one more to my count’). The control group did not form plans. The researchers hypothesized that plans would improve activation of the intention to count the letter, ‘F’. Participants who formed plans counted significantly more Fs in the text than participants in the control group. Linking the contextual cue (‘If F’) to the behaviour (‘…then count’) led to improved memory to detect the critical cue. Forming plans increased intention activation by focusing attention on the letter F. Furthermore, participants in the planning group were less likely to miss counting the letter F in the word ‘of’ than participants in the control group. Intentions that were sufficiently activated through plans were less likely to be forgotten.

Insufficiently activated intentions can lead to forgetting to execute intentions and goal reprioritization. Forgetting to execute an intention leads to failure to perform a target behaviour (Orbell, Hodgdlns, & Sheeran, 1997). Goal reprioritization can result if intentions are not activated enough and are postponed or disregarded (Milne et al., 2002). In summary, intentions that are not adequately activated at a particular time and setting can be forgotten, delayed or dismissed.

**2.3.2 Elaboration**

People may fail to engage in behaviour if they do not elaborate on their intentions enough (Conner & Norman, 2005). That is, even if an intention is activated, if an individual has not formulated a defined set of actions to enact this intention, the likelihood that the intention is
realized is low. Intentions that include an explanation of required actions and identify appropriate situations for intention realization are more likely to be performed.

Armitage (2007) investigated whether forming plans for fruit consumption increased fruit consumption relative to a control group. In the experimental group, participants were told they would be more likely to achieve their intention of eating an extra piece of fruit each day if they elaborated when and where they would eat fruit. They were asked to record when and where they would eat an extra piece of fruit, every day over the proceeding two weeks. Participants in the control group were given the goal to eat an extra piece of fruit each day, but were not instructed to form plans. As expected, participants that elaborated when and where they would eat fruit were more likely to have met their intentions of increased fruit consumption over two weeks. Contrastingly, fruit consumption declined among the control group. Elaborating when and where behaviour was to be performed increased the likelihood that the intentions were enacted upon.

In sum, intentions that are insufficiently activated and elaborated may not be translated into behaviour, leading to the elusive ‘intention-behaviour’ gap. Researchers have directed much attention towards identifying and testing mediators of this intention-behaviour gap (Scholz, Schuz, Ziegelmann, Lippke, & Schwarzer, 2008). One such mediator is planning. Planning has been shown to activate and elaborate intentions to improve the chances of behavioural performance and ultimately, goal achievement.

2.4 Planning

In research, the word ‘plan’ is used interchangeably with the term ‘implementation intention’ to describe a process for achieving a specific goal or outcome (Bélanger-Gravel, Godin, & Amireault, 2011; Conner & Norman, 2005; Morris & Ward, 2005). Plans are mental representations of what we want to do (Friedman & Scholnick, 1997). The process of planning uses cognitive resources to execute a set of mental and behavioural sequences to reach an end goal. The Rubicon Model of Action Phases (Heckhausen & Gollwitzer, 1987) positions the
process of planning within a framework of goal achievement. The model differentiates between planning during a motivational phase for intention formation (predecisional) and planning during a volitional phase for intention realization (preactional) (Gollwitzer, 1990). The predecisional phase involves wishing and deliberation. During this phase, individuals must choose which of their wishes they will pursue. A decision to pursue a wish that is both desirable and feasible constitutes intention formation and movement into the preactional phase (Gollwitzer, 1990). The primary process in the preactional phase is planning. Planning involves identifying when and where to start acting, how to act and how long to act.

The act of forming plans creates a link between the anticipated situation and the goal-directed response. An association is created in memory between the mental representation of the situation and the behavioural response. Plans are an effective tool for addressing inadequate intention activation and elaboration (Conner & Norman, 2005). Intentions that are not sufficiently activated can lead to memory failure (Orbell et al., 1997). Plans identify an appropriate opportunity to act and increase the cognitive accessibility of intentions, in turn, reducing the chance of memory failure. Creating plans elaborates intentions. If-then plans include specific behaviours to perform in specific situations to achieve goals. Creating plans can lead to the efficient and precise recognition of opportunities to initiate behaviour (Steadman & Quine, 2004).

2.4.1 Planning and Goal Pursuit

The impact of forming plans on goal achievement has been summarized in meta-analyses (Gollwitzer & Sheeran, 2006; Koestner, Lekes, Powers, & Chicoine, 2002; Sheeran, 2002). Gollwitzer and Sheeran (2006) tested the overall effect of plan formation on goal achievement and the effects of plans on personal goals, laboratory-assigned goals and health-related goals. Studies were selected in which participants formed plans that specified a cue with a goal-directed response and if an association between plan formation and an outcome resulted.
Across 94 tests involving 8461 participants, forming plans was an important determinant of whether or not individuals achieved their goals. The effect of forming plans on goal achievement was medium to large. Plan formation facilitated intention accessibility by promoting memory of intended actions, focusing attention on appropriate opportunities to act and reducing goal reprioritization. Furthermore, the effects of plans were consistently of medium to large size across objectively measured and self-reported outcomes. Effects were particularly strong for participants who already had problems with goal striving. Twenty-three of the ninety-four tests examined the impact of plan formation on attaining health-related goals. The average effect of plan formation on achieving health goals was medium to large. Although Gollwitzer & Sheeran (2006) did not report the specific effects of planning on physical activity, their meta-analysis provides preliminary evidence for planning as a strategy for translating health-related intentions into behaviour.

Since Gollwitzer & Sheeran (2006) analysis, several studies have assessed the influence of plan formation on physical activity within clinical and general adult populations (De Vet, Oenema, Sheeran, & Brug, 2009; Latimer, Ginis, & Arbour, 2006; Luszczynska, 2006). Planning has been tested among individuals with spinal cord injury, (Latimer et al., 2006) and within the non-clinical, adult population (Arbour & Martin Ginis, 2009; De Vet et al., 2009; Luszczynska, 2006; Prestwich et al., 2012). Overall, evidence has supported the efficacy of planning for translating physical activity intentions into behaviour.

### 2.4.2 Planning and Physical Activity

Belanger-Gravel, Godin & Amireault (2011) expanded on Gollwitzer and Sheeran’s (2006) work through a systematic review on experimental studies of planning on physical activity. Experimental planning studies involve inducing or manipulation the process of action planning formation by having participants form action plans. Eighteen of twenty-six studies framed their work around the model of action phases (Heckhausen & Gollwitzer, 1987). The
remaining studies were framed around Schwarzer’s (1992) Health Action Process Approach. Planning had a small to medium effect at post intervention and after follow up on physical activity. The effects of planning on physical activity were smaller than the effects of planning on health goals reported by Gollwitzer and Sheeran (2006). However, evidence revealed stronger effects when the experimenter assisted the participants in forming their plans and when participants were required to repeatedly form plans.

The meta-analysis of Carraro & Gaudreau (2013) was designed to extend the review of experimental studies by Belanger-Gravel et al. (2011) to include correlational studies about planning (Carraro & Gaudreau, 2013). Correlational studies allow for the analysis of the structure and content of plans that participants make naturally, that are not prompted by an experimenter. Carraro & Gaudreau (2013) assessed the mediating role of action planning in the intention-behaviour relationship. They also tested if a greater number of components included in action plans led to stronger effects.

The average correlation between action planning and exercise behaviour was medium to large for naturally occurring plans and small to medium for experimenter-prompted plans. Planning was a mediator of the intention-behaviour relationship for both naturally and experimenter-prompted action plans. These effects were similar to the effects identified by Belanger-Gravel et al. (2011) for experimenter-prompted action planning. Plans that included four to five components had greater effects on activity behaviour than plans of two components or fewer. Furthermore, planning had a greater effects for sedentary compared to mixed samples, suggesting that planning is beneficial for those who already have trouble regulating their own behaviour (Carraro & Gaudreau, 2013; Gollwitzer & Sheeran, 2006).

2.4.3 Plan Formation

There is compelling evidence that forming plans can lead to physical activity performance. However, there is no evidence showing if and how individuals form plans for
physical activity. Evidence reveals that merely measuring planning can be enough to increase physical activity behaviour (Conner, Sandberg, & Norman, 2010). Yet, little effort has been made to promote the strategy of planning as a means to increasing physical activity. It is unknown if encouraging individuals to form plans has a significant influence on their planning behaviour and subsequently, on physical activity participation.

2.4.4 Promoting Planning

Two studies have investigated the promotion of planning as a means for increasing physical activity. Sweet, Brawley, Hatchell, Gainforth and Latimer-Cheung (submitted) tested the efficacy of persuasive messaging to promote action planning. Researchers conducted two studies to see if individuals who received persuasive messages about action planning would be more likely to create an action plan. In their first study, participants were randomly assigned to read a control message about the benefits of physical activity, or an experimental message about the benefits of physical activity and action planning. After reading their respective message, they were given the opportunity to create their own action plan. Messages containing information about action planning were not more persuasive than generic messages about physical activity, as only 45-55% of individuals actually made an action plan irrespective of experimental group.

In their second study, individuals were assigned to the same generic, physical activity message, followed by a message emphasizing the benefits of creating an action plan or the costs associated with failing to create an action plan. Individuals who read messages about the benefits of creating an action plan made more plans after two weeks than those who read about the costs of not creating an action plan. Furthermore, those who read about the benefits of action planning maintained their rate of action planning, while those who read about the costs reported decreasing rates of planning. The authors recommended future investigations determine the content of messages that could best encourage individuals to form action plans.
Keeping these findings in mind, there are several avenues for future research. Despite receiving messages specifically encouraging physical activity plan creation, rates of planning remained modest. Less than half of participants formed plans for activity. Strategies to boost rates of planning are needed. Certain types of messages about action plans may promote increased rates of planning. Participants in the Sweet et al. (submitted) studies all received the same message based on their experimental group. These types of “generic” messages are a fast and inexpensive way to send information to participants in a study. They can also be effective for increasing awareness and knowledge about physical activity in the population (Cavill, 2004; Huhman, 2005; Kreuter, Strecher, & Glassman, 1999). However, the effects of generic messages for changing individual behaviour are modest at best. To understand how to best promote behaviour change through messages, we must understand how individuals process messages. Strategies for enhancing the impact of these messages are needed. Additionally, consideration of how people process messages provides direction for creating effective messages.

2.5 Elaboration Likelihood Model

The Elaboration Likelihood Model (ELM) is a framework for understanding how individuals process persuasive communications (Petty & Cacioppo, 1986). The ELM proposes that two processes can lead to persuasion from messages; central or peripheral processing. Persuasion can occur through the peripheral route when elaboration of the information at hand is low (Petty & Cacioppo, 2004). An individual can lack motivation to process a message if a message is not perceived as personally relevant. In peripheral processing, the receiver uses cognitive shortcuts and does not think deeply about the information. Alternatively, when elaboration is high, persuasion occurs through the central processing route. An individual can be motivated to process information if it is personally relevant. Central processing is characterized by deep, involved thinking and the formation of arguments in favour or opposed to the information at hand (Chaiken, 1980).
Generic, behaviour messages sent to the masses can lack personal relevance to the target audience (Kreuter, Oswald, Bull, & Clark, 2000). Messages that are not deemed to be personally relevant can lead to low motivation to process the message and low elaboration on the message content. The ELM would predict that generic, behaviour messages, such as those delivered in the Sweet et al. (submitted) studies would result in peripheral processing. On the other hand, behavioural messages that are specific to individuals are personally relevant (Rimer & Kreuter, 2006). Message tailoring can be defined as any combination of strategies and information used to reach one specific person, based on characteristics of that person, the outcome of interest, and resulting from individual assessment (Kreuter et al., 1999). These messages are more likely to result in high motivation to process the message and high elaboration on the content of the message. According to the ELM, messages that are specific to an individual are actively processed, retained for a longer period of time, and can lead to permanent change (Petty & Cacioppo, 1986). The ELM posits that messages that are personally relevant are more likely to be processed centrally, result in high elaboration and ultimately, attitude change.

2.5.1 Tailored Messages

Reviews support the use of tailored over generic messages (Kroeze, Werkman, & Brug, 2006; Lustria et al., 2009; Rimer & Glassman, 1999; Scholz et al., 2008; Skinner, Campbell, Rimer, Curry, & Prochaska, 1999). One study has quantitatively assessed the impact of tailored, health behaviour communications (Lustria et al., 2009; Noar et al., 2007).

Noar and colleagues (2007) summarized the effect of printed, tailored messages on health behaviour. They also examined moderators of the relationship, including participant characteristics, type of behaviour, type of intervention, methodological features, and theoretical concepts. Fifty-six, theoretically-framed studies were included in Noar et al.’s (2007) meta-analysis. Overall, they observed a small effect of tailored communications on behaviour. The effects were equal across gender, race and sociodemographic backgrounds. The largest effects
were seen among prevention behaviours for promoting health and reducing the risk of disease.
In nearly all cases, tailored messages had a greater impact on health behaviour than did comparison or generic, control conditions. Studies averaged 4 tailored components, and the strongest effects emerged when the intervention was theoretically tailored. Tailoring on 4-5 theoretical concepts was more effective than tailoring on 0-3 concepts, and the strongest effects were seen when messages were tailored to participants’ attitudes, self-efficacy and social support (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008).

More recently, Lustria, Coretese, Noar & Glueckauf (2009) conducted a review to determine how computer-tailored interventions were delivered over the internet and the mechanisms used to individualize health messages in computer-based, tailored, behavioural interventions. The review consisted of thirty, online behavioural interventions, seven of which were focused on physical activity. The authors defined tailoring as a “multidimensional, communication strategy aimed at increasing the perceived personal relevance of health messages, which consequently, helps create ideal environments for persuasion and behaviour change to occur” (p158). Nine studies used participants’ online assessments to deliver personalized content. Assessments were often taken at multiple time points throughout the intervention. Many interventions delivered skill-building tools to participants. Studies in the review tailored messages based on age, gender, health beliefs or information needs and theory-based constructs. As observed in Noar et al. (2007), tailoring based on theoretical-frameworks increased the chances of success of tailored health interventions. Studies targeting physical activity delivered personalized content through email in addition to goal setting and self-monitoring tools. There was a consistent advantage of tailoring intervention materials to specific participants for changing physical activity behaviour.

Implications can be drawn from Lustria et al. (2009) and Noar et al. (2007). Tailoring messages can have a stronger effect on behaviour than generic messages (Lustria et al., 2009;
Noar et al., 2007). Tailoring messages to a particular behaviour, demographic variables and theoretical concepts can have an even greater impact on behaviour (Lustria et al., 2009; Noar et al., 2007). However, studies typically only provide feedback on a behaviour.

The effects of tailoring are salient, however, generic messages continue to be used in behaviour change interventions (Lustria et al., 2009). Tailoring messages can be expensive and time-consuming. Fortunately, the advancement of mobile technology has dramatically reduced the financial and technological barriers associated with tailoring messages (Fanning et al., 2012). Tailored messages can now be delivered to individuals at a very low cost and without much difficulty.

2.6 Mobile Phones and Text Messages

Cell phone service is accessible to 99% of the Canadian population (CWTA, 2012). Nearly 76% of Canadian adults subscribe to a wireless phone service. Using these services, Canadians sent 78 billion text messages in 2011, a 60% increase over the previous two years. The average adult between the ages of 25 and 34 sends or receives approximately 42 text messages per day (Smith, 2011). Text messages have quickly become the preferred mode of communication across all ages, cultures and socioeconomic backgrounds (CWTA, 2012). Text messages allow users to send messages of 160 characters or less to individuals at any time, place or setting. Text messages are the least advanced, but the most widely adopted of cell phone applications (CWTA, 2012).

Given its inexpensiveness and accessibility (Fanning et al., 2012), text messages are being used increasingly to encourage health promotion and disease prevention behaviours (Cole-Lewis & Kershaw, 2010). Text messages provide a unique opportunity for the delivery of health interventions. Text messages can be sent with ease and efficiency and require less time and resources than telephone calls or in-person counseling (Buhi et al., 2012). A report from the Canadian Wireless Telecommunications Association (2012) indicated that 26% of Canadian
adults with a cell phone use health related tools on their mobile phones. The majority of those who used health-related tools were between the ages of 18 and 34 (26%). Within this cohort, 14% used health-related tools either “often” or “sometimes” and approximately 7% of these users were receiving health-related, text message reminders. A preliminary, peer-reviewed meta-analysis of internet interventions reveals text messages can be highly effective for promoting interaction with researchers, sending motivation messages, challenging misguided beliefs and for providing cues to action (Webb, Joseph, Yardley, & Michie, 2010).

2.6.1 Text Messages and Health Behaviour

Evidence from systematic reviews on text messages and health behaviour change is consistent (Buhi et al., 2012; Cole-Lewis & Kershaw, 2010; Fjeldsoe, Marshall, & Miller, 2008; Lau, Lau, Wong, & Ransdell, 2011; Vodopivec-Jamsek, de Jongh, Gurol-Urganci, Atun, & Car, 2012; Webb et al., 2010; Wei, Hollin, & Kachnowski, 2010). Text messages have great promise as a modality for health behaviour change. Significant, positive changes in health behaviour were observed in each review. Nevertheless, there remains a need for additional research in this field. Specifically, theory-based applications of text messages are needed to identify the reasons and mechanisms for behaviour change (Buhi et al., 2012; Cole-Lewis & Kershaw, 2010; Fanning et al., 2012; Fjeldsoe et al., 2008; Krishna, Boren, & Balas, 2009; Lau et al., 2011). Theory based interventions have shown efficacy when delivered over the internet (Webb et al., 2010), but the evidence is sparse for text message applications. Within applications of text messages, the efficacy of text messages should be clearly defined, including message dose, frequency and theoretical content (Cole-Lewis & Kershaw, 2010; Fjeldsoe et al., 2008; Wei et al., 2010). Text message characteristics such as initiation, tailoring and interaction should also be described. Examining the aforementioned components will help to identify the ideal components for text message-based interventions for health behaviour change.

2.6.2 Text Messages and Physical Activity
To date, only one meta-analysis has examined the efficacy of mobile devices for changing physical activity behaviour (Fanning et al., 2012). The analysis was limited to studies that delivered information via text messages or native mobile applications. The authors identified four studies of good quality and seven studies of fair quality that used mobile phones to change physical activity behaviour. Eight of the eleven studies used text messages as part of the intervention. Text messages were used for data collection or to deliver the intervention. The authors observed text messages as an efficient way to provide feedback to participants, provide participants freedom in accessing the intervention and to assess behaviour in real time.

Research on physical activity and text messaging is still in its infancy (Fanning et al., 2012). However, the research available is promising. Mobile phones can be a valuable tool for behaviour scientists, as they allow for information to be collected and individualized content to be delivered to devices that are carried by the individual. It was recommended that theory should be applied to guide interventions to understand how physical activity can be changed using mobile phones.

2.6.3 Text Messages and Planning

Prestwich et al. (2009) applied theory about planning for physical activity to examine how text messages could be used to promote physical activity plan execution. Prestwich et al. (2009) tested if the effects of plans could be strengthened with the addition of text message reminders to execute plans. The randomized control trial was a 2x2 design. Participants either formed plans for exercise or not, and received reminders to execute their plans or did not. Participants self-reported their physical activity at baseline and after one-month. Analysis revealed that plans combined with text messages had the strongest impact on physical activity than planning or text messaging alone. When an individual chose to receive text message reminders to execute their plans, the effects of plans on physical activity were the strongest. The authors suggested the intervention increased the accessibility of the environmental cue or cue to
implement their plan for physical activity. In summary, the combination of plans with reminders to execute physical activity plans may have more efficacy than planning alone.

2.7 Summary

It is well established that physical activity intentions can be translated into behaviour through planning (Bélanger-Gravel et al., 2011; Carraro & Gaudreau, 2013). But it has yet to be determined how messages can be enhanced to better promote planning (Sweet, submitted). It is also well-known that tailored, theoretically-based messages are more likely to change behaviour than generic, non-theoretical messages (Lustria et al., 2009; Noar et al., 2007). However, researchers have yet to test if tailored, theory-based messages can promote planning for physical activity. Finally, text messages can change physical activity behaviour (Fanning et al., 2012), including promoting plan execution (Prestwich et al., 2009). However, it is still unknown if text messages can be used to promote physical activity plan formation. The present study aimed to address this gap by investigating if tailored text messages could be used to promote the formation of physical activity plans.

2.8 Purpose

We determined if receiving text messages about planning enhanced planning behaviour. Second, we determined if tailored messages about planning enhanced planning behaviour more so than generic planning messages. The secondary objective was to determine if planning messages enhanced physical activity above messages about physical activity, and if tailored planning messages enhanced physical activity above generic planning messages. Finally, we determined if planning strengthened the physical activity, intention-behaviour relationship.

2.9 Hypotheses

2.9.1 Primary Outcomes

2.9.1.1 H1a.
We expected participants who received messages about planning would be more likely to make at least one plan after one and two months compared to participants who received messages about physical activity. We also expected participants who received tailored messages about planning would be more likely to make at least one plan after one and two months compared to participants who received generic messages about planning.

2.9.1.2 H1b.

We expected participants who received tailored messages about planning to maintain planning over time. We expected participants who received generic messages about planning to decrease planning over time. We also expected participants in the generic physical activity group to decrease planning over time.

2.9.2 Secondary Outcomes

2.9.2.1 Physical Activity.

2.9.2.1.1 H2a.

We expected an interaction effect of experimental condition over time. We expected participants that received messages about planning to report increased moderate to vigorous physical activity over time compared to participants who received messages about physical activity. We also expected that individuals who received tailored messages about planning would report increased moderate to vigorous physical over time compared to participants who received generic messages about planning.

2.9.2.2 Intention-Behaviour Relationship.

We expected planning to strengthen the physical activity intention-behaviour relationship. We expected participants who planned at least once after one month and two months would report intentions that were more strongly correlated to their activity than participants who did not plan by one or two months.
Chapter 3

Methods

3.1 Design

This study used a between-participants, repeated measures study design. The text message content (planning vs. physical activity) as well as the tailoring (generic vs. tailored) were manipulated. As such, participants received generic messages about physical activity (GPA), generic messages about planning for physical activity (GPL), or tailored messages about planning for physical activity (TPL). Planning behaviour was the primary outcome and self-reported physical activity was measured as a secondary outcome. Data were collected at baseline (T0), at a 4 week follow-up (T1) and at an 8 week follow-up (T2).

3.2 Participants

3.2.1 Eligibility

Participants included those who: a) were between the ages of 25 and 45 years; b) were residents of Canada; c) had access to email and text messaging; d) had self-reported medical clearance to perform physical activity; and e) over the past month, had been inactive according to the Canadian Physical Activity Guidelines, but had intentions to become more active. An age range was imposed because recommendations have been made to test the efficacy of text messages in the general population of adults as opposed to among young adults (Bélanger-Gravel et al., 2011; Conner et al., 2010; Vodopivec-Jamsek et al., 2012).

3.2.2 Sample Size

Sample size was calculated in GPower (version 3.1). For our first hypothesis the following parameters were entered in GPower: $f = 0.10$, $\alpha = .20$, power = .80, numerator $df = 2$. For our second hypothesis and manipulation checks, sample size was calculated with the
following parameters: Effect size $f = 0.13$, $\alpha = .20$, power = .80, numerator $df = 4$, number of
groups = 3. The small effect sizes were based on previous effects of tailored messages and text
messages on physical activity (Cole-Lewis & Kershaw, 2010; Noar et al., 2007). Based on these
calculations, the desired sample size was 228 participants. We did not account for participant
attrition because if participants were included even if they did not complete the weekly planning
tool. Those who did not complete the planning tool were given a score of zero and were included
in our analyses. The large sample size in our study addresses previous limitations of planning-
based studies (Prestwich & Kellar, 2010) and recommendations in text messaging and behaviour
change reviews (Buhi et al., 2012; Fjeldsoe et al., 2008; Krishna et al., 2009; Stephens & Allen,
2012; Vodopivec-Jamsek et al., 2012).

3.2.3 Recruitment

Participants were recruited online through social networking sites, including Facebook
and Twitter. Advertisements were also posted on Kijiji, an online classified site. Individuals who
participated in our study were offered $10 compensation to an online vendor of their choice.

3.3 Procedure

See Table 1 for a timeline of one week of the study. Those interested in participating
were asked to follow a link to the screening questionnaire (Appendix B). After completing their
T0 survey, participants responses were collected and they were assigned to an experimental
group.
Eligible participants completed a consent form followed by self-reported physical activity and demographics questionnaires. Participants’ also reported their current planning behaviour, physical activity intentions and theory-based manipulation check items. Subsequently, they completed the message tailoring questionnaire. Details of the measures are included in the measures section below.

Participants were assigned into GPA, GPL or TPL according to the day of the month they were born. This approach was used because the survey software did not allow for random assignment. Thus, a fixed assignment rule was required. Participants were blind to the study hypotheses and their experimental condition.

After completing the baseline questionnaire, participants received an email to confirm their participation in the study. The email also provided some introductory information. The introductory information of the email aligned with participants’ experimental condition.

On the first Thursday after enrolling in the study, participants received an email inviting them to make a physical activity plan using an online planning tool (Appendix J). The tool allowed participants to select the days of the week they wanted to plan for and to specify what, where, when and for how long they wanted to do physical activity on each of the selected days.
Participants were given the option to download their plans. Participants were given a deadline to complete their plans by 5pm on Sunday before the coming week.

During the first 4 weeks of the study, text messages were delivered to participants using the text-messaging application, SMS Communications Manager. Three messages were sent to participants each week. This messages frequency was based on previous, successful SMS-based interventions sending 3 to 5 messages to participants per week (Fjeldsoe, Miller, & Marshall, 2010). In the generic conditions (GPA & GPL), messages were sent on Mondays, Wednesdays and Fridays at 12pm when mobile phone usage peaks (CWTA, 2012). Messages for the tailored group (TPL) were sent according to schedules individualized for each participant’s message receiving preferences. Messages were delivered through the week as scheduled. The text messaging application was checked multiple times per day to ensure messages were being delivered.

Each Thursday, participants were sent an email invitation to create a physical activity plan. Proceeding the completion of Week 4, participants were emailed a link to complete the T1 survey. Participants reported their physical activity participation and intentions at this time. They also completed all manipulation check items.

From Weeks 5 to 8, participants no longer received text messages, but they continued to receive weekly invitations to create physical activity plans every Thursday. At the end of Week 8 (T2), participants completed a follow-up survey. Participants reported their physical activity participation and intentions. They also completed theory-based manipulation check items.

3.4 Measures

3.4.1 Demographics

Demographic information included age, gender, date of birth, minority status, education, employment, household income and marital status.
3.4.2 Screening Questionnaire

First, participants were asked to report if they were between the ages of 25 and 45. Second, participants were asked if they engaged in enough exercise to meet Canada’s Physical Activity Guidelines. They were reminded that 8 out of every 10 Canadians do not meet the guidelines. Participants reported whether they had been engaging in the recommended amount of exercise for more or less than a month and if they intended to do more exercise over the next 6 months. Third, participants were asked if they had access to email and if they were able to send and receive text messages from a cellular phone. Finally, participants were asked if they had permission from their doctor to participate in physical activity.

Participants were eligible for the study if they were between the ages of 25 and 45, had been active for less than six months or if they had not been active but intended to be active over the next six months, if they had access to email and text messaging and permission from their doctor to participate in physical activity.

3.4.3 Tailoring Questionnaire

Participants reported personal information that could be used to tailor messages. First, participants reported their name, email address and phone number to allow for interaction with the researcher. Secondly, participants chose 3 days of the week, and 3 specific times of the day at which they preferred to receive text messages. Lastly, participants indicated their physical activity goals, barriers to physical activity, barriers to planning and benefits of planning for physical activity. Please refer to Appendix E for the complete, tailoring questionnaire.

3.4.4 Primary Outcomes

3.4.4.1 Planning.

Participants’ plans were collected from the weekly planning tool. Each week, plans were scored dichotomously as being complete or incomplete from baseline to post-intervention. Since
rates of planning were low across all groups, participants were given a score of 0 or 1 for completing at least one plan over a 4 week period.

### 3.4.5 Secondary Outcomes

#### 3.4.5.1 Physical Activity.

The Godin Leisure-Time Exercise Questionnaire (GLTEQ) was used to measure self-reported physical activity. Participants reported the quantity and duration of their moderate and vigorous physical activity over the previous 7 days (Godin & Shephard, 1997). At each time point, the number of days and minutes of activity were multiplied and summed to establish moderate and vigorous minutes per week. The GLTEQ is a reliable measure of physical activity (Godin & Shephard, 1985). The GLTEQ is also a valid measure of physical activity and is comparable to other physical activity questionnaires (Helmerhorst, Brage, Warren, Besson, & Ekelund, 2012)

#### 3.4.5.2 Physical Activity Intentions.

Three items adapted from Sweet et al. (submitted) and Connor & Norman (2005) were used to assess participants’ intentions, including: “I intend to do physical activity over the next 4 weeks,”; “I will do physical activity over the next 4 weeks,”; “I will try to do physical activity over the next 4 weeks.” Items were rated on a 7-point scale from strongly disagree (1) to strongly agree (7). The items demonstrated internal consistency, Cronbach’s α > 0.875. Similar items have shown predictive validity for other health behaviours such as healthy eating (Conner, Norman, & Bell, 2002)

### 3.4.6 Manipulation Checks

#### 3.4.6.1 Self-reported Planning

Planning was measured as a continuous variable to account for plans that participants’ made aside from those on the weekly planning tool. Participants indicated on a 7-point scale from
strongly disagree (1) to strongly agree (7) if, over the past week, they had made a detailed plan regarding; ‘when to exercise’, ‘where to exercise’, ‘how to exercise’, ‘how often to exercise’ and ‘with whom to exercise’. These measures have shown internal consistency (α=.92) and validity in previous studies (Sniehotta, 2005).

3.4.6.2 Theoretical constructs.

For the manipulation check questionnaire, please refer to Appendix D.

3.4.6.2.1 Affective Attitudes.

Affective attitudes towards planning physical activity are positive or negative evaluations of planning for physical activity. Participants read the stem, “For me, planning my physical activity over the next four weeks will be….”, followed by six items with the following anchors; dull–interesting, unpleasant–pleasant, boring–stimulating, unhealthy–healthy, bad–good, and useless–useful. The items were rated on a 7-point, polarized scale. The items demonstrated internal consistency, Cronbach’s αs> 0.709.

3.4.6.2.2 Instrumental attitudes.

Instrumental attitudes towards planning for physical activity are beliefs about the outcomes of planning on physical activity. The measures that were used in the present study were developed by Sweet et al. (submitted). Participants read the stem, “Creating a detailed physical activity plan will…” followed by eight items: 1) Help to make my physical activity a routine; 2) Stop me from thinking about having to fit physical activity into my day; 3) Help me to remember to do physical activity; 4) Make it easier to fit my physical activity into my schedule; 5) Make it easier to manage obstacles that might get in the way of me being active; 6) Prevent me from forgetting to do physical activity; 7) Make me more confident that I can reach my physical activity goal; 8) Increase the likelihood that I will achieve my physical activity goal. Participants
rated each item on a 7-point scale from strongly disagree to strongly agree. The items were internally reliable, Cronbach’s αs > 0.893.

3.4.6.2.3 Perceived Behavioural Control.

Perceived behavioural control over planning represents an individual’s belief in his/her ability to engage in planning for physical activity and to overcome factors that may hinder his/her performance of planning. Four items rated on a scale of 1 (strongly disagree) to 7 (strongly agree) were used to assess perceived behavioural control over planning. Participants indicated if over the next four weeks they were, “…capable of planning for physical activity”; “…confident they would be able to plan for your physical activity”; “had the ability to plan physical activity”; and “Have complete control over planning for physical activity.” All items were internally reliable, Cronbach’s αs > 0.894.

3.4.6.2.4 Planning Intentions.

Three items were used to measure intention to plan for physical activity. On a scale from strongly disagree (1) to strongly agree (7), participants indicated if over the next four weeks they intended to plan for physical activity, they would try to plan for physical activity, and they would plan for physical activity (Conner & Norman, 2005). Similar items have shown predictive validity in previous physical activity research (Hagger et al., 2002). The items showed internal reliability, Cronbach’s αs > 0.842.

3.4.6.3 Technology Acceptance.

Participants responded on a 7-point scale of strongly disagree (1) to strongly agree (7) to the following 10 items: 1) Assuming that I have access to the weekly planning tool; I intend to use it; 2) Given that I have access to the weekly planning tool; I predict I would use it; 3) Using the weekly planning tool increases my chances of performing physical activity; 4) Using the weekly planning tool improves how well I plan for physical activity; 5) Using the weekly
planning tool enhances the effectiveness of my planning for physical activity; 6) I find the weekly planning tool useful for planning my physical activity; 7) My interaction with the weekly planning tool is clear and understandable; 8) Interacting with the weekly planning tool does not require a lot of my mental effort; 9) I find the weekly planning tool easy to use; 10) I find it easy to get the weekly planning tool to do what I want it to do. The items have shown reliability across studies and time ($\alpha > .80$). (Venkatesh & Davis, 2000). The measures were internally reliable in the present study, Cronbach’s $\alpha = 0.946$. A modified version of this measure has shown predictive validity for physicians’ intentions to use telemedicine technology (Hu, Chau, Sheng, & Tam, 1999).

3.4.6.4 Message Acceptance.

Message perceptions were assessed on a 7-point scale from strongly disagree (1) to strongly agree (7) (Beltramini, 1982). Participants were asked to report the extent to which the text messages they received during the study were; not believable–believable, not trustworthy–trustworthy, not convincing–convincing, not reasonable–reasonable, dishonest–honest, questionable–not questionable, inconclusive–conclusive, inauthentic–authentic and unlikely–likely. The items have shown validity in consumer research (Beltramini, 1988). The items were reliable, Cronbach’s $\alpha = 0.940$.

3.5 Messages

3.5.1 Introductory information

The introductory information participants received was the same information participants in the Sweet et al. study (submitted) received. Participants in GPA group received an email about the benefits of participating in physical activity. The email included efficacy information on how being physically active could help them to reach their health goals. The email explained that being active could reduce the risk disease and promote health. The email also contained
information about studies on physical activity and examples of ways to get active. Participants in GPL received an email about the benefits of planning for physical activity. The email contained facts about the benefits of planning on physical activity and an explanation of how to make an effective plan. Participants in TPL received an email that was identical to participants in the GPL group, except the email was personalized to their name.

3.5.2 Text messages

The present study builds upon previous research by delivering text messages to participants’ instead of emails. Text messages have shown promise as a tool for behaviour change (Cole-Lewis & Kershaw, 2010). Furthermore, text messages were sent to a personal device carried by participants. We did not assign participants to a control group that did not receive text messages because previous studies that did not use text messages have had limited success (Sweet, submitted). We also choose not to assign participants to receive tailored messages about physical activity, because the primary aim of the study was to promote planning for physical activity.

Over the course of the study, participants received 12 text messages. Six of the text messages targeted participants’ attitudes and six messages targeted their perceived behavioural control. Messages targeting attitudes and perceived control have had the strongest effects in previous research (Hawkins et al., 2008; Noar et al., 2007). The content of the message differed based on experimental condition. Message content was developed by the researcher and messages were reviewed by lab members with expertise in developing messages for national public health campaigns and previous research (Sweet, submitted).

In the GPA group, messages targeting participants’ attitudes towards activity were about the instrumental benefits of participating in physical activity, including keeping one’s body fit, heart healthy, relieving stress and increasing energy. Messages targeting participants’ perceived behavioural control over activity used verbal persuasion and reminders of mastery experiences to
increase participants belief in their ability to participate in physical activity. For a complete list of 
messages delivered to participants in GPA, refer to Appendix H.

In the GPL condition, messages targeting participants’ attitudes towards planning were 
focused on how planning could address barriers that may hinder participation in physical activity, 
such as lack of organization or being too busy. Messages targeting participants’ perceived 
behavioural control over planning used verbal persuasion and reminders of mastery experiences 
to increase participants’ belief in their ability to plan. For a complete list of messages delivered to 
participants in GPL, refer to Appendix H.

In the TPL condition, messages targeting participants’ attitudes and perceived control 
over planning for physical activity contained similar content to messages sent to participants in 
GPL. However, the messages were tailored to participants’ names and their perceived benefits 
and barriers to planning that were reported at baseline. Tailoring messages to participants 
attitudes and perceived behavioural control has shown efficacy in previous research (Noar et al., 
2007). Furthermore, including first names in text messages can promote the formation of virtual 
relationships in internet delivered physical activity interventions (Ferney, Marshall, Eakin, & 
Owen, 2009; Fjeldsoe et al., 2010). Tailored messages were sent according to participants’ 
preferences for the day and time they wanted to receive messages. Please refer to Appendix I for 
the template that was used to tailor messages to participants in TPL.

3.6 Data Analysis

3.6.1 Data Cleaning Plan

3.6.1.1 Outliers.

Participants who reported engaging in more than 7 days of activities per week at any 
intensity were given a maximum score of 7. At baseline (T0), post-intervention (T1) and follow- 
up (T2), 13, 11 and 18 individuals reported engaging in moderate or vigorous activities for more 
than 7 days per week, respectfully.
To test for outliers, Z-scores were calculated for the minutes that participants reported engaging in activity. Z-scores greater than 3.29 standard deviations from the mean were replaced with the next highest score that was not an outlier, plus a single minute (Field, 2009). At baseline (T0), post-intervention (T1) and follow-up (T2), 19, 10 and 3 participants reported minutes of activity that were deemed outliers. No outliers were identified for physical activity intentions or for the manipulation check items.

3.6.1.2 Normality.

Normality was assessed for physical activity participation, intentions and the manipulation check items. Variables were considered normally distributed if the skewness and kurtosis statistic fell within -1 and +1 (Field, 2009).

Manipulation check items were normally distributed. Moderate and vigorous minutes of activity per week and physical activity intentions were significantly skewed and kurtotic. Log, square root and inverse transformations were performed, however, the transformations did not resolve skewness and kurtosis. As a result, analyses were performed using the raw data.

3.6.1.3 Missing Data.

Due to error of the survey program (Fluidsurveys), weekly planning tools were not delivered consistently during the 9th week of the study. We conducted a chi-square test to determine if there was a difference in the number of participants missing data across experimental groups. Results indicate that the error was equally distributed across groups, $\chi^2(2) < 6.408$, $p > .05$. There were no differences in the number of people who did not receive a link to plan for physical activity across conditions and weeks. As a conservative approach, all plans were coded as incomplete for that particular week.

3.6.2 Multiple Imputation
Over the course of the intervention, participants were lost to attrition. High rates of attrition are common in internet-based interventions (Wangberg et al., 2008). To maintain the power of our sample, we used multiple imputation to address missing data for physical activity participation, intentions and manipulation check items at T2 (McKnight, McKnight, & Figueredo, 2007). We did not impute data for the primary outcome of planning because scores were dichotomous. Participants received a score of zero if they did not complete the tool and a score of one if they completed the tool. Data for all participants were complete at T0 and seventy-percent were complete at T1. There were sufficient data at T0 and T1 to impute sixty-percent of data at T2.

Multiple imputation involves using available data to inform simulations of the missing data. Furthermore, it involves replacing the missing data with values that would be most likely to be similar to the available data. This approach is appropriate for the current study because data were collected from participants at multiple time points. Complete data could be used to inform missing data at a particular point in time.

Before conducting multiple imputation, we classified our missing data. Data classification allows researchers to select an appropriate solution to handle missing data, to limit biases and facilitates communication (McKnight et al., 2007). Rubin provides a framework for classifying data into one of 3 possible categories; Missing Completely at Random (MCAR), Missing At Random (MAR), or Missing Not at Random (MNAR). We used various steps to classify our missing data. The steps were based upon recommendations from McKnight, McKnight & Figueredo (2007) and TheRMUoHP Biostatistics Resource YouTube Channel (tacappaert, 2013).

3.6.2.1 Step 1: Searching for Patterns.
All participants had complete data at baseline (T0). Seventy percent of participants remained in the study post intervention (T1). Forty percent of participants had complete data after the two month follow-up (T2).

3.6.2.2 Step 2: Analyzing Patterns.

We examined how our data were missing. Using SPSS, we developed a graph to display where missing cases were located in our data, relative to each variable. We examined the graph for consistently increasing or decreasing values of sequences, or ‘monotonicity’. Monotonicity is indicative of data that could be MNAR. The pattern of our missing data contained monotonicity and supported the classification of our data as MNAR.

3.6.2.3 Step 3: Imputing Data.

Complete values at T0 and T1 for demographics, planning, moderate to vigorous physical activity and physical activity intentions were used to form a model to impute data. Five imputations were conducted. For participants with complete data at T1, data were imputed for missing values at T2 for moderate to vigorous physical activity and physical activity intentions. Because ninety percent of participants who did not complete T1 did not complete T2, those with incomplete data at T1 and T2 were not included in the analyses presented. Complete case analysis for those who had complete data at T0, T1 and T2 were similar to analysis of the imputed data set.

3.7 Analyses

3.7.1 Testing Assignment

Chi-square tests were conducted to determine the success of the assignment in balancing participant characteristics of gender, ethnicity, martial status, education, employment and income across groups. We also tested assignment of participants baseline (T0) physical activity using one-way ANOVA.
3.7.2 Hypotheses Testing Plan

3.7.2.1 Planning.

Chi-square tests were conducted to determine if there were: a) differences in the expected and observed number of individuals that did or did not make at least 1 plan at T0, T1 and T2.

For each hypothesis, we first compared those who received messages about physical activity (GPA) with those who received messages about planning (GPL and TPL). Second, we compared those who received generic messages about planning (GPL) with those who received tailored messages about planning (TPL).

We conducted 3 McNemar’s tests for each group to determine if there were changes in rates of planning from T0 to T1, from T1 to T2 and from T0 to T2.

3.7.2.2 Physical Activity.

A repeated measures ANOVA was conducted to test between group effects on the amount of minutes per week participants spent engaging in moderate to vigorous physical activity. Significant main effects of time were decomposed using paired samples t-tests. Significant group effects were decomposed using Helmert contrasts to compare those who received generic physical activity messages (GPA) with those who received messages about planning (GPL & TPL), and those who received generic messages about planning (GPL) with those who received tailored messages about planning (TPL).

3.7.2.3 Intention-Behaviour Relationship.

Separate, Pearson bivariate correlations were calculated for individuals who did and did not make at least one plan at T1 and T2. Intentions at T0 were correlated with moderate to vigorous physical activity at T1. Correlations were also calculated for intentions at T1 and moderate to vigorous physical activity at T2. A z-test was applied to test differences between correlations for those who did and did not make at least one plan at T1 and T2.
3.7.2.4 Manipulation Checks.

Repeated measures ANOVA were conducted to test between group effects of planning, affective attitudes, instrumental attitudes, perceived behavioural control and intentions to plan. Significant main effects of time were decomposed using paired samples t-tests. One-way ANOVA were conducted to test between group differences of technology and message acceptance.
Chapter 4

Results

4.1 Participants

Three hundred and thirty-seven participants with access to email and text messaging enrolled in the study. Data were collected and imputed from a sample of 239 participants were included in the analysis ($M_{age} = 30.67 \pm 4.83$ yrs). The majority of the sample was female (77%), Caucasian (82%) and had some form of university education (78%). Over half of the sample were single (53%) and over a quarter were married (27%). Over half of our sample (53%) earned less than $65000$ per year. For complete demographic information, please refer to Table 2.
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<thead>
<tr>
<th>Age</th>
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<tr>
<td>50.5 - 55.0</td>
<td>4</td>
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Table 2. Participant Characteristics
4.2 Testing Assignment

Across all demographic variables, there were no significant differences between GPA, GPL and TPL. Participants were distributed equally according to their gender $\chi^2(2) = 3.098$, p>.05, ethnicity $\chi^2(8) = 7.156$, p>.05, marital status $\chi^2(10) = 11.890$, p>.05, education $\chi^2(18) = 18.167$, p>.05, employment $\chi^2(8) = 11.627$, p>.05, and income $\chi^2(14) = 13.422$, p>.05. There were no differences in terms of the mean age of participants across all three experimental conditions, F(2,233) = 1.735, p>.05. There were also no differences between groups in the number of participants that planned at baseline, $\chi^2(2) = 1.028$, p>.05. Across all groups, the mean moderate-vigorous minutes of physical activity per week $F(2,235) = 0.235$, p>.05 and intentions $F(2,235) = 0.514$, p>.05 to engage in physical activity were not different. There were, however, differences in participant attrition between groups. Participants that received TPL messages were less likely to have completed measures at T1. There were no differences in participant attrition in the GPA or GPL groups at T1. There were no differences in participant attrition in the GPA, GPL or TPL groups at T2. Please see Table 3 for complete participant attrition information.

Table 3. Participant Attrition

<table>
<thead>
<tr>
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<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>GPA</td>
<td>110</td>
<td>100.0</td>
<td>85</td>
</tr>
<tr>
<td>GPL</td>
<td>113</td>
<td>100.0</td>
<td>83</td>
</tr>
<tr>
<td>TPL</td>
<td>114</td>
<td>100.0</td>
<td>71*</td>
</tr>
<tr>
<td>Total</td>
<td>337</td>
<td>100.0</td>
<td>239</td>
</tr>
</tbody>
</table>

*$\chi^2 = 6.629$, p<.05
4.3 Planning

4.3.1 H1a

The chi-square tests comparing the frequency of planning across physical activity versus planning messages were not significant at T0 $\chi^2 (1) = 0.051, p>.05$, T1 $\chi^2 (1) = 1.087, p>.05$, or T2, $\chi^2 (2) = 0.206, p>.05$. Rates of planning did not differ between groups.

The chi-square comparing the frequency of planning between generic planning and tailored planning was not significant at T0, $\chi^2(1) = 0.960, p>.05$, but was significant at T1, $\chi^2(1) = 3.889, p=.049$. More participants than expected who received tailored text messages about planning (TPL) made at least one plan post-intervention than participants who received generic messages about planning. However, the difference between these groups did not persist at T2, $\chi^2 (2) = 1.225, p>.05$. 
Table 4. Frequency of Planning by Comparison over Time.

<table>
<thead>
<tr>
<th></th>
<th>T0</th>
<th></th>
<th>T1</th>
<th></th>
<th>T2</th>
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<tr>
<td></td>
<td>N</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>GPA</td>
<td>85</td>
<td>70</td>
<td>82.4</td>
<td>73</td>
<td>85.9</td>
<td>44</td>
</tr>
<tr>
<td>GPL &amp; TPL</td>
<td>154</td>
<td>125</td>
<td>81.2</td>
<td>124</td>
<td>80.5</td>
<td>75</td>
</tr>
<tr>
<td>GPL</td>
<td>83</td>
<td>65</td>
<td>78.3</td>
<td>62</td>
<td>74.7</td>
<td>37</td>
</tr>
<tr>
<td>TPL</td>
<td>71</td>
<td>60</td>
<td>84.5</td>
<td>62</td>
<td>87.3</td>
<td>38</td>
</tr>
</tbody>
</table>

Notes. GPA = Generic Physical Activity Messages, GPL = Generic Planning Messages. TPL = Tailored Planning Messages. Values in the same column that do not share the common subscript ‘a’ are significantly different, p<.05. Values in the same row that do not share the common subscript ‘b’ are significantly different, p<.05.
4.3.2 H1b

For all groups, the rate of planning remained the same from T0 to T1, ps>.05. For all 3 groups, planning decreased from T1 to T2 GPA: McNemar $\chi^2 (1) = 25.290, p < .001$; GPL: McNemar $\chi^2 (1) = 17.455, p < .001$; TPL: McNemar $\chi^2 (1) = 17.633, p < .001$, and from T0 to T2 GPA: McNemar $\chi^2 (1) = 18.382, p < .001$; GPL: McNemar $\chi^2 (1) = 19.184, p < .001$; TPL: McNemar $\chi^2 (1) = 14.700, p < .001$. There was a decrease in the rate of planning from T1 to T2.

4.4 Physical Activity

4.4.1 H2

There was a main effect of time on moderate to vigorous physical activity, $F(2,437.81)= 7.454, p<.05$. Participants’ moderate to vigorous activity did not differ from T0 to T1, t(117376)=-1.176, p>.05. Participants’ moderate to vigorous activity increased from T1 to T2, t(19)=2.179, p<.05, and from T0 to T2, t(34)=2.749, p<.05.
Table 5. Descriptive Statistics for Moderate to Vigorous Physical Activity and Physical Activity Intentions by Comparison over Time.

| Notes. GPA = Generic Physical Activity Messages, GPL = Generic Planning Messages. TPL = Tailored Planning Messages. Values in the same row that do not share a common subscript are significantly different, $p<.05$. Ratings of physical activity intentions were made on a 7-point scale. |

<table>
<thead>
<tr>
<th></th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>M</th>
<th>SE</th>
<th>M</th>
<th>SE</th>
<th>M</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate to Vigorous Physical Activity (minutes/week)</td>
<td>Physical Activity Intentions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPA</td>
<td>85</td>
<td>164.94</td>
<td>17.44</td>
<td>185.67</td>
<td>13.39</td>
<td>204.66</td>
<td>20.28</td>
<td>6.31</td>
<td>0.10</td>
</tr>
<tr>
<td>GPL &amp; TPL</td>
<td>154</td>
<td>157.72</td>
<td>13.79</td>
<td>166.09</td>
<td>8.93</td>
<td>197.93</td>
<td>13.89</td>
<td>6.19</td>
<td>0.09</td>
</tr>
<tr>
<td>Total</td>
<td>239</td>
<td>160.27</td>
<td>10.82</td>
<td>173.06</td>
<td>7.48</td>
<td>200.32</td>
<td>12.45</td>
<td>6.23</td>
<td>0.07</td>
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<tr>
<td>GPL</td>
<td>83</td>
<td>165.31</td>
<td>22.31</td>
<td>168.51</td>
<td>12.90</td>
<td>203.87</td>
<td>16.91</td>
<td>6.22</td>
<td>0.12</td>
</tr>
<tr>
<td>TPL</td>
<td>71</td>
<td>148.86</td>
<td>14.76</td>
<td>163.27</td>
<td>12.25</td>
<td>190.99</td>
<td>18.32</td>
<td>6.14</td>
<td>0.14</td>
</tr>
<tr>
<td>GPA &amp; TPL</td>
<td>154</td>
<td>157.72</td>
<td>13.79</td>
<td>166.09</td>
<td>8.93</td>
<td>197.93</td>
<td>13.89</td>
<td>6.13</td>
<td>0.07</td>
</tr>
<tr>
<td>Total</td>
<td>239</td>
<td>160.27</td>
<td>10.82</td>
<td>173.06</td>
<td>7.48</td>
<td>200.32</td>
<td>12.45</td>
<td>6.16</td>
<td>0.06</td>
</tr>
<tr>
<td>GPA</td>
<td>83</td>
<td>165.31</td>
<td>22.31</td>
<td>168.51</td>
<td>12.90</td>
<td>203.87</td>
<td>16.91</td>
<td>6.22</td>
<td>0.12</td>
</tr>
<tr>
<td>TPL</td>
<td>71</td>
<td>148.86</td>
<td>14.76</td>
<td>163.27</td>
<td>12.25</td>
<td>190.99</td>
<td>18.32</td>
<td>6.14</td>
<td>0.14</td>
</tr>
<tr>
<td>GPA &amp; TPL</td>
<td>154</td>
<td>157.72</td>
<td>13.79</td>
<td>166.09</td>
<td>8.93</td>
<td>197.93</td>
<td>13.89</td>
<td>6.13</td>
<td>0.07</td>
</tr>
</tbody>
</table>
4.5 Intention-Behaviour Relationship

4.5.1 H3

At T1, the correlation between intentions and physical activity was not significant for participants who created at least one plan at T1, r=0.07, p>.05 or for participants who did not create a plan at all, r=-0.188, p>.05. At T2, the correlation between intentions and physical activity was significant for those who planned at least once, r=0.229, p<.05, but not for those who failed to create a plan, r=0.13, p>.05. The difference between these correlations was not significant at T1, z=-0.75, p>.05 or T2, z=-0.78, p>.05.

4.6 Manipulation Checks

4.6.1 Self-reported Planning.

There was no main effect of time or condition on self-reported planning, ps>.05. There was also no interaction effect of self-reported planning by condition over time, p>.05.

4.6.2 Affective Attitudes

There was a main effect of time on affective attitudes, F(2, 468.03)= 7.18, p<.05. Participants reported decreasing affective attitudes from T0 to T1 t=2.809, p<.05 and from T0 to T2, t(39)=3.005, p<.05. There was no difference in affective attitudes towards planning for physical activity from T1 to T2, t(39)=0.709, p>.05. There was no main effect of group on affective attitudes, p>.05. There was also no condition by time interaction effect of affective attitudes, p>.05.

4.6.3 Instrumental Attitudes

There was a main effect of time on instrumental attitudes, F(2,435.91)= 30.62, p<.05. Instrumental attitudes towards planning decreased from T0 to T1, t(5074)=6.853, p<.05 from T1 to T2, t(22)=-2.671, p<.05 and from T0 to T2, t(22)=3.689, p<.05. There was no main effect of
There was no interaction effect of instrumental attitudes by condition over time, p>.05

**4.6.4 Perceived Behavioural Control**

There was a main effect of time on perceived behavioural control over planning, F(2,463.89)= 10.7144, p<.05. Perceived behavioural control over planning did not differ from T0 to T1, t(8627)=1.641, p<.05. It decreased from T1 to T2, t(40)=2.402, p<.05 and from T0 to T2, t(35)=3.589, p<.05. There was no main effect of condition on perceived control over planning, p>.05. There was no condition by time interaction effect for perceived behavioural control over planning, p>.05.

**4.6.5 Planning Intentions**

There was a main effect of time on intentions to plan, F(2,444.71)= 43.5352, p<.05. Participants reported decreasing intentions to plan from T0 to T1, t(153)=4.75, p<.05, from T1 to T2, t(8)=2.524, p<.05 and from T0 to T2, t(11)=5.298, p<.05. There was no main effect of condition on intentions to plan, p>.05. There was no interaction effect of intentions to plan by condition over time, p>.05.

**4.6.6 Technology Acceptance**

There were no differences in participants’ technology acceptance between groups, F(2,228)=1.853, p>.05.

**4.6.7 Message Acceptance**

There were no differences in participants’ message acceptance between groups, F(2,236)=1.398, p>.05.
Table 6. Descriptive Statistics for Manipulation Checks by Group over Time.

<table>
<thead>
<tr>
<th>Message Acceptance</th>
<th>Technology Acceptance</th>
<th>Perceived Behavioral Control</th>
<th>Instrumental Attitudes</th>
<th>Affective Attitudes</th>
<th>Planning</th>
<th>Self-Reported Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td>GPL</td>
<td>TPL</td>
<td>GPA</td>
<td>GPL</td>
<td>TPL</td>
<td>GPA</td>
</tr>
<tr>
<td>T0</td>
<td>T1</td>
<td>T2</td>
<td>T0</td>
<td>T1</td>
<td>T2</td>
<td></td>
</tr>
<tr>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
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<td></td>
</tr>
<tr>
<td>(0.16)</td>
<td>(0.22)</td>
<td>(0.15)</td>
<td>(0.16)</td>
<td>(0.15)</td>
<td>(0.14)</td>
<td></td>
</tr>
<tr>
<td>Notes: GPA = Generic Physical Activity Messages, GPL = Generic Planning Messages, TPL = Tailored Planning Messages. All ratings were made on 7-point scales.</td>
<td></td>
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</table>
Chapter 5

Discussion

The current study examined whether receiving text messages about planning, particularly tailored text messages, enhanced planning and physical activity. We also examined whether planning, resulting from our intervention, strengthened the physical activity intention-behaviour relationship. Receiving tailored text messages about planning enhanced planning more than generic text messages about planning after one month. However, when compared to participants who received text messages about physical activity, there appeared to be no relative advantage to delivering planning messages. Physical activity consistently increased across all experimental groups while rates of planning decreased. Accordingly, the intervention did not strengthen the intention-behaviour relationship. Although these study findings are largely contrary to our hypotheses, they have important practical and theoretical implications.

If the content of text messages focuses on planning for physical activity, there may be a benefit in tailoring these messages. Participants who received tailored messages about planning were more likely to have made at least one plan after one month than participants who received generic messages about planning. These findings were in partial support of our hypothesis, as we expected tailored messages to enhance planning relative to generic messages after one and two months. Our findings are consistent with previous meta-analyses on message tailoring, which found tailored messages to increase behaviour change more than generic messages (Lustria et al., 2009; Noar et al., 2007). Messages were tailored to participants’ names, self-reported benefits and barriers to planning and their physical activity goals. According to the elaboration likelihood model (Petty & Cacioppo, 2004), the tailoring advantage may be a result of participants
perceiving messages to be more personally relevant, and in turn, being more persuaded by the messages. Theory suggests participants would be more likely to change their behaviour in response to tailored messages compared to generic messages (Petty & Cacioppo, 1986).

However, when participants no longer received text messages, the effects of tailored messages over generic messages did not persist. Given that the present study is one of the first studies to determine if tailored text messages can have long-term effects, the need for additional research is clear. Messages may need to be sent over longer durations to have longer-lasting effects. Given the ease of delivering tailored messages through text messaging, longer interventions are now feasible. Furthermore, messages in the present study were tailored to participants perceived benefits and barriers to planning at baseline. Participants’ benefits and barriers may have changed over the course of the intervention, yet the content of the messages remained the same. The effects of the tailored messages might not have persisted because messages may have become less personally relevant over time. Future studies should assess participants’ benefits and barriers more frequently and tailor messages with recent, relevant information.

Similar to message tailoring, the content of text messages for physical activity did not impact planning as we expected it would. Participants who received messages about planning were equally likely to make at least one plan after one or two months as participants who received messages about physical activity. Rather, our results were consistent with Sweet et al. (submitted) where they found that messages about planning were not more persuasive than messages about physical activity for encouraging individuals to plan for physical activity. This finding was not in support of our hypothesis, as we expected text messages about planning to enhance planning relative to messages about physical activity. We had not expected our findings to be consistent in
this way because in our study, participants received twelve intervention messages over a month directly to their mobile phone versus participants in the Sweet et al. (submitted) study, who read only one intervention message immediately after completing the baseline survey on a web browser. We believed that increasing the frequency of messages, delivering them over a longer period of time to a device carried by the individual would result in different effects than Sweet et al. (submitted). The replication of Sweet et al.’s (submitted) findings provide mounting evidence that messages about planning may not be more persuasive than generic messages about physical activity for encouraging individuals to form plans for physical activity. Other strategies for increasing planning behaviour are needed.

This need is further emphasized by our finding that planning with the weekly planning tool consistently decreased over time, regardless of group. We had expected to see declines in planning among those who received generic messages about physical activity or planning but not among those participants who received tailored messages about planning. According to the elaboration likelihood model, tailored messages can lead to persistent behaviour change. The consistent decrease across all groups corresponds with a decline in participants’ attitudes, perceived behavioural control and intentions to create a plan. Over the course of the intervention, participants may have perceived planning to be less useful and less important for engaging in physical activity. Also, if participants had difficulty creating plans, they may have reported decreased control over planning for activity over time. In turn, participants’ decreasing attitudes and perceived behavioural control may have diminished their intentions to continue planning. Alternate strategies for promoting physical activity planning must aim to enhance (rather than decrease) people’s perceptions of the benefits of planning and their ability to plan. One strategy might be to educate participants how to plan effectively and to provide feedback on their plans.
Since planning with the weekly planning tool decreased over time, we expected to see a consistent decrease in self-reported planning over time. However, this was not the case. Across all three groups, there were no changes in self-reported planning over the duration of the study. Generic or tailored text messages about physical activity or planning may have prompted participants to plan their activity, but may not have prompted them to plan with the planning tool. This is consistent with the content of the messages, as there was no mention of the planning tool. Text messages in future interventions should prompt participants use the tool specific to the intervention for consistency of measurement.

Contrary to planning behaviour which consistently decreased, physical activity behaviour increased over time for all groups. We had expected to see differential increases across groups. However, given that our findings point to generally consistent effects across groups and all measured outcomes, this finding is not surprising. Our results support previous findings on the utility of text messages for promoting physical activity (Cole-Lewis & Kershaw, 2010; Fanning et al., 2012). Text messages about planning or physical activity may have provided a cognitive cue to remind individuals to participate if they had forgotten or had prioritized other goals ahead of exercise. Regardless of whether a text messages focus on physical activity planning or performance, they may promote increased physical activity over time.

Interestingly, participants who planned at least once did not report intentions that were more strongly correlated to their activity than participants who did not plan after one and two months. This result was not consistent with our hypothesis, as we expected participants who planned at least once to report a significantly stronger intention-behaviour relationship than participants who did not plan. Previous research on planning has consistently shown planning to strengthen the physical activity intention-behaviour relationship (Bélanger-Gravel et al., 2011;
However, our results did not support these findings. The lack of support of previous findings could be for one of two reasons. First, the intention-behaviour relationship may not have been strengthened because planning decreased yet activity increased over two months. Planning may be important for initiating activity, but planning may be less important for continuing physical activity over time. Future studies should examine the intention-behaviour relationship for maintenance of activity beyond two months. Secondly, the present study is the first to observe how text messages can influence the physical activity intention-behaviour relationship. Text messages may temporarily remind people to maintain their planning and to execute their plans.

5.1 Strengths

The present study answers calls to understand ways to promote planning for physical activity (Conner et al., 2010). It seems that text messages about planning are not an optimal way to promote planning, thus highlighting the need to identify other persuasive approaches. Our study addressed the need for theory-based applications of text messages in two different ways. (Buhi et al., 2012; Cole-Lewis & Kershaw, 2010; Fanning et al., 2012; Fjeldsoe et al., 2008; Krishna et al., 2009; Lau et al., 2011). We applied the theory of planned behaviour to create messages used in the intervention and as a component of our evaluation strategy to use attitudes, perceived behavioural control and intentions to explain the reasons for the decrement in planning behaviour. We tested the efficacy of text messages in the general population of adults as opposed to among young adults and students as in previous research (Bélanger-Gravel et al., 2011; Conner et al., 2010; Vodopivec-Jamsek et al., 2012). Using an older age group relative to previous research (25-45) allows us to generalize our findings to a different sample of the population. The large sample size in our study addressed limitations of previous research on planning and physical
activity (Prestwich & Kellar, 2010) and recommendations in text messaging and behaviour change reviews (Buhi et al., 2012; Fjeldsoe et al., 2008; Krishna et al., 2009; Stephens & Allen, 2012; Vodopivec-Jamsek et al., 2012). The sample size was large enough for us to detect significant effects. The present study assessed planning of physical activity over longer time intervals than previous studies (Conner et al., 2010; Sweet, submitted).

5.2 Limitations

Our study is not without limitations. First off, we measured physical activity using self-report, which can be subject to bias. However, the GLTEQ is a valid measure of physical activity, and has shown test-retest reliability in previous research. We did not measure participants’ perceptions of the study. Despite receiving information clearly stating the objectives of the study, some participants might have thought the text messages were supposed to be reminders to execute the activity they had planned. If participants did not expect to receive messages about planning, their perceptions of the messages may not have aligned with what they expected the study was about. As a result, participants may not have responded as theory would have predicted. Furthermore, we were unaware if participants opened or read the text messages they received. Future messaging studies should utilize software that indicates whether or not messages were opened or not, or require participants to respond to each message.

Although messages were tailored to attitudes and perceived behavioural control, participants in the TPL group may have perceived messages to be less tailored or personally relevant over time. The content of the twelve text messages were tailored to participants’ baseline perceived benefits and barriers to planning. The design of our study did not allow for text messages to be updated to participants changing attitudes and perceived control over the course of the intervention. Our findings can only be generalized to messages tailored to baseline attitudes
and perceived control towards planning. Although our results do not support message tailoring, message tailoring should not be completely abandoned. As previous reviews have indicated, tailoring to demographic variables and providing feedback in addition to tailoring to theoretical content can be effective (Lustria et al., 2009; Noar et al., 2007). Future studies should determine the degree of tailoring needed for participants to perceive messages to be tailored and personally relevant.

Our intervention was not interactive, previous studies sending text messages to change physical activity reported success with increasing interaction with participants (Patrick et al., 2009). Interaction between participant and researcher can enhance the effects of text messages on physical activity behaviour change (Fjeldsoe et al., 2008). Future research should assess the frequency and type of interaction between participant-researcher needed to optimize behaviour change.

5.3 Future directions

Evidence from the present study does not support the efficacy of using text messages to promote planning for physical activity. Rates of planning declined over time, regardless of text message content. Further research is needed to investigate ways to curb declines in planning over time.

First, increasing the frequency of messages or sending messages to participants for longer than one month may increase planning behaviour. Research has yet to determine the optimal frequency or duration that messages should be delivered to promote planning. Second, previous research has suggested that interaction between participants and researchers can increase the influence of text messages. Researchers can provide feedback to participants about the frequency or the quality of participants plans. Feedback has shown promise in previous text messaging
interventions (Patrick et al., 2009). Third, text messages can be used to collect data from participants, which may increase responsiveness to the intervention. Participants may be ask to report their daily plan for physical activity or self-report their physical activity for the day (Fanning et al., 2012).

Future studies should determine the effect of tailored messages about physical activity on planning and physical activity. Future studies should also explore different theoretical frameworks for tailoring messages. Messages tailored to social cognitive theory have shown efficacy as a framework for tailoring in a text messaging intervention targeting postnatal mothers (Fjeldsoe et al., 2010). Future investigations should continue to examine the physical activity intention-behaviour relationship. Although there is a great deal of correlational evidence, there is currently no causal evidence that physical activity plans are executed as intended. Future studies utilizing mobile phones and text messages should follow-up with participants daily to determine if they executed their plans as they initially intended.

5.4 Theoretical Implications

The current study is the first to examine the effects of tailored text messages on planning for physical activity. Previous planning research only examined the impact of generic messages (Sweet, submitted). In the present study, tenets of the theory of planned behaviour were applied to assess the impact of generic messages to tailored messages. Tailored messages may be more personally relevant and in turn, more persuasive for encouraging planning relative to generic messages about planning.

Finally, the present study investigated the impact of theoretically targeting messages about planning. Previous research strongly recommended the use of theory for message tailoring. Messages in the present study were grounded in the theory of planned behaviour and targeted
participants attitudes and perceived behavioural control over planning. Although the messages led to a decline in planning, there was a consistent increase in physical activity over time. Future studies should continue to base message content in theory and to test alternative content for promoting planning for activity.

5.5 Practical Implications

Practical implications can be made for text messaging campaigns aimed at increasing planning and physical activity among inactive adults between the ages of 25 and 45 with intentions to be active. The results can help to guide the content of messages used in future research or interventions. First, it seems that planning messages provide little advantage relative to physical activity messages. Second, rates of planning may decrease when messages are no longer delivered. Extending the messaging campaign beyond one month may prove to be useful for promoting planning maintenance. Furthermore, messages that are tailored or generic and are about planning or physical activity may increase participation in activity over time.

5.6 Conclusion

While text messages about planning can lead to increased physical activity, there seems to be little advantage relative to generic messages about physical activity in persuading planning behaviour. Research is needed to identify other strategies for promoting planning.
References


Sweet, S. N., Brawley, L. R., Hatchell, A., & Gainforth, H. L. & Latimer-Cheung, A. E. (submitted). Can persuasive messages encourage individuals to create action plans for physical activity?


Appendix A

Screening Questionnaire

Thank you for your interest in our study. This first set of questions assess whether you are eligible for the current study. Please respond to the following questions and remember to give true and honest answers.

Are you between the ages 25 and 45?
- Yes, I am between the ages 25 and 45.
- No, I am not between the ages 25 and 45.

Canada's New Physical Activity Guidelines
Canada's New Physical Activity Guidelines recommend that adults accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic exercise per week in bouts of 10 minutes or more. It is also beneficial to add muscle strengthening exercises using major muscle groups at least 2 days per week. This should be exercise that you do during your spare time, not something you have to do at work or around the house. For your information, a recent report from Statistics Canada found that 8 out of 10 Canadian adults do not do enough exercise to meet this guideline.

Do you engage in enough exercise to meet Canada's physical activity guidelines?
Please tell me which of the following statements best describes you:
- Yes, I have been doing 150 minutes of moderate- to vigorous-intensity physical activity and 2 days of strength training per week, for MORE than 6 months.
- Yes, I have been doing 150 minutes of moderate- to vigorous-intensity physical activity and 2 days of strength training per week, for LESS than 6 months.
- No, I am not doing 150 minutes of moderate- to vigorous-intensity physical activity and 2 days of strength training per week, but I INTEND to start doing more exercise in the next 6 months.
- No, I am not doing 150 minutes of moderate- to vigorous-intensity physical activity and 2 days of strength training per week, and I do NOT intend to start doing more exercise in the next 6 months.

Do you have access to email and can you send and receive text messages from a cellular phone?
- Yes
- No
Are you physically able to perform physical activity (that is, do you have permission from your doctor to participate in physical activity)?

- Yes
- No
Appendix B

Godin Leisure-Time Exercise Questionnaire (GLTEQ)

Please answer the following questions:
What are the FIRST 3 letters of your mother's maiden name?

What are the LAST 3 characters your postal code?

Physical Activity
Like most people, it is likely that you do not exercise as much as you would like. In fact, even the most disciplined people have difficulties doing as much exercise as they would wish to because of family demands, fatigue at the end of the working day, unexpected situations, etc. We need to understand how much exercise people are really doing. Please tell us what you are actually doing. Don't worry if you have not exercised as much as you wish you had. We need to know what is really happening, not what you think we 'want to hear'. The most difficult thing will no doubt be for you to remember when you exercised, what type of physical activity you did and how hard you did it. It is important for you to do your best to remember so that your answers are as precise as possible. Take the time you need to answer.

STRENUOUS/VIGOROUS Physical Activity (Heart Beats Rapidly)
Examples include running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming and vigorous long distance bicycling.

Considering a A TYPICAL WEEK in the past month, how many times on average have you done STRENUOUS/VIGOROUS physical activity for more than 20 minutes during your free time?
Number of Times: 

For approximately how many minutes do you participate in each STRENUOUS/VIGOROUS physical activity session?
Minutes:

MODERATE Physical Activity (Not Exhausting)
Examples include fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing.
Considering a A TYPICAL WEEK in the past month, how many times on average have you done MODERATE physical activity for more than 20 minutes during your free time?
MILD Physical Activity (Minimal Effort)
Examples include yoga, archery, fishing from river band, bowling, horseshoes, golf, snow-mobiling and easy walking.

Considering a A TYPICAL WEEK in the past month, how many times on average have you done MILD physical activity for more than 20 minutes during your free time?
Number of Times: 

For approximately how many minutes do you participate in each MILD physical activity session?
Minutes: 

Please indicate the extent to which you agree or disagree with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Slightly Disagree (3)</th>
<th>Neutral (4)</th>
<th>Slighty Agree (5)</th>
<th>Agree (6)</th>
<th>Strongly Agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I intend to do physical activity over the next 4 weeks</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>I will do physical activity over the next 4 weeks</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>I will try to do physical activity over the next 4 weeks</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>
Appendix C

Manipulation Check Questionnaire

Physical Activity Planning
Creating a physical activity plan involves specifying WHEN, WHERE and WHAT you will do for physical activity and HOW OFTEN you will do it. The following questions will ask you about physical activity and planning for physical activity. Please read the questions carefully and indicate the extent to which you agree or disagree with the statements on a 7-point scale, from 1 being that you "strongly disagree" with the statement and 7 being that you "strongly agree" with the statement.

For me, making detailed plans for my physical activity over the next 4 weeks will be...

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dull</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Pleasant</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Boring</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Important</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Bad</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Useful</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

Creating a detailed physical activity plan will...

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Slightly Disagree (3)</th>
<th>Neutral (4)</th>
<th>Slightly Agree (5)</th>
<th>Agree (6)</th>
<th>Strongly Agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help to make my physical activity a routine</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Stop me from thinking about having to fit physical activity into my day</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Help me to remember to do physical activity</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Make it easier to fit my physical activity into my</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Statement</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Slightly Disagree</td>
<td>Neutral</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>-------------------</td>
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<td>-------------------</td>
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<td>----------------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>I am capable of planning for physical activity over the next 4 weeks</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I am confident that I will be able to plan for my physical activity</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>over the next 4 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have the ability to plan for physical activity over the next 4 weeks</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Please indicate the extent to which you agree or disagree with the following statements:

- Schedule
- Make it easier to manage obstacles that might get in the way of me being active
- Prevent me from forgetting to do physical activity
- Make me more confident that I can reach my physical activity goal
- Increase the likelihood that I will achieve my physical activity goal
I have complete control over planning for physical activity over the next 4 weeks

Please indicate the extent to which you agree or disagree with the following statements:

<table>
<thead>
<tr>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Slightly Disagree (3)</th>
<th>Neutral (4)</th>
<th>Slightly Agree (5)</th>
<th>Agree (6)</th>
<th>Strongly Agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I intend to plan for physical activity over the next 4 weeks
I will plan for physical activity over the next 4 weeks
I will try to plan for physical activity over the next 4 weeks
Appendix D

Tailoring Questionnaire

Privacy and Confidentiality
Thank you for completing the first section of the survey. For the second section of the survey, we will be asking you to report some of your personal information. We ASSURE you that the following information will be kept PRIVATE and CONFIDENTIAL and will ONLY be used for research purposes. You will be asked to provide your email address, which will ONLY be used for communication with the researcher and for receiving a link to a physical activity planning tool.

You will also be asked to provide your cell phone number. You will receive text messages to the cell phone number you provide ONLY through the duration of the study. Upon completion of the study, your cell phone number will IMMEDIATELY be removed from the researchers records and will NOT be used again. IMPORTANT: Please ensure that you are able to send and receive text messages through your current cell phone subscription. Sending and receiving text messages for this study will result in the SAME cell phone charges as those you normally receive. Any additional charges incurred will NOT be covered by the researcher. Assuming that you send and receive text messages regularly through your cell phone, there should NOT be any additional charges by participating in the present study. Finally, you will be asked to report your first name and the names of people who are important to you. These names MAY be used in the text messages that you will be sent through the study. Again, the names will ONLY be used for research purposes and will be COMPLETELY CONFIDENTIAL.

Participant ID
Please answer the following questions:
What are the FIRST 3 letters of your mother's maiden name? 

What are the LAST 3 characters your postal code? 

Please provide your email address and cell phone number for which you can receive text messages to. Again, the following information will be kept PRIVATE and CONFIDENTIAL will ONLY be used for research purposes.
Email Address 

Phone Number 

You will be receiving a link to a physical activity planning tool each Wednesday over the
next 4 weeks to plan your physical activity. Would you like to receive the link through Email ONLY, or through Email AND Text Message?
- Email ONLY
- Email AND Text Message

What is your first name or what do most friends and family address you as?

If it were up to you, on which days of the week and what time of the day would you want to receive text messages? The messages could be spread through the week at varying times or could all be received on one day at the same time, or any variation...which ever option works best for YOU.

<table>
<thead>
<tr>
<th>Day</th>
<th>SPECIFIC Time (ex. 9:10am)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message 1</td>
<td></td>
</tr>
<tr>
<td>o Monday</td>
<td></td>
</tr>
<tr>
<td>o Tuesday</td>
<td></td>
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<tr>
<td>o Wednesday</td>
<td></td>
</tr>
<tr>
<td>o Thursday</td>
<td></td>
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<tr>
<td>o Friday</td>
<td></td>
</tr>
<tr>
<td>o Saturday</td>
<td></td>
</tr>
<tr>
<td>o Sunday</td>
<td></td>
</tr>
<tr>
<td>Message 2</td>
<td></td>
</tr>
<tr>
<td>o Monday</td>
<td></td>
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<tr>
<td>o Tuesday</td>
<td></td>
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<td>o Wednesday</td>
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<td>o Thursday</td>
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<tr>
<td>o Friday</td>
<td></td>
</tr>
<tr>
<td>o Saturday</td>
<td></td>
</tr>
<tr>
<td>o Sunday</td>
<td></td>
</tr>
</tbody>
</table>
What are the barriers that might prevent you from DOING physical activity? (ex. lack of time, no energy, tired, price, weather, etc.)

Barrier #1
Barrier #2
Barrier #3
Barrier #4

What is your physical activity goal? Why do you want to be more active?

What are the benefits of PLANNING for physical activity for you? (e.g. helps me to stay organized, good habits, meet your goals)

Benefit #1
Benefit #2
Benefit #3
Benefit #4

What are some barriers that might prevent you from PLANNING your physical activity? (e.g. forget to do it, not necessary, too lazy)

Barrier #1
Appendix E

Demographic Questionnaire

What is your date of birth?
Day
Month
Year

Gender
○ Male
○ Female

Are you a visible minority?
○ Yes
○ No

Please check all responses that apply to you:
□ Black (e.g., African American, Canadian, Caribbean)
□ Chinese
□ Filipino
□ Japanese
□ Korean
□ Indigenous person from outside North America
□ South Asian/East Indian (e.g., Bangladeshi, Pakistani, Indian from India, East Indian from Guyana, Trinidadian, Sri Lankan, East African)
□ South East Asian (e.g., Burmese, Cambodian/Kampuchean, Laotian, Malaysian, Thai, Vietnamese, Indonesian)
□ Non-White West Asian (e.g., Iranian, Lebanese, Afghan)
□ Non-White North African (e.g., Egyptian, Libyan)
□ Arab
□ Non-White Latin American (including indigenous persons from Central and South America)
□ Person of mixed origin (with one parent in one of the visible minority groups listed above)
□ Other (please specify) ______________________

What is your marital status?
○ Single
○ Common-law
○ Married
○ Divorced
○ Do not wish to specify
○ Other (please specify) ______________________

Do you have any children?
○ Yes
○ No
○ Do not wish to specify

How many children do you have?
○ 0
○ 1
○ 2
○ 3
○ 4 or more
○ Do not wish to specify
What is your highest level of education?
- Less than high school degree
- High school degree or equivalent
- Some college (no diploma)
- College diploma
- Some University (no degree)
- University - Bachelor degree (BA, BSc, etc.)
- University - Graduate degree (MS, MA, etc.)
- University - Doctorate-level degree (Ph.D)
- University - Professional Post-Graduate (M.D, etc.)
- Do not wish to specify

Which of the following categories best describes your employment status?
- Employed, working 1-39 hours per week
- Employed, working 40 or more hours per week
- Not employed, looking for work
- Not employed, NOT looking for work
- Retired
- Do not wish to specify

What is your household income?
- Less than $35,000
- $35,000 to $49,999
- $50,000 to $64,999
- $65,000 to $74,999
- $75,000 to $99,999
- $100,000 to $149,999
- $150,000 or More
- Do not wish to report
Appendix F

Technology and Message Acceptance Questionnaires

Please indicate the extent to which you agree or disagree with the following statements:

<table>
<thead>
<tr>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Slightly Disagree (3)</th>
<th>Neutral (4)</th>
<th>Slighty Agree (5)</th>
<th>Agree (6)</th>
<th>Strongly Agree (7)</th>
</tr>
</thead>
</table>

Assuming that I have access to the weekly planning tool, I intend to use it.

Given that I have access to the weekly planning tool, I predict I would use it.

Using the weekly planning tool increases my chances of performing physical activity.

Using the weekly planning tool improves how well I plan for physical activity.

Using the weekly planning tool enhances the effectiveness of my planning for physical activity.

I find the weekly planning tool useful for planning my physical activity.
My interaction with the weekly planning tool is clear and understandable. Interacting with the weekly planning tool does not require a lot of my mental effort. I find the weekly planning tool easy to use. I find it easy to get the weekly planning tool to do what I want it to do.

Please answer the following questions about the text messages you received through the duration of the study. To what extent were the text messages you received:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Believable</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Not Trustworthy</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Not Convincing</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Not Reasonable</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Dishonest</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Questionable</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Inconclusive</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Inauthentic</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Unlikely</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

Believable
Trustworthy
Convincing
Reasonable
Honest
Not Questionable
Conclusive
Authentic
Likely
# Appendix G

## GPA and GPL Messages

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>GPA</th>
<th>GPL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td>Received automatically after completing Baseline Survey</td>
<td>Dear Study Participant, Thank you for completing the survey and participating in our study! Each week over the next 4 weeks, you will receive an email with a link to an online tool that you can use to plan your physical activity. You will receive your first link this coming week. Remember, being physically active can help you to reach your health goals! Being active can reduce the risk of: - Premature death - Heart disease - Stroke - High blood pressure - Certain types of cancer - Type 2 diabetes - Osteoporosis - Overweight and Obesity And can lead to improved: - Fitness - Strength - Mental Health (morale and self-esteem)</td>
<td>Dear Study Participant, Thank you for completing the survey and participating in our study! Each week over the next 4 weeks, you will receive an email with a link to an online tool that you can use to plan your physical activity. You will receive your first link this coming week. Remember, making a detailed plan to be physically active can help you reach your physical activity goals! Planning can help you to: - Create a routine that works with your schedule - Stay focused on your physical activity goals - Have a sense of accomplishment - “I did it!” - Help you feel less stressed about fitting physical activity into your schedule</td>
</tr>
</tbody>
</table>
physically active, adults should accumulate 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week, in bouts of 10 minutes or more
- More physical activity provides greater health benefits

WAYS TO GET ACTIVE
There are a variety of ways you can do physical activity.
- Join a community running or walking group
- Go for a brisk walk around the block after dinner
- Take a dance class after work
- Bike or walk to work everyday
- Rake the lawn, and then offer to do the same for your neighbour
- Train for and participate in a run or walk for charity
- Take up a favourite sport again or try a new sport
- Be active with the family on the weekend

We look forward to your continued participation!

People who plan are also more active than people who do not plan. Planning gets you thinking about your activity NOW, instead of forgetting about it later!

People often make plans that are too general. For example, a plan that looks like this: ‘I plan to be active on Mondays, Wednesdays and Fridays’ does not provide enough detail.

Instead, plan WHEN, WHERE and WHAT you will do to be active. Here is an example of a good detailed plan: ‘I will be active on Mondays, Wednesdays and Fridays at noon. I will go to the gym, run on a treadmill for 30 minutes, and bike for 20 minutes.’

We look forward to your continued participation!

0  Welcome Text
  Thank you for participating in our study at Queen’s! To confirm this is your cell phone number, please respond back with the word yes.

Week 1 1  ATT
  Engaging in physical activity is a great way to keep your body fit and your heart healthy! (instrumental)

Planning your exercise is an easy way to make sure you fit exercise into your busy schedule. (instrumental)
<table>
<thead>
<tr>
<th>Week</th>
<th>2</th>
<th>PBC</th>
<th>You can do it. Prepare what you need to exercise, get out there and get active! (persuasion)</th>
<th>Planning your exercise is easy. Schedule your exercise into your week today! (persuasion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>ATT</td>
<td>Participating in regular physical activity is important. Your friends and family think so too!</td>
<td>Planning when you will work out will help you stay organized so that you can find time to spend with your friends and family.</td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>4</td>
<td>PBC</td>
<td>You have exercised before, so you can do it again. You are going to feel great after you exercise! (mastery)</td>
<td>You have scheduled exercise into your day before, so why not do it again? You’ll have a better chance of meeting your physical activity goal. (mastery)</td>
</tr>
<tr>
<td>5</td>
<td>ATT</td>
<td>Being active is important for relieving stress and can give you a lot more energy. (instrumental)</td>
<td>Planning your exercise will make it easier to manage obstacles that might get in the way of getting active. (instrumental)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>PBC</td>
<td>Think about the last time you exercised. It wasn’t that hard, was it? Just get out there and do it! (mastery)</td>
<td>Planning can be quick and effective. Write down what where, when and how you are going to exercise to overcome what might get in the way of your activity.</td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>7</td>
<td>ATT</td>
<td>If you exercise regularly, you have a better chance of reaching your exercise goals. (instrumental)</td>
<td>If you plan your exercise, you have a better chance of reaching your exercise goals. (instrumental)</td>
</tr>
<tr>
<td>8</td>
<td>PBC</td>
<td>If you are regularly active, keep it up. If not, try just a few minutes every day.</td>
<td>Think about the last time you planned your exercise. It wasn’t that hard, was it? Plan your exercise today! (mastery)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATT</td>
<td>Engaging in physical activity each week can improve your overall health. It could even make you feel relaxed, happier and more energetic!</td>
<td>Planning what, when and where you will do your exercise is a good way to make sure you exercise each day.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>-----</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Week 4</td>
<td>1 0</td>
<td>ATT</td>
<td>If you are exercising regularly, keep it up! If not, you can do it! Get out there and exercise today. (persuasion)</td>
<td>Planning your exercise is really easy. It only takes a couple of minutes to do each day. Planning can help to manage things that might get in the way of following through (persuasion).</td>
</tr>
<tr>
<td>1 1</td>
<td>ATT</td>
<td>Exercising regularly is an important part of leading a healthy and active lifestyle. (instrumental)</td>
<td>Planning your exercise can help you to make a physical activity routine. (instrumental)</td>
<td></td>
</tr>
<tr>
<td>1 2</td>
<td>PBC</td>
<td>Add 10 minutes of physical activity to your day, it is that easy…you can do it!</td>
<td>Creating an exercise plan is simple. Plan what, where, when and how you are going to do your activity today. It will not take long and it is important.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix H

TPL Tailoring Template

<table>
<thead>
<tr>
<th>#</th>
<th>Date/Time</th>
<th>Message</th>
</tr>
</thead>
</table>
| Email | After completing baseline survey | Dear «NAME»,
Thank you for completing the survey and participating in our study! Each week over the next 4 weeks, you will receive an email with a link to an online tool that you can use to plan your physical activity. You will receive your first link this coming week.

Remember, making a detailed plan to be physically active can help you reach your physical activity goals!

Planning can help you to:
- Create a routine that works with your schedule
- Stay focused on your physical activity goals
- Have a sense of accomplishment - “I did it!”
- Help you feel less stressed about fitting physical activity into your schedule

DID YOU KNOW?
- Studies have shown that people who have a physical activity plan are more likely to reach their physical activity goals than people who do not plan.
- People who plan are also more active than people who do not plan.
Planning gets you thinking about your activity NOW, instead of forgetting about it later!

People often make plans that are too general. For example, a plan that looks like this: ‘I plan to be active on Mondays, Wednesdays and Fridays’ does not provide enough detail.

Instead, plan WHEN, WHERE and WHAT you will do to be active. Here is an example of a good detailed plan:
‘I will be active on Mondays, Wednesdays and Fridays at noon. I will go to the gym, run on a treadmill for 30 minutes,
and bike for 20 minutes.’

We look forward to your continued participation!

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
</table>
| Day 1| «DAY_1»| «NAME», you said that planning your exercise is «PLANNING_BENEFIT_1».
| Time 1| «TIME_1» | «NAME», planning when you will work out will help you stay organized so «PLANNING_BENEFIT_2».
| Day 2| «DAY_2» | «NAME», planning your exercise is easy. You can overcome «PA_BARRIER_1».
| Time 2| «TIME_2» | «NAME», planning your exercise will help you to manage «PLANNING_BENEFIT_3».
| Day 3| «DAY_3» | «NAME», planning can be quick and effective. Write down what where, when and how you will exercise to overcome «PA_BARRIER_2».
| Time 3| «TIME_3» | «NAME», you have scheduled exercise into your day before, so why not do it again? You can meet your physical activity goal of «GOAL».
| Day 1| «DAY_1» | «NAME», you said that planning your exercise is «PLANNING_BENEFIT_1».
| Time 1| «TIME_1» | «NAME», if you plan your exercise, you have a better chance of reaching your goal of «GOAL».
| Day 2| «DAY_2» | «NAME», planning your exercise will help you to manage «PLANNING_BENEFIT_3».
| Time 2| «TIME_2» | «NAME», thinking about the last time you planned your exercise. It wasn’t that hard, was it? Plan your exercise today!
| Day 3| «DAY_3» | «NAME», you said that planning what, when and where you will do your exercise is a good way to «PLANNING_BENEFIT_4».
| Time 3| «TIME_3» | By planning your exercise, «NAME», it will be easier to manage things that might get in the way of following through, like «PA_BARRIER_3».
| Day 2| «DAY_2» | «NAME», you said that planning your exercise will help you to «PLANNING_BENEFIT_1».
| Time 2| «TIME_2» | «NAME», creating an exercise plan is simple. Plan what, where, when and how you are going to do your activity because it doesn’t need to be «PLANNING_BARRIER_4».

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Appendix I

Weekly Planning Tool

Please use the following tool to plan your physical activity for the coming week.

What is your first name?

What are the last 4 digits of the cell phone number for which you are receiving text messages for this study?

On what days would you like to plan physical activity this coming week?
- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday

What will you do for physical activity on Monday?

Where will you do physical activity on Monday?

When will you start your physical activity on Monday?

How long will you do physical activity on Monday?
- 0-15 mins
- 15-30 mins
- 30-45 mins
- 45-60 mins
- 1 hour 15 mins
- 1 hour 30 mins
- 1 hour 45 mins
What will you do for physical activity on Tuesday?

Where will you do physical activity on Tuesday?

What time will you start your physical activity on Tuesday?
__:__:__ (HH/MM/SS)

How long will you do physical activity on Tuesday?
Hours
- 0 hours
- 1 hour
- 2 hours
- 3 hours
- 3+ hours

Minutes
- 10 mins
- 15 mins
- 20 mins
- 25 mins
- 30 mins
- 35 mins
- 40 mins
- 45 mins
- 50 mins
- 55 mins

What will you do for physical activity on Wednesday?

Where will you do physical activity on Wednesday?

What time will you start your physical activity on Wednesday?
__:__:__ (HH/MM/SS)

How long will you do physical activity on Wednesday?
Hours
- 0 hours
- 1 hour
What will you do for physical activity on Thursday?

Where will you do physical activity on Thursday?

What time will you start your physical activity on Thursday?
__:__:__ (HH/MM/SS)

How long will you do physical activity on Thursday?

Hours
- 0 hours
- 1 hour
- 2 hours
- 3 hours
- 3+ hours

Minutes
- 10 mins
- 15 mins
- 20 mins
- 25 mins
- 30 mins
- 35 mins
- 40 mins
- 45 mins
- 50 mins
- 55 mins
What will you do for physical activity on Friday?


Where will you do physical activity on Friday?


What time will you start your physical activity on Friday?

__:__:__ (HH/MM/SS)

How long will you do physical activity on Friday?
Hours
○ 0 hours
○ 1 hour
○ 2 hours
○ 3 hours
○ 3+ hours
Minutes
○ 10 mins
○ 15 mins
○ 20 mins
○ 25 mins
○ 30 mins
○ 35 mins
○ 40 mins
○ 45 mins
○ 50 mins
○ 55 mins

What will you do for physical activity on Saturday?


Where will you do physical activity on Saturday?


What time will you start your physical activity on Saturday?

__:__:__ (HH/MM/SS)

How long will you do physical activity on Saturday?
Hours
○ 0 hours
○ 1 hour
○ 2 hours
○ 3 hours
○ 3+ hours
Minutes
○ 10 mins
What will you do for physical activity on Sunday?


Where will you do physical activity on Sunday?


What time will you start your physical activity on Sunday?
__:__:__ (HH/MM/SS)

How long will you do physical activity on Sunday?
Hours
  o  0 hours
  o  1 hour
  o  2 hours
  o  3 hours
  o  3+ hours
Minutes
  o  10 mins
  o  15 mins
  o  20 mins
  o  25 mins
  o  30 mins
  o  35 mins
  o  40 mins
  o  45 mins
  o  50 mins
  o  55 mins