University of Alberta

Diabetes NetPLAY: A Physical Activity Website and Linked E-mail Counselling Intervention for Individuals with Type 2 Diabetes

by

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ABSTRACT

Physical activity has long been recognized as an integral part of diabetes management. However, surveys indicate that over half of individuals with type 2 diabetes are not active. The objectives of this study are to: 1) examine the feasibility (recruitment, retention, adherence and satisfaction) and; 2) preliminary efficacy of a 12-week website and linked email counselling intervention on physical activity behaviour in individuals with type 2 diabetes. A total of 49 individuals with type 2 diabetes were randomly assigned to the Diabetes NetPLAY intervention or control condition. Those in the intervention condition received weekly information grounded in the Social Cognitive Theory (SCT). The intervention group demonstrated a significant improvement in total vigorous and moderate minutes of physical activity compared to the control group over the 12-week study. This study demonstrates that web-based interventions are feasible in this population and show great potential for improving positive physical activity outcomes.

Dedication

I dedicate this thesis to those who have made me the person I am today and to those who have yet to make their impact.

Acknowledgement

I would first like to thank my family and friends for their support and encouragement throughout this journey, without you this would have never been possible. The patience, dedication and understanding you have shown me will never be forgotten.

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Chapter 1 – Introduction

1.1 Overview of the chapter

This chapter provides a brief overview of the role of physical activity in the effective management of type 2 diabetes in the adult population, the use of behaviour change theories in the development of physical activity interventions and the utility of computer technology in delivering such interventions. In addition, the overall study rationale, aim and thesis plan are outlined.

1.2 Introduction

Diabetes mellitus is becoming a major health concern worldwide. According to the International Diabetes Federation, the highest rates of diabetes prevalence are found in the North American region, with an estimated of 9.2% of the population affected (International Diabetes Federation, 2006). According to the Canadian Diabetes Association (CDA), diabetes is the seventh leading cause of death by disease in Canada and direct medical costs to treat diabetes are roughly $13.2 billion every year (CDA, 2003). Type 2 diabetes represents approximately 90% of diagnosed cases with type 1 diabetes making up the remaining 10%; however, the prevalence of type 2 cases is expected to increase dramatically (CDA, 2003).

Physical activity has long been recognized as a vital component of diabetes management (CDA, 2003; Sigal, Kenny, Wasserman & Castaneda-Sceppa, 2004). Physical activity, including endurance and resistance training, can help diabetes patients achieve a variety of goals including improved glycemic control, increased cardiorespiratory fitness, increased insulin sensitivity and weight maintenance (CDA,

2003). Despite the overwhelming positive impact of physical activity, more than 60% of individuals with type 2 diabetes are inactive (Plotnikoff, 2006; Health Canada, 2003) and report more lapse in physical activity than the general population (Krug, Haire-Joshu & Heady, 1991).

The low rate of physical activity participation in this population may be due to a number of factors. People with type 2 diabetes report receiving less education, information and support for physical activity compared with other key management components of diabetes such as nutrition and medications (Wilson, Ary, Biglan, Glasgow, Toobert & Campbell, 1986). In addition, it appears more time and effort is required to engage in regular physical activity than modifying diet and taking medication. Further, individuals with diabetes also view physical activity as a difficult behaviour to change (Di Loreto et al., 2003). It has also been reported that over 50% of those with diabetes state some form of physical limitation or injury (Ford & Herman, 1995), which could further contribute to physical inactivity.

To add to the complexity, it is reported that patients identify family physicians as a reliable and preferred source of encouragement and information for physical activity (Petrella & Lattanzio, 2002). However, only 25% of individuals with type 2 diabetes report receiving specific instructions about physical activity from health care professionals, indicating that exercise is often overlooked and underemphasized by both patients and health care providers (Petrella & Lattanzio, 2002). In addition, the positive results of physical activity often take place over the long-term, making tangible, timely feedback difficult to provide (Krug, et al., 1991).

Plotnikoff, Brez, & Hotz (2000) point out that among the cognitive variables; self-efficacy has been strongly correlated with physical activity participation in the general population. However, exercise self-efficacy scores appear to be low compared with other self-care behaviours in the diabetes population, indicating that individuals in this population might lack the confidence to engage in physical activity (Glasgow, Toobert, Riddle, Donnelly, Mitchell & Calder, 1989). Along with self efficacy, motivational barriers have shown to be significant correlates of physical activity in those with diabetes, indicating that many individuals lack sufficient motivation to engage in activity (Hays & Clark, 1999). Those with diabetes have also shown lower perceived control and increased fear and vulnerability scores than those without diabetes, indicating that the focus should be aimed at increasing confidence to undertake exercise and limiting the delivery of fear messaging (Plotnikoff, Brez & Brunet, 2003).

There has been a growing body of literature using behaviour change theories to understand and predict physical activity behaviour in the diabetes population. Albert Bandura's (1986) Social Cognitive Theory (SCT) has been used to explain physical activity behaviour in the general population and has also recently been employed in the diabetes population. SCT attempts to explain human behaviour in terms of reciprocal determinism, in that behaviour, personal factors and environmental surroundings interact to shape behaviour (Baranowski, Perry & Parcel, 2002). According to Bandura (2004), SCT specifies a set of core determinants, the methods through which they work, and the best ways of translating this knowledge into effective health practices. In the general population several SCT constructs, including self-efficacy, outcome expectations,

outcome expectancies, social support and self-regulation, have proved to be predictive of physical activity behaviour (Baranowski et al., 2002).

In the diabetes population, the use of SCT to predict physical activity behaviour is relatively novel. However, this theory appears to have promise for guiding diabetes educators in designing physical activity interventions (Allen, 2004). In a recent review by Allen (2004), 13 studies were identified that explored the relationship between self-efficacy, outcome expectations and exercise. A significant relationship between self-efficacy and exercise behaviour was found in all 10 correlational studies, meanwhile, results from the 8 predictive studies reinforce the predictability of self-efficacy for physical activity behaviour (Allen, 2004). However, mixed results for the predictability of outcome expectations on physical activity behaviour were found. To better understand physical activity behaviour in this population, theoretically-based interventions need to be developed and explored in more detail.

There is an increasing need for effective low-cost interventions to assist individuals with type 2 diabetes to make positive lifestyle changes (McKay, Feil, Glasgow & Brown, 1998). Although the challenging regimens of diabetes self-care and management benefit from face-to-face counselling; complexities, cost and investment of, often make it an impractical option (Tate, Jackvony & Wing, 2003). The internet offers a unique opportunity for delivering innovative, large scale behavioural change interventions, including physical activity (McKay, Feil, Glasgow & Brown, 1998) and has shown promise as an effective delivery mode for the general population (Plontikoff, McCargar, Wilson, & Loucaides, 2005). Several advantages exist with internet health technology. Information is available to users 24 hours a day, allowing for information to

be viewed at their convenience. The use of internet options such as chat rooms and web conferencing can facilitate social support and communication from other users and health care providers (McKay, King, Eakin, Seeley & Glasgow, 2001).

The number of Canadians searching for health information has dramatically expanded. Almost 65% of Canadian households report having at least one member using the internet to search for medical or health related information, accounting for the third most popular use after email and general browsing (Statistics Canada, 2003). For these reasons, the internet and specifically email may be considered as a potential channel for the administration and delivery of physical activity interventions (Napolitano, Fotheringham, Tate, Sciamanna, Leslie, Owen, et al., 2003).

1.3 Overall Rationale for the Study

The prevalence rates of type 2 diabetes in this country and around the world are approaching epidemic proportions. Physical activity continues to be a vital component in the effective management of this disease, yet, research has shown that over half of those with diabetes are insufficiently active (Health Canada, 2002). The use of theoretically-based models, such as SCT, in the diabetes realm are key to understanding physical activity behaviour change and leading the development of successful interventions (Allen, 2004). The mode of interactive technology to promote physical activity behaviour change shows promise and is receiving a great deal of attention. With technology becoming a major component of our society, the internet is an ideal medium through which to direct behaviour change programs (Marcus, Nigg, Riebe & Forsyth,

2000). The use of such technology has the potential to have widespread reach and significant impact in the diabetes population.

However, knowledge surrounding SCT constructs and their impact on physical activity behaviour change in people with type 2 diabetes is still limited. In addition, the use of interactive technology and email counselling to change physical activity behaviour in this population is still relatively unexplored. Data gathered from this research project may further our knowledge on the use of interactive technologies to assist individuals with diabetes in adopting a physical active lifestyle.

1.4 Overall Aim for the Study

The overall purpose of this study is to explore the feasibility and preliminary efficacy of a website and email counselling intervention on physical activity behaviour change in individuals with type 2 diabetes. The primary study objectives are to:

1. determine the feasibility (i.e., *recruitment*, *retention*, *adherence* and *satisfaction)* of the internet as a mode of delivery for diabetes related physical activity information for individuals with type 2 diabetes, and
2. establish *preliminary efficacy* of the internet as a mode of delivery for eliciting recommended changes in physical activity related cognitions and behaviours for individuals with type 2 diabetes.

We hypothesize that individuals in the intervention group will report greater increases in physical activity related cognitions and behaviours than those in the control condition.

1.5 Plan of Thesis

This thesis is a *mixed paper format*, as classified by the guidelines set by the Faculty of Graduate Studies and Research and the Centre for Health Promotion Studies at the University of Alberta. The thesis begins with an introductory chapter (Chapter 1) and a literature review (Chapter 2). Following this, the primary paper (Chapter 3) is presented, which contains introductory, methods, results and discussion sections. Therefore, repetition within the chapters (e.g., portions of the methods sections) is unavoidable. A conclusion (Chapter 4) summarizes the study and provides recommendations and future directions. The appendices include a comprehensive methods section (Appendix I), instrumentation (Appendix II), website content (Appendix III), information letters and consent forms (Appendix IV) and ethical approval documentation (Appendix V).

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Chapter 2 - Literature Review

2.1 Overview of Chapter

The aim of this chapter is to review the significant issues related to physical activity among people with type 2 diabetes and identify gaps in the literature that need to be addressed. The literature review will then focus on the following: (1) the prevalence and consequences of diabetes; (2) the role of physical activity in the effective management of type 2 diabetes and current physical activity recommendation; (3) determinants of physical activity in the general population; (4) determinants of physical activity in individuals with type 2 diabetes; (5) lifestyle interventions for the prevention and management of type 2 diabetes; (6) the efficacy of the Social Cognitive Theory for the study of physical activity; and (7) the use of the internet and electronic modes of delivery in behaviour change interventions

2.2 Background

2.2.1 Prevalence and Consequences of Diabetes

Type 2 diabetes has become a prominent public health issue in Canada and around the world. According to the International Diabetes Federation, it is estimated that 246 million people worldwide will have type 2 diabetes by 2007 (International Diabetes Federation (IDF, 2006). The prevalence rates are predicted to steadily rise and reach epidemic proportions in upcoming decades. It is estimated that 300 million people globally will have diabetes by 2025 with increases of 170% in western countries and 42% in developing countries (IDF, 2006).

In Canada, the prevalence of physician diagnosed diabetes in individuals over the age of 20 is 5.1% with approximately 90-95% of these cases classified as type 2 (Health Canada, 2003a). However, prevalence rates identified in population-based studies are reported to be 30-50% higher than current estimates, indicating prevalence rates could be as high as 7% in Canada (Leiter et al, 2001). It is estimated that 2.4 million Canadians will have diabetes by the year 2016, representing an increase of 72% from 2000. Projections indicate the prevalence of diabetes will be greatest in the age groups of 55-69 years and ≥80 years, largely due to an aging population (Ohinmaa, Jacobs, Simpson, & Johnson, 2004). Rising prevalence rates in Canada can also be attributed to increasing immigration from high-risk populations (Statistics Canada, 2003), growth in the Aboriginal population (Statistics Canada, 2005) and growing obesity trends in the Western World (Mokdad, Bowman, Ford, Vinicor, Marks & Koplan, 2001).

Health care related costs of diabetes to both the affected individual and to society are high. Individuals with diabetes incur medical costs that are approximately 2-4 times higher than those without diabetes (American Diabetes Association, 2003). One study estimates that the direct medical costs of diabetes and its related complications in 1998 was approximately $3.86 billion (Dawson, Gomes, Gerstein, Blanchard, & Kahler, 2002). Ohinmaa and colleagues estimate a 72% increase in medical costs between the year 2000 and 2016, which will result in an estimated $8.14 billion to the Canadian health care system (Ohinmaa et al., 2004). Treatment of chronic complications of diabetes represents 35% of the direct medical costs incurred, with cardiovascular disease (CVD) being the costliest (Dawson et al., 2002). These alarming statistics emphasize the importance of lifestyle modification in individuals with type 2 diabetes as well as

preventative strategies for those at risk of the disease. In a recent study by Plotnikoff, Karunamuni, Johnson, Kotovych, & Svenson (under revision), they found that individuals with type 2 diabetes who are not meeting recommended physical activity guidelines incur higher resource utilization and costs than individuals who are meeting recommended guidelines.

2.3 Physical activity and type 2 diabetes

2.3.1 Importance of physical activity

Physical activity, along with diet and medication, has long been recognized as a cornerstone of diabetes prevention and management (Sigal, Kenny, Wasserman, & Castaneda-Sceppa, 2004). Physical activity, including aerobic and resistance exercise, can assist individuals with type 2 diabetes in achieving a variety of goals including improved glycemic control, increased cardiorespiratory fitness, increased insulin sensitivity, improved lipid profile and weight maintenance (Ivy, Zderic, & Fogt, 1999). Large cohort studies have indicated that high levels of habitual physical activity are linked to lower overall mortality, to an even greater degree than could be explained by lowering glucose levels alone through other means (Sigal et al., 2004). Reductions in cardiovascular and overall mortality of 45-70% over 12 to 14 years has also been associated with moderate to high levels of cardiorespiratory fitness in individuals with type 2 diabetes (Hu et al., 2001).

Cardiovascular disease is a major complication associated with diabetes. Approximately 80% of individuals with diabetes will die as a result of a vascular event (Barrett-Connor & Pyorala, 2001). Because of this extreme risk, the Canadian Diabetes

Association (2003) recommends the first priority in preventing diabetes complications should be the reduction in cardiovascular risk by vascular protection through an all-inclusive comprehensive approach including lifestyle modifications.

To aid in the prevention of vascular disease, aggressive lipid management is generally required. A major component in the management of dyslipidemia in diabetic patients is the inclusion of lifestyle modification (CDA, 2003). In many cases individuals with type 2 diabetes are overweight and sedentary. A modest weight loss of 5-10% of initial body weight in these individuals can result in an improvement in lipid profile. Regular physical activity, along with a well balanced diet, can help individuals lose weight and maintain weight loss over time (Wing, 2001). Regular exercise has also been linked with improvements in high density lipoproteins (HDL) and glycemic control and reductions in triglyceride (TG) levels (Boule, Haddad, Kenny, Wells, & Sigal, 2001)

Resistance exercise is defined as "activities that use muscular strength to move a weight or work against a resistant load" (CDA, 2003). The importance of resistance exercise in the management of diabetes is increasingly being recognized. Although a relatively new area of research, several studies have demonstrated positive effects of resistance exercise on HbA1c.

In a recent review by Eves & Plotnikoff (2006), resistance training appeared to just as effective, in not more so, than aerobic training as a beneficial intervention for those with type 2 diabetes. This is particularly beneficial for those who report limited mobility as it has been reported that increases in skeletal muscle mass is related to decreased HbA1c levels (Eves & Plotnikoff).

2.3.2 Physical activity recommendations

The CDA Clinical Practice Guidelines recommend those with type 2 diabetes accumulate at least 150 minutes of moderate intensity aerobic activity per week spread over at least three non-consecutive days and if possible, four hours or more would be ideal. The recommendations also include resistance exercises at least three times per week (CDA).

The American College of Sports Medicine further recommends those with diabetes engage in at least three non-consecutive days and up to five physical activity sessions every week to improve cardiorespiratory fitness and metabolic functioning (Albright et al., 2000). Activity should be performed for a minimum of 30 minutes per session at a low-to-moderate intensity (40-70% VO2 max); however, three 10-minute sessions of activity have also been shown to produce similar energy expenditure and fitness improvements in this population (Albright et al., 2000).

These recommendations demonstrate a movement away from the traditional exercise-fitness model to a broader physical activity-health concept. The promotion of moderate intensity physical activity and the accumulation of activity in short, intermittent bouts allows for the inclusion of activities commonly reported by individuals (Albright et al., 2000). Previous recommendations focused on a more traditionalist exercise approach, encouraging high-intensity, continuous bouts of activity, making it difficult for individuals to achieve.

2.3.3 Physical activity prevalence

Despite the overwhelming evidence on the importance of physical activity, the majority of Canadians continue to lead inactive lifestyles. According to a Statistics Canadian Report (2007), approximately 48% of Canadian adults are inactive and,

therefore, at significant risk for chronic diseases and premature death. Women also tend to be more inactive then men, with the largest sex-related difference seen in older adults groups. Lower levels of both household income and education also appear to have an impact on activity levels, with these individuals less likely to be classified as moderately active (Canadian Fitness and Lifestyle Research Institute, 2004). Individuals with self-reported diabetes reported even higher inactivity rates with approximately 60-80% of adults with diabetes not meeting recommended physical activity guidelines for aerobic activity (Kirk, Mutrie, MacIntyre, & Fisher, 2003; Plotnikoff, Taylor, Wilson, Courneya, Sigal, Birkett et al., 2006).

2.4 Determinants of Physical Activity

2.4.1 General Population

Understanding the underlying variables that influence physical activity is an important prerequisite for designing and implementing successful interventions (Trost, Bauman, Sallis & Brown, 2002). Limited research, however, has been conducted on the determinants of physical activity in the diabetic population. Even though individuals with diabetes face additional barriers to being active, understanding the determinants of physical activity behaviour in the general population can provide a good foundation for additional research in the diabetes population (Eyler, 2003). Therefore, physical activity determinants of the general population will also be briefly examined.

Participation in physical activity is influenced by a variety of personal, social and environmental factors (Trost et al., 2002). In a recent review by Trost and colleagues (2002), personal factors positively associated with physical activity behaviour included

age and gender, socioeconomic status, occupational status and educational attainment, while being overweight or obese was negatively associated with physical activity behaviour.

Self-efficacy consistently emerges as a strong predictor of physical activity behaviour (Trost et al., 2002; Eyler, 2003; Plotnikoff, Mayhew, Birkett, Loucaides & Fodor, 2004). Booth, Owen, Bauman, Clavisi, & Leslie (2000) examined 449 Australian adults over the age of 60 years and found self-efficacy to be strongly related to physical activity behaviour.

Social support has also been shown to have a positive association with physical activity behaviour in adults (Booth et al., 2000; Trost et al., 2002; Plotnikoff et al., 2004). This finding is consistent with other studies conducted in a number of previous settings (Plotnikoff et al., 2004).

Barriers to physical activity consistently appear to have a strong relationship with physical activity behaviour (Trost et al., 2002; Eyler, 2003, Plotnikoff et al., 2004) with lack of time the most commonly cited barrier (Eyler, 2003). However, Plotnikoff and colleagues (2004), in a large sample of approximately 20,000 adults, found that barriers to physical activity varied with age. Lack of time was cited most often in younger individuals while poor health was more likely to prevent elderly individuals from participating in physical activity (Plotnikoff et al., 2004).

Interestingly, Trost et al., (2002) found that knowledge of physical activity and heath was not significantly related to actual physical activity behaviour. This may suggest that while physical activity knowledge is important, it is not a driving force in actual behaviour change.

Relatively few empirical studies have been conducted on the associations between environmental factors and physical activity behaviour (Trost et al., 2002, Eyler, 2003). In a review of the literature, Trost et al. (2002) found that associations varied from study to study but a number of individual and community level influences did emerge as having an impact on physical activity behaviour in adults. Individual level influences included exercise equipment at home, access to facilitates, satisfaction with recreational facilities, while community level influences such as neighbourhood safety, hilly terrain, frequent observational learning and enjoyable scenery were frequently cited (Trost et al., 2002).

In a study conducted by Booth and colleagues (2000), a significantly greater proportion of older adults who reported being active had access to a recreation centre, a cycle track, a golf course, a park and swimming pool and also reported they regularly received support and encouragement from their family and friends to be active.

2.4.2 Diabetes Population

According to the Third National Health and Nutrition Examination Survey nearly one third of those with type 2 diabetes reported no physical activity in the month previous while another 38% reported being insufficiently active to meet health guidelines (Nelson, Reiber & Boyko, 2002). To effectively promote the adoption and maintenance of physical activity in this population, it is important to determine the sociodemographic, cognitive, and environmental correlates of physical activity behaviour (Hays & Clark, 1999).

Sociodemographic correlates of physical activity in individuals with type 2 diabetes closely resemble that of the general public. Younger age, male gender, and

higher income levels are positively associated with physical activity (Plotnikoff, Taylor, Wilson, Courneya, Sigal, Birkett et al., 2006). In addition, females, minority groups and those taking insulin are more likely to report zero minutes of leisure-time physical activity (Hays et al., 1999; Nelson et al., 2002).

Physical disability also appears to be negatively associated with physical activity in this population. Plotnikoff and colleagues (2006) found that level of disability was the strongest medical correlate of physical activity in a population sample of 1,614 individuals with type 2 diabetes. Furthermore, Ford & Herman (1995) reported that people with diabetes who do not report physical limitations are exercising at levels similar to the general population, however, over 57% of individuals surveyed reported some form of physical limitation. This finding indicates the importance of promoting moderate activities that can be done by individuals with various health concerns.

Self-efficacy has been found to be strongly associated with physical activity behaviour in the diabetes population (Hays et al., 1999; Plotnikoff, Brez, & Hotz, 2000; Allen, 2004). In fact, Plotnikoff and colleagues (2000) demonstrated that self-efficacy was the only cognitive measure that predicted energy expenditure and exercise stage of change in a diabetes sample. Allen (2004), also found a significant relationship between self-efficacy and exercise behaviour in 10 correlational studies, while results from 8 predictive studies substantiate the predictability of self-efficacy for exercise behaviour (Allen, 2004).

Hays and Clark (1999) were also able to show motivational barriers as a significant correlate of physical activity in this population, while outcome expectations and knowledge were found not to be associated with physical activity behaviour. This

could indicate that individuals with diabetes are not motivated to do physical activity and simply having knowledge about the benefits of activity does not necessarily translate into behaviour change.

Social support has also been positively associated with physical activity adherence in the diabetes population (Swift, Armstrong, Beerman, Campbell & Pond-Smith, 1995). In fact, Deshpande and colleagues (2005) found that when physicians helped patients make a plan and followed-up, positive associations were observed. Krug, Haire-Joshu, & Heady (1991) also reported a significant correlation between the frequency of dialogue about exercise and individuals perceptions of the importance the health care professional placed on exercise. However, very few individuals report receiving specific guidelines regarding type, frequency or duration of exercise in managing their diabetes.

The examination of the environmental correlates of physical activity in the diabetes population is gaining momentum as of late; therefore, additional examination into this particular area is needed. In a recent study, researchers found that active individuals were more likely to use parks, walking trails, schools, recreation centres and health clubs, with the later two showing the strongest correlations (Deshpande et al., 2005). These researchers also found that walking distances to these facilities were closer for those who reported more physical activity (Deshpande et al., 2005).

2.5 Lifestyle Modification

2.5.1 Diabetes Prevention

Several long-term randomized controlled trials have provided evidence that modifications in lifestyle including physical activity and dietary habits are effective in delaying, and possibly preventing the onset of type 2 diabetes (Pan et al., 1997; Tuomilehto et al., 2001; Knowler et al., 2002).

The Chinese Da Qing Study (1997) consisted of 577 participants randomly assigned to one of four groups (control, diet only, exercise only or diet plus exercise). At the six year follow-up, the incidence of type 2 diabetes was 68% in the control group, 44% in the diet only group, 41% in the exercise only group and 46% in the diet plus exercise group. All three intervention groups had a reduced rate of diabetes diagnosis compared to the control group, indicating the effectiveness of lifestyle interventions on the delaying and/or prevention of type 2 diabetes (Pan et al. 1997).

The Finnish Diabetes Prevention Study (DPS) (2003) included 522 middle-aged, overweight participants with impaired glucose tolerance randomized to either an intensive lifestyle intervention group or a usual care control group over three years. The intervention group received circuit-type resistance training sessions including recommendations on increasing overall physical activity plus individualized dietary counselling from a nutritionist. The first year of the intervention was most intense, followed by a maintenance period. Goals of the intervention group included a 5% or more reduction in body weight, reduction in dietary and saturated fat intake to less than 30% of total energy consumed and 30 minutes of moderate intensity exercise per day. The control group received general dietary and exercise information at baseline and attended an annual examination with a physician.

Participants were followed for a mean duration of 3.2 years. Diabetes was diagnosed in 86 participants (27 intervention, 58 control) after four years, representing a cumulative incidence of 11% in the intervention group and 23% in the control group. Using Cox regression analysis of all person-years accumulated, researchers were able to show the cumulative incidence of diabetes was 58% lower in the intervention group compared to the control ($p<0.001$) (Tuomilehto et al., 2001). The intervention group showed significantly greater improvements in all intervention outcomes. Weight reductions were 4.5 and 3.5 kg in the intervention group and 1.0 and 0.9kg in the control group after 1 and 3 years respectively. Glycemia and lipemia levels also improved in the intervention group over the course of the study (Tuomilehto et al., 2001).

The Diabetes Prevention Study (DPP) (2002) was conducted to determine if lifestyle intervention or treatment with metformin can prevent or delay the onset of diabetes. The study also set out to examine whether lifestyle or metformin differ in efficacy and if these differences were influenced by age, sex, or ethnicity (Knowler et al., 2002). The study was conducted over 27 centres in the United States involving 3234 non-diabetic patients randomly assigned to one of three groups: standard lifestyle recommendations plus metformin, standard lifestyle recommendations plus placebo, or an intensive lifestyle modification program.

The goals of the intensive lifestyle modification program were to achieve and maintain a 7% reduction in body weight by following a low calorie, low fat diet and to participate in moderate intensity physical activity for at least 150 minutes per week. The program consisted of 16 sessions that were individualized and culturally sensitive (DPP Group, 2002).

Participants were followed for an average of 2.8 years during which 50% of the intensive lifestyle modification group surpassed the goal of a 7% reduction in body weight while 38% had achieved at least a 7% reduction. In addition, 74% of individuals in this group reached at least 150 minutes of physical activity at 24 weeks and 58% continued to do so at most recent visit (DPP Group, 2002).

The DPP (2002) demonstrated that the participants in the intensive groups had much greater weight loss and a greater increase in leisure time physical activity than did the placebo or metformin groups ($p<0.001$) and results indicated the cumulative incidence of diabetes was lower in the metformin and lifestyle-intervention groups than the control (placebo) group. The incidence of diabetes was 58 percent lower in the lifestyle-intervention group and 31 percent lower in the metformin group than in the placebo group while the incidence of diabetes was 39 percent lower in the lifestyle-intervention group than in the metformin group. Treatment effects were not shown to differ significantly by sex and ethnicity. These three studies demonstrate the great potential of lifestyle interventions including physical activity in the prevention of type 2 diabetes.

2.5.2 Diabetes Management

Several studies have also been conducted to determine the effectiveness of lifestyle interventions in the management of type 2 diabetes. Hanefeld and colleagues (1991) randomized individuals with diabetes to one of three groups (control, intervention plus placebo, and intervention plus cliborific) in an effort to test the efficacy of an intensive health education program on metabolic control and the reduction of cardiovascular risk factors. The intensive health education group received advice on diet,

smoking and alcohol behaviours and ways to enhance physical activity. After 5 years, beneficial effects were found in smoking and physical activity habits with both treatment groups showing significant improvements in physical activity (as compared to the control group $p<0.01$), demonstrating the beneficial effects of intensive health education on physical activity in this population (Hanefeld et al.).

In a study conducted by Wood (1989), hospitalized patients with type 2 diabetes were followed for a 4-month period after discharge. These patients attended an in-patient group diabetes education program aimed at improving self-care behaviours including diet and exercise. After one month, 34% of the intervention group (those receiving the group education) versus 18% of the control group maintained an exercise program ($p=.05$). At four months, the intervention group also improved significantly with 30% maintaining an exercise program compared to 13% of the control. Those attending a group lifestyle modification program aimed at improving self care behaviours had a greater improvement and adherence of self care behaviours than those who did not attend the group classes.

Glasgow and colleagues (1992) randomly assigned 102 individuals with type 2 diabetes over the age of 60 to either an immediate or delayed intervention group. The intervention program focused on self-care behaviours including diet, exercise and blood glucose monitoring as identified in focus groups as behaviours that the most assistance was needed. Goals for the exercise portion of the program included regular participation in low level aerobic activity (walking and stationary cycling) focusing on the development of individualized plans to overcome barriers and improve problem solving skills. The intervention group met weekly for 8 weeks and also attended twice weekly

group walking sessions and were encouraged to exercise one other time per week using a buddy system. Results of the 10-week program indicated no significant changes on short term exercise behaviour in the immediate intervention group, however, at 6-months follow-up, the average number of minutes of physical activity per day had substantially increased in this group compared to the delayed intervention group (Glasgow et al.).

2.6 Behaviour Change Theories

2.6.1 Importance of theoretically-based interventions

Lifestyle-related behaviours including diet and exercise are viewed as important but difficult and often seen as unachievable, suggesting that emphasis be placed on behavioural aspects of initiating and maintaining positive lifestyle changes. Therefore, it is important for patient education programs to develop methods and materials that are customized to address the unique needs and concerns of this population (Clark, Hampson, Avery, & Simpson, 2004).

Several studies have demonstrated little or no significant change in physical activity behaviour among individuals with diabetes when given written and oral instructions for exercise (Vanninen, Uusitupa, Siitonen, Laitinen, & Lansimies, 1992; Uusitupa, 1996; Wing, Epstein, Nowalk, Koeske, & Hagg, 1985). However, these interventions lacked theoretically-based, individually tailored motivational messages (Kirk, Mutrie, MacIntyre, & Fisher, 2004).

Behaviour change theories can help to explain why individuals are not following medical advice or neglecting to take care of themselves (Glanz, Rimer & Lewis, 2002). Understanding *why* individuals do or do not engage in healthy behaviours can aid in the

development of effective health promotion programming that will have a larger impact on such behaviours. By understanding *what* to target, researchers and practitioners can design effective programs and target resources where they will be most useful. Thus, theories provide a framework in which to work from and a basis for assessing whether all the key elements of a program are in place (Green, 2000) and explain what happens in a program and why (Tudor-Locke, Myers, & Rodger, 2001).

2.7 Social Cognitive Theory

2.7.1 Background

Theoretical approaches have been used not only to understand physical activity as a behaviour but also to provide the conceptual and empirical knowledge base for the design of activity promoting programs. To provide guidance for the design of effective programs, theoretically-based interventions must be predictive of behaviour and suggest ways to promote change in behaviour (Baranowski, Anderson, & Carmack, 1998).

The Social Cognitive Theory (SCT) as presented by Bandura (1986) postulates that personal, behavioural and environmental factors operate as reciprocal interacting determinants of human functioning. Furthermore, the notion of reciprocal determinism suggests that individuals are both agents and recipients of their behaviours. According to the SCT, a change in behaviour is possible if one has a personal sense of control. If an individual believes they can take action to solve a problem, they are more committed and inclined to do so (Luszczynska & Schwarzer, 2005).

According to Bandura (1997; 2004) a number of crucial factors influence behaviour. These core determinants include knowledge of health risks and benefits of

different health practices, perceived self-efficacy that one can exercise control over their individual health habits, the health-related goals they set for themselves and the specific plans and strategies for realizing them, as well as the perceived facilitators and impediments to the changes they strive for. Other critical factors included in the SCT are the individuals' capabilities to symbolize behaviour, to learn by observing others, to have confidence in performing a behaviour, to self-regulate or self-determine behaviour and to reflect on and analyze experience (Bandura, 1997).

Knowledge of health benefits and risks is considered the prerequisite to behaviour change. If an individual doesn't have the required knowledge about how their lifestyle habits affect their health then they would have little reason to think about changing the habits they currently practice (Bandura, 2004).

Baranowski, Perry & Parcel (2002) have taken Bandura's critical factors important for behaviour change and divided them into ten specific constructs: self-efficacy, self-regulation, outcome expectations, outcome expectancies, behavioural capacity, observational learning, reinforcement, emotional coping response, perceived environment and situation. These specific constructs and processes can be used to target important avenues in behavioural intervention programs and will be described in further detail below.

2.7.2 Self-efficacy

Self-efficacy is considered a central concept within SCT and a strong determinant of behaviour because of its indirect and direct influence on other determinants (Bandura, 1986). Self-efficacy is described as the degree to which an individual believes they can successfully carry out a specific behaviour (Marcus, King, Clark, Pinto, & Bock 1996).

It is different from self-esteem or self-concept in a three ways: a) self-efficacy involves an internal attribution, b) it is prospective, referring to future behaviour and c) it is a functioning construct, implying this factor is proximal to the specific behaviour (Luszczynska & Schwarzer, 2005).

Self-efficacy is central to an individual's decision to participate in physical activity and has been shown to be a strong predictor of physical activity participation among adults (Sallis, Hovell, & Hofstetter, 1992; Dzewaltowski, Noble, & Shaw, 1990). Self-efficacy is thought to influence an individual's behaviour in two distinct ways. First, people who have a high degree of self-efficacy for a particular behaviour are more likely to exert considerable effort to engage in that behaviour (Sanderson, 2004). Second, individuals with low self-efficacy have a greater physiological response to stressful situations (i.e. behaviour change) including higher heart rate and blood pressure compared to those with higher self efficacy (Sanderson). Further, individuals with high self-efficacy report a high association between knowledge and behaviour and are more likely to act on that knowledge (Sanderson). Social cognitive theory proposes that by enhancing an individual's confidence in their ability to exercise will lead to behaviour change.

Self-efficacy can be enhanced through four mechanisms: 1) performance accomplishments, 2) vicarious experience, 3) verbal persuasion and 4) physiological feedback (Bandura, 1997). Performance accomplishments or mastery can increase self-efficacy through successes that can be attributed internally and can be repeated while vicarious experience can enhance self-efficacy through the process of social comparison (Bandura, 1997). Self-efficacy can also be strengthened via verbal persuasion from

others in addition to managing emotional arousal in order to deal successfully with threatening situations and thereby mastering situations (Luszczynska & Schwarzer, 2005).

Self-efficacy levels can affect the motivation to act. Individuals with high self-efficacy choose more readily to perform new challenging tasks and often set higher goals and stick to them (Locke & Latham, 1990). Self-efficacy also shapes the outcomes individuals expect from their efforts (Bandura, 2004). Those with high self-efficacy often expect substantial outcomes as a result from their behaviour while those with low self-efficacy tend to identify outcomes as having little value. Finally, self-efficacy determines how barriers and impediments are viewed (Bandura, 2004). Those with low self-efficacy will often identify many barriers to behaviour change and often see these barriers as significantly impacting their ability to be successful. On the other hand, those with high self-efficacy will identify fewer barriers or will view barriers as being something they can overcome in order to be successful.

2.7.3 Outcome expectations and expectancies

Outcome expectations are the anticipated outcomes of a particular behaviour while outcome expectancies are the value placed on those anticipated outcomes (Baranowski et al., 2002). King, Stokols, Talen, Brassington, & Killingsworth. (2002) state that outcome expectancies have been identified as an important part of the motivational formation for behaviour especially if the desired outcome is highly valued. Like self-efficacy, outcome expectations and expectancies operate through indirect pathways, influencing goal setting and the perception of social structural factors (Luszczynska & Schwarzer, 2005).

Bandura (2004) suggests that outcome expectations take several forms. *Physical* outcomes include both short and long term gratifying and aversive effects of the particular behaviour. *Social* outcomes entail the social approval or disapproval a particular behaviour produces in an individual's social network. Finally, *self-evaluative* outcomes refer to the positive and negative self-evaluative reactions one has to their own health behaviour and health status. Individuals tend to engage in behaviours that produce feelings of self satisfaction and self worth while avoiding those that cause self-dissatisfaction (Bandura, 2004; Luszczynska & Schwarzer, 2005)

Grembowski and colleagues (1993) have demonstrated that outcome expectations are an important factor related to physical activity for two reasons. First, if a change in behaviour is relatively simple but has uncertain perceived consequences, the primary motivation may lie largely on outcome expectations. Second, if the health behaviour is hard to change and has uncertain consequences, both self-efficacy and outcome expectations may weigh heavily in achieving behaviour change (Strecher, DeVellis, Becker, & Rosenstock, 1986).

According to Allen (2004), outcome expectancies can also be operationalized through the same four mechanisms as self-efficacy. Outcome expectancies can be operationalized specifically through direct experience, peer observation, anticipated outcomes from physical activity and social persuasion (Petosa, Suminski & Hortz, 2003).

2.7.4 Self-regulation

The fourth cognitive process that interacts with self-efficacy, outcome expectations and outcome expectancies in shaping physical activity is self-regulation (Hallam & Petosa, 2004). Self-regulation is the personal regulation of goal-orientated

behaviour or performance. According to Bandura (1997), the self-regulation construct has several component sub-functions including the monitoring of one's own behaviour and its determinants and effects; comparison of behaviour and its outcomes to personal benchmarks; particularly self-set goals. Self-efficacy plays an important role in self-regulation in terms of choosing the level of behaviour for change and the practice for building confidence in self regulation. Goal setting may be one of the most important factors in behaviour change (Baranowski et al., 2002) and by providing participants with detailed information and feedback on goal setting and self monitoring, self-efficacy has been shown to increase (Dzewaltowski, 1994).

2.7.5 Environments and Situations

Baranowski et al. (2002) defines environment as the physically external objective features that can affect an individual's behaviour. Family members, friends, and peers are all examples of the social environment while the physical environment may include the size and temperature of a room or the physical characteristics of one's neighbourhood.

Situation is characterized as the cognitive or mental interpretation of the environment which can be real, distorted or imagined that may impact a person's behaviour (Baranowski et al., 2002). The situation is an individual's perception of the environment and can include time, place, physical features, activity and their own role in the situation (Baranowski et al., 2002).

The integration of environment and situation into behaviour change programs is important when considering the notion of reciprocal determinism, whereby individuals are, in part, products of their surroundings. It is essential to consider those surroundings

and how they influence behaviour when developing interventions as this can be a powerful facilitator or impediment to behaviour change.

2.7.6 Observational Learning

Observational learning occurs as a result of watching the actions of another person and the reinforcements the individual receives. In this process the learner determines rules that explain behaviour by observing this behaviour in others and the reinforcements they receive as a result (Baranowski et al., 2002). Bandura referred to the process of observational learning also as vicarious experience (Bandura, 1997).

2.7.7 Behavioural Capacity

Behavioural capacity encompasses the concepts of knowledge and skill in regards to a particular behaviour. This construct claims that if an individual is to perform a particular behaviour, they must have knowledge of the behaviour as well as the necessary skill to perform the behaviour (Baranowski et al., 2002). Knowledge in itself does not necessarily constitute behaviour change as tasks can be learned but not performed whereas performance presumes learning has already occurred (Baranowski et al., 2002).

2.7.8 Reinforcement

The concept of reinforcement is characterized as the responses to an individual's behaviour that will increase or decrease the likelihood of reoccurrence (Baranowski et al., 2002). Reinforcement can be further broken down into extrinsic (external) or intrinsic (internal) reinforcement. Extrinsic reinforcement is when an event or act takes place where the outcome has known predictable reinforcement value. Intrinsic reinforcement, on the other hand, is an individual's own perception or experience that an event had value (Baranowski et al., 2002).

2.7.9 Emotional Coping Response

Bandura (1997) believed that an increase in emotional arousal inhibited the learning and performance of behaviour. The concept of emotional coping response deals with giving the individual mechanisms through which to effectively deal with and manage excessive emotional arousal allowing for behaviour change to occur. SCT typically deals with methods and concepts that allow the individual to learn behavioural management skills (Baranowski et al., 2002).

2.7.10 Social Support

Although not a specific construct in the SCT, social support is an inherent underlying concept throughout this theory. Social support is described as aid and assistance exchanged through social interaction and personal relationships (Heaney & Israel, 2002). Intended to be helpful, social support, is seen as an external motivator, influencing opportunities for reinforcement (Tillotson & Smith, 1996). Bandura (1977) suggested that self-efficacy can influence the effects of social support, where others can act as a source of efficacy information specific to the behaviour. Therefore, an absence of social support may lead to lower levels of self-efficacy which in turn may reduce the likelihood of the behaviour at hand (Bandura, 1977).

In summary, SCT proposes both predictors and principles on how to inform, enable, lead and motivate individuals to embrace habits that promote health. Health habits are changed through the development of motivational and self-regulatory skills, the use of proximal goals to motivate and guide behaviour and the knowledge on how to create personal incentives and to enlist social supports to help sustain their efforts (Bandura, 2004).

2.8 SCT and Physical Activity

SCT is acknowledged as one of the more dominant health behaviour theories used to explain and predict physical activity (Marcus et al, 1996; Keller, Fleury, Gregor-Holt & Thompson, 1999; Allen, 2004) in addition to being an important framework for the design of physical activity interventions (Keller et al., 1999).

An extensive review of the exercise behaviour literature pinpoints four SCT constructs that are highly associated with exercise behaviour to help explain adult's motivation to engage in physical activity; self-efficacy, outcome expectancies, outcome expectations and self-regulation (Hallam & Petosa, 2004; Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003; Petosa et al., 2003; Dzewaltowski, 1994).

Keller and colleagues (1999), examined the predictive ability of SCT on exercise behaviour in a variety of patient populations. They found a statistically significant relationship between self-efficacy and exercise behaviour in all 14 descriptive studies examined. In examining intervention based studies, the authors discovered that participation in a physical activity program promoted self-efficacy, and programs designed to increase outcome expectations and self-efficacy significantly increased physical activity behaviour (Keller et al., 1999).

Hallam & Petosa (1998) conducted a four-week work site intervention study that measured exercise self-efficacy, self-regulation and outcomes expectancy value for exercise. The intervention group consisted of 48 participants that participated in four 1-hour group sessions that focused on topics such as expected outcomes of behaviour, goal setting, time management, reinforcements, relapse prevention, social support and education.

Statistically significant increases ($p<0.0001$) were found in the treatment group for changes in self-regulation and outcome expectation value after four weeks (Hallam & Petosa, 1998). Outcome expectancies also increased, though not significantly. Hallam & Petosa (1998) were able to demonstrate that social cognitive variables associated with the adoption of exercise are changeable in a short amount of time and can have a prolonged impact (Hallam & Petosa, 2004). The authors continued to survey participants at the 6-week, 6-month and 12-month marks to evaluate the long term effects of this work-site intervention. Self-regulation was found to mediate behaviour and the worksite intervention was effective at increasing the use of self-regulation skills over the next 12 months.

Petosa et al., 2003, examined 350 college students with the intent of testing SCT constructs in predicting vigorous physical activity. More specifically, they examined the SCT constructs of social support, self-regulation, outcome expectancy, self-efficacy, exercise role identity and positive exercise experience. Students completed a series of questionnaires assessing specific SCT constructs over three classroom sessions. During the next four weeks, participants completed a 7-day recall of their physical activity (Petosa et al., 2003). In testing the ability of SCT to predict vigorous physical activity, the authors used a hierarchical multiple regression model based on a predetermined ordering of variables. Results indicated that all of the SCT variables contributed to a significant portion of the 27.2% variance in physical activity. This revealed that each of the SCT constructs made a distinctive contribution to predicting days of physical activity among college students.

In summary, Social Cognitive Theory has shown very promising results in the physical activity domain within the general population. However, additional research examining SCT in its entirety would benefit the understanding of the theory and its components.

2.9 SCT and physical activity in type 2 diabetes

Social cognitive theory appears to have compelling potential as a guide to understanding physical activity behaviours and developing appropriate interventions to promote the initiation and maintenance of physical activity in individuals with diabetes (Allen, 2004).

In a review of non-interventional studies conducted by Allen (2004), empirical diabetes literature was examined and organized as two questions; 1) is SCT related to exercise adherence and 2) can SCT predict exercise adherence and maintenance? Ten studies reported a significant relationship between self-efficacy and exercise behaviour among individuals with diabetes. In nine of those studies, variance for explaining self-efficacy for exercise behaviour ranged from 15% to 53% with the exception of one study. Adherence was defined differently in the studies examined by Allen (2004). Two studies defined adherence as following a specific exercise program, in which case both showed that self-efficacy predicted exercise adherence. In eleven other studies, adherence was defined as self-report or self-care activities and/or exercise level. Using this definition, seven showed self-efficacy to predict exercise adherence (Allen, 2004). Ten studies in the review examined outcome expectancies, of which three significantly predicted

exercise adherence. Five showed mixed results and two reported an insignificant relationship between outcomes expectancies and exercise (Allen, 2004).

In answering the second research question, Allen (2004), examined longitudinal studies assessing the predictive ability of self-efficacy on physical activity behaviour. Self-efficacy was shown to be predictive of exercise initiation in four of the five studies and of maintenance in all five studies. Three intervention studies were also examined and produced inconclusive results of the predictive ability of self-efficacy on exercise behaviour.

SCT has been applied to diabetes management studies aimed at increasing physical activity in this population. The First Step Pedometer Program developed by Tudor-Locke and colleagues (2004) operationalized self-efficacy and outcome expectations from SCT with the short-term goal of increasing physical activity (walking) in overweight/obese individuals with diabetes. During the initial four weeks (adoption phase), participants were asked to attend four-weekly group meetings in which pedometers and study manuals were given. The study manual contained goal-setting and problem solving exercises along with a log to self-monitor their activity. Following the adoption phase, participants were followed for an additional 12 weeks (adherence phase) for which they were told to use their logs to set goals and self-monitor. At weeks 6 and 10, postcards were sent to both intervention and control groups thanking them for their participation in the program. Pedometers and logbooks were returned by the intervention group at the commencement of the study and were examined to verify pedometer use, the number of days/week personal goals were reached and to calculate the average steps/day. At the conclusion of the 24 week follow-up, the intervention group had increased their

physical activity by 3000 steps/day or approximately 30 minutes/day ($p<0.001$) compared with that of the control group. The authors concluded, therefore, the First Step Program is a practical intervention that brings about an immediate and profound change in physical activity behaviour in a largely sedentary population (Tudor-Locke et al., 2004).

In another study, Di Loreto and colleagues (2003) developed a counselling strategy, based on self-efficacy and outcome expectations constructs from SCT, to increase physical activity behaviour in individuals with type 2 diabetes. In this study, 342 individuals were randomized to either an intervention group or usual care group. All participants were seen by a physician with the intervention group receiving an additional 30 minutes of structured counselling recommending physical activity. Additionally, all participants received a follow-up phone call one month post session plus a 15 minute follow-up appointment every 3 months. A structured protocol was followed by the counselling physician and focused on motivation, self-efficacy, pleasure, support, comprehension, lack of impediments and self-monitoring.

At the two year follow-up, results indicated the intervention group increased energy expenditure seven-fold ($p<0.001$) as compared to the control group with significant improvements also seen in HbA1c and BMI. These results indicate the effectiveness of a simple, physician-led counselling strategy to motivate individuals with type 2 diabetes to increase their physical activity behaviour.

2.10 Web-based Behaviour Change Interventions

The internet offers a unique opportunity for delivering innovative, large scale behavioural change interventions, including physical activity (McKay, Feil, Glasgow & Brown, 1998; Vandelanotte, Spathonis, Eakin, & Owen, 2007). Several advantages exist for internet health technology. Information is available to users 24 hours a day, at all times, allowing for information to be viewed at their convenience. The use of internet options such as chat rooms and web conferencing can facilitate social support and communication from other users and health care providers (McKay, King, Eakin, Seeley & Glasgow, 2001). The large proportion of the population logging on to the internet suggests that it might be a cost-effective mode for delivering health behaviour change interventions (Plotnikoff, McCarger, Wilson & Loucaides, 2005).

According to Statistics Canada (2003), 64% of Canadian households had at least one member who accessed the Internet regularly either from home, work, school, public library or another location. Of internet users, 84% report having access to email with 39% using it everyday to communicate and 25% making use of email at least once a week (Statistics Canada, 2003b). Canadians search for health information has dramatically expanded to the internet. Almost 65% of Canadian households had at least one member who used the internet to search for medical or health related information, accounting for the third most popular use after email and general browsing (Statistics Canada, 2003b). For these reasons the internet, and specifically email, can be considered as a potential channel for the administration and delivery of physical activity interventions (Napolitano et al., 2003).

These technologies also attract users because of their newness and novelty, receiving and communicating messages through new mediums can make them more

appealing and attractive (Fotheringham, Owies, Leslie, & Owen, 2000). Using computer-mediated communication also allows for data to be collected automatically and feedback to be generated almost instantaneously allowing for more complete statistics on use of intervention materials. Further, evidence suggests that individuals participating in computer-mediated interventions may be less influenced by social standards and communicate more openly than done so by telephone or face-to-face interviews (Fotheringham et al., 2000).

There is an increasing need for effective low-cost interventions to assist individuals with type 2 diabetes in positive lifestyle changes (McKay et al., 1998). Although the challenging regimens of diabetes self-care and management benefit from face-to-face counselling, the complexities and cost of such methods is time and cost consuming and often has limited reach and support required for maintenance of long-term behaviour change (McKay et al., 1998), making it an impractical option (Tate, Jackvony & Wing, 2003).

Individuals with diabetes that reside in non-urban settings may also face additional barriers when it comes to diabetes care. Distance, travel time, weather conditions and transportation requirements have the potential to impact the relationship and care between the diabetes health care team and the diabetes patient (Smith & Weinert, 2000), which in turn, may impact self care behaviours. Hence, it is important to find alternate ways of connecting with individuals who do not benefit from face-to-face physical activity promotion programs (Pinto, Friedman, Marcus, Kelley, Tennstedt & Gillman, 2002).

2.11 Web-based interventions

The use of interactive technology to change behaviour is expanding the scope and flexibility of intervention and teaching options (Fotheringham et al., 2000). The use of internet technology and e-counselling techniques has shown promising results in the weight loss (Tate, Wing & Winett, 2001; Tate, et al., 2003) nutrition (Oenema et al., 2005; Glasgow, Boles, McKay, Feil, & Barrera, 2003), and physical activity domains (Plotnikoff et al., 2005; Napolitano et al., 2003; Rovniak, Hovell, Wojcik, Winett & Marinez-Donate, 2005). See table 1 at the end of Chapter 2 for a detailed summary of web-based interventions.

Oenema and colleagues (2005) randomly assigned 782 individuals to one of three groups (tailored information group, generic information control group and no information control group) in order to test the short-term effect of an internet-based tailored nutrition education program that aimed to encourage individuals to modify their saturated fat, fruit, and vegetable intakes. The researcher also examined whether perceived personal relevance, perceived individualization and perceived interestingness of the information mediated the impact of the intervention. The tailored information group received feedback based on previous responses to questions that were compared with normative data as well as providing information for change based on the Transtheoretical Model. Information on how to make positive dietary changes was provided to increase self-efficacy and participants were encouraged to make specific action plans about where and when they were going to eat fruit and vegetables. Results of this study showed the tailored nutrition information resulted in a significant effect on the determinants of fat, fruit and vegetable intake compared to the two control groups.

The tailored intervention was also rated more interesting, personally relevant, individualized and new compared to that of the generic nutrition information (Oenema et al., 2005).

Several randomized controlled trials have been conducted by Tate and colleagues assessing the efficacy of the internet for the delivery of weight loss programs (Tate et al., 2001; Tate et al., 2003). The first study proposed that using the internet to deliver an SCT-based structured weight loss program would produce greater initial weight loss and decreases in waist circumference than providing access to weight loss education websites. The 6-month weight loss program consisted of randomly assigning participants to either internet education (n=32) or internet behavioural therapy (n=33). Both groups were given access to a website with organized links to internet weight loss resources. In addition, participants in the behavioural therapy group received a sequence of 24 weekly behavioural lessons via email, weekly online self-monitoring diaries with individualized feedback via email and access to an online message board. Results showed that the behavioural therapy group lost an average of 4.0 kg by 3 months and 4.1 kg by 6 months, where as weight loss in the education group was 1.7 kg and 1.6 kg at 3 and 6 months respectively (Tate et al., 2001). Changes in waist circumference were also greater in the behavioural therapy group at both 3 months ($p=0.01$) and 6 months ($p=.005$) (Tate et al., 2001).

Tate and colleagues (2003) conducted a second internet weight loss program to assess the long term efficacy of such a program when used alone or with the addition of email counselling from a therapist. A total of 92 participants at risk for type 2 diabetes were randomized to a basic internet (n=46) or to an internet plus behavioural counselling

program (n=46) for one year. Both groups were exposed to the same core internet programs and were directed to submit weekly weights. Participants in the email counselling group were also asked to calorie and exercise information and received weekly email counselling and feedback. At the conclusion of 12 months, results showed that the email counselling group lost an average of 4.4 kg vs. 2.0 kg in the basic internet group (p=.04), they also had greater decreases in waist circumference (~7.5 cm vs. ~ 4.4 cm; p=.05).

In the physical activity domain, Plotnikoff and colleagues (2005) assessed the efficacy of a 12-week e-mail physical activity and nutrition intervention on knowledge, attitude and behaviour change in a large workplace sample. Theoretically-based active living and healthy eating messages were delivered on a weekly basis to the intervention group while the control group did not receive any messages during this period. Significant results at the end of the 12 weeks indicated an increase in total activity levels by the intervention group while the control group reduced their physical activity levels. The intervention group also reported higher confidence and intention levels while the control group reported decreased levels in both domains. As well, the intervention group perceived more pros and less cons related to physical activity participation while the control group reported no change in these variables at 12 weeks.

Napolitano et al., (2003) tested the efficacy of a theoretically-based physical activity web-site plus 12 weekly e-mail tip sheets on a sample of sedentary employees of several large hospitals. Individuals were randomly assigned to the intervention group or waiting list control group. Participants were allowed access to the web-site for 3 months and also received weekly e-mail tip sheets that included topics such as: getting started,

monitoring your progress, setting goals, rewarding yourself, and getting support. Participants were also required to complete a quiz to assess their stage of readiness each time they logged onto the website. At 1-month follow-up, participants in the intervention group demonstrated higher levels of moderate physical activity minutes ($p<.05$) and also exhibited higher levels of walking minutes ($p<.001$). Additionally, participants were more likely to have progressed in stage of motivational readiness than those in the control ($p<.05$). At 3-months follow-up, those individuals in the intervention group were more likely to significantly progress in stage of motivational readiness than individuals in the control ($p<.01$).

Rovniak et al. (2005) used a two-group randomized controlled trial to test the effectiveness of two walking programs based on the SCT. Sixty-one sedentary females took part in a 12 week email-based walking program comparing two levels of theoretical fidelity. Participants were randomly assigned to the high fidelity SCT (intervention) walking group or the low fidelity SCT (control) walking group. Both groups received an email-based 12-week walking program and in-person orientation. The high-fidelity walking program focused on the key mastery procedure of SCT which included a brief modeling demonstration, specific short and long-term goals, more defined, immediate self-monitoring, more feedback about performance and a more finite walking protocol while the low fidelity group received general SCT feedback.

Post-test measurement at 12 weeks showed the high fidelity group improved more than twice as much as the low fidelity group on the 1-mile walk test time (86 vs. 32 sec., $p<0.05$), goal setting ($p<0.05$), and positive outcome expectations ($p<0.05$) (Rovniak et al.., 2005). The high fidelity group also reported greater program

satisfaction and although not significant, an increase in estimated $V0_2max$ over the 12 week intervention was observed. In addition, at the one-year follow-up point, the high fidelity group reported walking twice as much as compared to the low fidelity group ($p=0.08$).

2.12 Web-based Physical Activity Interventions in the Diabetes Population

There is a growing number of diabetes-related websites targeting diabetes education and support; however, the use of interactive computer technology to increase physical activity behaviour in individuals with type 2 diabetes is in its infancy. In light of this new technology base, there is little empirical evidence that such interventions improve the outcomes and quality of life of those individuals who use this technology (Eng, Gustofson, Henderson, Jimison & Patrick, 1999).

In one of the first studies of its kind, McKay and Colleagues (2001) conducted an 8-week pilot study to evaluate the feasibility and impact of the Internet-based Diabetes Network (D-Net) Active Lives Physical Activity Intervention. A total of 78 individuals with type 2 diabetes were randomized to the D-Net intervention site or to an internet-information only condition. The internet-information only group could access diabetes-specific articles through the websites on-line library in addition to real-time blood glucose monitoring for the duration of the 8-week study. The intervention group received specific feedback on their baseline activity levels and were then led through the "5 Steps to Action" planning process. This planning process consisted of personal motivators, goal-setting, strategies to overcome barriers and types of physical activity. Over the 8-week study, intervention participants received five tailored messages from

their personal coach and were encouraged to initiate ongoing contact by posting questions, problems and accomplishments. Participants also had the opportunity to interact with others in the study through chat rooms and message board postings.

At the 8-week follow-up, results indicated an overall moderate improvement in physical activity levels within both groups, with no significant improvement in regard to condition effects. Among participants in the intervention group, those who utilized the site more regularly obtained significantly greater benefits compared to the control group who showed no greater improvements with increased program use. On-line interactions with the personal coach were mainly focused on behavioural issues around initiating and maintaining physical activity, rather than specific exercise recommendations, suggesting this population may need more support than specific exercise advice.

2.13 Summary of Literature Review

According to the Canadian Diabetes Association, over two million Canadians are living with type 2 diabetes. Physical activity has been identified as a vital component in managing the disease, yet activity levels of those with type 2 diabetes remain low. Researchers continue to explore various modalities for the delivery of physical activity interventions. The internet has recently been identified as an optimal source for reaching large numbers of individuals living with type 2 diabetes.

The Social Cognitive Theory may provide a useful framework for the design of physical activity interventions within this population. Taking into account the various psychosocial and environmental determinants of physical activity, SCT may help us to

better target and deliver effective programs aimed at increasing levels of physical activity in individuals with type 2 diabetes.

2.1 Literature Summary Table

Study	Design & Sample	Outcome	Theory	Intervention	Results
Glasgow (2003) Feil (2000)	RCT 320 type 2 diabetes patients 10 month intervention + 10 month follow-up period	nutrition behaviour	SET & SST	Initial face to face training on computers placed in homes (all) 10 month intervention with 1) access to internet diabetes info + SM training or 2) access to internet diabetes info + peer support or 3) access to internet diabetes info + SM training + peer support or 4) access to internet diabetes info only	10 month assessment revealed a significant improvement from baseline measures in majority of outcomes, however, there was no significant improvements between groups. Improvements were largest for the targeted dietary outcomes followed by psychosocial and biological outcomes
Hager (2002)	RCT 525 university employees 6 week intervention	PA	TTM	SBG received stage matched email message each wk AMG received weekly action/maintenance targeted email messages Control grp received weekly email messages encouraging proper nutrition	Significant ↑ in leisure time, occupational time and daily energy expenditure among AGM group All three groups demonstrated small improvements in stage of readiness to change
Harvey-Berino (2002)	RCT 122 healthy overweight adults 12 month intervention + 6, 12, and 18 month follow-up	weight, PA behaviour, attendance	SM	24-week in-person weight control program prior to internet program (all) followed by 12 month maintenance thru 1) frequent in-person support (F-IPS) or 2) minimal in-person support (M-IPS) or 3) internet support (IS)	no significant difference in weight loss between group in first 6months of program with all groups losing an average of 9.5 kg ($p<0.05$). IS gained significantly more weight in the maintenance phase ($p<0.05$). ↑attendance for F-IPS group ($p<0.05$). IS reported significantly more peer support contacts compared to F-IPS group ($p<0.05$). F-IPS maintained PA ($p<0.01$)

Harvey-Berino (2002)	RCT 44 overweight adults 15 week treatment program followed by 22-week maintenance and 22 week follow-up programs	weight, diet, exercise and program adherence	NR	15-week in person treatment program focusing on activity and eating modification. Randomly distributed into 3 maintenance grps a) in-person therapist-led (TL); b) internet (I) and; c) no treatment (C). Bi-weekly contact was made with intervention groups through their respective mediums. During off weeks, telephone calls or emails were sent to respective groups. Both groups participated in SM, group discussions and peer support	TL group were more likely to attend their bi-weekly meetings. All peer support contacts were initiated in both groups through email. No significant differences in groups after maintenance phase of intervention with respect to BMI, diet or PA
Marshall (2003)	RCT 655 University staff 8-week intervention followed by 10-week follow-up	PA behaviour	TTM	C=stage-targeted print material delivered over 8 weeks plus 4 letters with stage-targeted advice I=stage-targeted website with interactive features, goal setting, activity planning and PA readiness q'aire. Personalized stage-matched reinforcement emails were sent every 2 weeks	I= ↓ in time spent sitting ($p<0.05$) 9% progression in SOC
McKay (2001)	RCT 78 adults with type 2 diabetes 8-week intervention 8-week follow-up	Physical activity behaviour depression	SEM for diabetes self-managment	C=information only; access to diabetes specific articles, real time glucose tracking and graphic feedback I=personalized PA program tailored to needs; feedback and comparison of baseline PA levels; 5 personalized messages over 8 weeks; as needed correspondence; peer support, live chat; PA tracking and graphic feedback	no significant difference by group both groups had significant improvements in PA and walking I=those who used the site more regularly had significantly greater benefits

Napolitano (2003)	RCT 65 sedentary hospital employees 3 month intervention followed by 1 and 3 month follow-up	Physical activity behaviour	SCT, TTM	I=access to internet website plus weekly email stage-matched tip sheets encouraging website login C=waitlisted	I= ↑ in levels of moderate PA minutes ($p<0.05$); ↑ levels of walking minutes ($p<0.001$) Follow-up (3 months): ↑ minutes of walking only
Plotnikoff (2005)	RCT 2121 worksite employees 12 week intervention follow-up at week 13	Physical activity behaviour and nutrition	SCT, TTM, TPB	I=12 weekly PA and nutrition messages, resource file with additional information and websites about PA and nutrition C=no weekly messages	I= ↑ MET minutes of PA ($p<0.01$); ↑ in social cognitive variables ($p<0.01$)
Rovniak (2005)	2 group RCT 61 sedentary adults females 12 wk intervention with 1 yr follow-up	Physical activity behaviour	SCT	I=12 week email walking program with tailored high fidelity SCT feedback focusing on key mastery procedures C=12 week email walking program with low fidelity general SCT feedback	I= Twice as much improvement in in 1-mile walk test. Increase in estimated Vo_2max (although not significant) during intervention and self reported walking quantity at 1 yr follow-up
Spittaels (2007)	RCT 434 healthy adults 8 week intervention with 6 month follow-up	Physical activity behaviour	TTM, TPB	3 groups: a) online tailored PA advice plus repeated tailored PA feedback b) online tailored PA advice c) wait list control	Significant increases were found in both intervention groups compared to control group with respect to active transportation, LTPA, decrease in minutes sitting on weekdays. No significant differences were found between intervention groups.
Tate (2001)	RCT 91 healthy adult hospital employees 6 month intervention with 3 & 6 month follow-up	weight loss, waist circumference	CBT	C=basic education about weight loss, diet, PA and how to self monitor I=all the above plus self-monitoring diaries including weight, calories, fat grams, and PA expenditure. Email message every week with behavioural weight loss lesson and feedback, access to electronic bulletin board	I= ↑ weight loss ($p=0.05$) from baseline to 3 months and maintained weight loss from 3-6 months. ↓ in waist circumference ($p<0.05$) at 3 and 6 months. C & I= ↑ in PA and ↓ in daily caloric intake. I= ↑ login frequency ($p<0.001$) and login frequency was significantly correlated with weight change between 0 and 6 months ion I group ($p<0.01$) and C group ($p<0.05$).

Tate (2003)	RCT 92 overweight adults 12 month intervention with follow-up at 3, 6 and 12 months	weight and WC	SM	Both groups received 1hr intro group weight loss session C=basic internet, weekly tips and links plus weekly email reminders to submit weight I=same as control + email communication with wt loss counselor; submission of daily diaries for first month; 1st month-5 emails each wk; last 11 months-once/wk; feedback on self-monitoring records, reinforcement, recommendations for change, general support	I=↑wt loss, ↓BMI and WC; logins significantly correlated with wt change between 0 and 12 months I sustained greater wt loss and WC compared to C.
Woolfe (2006)	Non-randomized control 273 adults from 6 family practices Access to website until follow-up with follow-up @ 1 & 4 months	PA and other health behaviours	TTM	Patients were directed to website and completed behavioral history I=extensive resources and tailored health advice C=static health information	SOC and health behaviours changed in both groups at month 1 I=↑light/mod PA (p=.10) but no significance @ 4 months

AMG, action message group; BMI, body mass index; C, control group; CBT, Cognitive Behavioural Theory ; I, intervention; LTPA, leisure-time physical activity; NR, not reported; PA, physical activity; PMT, Protection Motivation Theory; RCT, Randomized Controlled Trial; SBG, stage-based group; SEM, socioecological model; SET, Self-efficacy Theory; SM, self-management; SOC, stage of change; SST, Social Support Theory; TPB, Theory of Planned Behaviour; TTM, Trans-theoretical Model; WC, waist circumference.

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Diabetes NetPLAY: A Physical Activity Website and Linked E-mail Counselling Intervention for Individuals with Type 2 Diabetes

(Manuscript in preparation for submission)

ABSTRACT

OBJECTIVE – This pilot study evaluated the feasibility and preliminary efficacy of a 12-week website and email counselling intervention on physical activity behaviour change in individuals with type 2 diabetes.

RESEARCH DESIGN AND METHODS – A total of 49 individuals with type 2 diabetes (59% female, average age 54.1 years) were randomized to the Diabetes NetPLAY intervention or control condition. The intervention condition received information grounded in the Social Cognitive Theory (SCT), personalized weekly emails, an on-line logbook and message board. Key outcomes included physical activity behaviour and related cognition changes. The control condition was provided links to the Canadian Diabetes Association's Physical Activity Recommendations and Canada's Guide to Physical Activity.

RESULTS – Intervention participants indicated high levels of satisfaction for this mode delivery and study results demonstrated the feasibility of web-based mediums for the delivery of physical activity information in this population. The intervention group demonstrated a significant improvement in total vigorous and moderate minutes of physical activity ($p=0.05$) compared to the control group over the 12-week study. Of the SCT variables, behavioural capacity, showed a significant increase ($p<0.001$) among intervention participants.

CONCLUSIONS – Web-based interventions for individuals with type 2 diabetes are feasible and show great potential for improving positive physical activity outcomes.

INTRODUCTION

Physical activity has long been recognized as one of the cornerstones of diabetes management (Sigal, Kenny, Wasserman, & Castaneda-Sceppa, 2004). Physical activity, including aerobic and resistance training, can assist individuals with type 2 diabetes in achieving a variety of goals including improved glycemic control, increased cardiorespiratory fitness, decreased insulin resistance, improved lipid profile and weight management (Ivy, Zderic, & Fogt, 1999). Moderate to high levels of cardiorespiratory fitness in those with type 2 diabetes has been associated with a 45-70% reduction in both cardiovascular and overall mortality (Hu et al., 2001).

The Canadian Diabetes Association Clinical Practice Guidelines recommend those with type 2 diabetes accumulate at least 150 minutes of moderate intensity aerobic activity per week spread over at least three non-consecutive days (CDA, 2003). However, individuals with diabetes report high inactivity rates, with more than 60% of adults not meeting recommended physical activity guidelines (Kirk, Mutrie, MacIntyre, & Fisher, 2003; Plotnikoff et al., 2006).

The internet offers a unique opportunity for delivering innovative, large scale behavioural change interventions, including physical activity (McKay, Feil, Glasgow & Brown, 1998; Vandelanotte, Spathonis, Eakin, & Owen, 2007). Several advantages exist for internet health technology. Information is available to users 24 hours a day allowing for information to be viewed at their convenience. It also houses components such as chat rooms and web conferencing which can facilitate social support and communication from other users and health care providers (McKay, King, Eakin, Seeley & Glasgow, 2001).

According to Statistics Canada (2003), 64% of Canadian households have at least one member who accesses the Internet regularly either from home, work, school, public library or another location. Of internet users, 84% report having access to email with 39% using it everyday to communicate and 25% making use of email at least once a week (Statistics Canada, 2003). Additionally, more people are using the internet to find health information, which represent the third most searched topic behind email and general browsing. For these reasons the internet, and specifically email, can be considered as a potential channel for the administration and delivery of physical activity interventions (Napolitano et al., 2003).

The use of interactive technology to change behaviour is expanding the scope and flexibility of intervention and teaching options (Fotheringham, Owies, Leslie, & Owen, 2000). The use of internet technology and e-counselling techniques has shown promising results in the weight loss (Tate, Wing & Winett, 2001; Tate, Jackvony, & Wing, 2003) nutrition (Oenema, Tan & Brug, 2005; Glasgow, Boles, McKay, Feil, & Barrera, 2003), and physical activity domains (Plotnikoff, McCargar, Wilson, & Loucaides, 2005; Napolitano et al., 2003; Rovniak, Hovell, Wojcik, Winett & Marinez-Donate, 2005).

In the physical activity domain, Plotnikoff and colleagues (2005) assessed the efficacy of a 12-week, e-mail physical activity and nutrition intervention on knowledge, attitude and behaviour change in a large workplace sample. At the conclusion of the study the intervention group, in comparison to the control group, significantly increased their total activity levels and reported higher confidence and intention levels related to physical activity participation.

Napolitano et al., (2003) tested the efficacy of a theoretically-based physical activity web-site plus 12 weekly e-mail tip sheets on a sample of sedentary employees of several large hospitals. At 1-month follow-up, participants in the intervention group demonstrated significantly more minutes of moderate physical activity and walking minutes per week. Additionally, a greater proportion of those in the intervention group progressed in stage of motivational readiness than those in the control condition. At 3-months follow-up, those individuals in the intervention group were more likely to progress in stage of motivational readiness than control individuals.

There is a growing number of diabetes-related websites targeting diabetes education and support; however, the use of interactive computer technology to increase physical activity behaviour in individuals with type 2 diabetes is in its infancy. In light of this new technology base, there is limited empirical evidence that such interventions improve the outcomes and quality of life of those who participate in them (Vandelanotte et al., 2007).

In one of the first studies in this domain, McKay and Colleagues (2001) conducted an 8-week pilot study to evaluate the feasibility and impact of the Internet-based Diabetes Network (D-Net) Active Lives Physical Activity Intervention. A total of 78 individuals with type 2 diabetes were randomized to the D-Net intervention site or to an internet-information only condition. At the 8-week follow-up, results indicated an overall moderate improvement in physical activity levels within both groups, with no significant improvement in regard to condition effects. Among participants in the intervention group, those who utilized the site more regularly obtained significantly

greater benefits compared to the control group who showed meaningful improvements with increased program use.

Theoretical approaches have been used not only to understand physical activity as a behaviour but also to provide the conceptual and empirical knowledge base for the design of activity promoting programs. To provide guidance for the design of effective programs, such as web-based strategies, interventions must be grounded in behaviour change theory (Baranowski, Anderson, & Carmack, 1998).

One of the major behaviour change theories is the Social Cognitive Theory (SCT) developed by Bandura (1986). This theory postulates that personal, behavioural and environmental factors operate as reciprocal interacting determinants of human functioning. Furthermore, the notion of reciprocal determinism suggests that individuals are both agents and recipients of their behaviours (Bandura, 1986). According to Bandura (1997; 2004) a number of crucial factors influence behaviour. These core determinants include knowledge of health risks and benefits of different health practices, perceived self-efficacy that one can exercise control over their individual health habits, the health-related goals they set for themselves and the specific plans and strategies for realizing them, as well as the perceived facilitators and impediments to the changes they strive for. Other critical factors included in the SCT are the individuals' capabilities to symbolize behaviour, to learn by observing others, to have confidence in performing a behaviour, to self regulate or self determine behaviour and to reflect on and analyze experience (Bandura, 1997). Baranowski, Perry & Parcel (2002) present the SCT as ten specific constructs: self-efficacy, self-regulation, outcome expectations, outcome

expectancies, behavioural capacity, observational learning, reinforcement, emotional coping response, perceived environment and situation.

SCT has been acknowledged as one the leading health behaviour change theories used to explain and predict physical activity (Marcus, King, Clark, Pinto, & Bock, 1996; Keller, Fleury, Gregor-Holt, & Thompson, 1999) in the general population and in those with type 2 diabetes (Allen, 2004). SCT has been applied to several diabetes management studies aimed at increasing physical activity in this population (Tudor-Locke et al., 2004; Di Loreto et al., 2003). The First Step Pedometer Program developed by Tudor-Locke and colleagues (2004) operationalized self-efficacy and outcome expectations from SCT with the short-term goal of increasing physical activity (walking) in overweight/obese individuals with diabetes. At the conclusion of the 24 week follow-up, the intervention group had increased their physical activity by 3000/day or approximately 30 minutes/day ($p<0.001$) compared with that of the control group.

Di Loreto and colleagues (2003) developed a counselling strategy, based on self efficacy and outcome expectations constructs from SCT, to increase physical activity behaviour in individuals with type 2 diabetes. In this study, 342 individuals were randomized to either an intervention or usual care group. At the two year follow-up, results indicated the intervention group, compared to the control group, significantly increased energy expenditure seven-fold ($p<0.001$) with significant improvements also reported in HbA1c and BMI.

In summary, the use of web-based technology to deliver physical activity information relevant to those living with type 2 diabetes is increasing. However, further research on designing and testing theoretically grounded web-based interventions is

needed for changing health behaviour in this population. The purpose of this study, therefore, is to explore the feasibility and preliminary efficacy of a website and email counselling intervention on physical activity behaviour change in individuals with type 2 diabetes. We examine the *recruitment*, *retention*, *adherence* and *satisfaction* of the internet as a mode of delivery for diabetes-related physical activity information for individuals (study objective 1). In addition, the *preliminary efficacy* of the internet as a mode of delivery for eliciting recommended changes in physical activity-related cognitions and behaviours is also examined (study objective 2).

RESEARCH METHODS

Design

This study consists of a 12-week, pre-post randomized controlled design.

Recruitment

A sample of men and women with type 2 diabetes were recruited through diabetes education classes, newspaper advertisements, recruitment posters, health care professionals and previous research involvement.

Interested respondents were screened via telephone/in person for participation criteria and, if eligible, informed consent was obtained. Inclusion criteria included a diagnosis of type 2 diabetes and having access to the internet and email. Contraindications for physical activity were accessed by the Physical Activity Readiness Questionnaire (PAR-Q) (Canadian Society for Exercise Physiology, 2002). Participants, who indicated a contraindication to physical activity based on the PAR-Q, were required to provide written consent from a primary care physician.

A total of 235 study information packages were distributed over the 3 month recruitment period. Seventy-eight individuals responded to the information packages, with 50 people providing consent to participate. Of those individuals that didn't give consent, 10 were not further interested in the study, 8 indicated other commitments, and 8 failed to return the required consent forms. One individual failed to be reached after consent to participate in the study was given. Ethical clearance for this study was obtained from the Faculty of Physical Education and Recreation Research Ethics Board at the University of Alberta.

Procedures

A total of 49 individuals with type 2 diabetes were randomly assigned into the control conditions (n=24) or Diabetes NetPLAY intervention group (n=25). An on-line questionnaire assessed baseline measurements of physical activity related behaviour and related cognitions, and demographic characteristics. All measures were administered on-line at baseline and at the end of the 12-week study. Reminder emails were sent if participants failed to complete questionnaires within 10 days of initial administration. Upon completion of the baseline measures, all eligible participants were randomly assigned to either intervention or control conditions. All participants were provided with confidential usernames and password to access the appropriate website.

Diabetes NetPLAY intervention group

The Diabetes NetPLAY program was designed based on Bandura's (1997) Social Cognitive Theory (SCT) and aimed to provide participants with the education and skills important for long term behaviour change. The website was comprised of five main sections (weekly topic, education, research, fitness tips and physical activity myths)

which were updated and archived on a weekly basis. The website also contained several interactive features to engage participants through the duration of the study. These features included a physical activity logbook, message board and email counselling from the study coordinator. Participants in the intervention group also received links to the CDA Clinical Practice Guidelines (2003) for physical activity in addition to Health Canada's Physical Activity Guide (Health Canada, 2000).

The Diabetes NetPLAY website was updated on a weekly basis at which time the study coordinator would contact intervention group participants via email indicating the update and a reminder to log on using the link embedded in the email. Participants were encouraged to browse the website at their leisure.

Each week a new theme was featured based on a specific SCT construct. The weekly topics were aimed at operationalizing the SCT construct in a meaningful way. As a way of invoking thoughts and actions around the various constructs, participants were asked to complete an activity and email responses to the study coordinator. Goal setting and time management were some of the activities discussed.

Physical activity logbook: Participants in the treatment group were encouraged to log their physical activity minutes using the on-line logbook section of the website. The logbook allowed for participants to track the date, length and type of physical activity they engaged in. This feature also allowed participants to write in comments beside their activity sessions and track their daily progress.

Message board: The message board feature was launched in the second week of the study. The study coordinator posted weekly topics based on the social cognitive construct featured that week. Participants could respond and view postings at their

leisure. This allowed participants a forum in which to exchange ideas and receive support from other study participants.

Email counselling: The email counselling feature of the website allowed participants the opportunity to communicate with their counsellor (study coordinator) in a simple and efficient way. Beginning in the first week, participants were asked to email their counsellor with responses to the relevant topic discussed; however, participants could communicate with their counsellor via email at any time throughout the week on topics of importance to them. If participants failed to contact their counsellor on any given week, a brief email 'checking in' on the participant was sent as a reminder.

Control condition

The control group only received static links to the CDA Clinical Practice Guidelines (2003) for Physical Activity and Health Canada's (2000) Physical Activity Guide (as standard care material) for the duration of the 12-week study. Upon completion of the post-test questionnaire, control group participants were given full access (minus email counselling feature) to the study website. As the website was no longer being maintained and updated, these participants were directed to review the weekly archived items at their leisure. Incentives were offered to control participants upon completion of the post-test questionnaire. Incentives included a choice of a pedometer and water bottle or a $25 gift certificate from a national bookstore chain.

Measures

Baseline demographic variables were included based on various socio-demographic measures from Statistics Canada (2001). Participants were asked their age,

gender, marital status, first language, education, current employment status, and gross annual family income. Health status was assessed using previously published self-report measures (Plotnikoff et al., 2006). Participants were also asked to report their height (in feet/inches or meters/centimetres) and weight (in pounds or kilograms), in order to calculate BMI (kg/m^2). BMI categories were defined by Health Canada (2001). Finally, computer usage data were collected using items from Statistics Canada's Household Internet Use Survey (2003).

Physical Activity: Leisure-time physical activity (LTPA) was assessed using a modified version of the validated Godin Leisure-Time Exercise Questionnaire (GLTEQ) (Godin & Shepard, 1997). In this instance, LTPA was defined as a physical activity session longer than 10 minutes in duration and was not part of employment or household chores. Based on an average of the past month, participants were asked to report: 1) frequency (times per week), and 2) duration (average time per session), of activity in each intensity category (strenuous, moderate or mild). The reliability of the GLTEQ has been independently evaluated and found to compare favourably to nine other measures of self-reported exercise including test-retest scores, objective activity monitors, and fitness indices (Jacobs, Ainsworth, Hartman & Leon, 1993). Participants' responses were then converted into: (1) MET minutes by multiplying weekly minutes of moderate activity by 4 METS and vigorous activity by 7.5 METS (Brown & Bauman, 2000); and, (2) *unweighted* minutes by summing weekly minutes of moderate and vigorous PA. Mild activity levels were not included in either calculation for three reasons: 1) all psychosocial variables are based on a definition of physical activity of moderate or greater intensity; 2) population-based MET values have only been defined for moderate

activity or greater (Brown & Bauman, 2000); and 3) the CDA Clinical Practice Guidelines (2003) state that moderate to high levels of physical activity are associated with substantial decreases in mortality and morbidity in individuals with type 2 diabetes.

A resistance training (RT) measure was also incorporated into the GLTEQ in which participants were asked to report on average in the past month, frequency (times per week), and duration (average times per session) they had engaged in resistance training activities. Participation responses were captured by multiplying frequency by duration to produce a final RT score.

Social Cognitive Measures

Self-efficacy: Self efficacy is described as the degree to which an individual believes they can successfully engage in physical activity (Marcus et al., 1996) and was assessed using a validated 12-item scale (Plotnikoff, Hotz, Birkett, & Courneya, 2001; Marcus, Shelby, Niaura & Rossi, 1992). Each item was measured on a five point Likert-type scale and asked individuals to rate their confidence in performing regular physical activity in a variety of circumstances from "not at all confident" (1) to "extremely confident" (5). For example, "In the next 3 months, I am confident that I can participate in regular physical activity when I am a little tired."

Outcome expectation: Outcome *expectations* was assessed using a 5 point Likert-type scale with response options ranging from "strongly disagree" (1) to "strongly agree" (5), and had participants rate their agreement with a 17 expectation items of engaging in regular physical activity. A sample item from this scale was "I will feel better physically if I get regular physical activity." The outcome *expectations* measure was adapted from two sources: (1) the decisional balance scale originally designed by Marcus, Rawkoski,

& Rossi (1992), and adapted for a Canadian population by Plotnikoff et al. (2001); and, (2) the physical activity expectations scale used in the PARR project (Lewis, Raczynski, Heath, Levinson, Hilyer, & Cutter, 1993).

Outcome expectancies: Outcome *expectancies* were parallel items to the outcome *expectations* items in this questionnaire. Participants were asked to rate on a three point Likert-type scale, ranging from "unimportant" (1) to "very important" (3) the perceived importance of the 17 previously stated expectations. An example of an item from this scale was "How important is feeling better physically to you?" The outcome expectances scale was adapted from the PARR project (Lewis et al., 1993) which had originally been developed and tested with a low-income population.

Self-regulation: The self-regulation measure used in this study was adapted from a subscale of the Behaviour Regulation in Exercise Questionnaire (BREQ-2 - Mullan, Markland, & Ingledew, 1997) identified for exercise regulation. The three item scale had participants indicate how true a variety of reasons were for them in participating in regular physical activity, with response items ranging from "not at all true" (1) to "very true" (2). An example of a scale item is "I value the benefits of exercise."

Situation: The situation construct was measured by having participants indicate how often in the past three months various situations prevented them from getting regular physical activity. Response options for this 17 item scale ranged from "never" (1) to "very often" (5) and was adapted from a previous physical activity scale used in a study of breast cancer survivors (Rogers, Shah, Dunnington, Greive, Shanmugham, Dawson, & Courneya, 2005).

Reinforcement: Reinforcement was measured using a five-point Likert-type scale with responses ranging from "never" (1) to "always" (5). Participants were asked to specify how often in the last three months they had rewarded themselves and set realistic goals. A sample question from this four item scale developed by Marcus, Rossi, Niaura & Abrams, 1992, is "I reward myself when I am physically active."

Social Support: The social support construct, previously used by Courneya, Plotnikoff, Hotz & Birkett (2000), consisted of two items measured on a 7-point Likert-type scale with options ranging from "strongly disagree" (1) to "strongly agree" (7). A sample item of this scale was "over the next three months, people in my social network are likely to help me participate in regular physical activity."

Emotional Coping Response: The emotional coping response measurement was adapted from the emotional well-being subscale (Yellen, Cella, Webster, Blendowski & Kaplan, 1997) and assessed how participants felt about their diabetes over the past month. Response options for the 5-item scale ranged from "not at all" (1) to "very much" (5). An example from this scale was "I am proud of how I'm coping with my diabetes."

Behavioural Capacity: Behavioural capacity was measured using four items on a 5-point Likert-type scale in which participants were asked to rate how confident they were in performing specific tasks within the last three months. Response options ranged from "never" (1) to "always" (5). A sample item for this scale developed for patients with chronic disease (Roger, Humphries, Davis, & Gutin, 1998) was "I can walk briskly for 20 minutes without stopping."

Environment: The environment measure was assessed using an adapted form of the International Physical Activity Prevalence Study: Environmental Module, 2002. Seven items asked participants to rate on a 5-point Likert type scale, with options ranging from "strongly disagree" (1) to "strongly agree" (5) how given statements described the area in which they lived. For example, "There are sidewalks on most of the streets in my local area."

Observational Learning: Observational learning was measured using two items previously used by (Plotnikoff et al., 2006) on a 5-point Likert-type scale in which participants were asked to rate how often they observed others being active in the last three months. Response options ranged from "never" (1) to "very often" (5), with an example item being "I have observed people who are important to me engaging in regular physical activity."

Satisfaction: Participants randomized to the treatment group completed a 15-item satisfaction survey adapted from the Health *e*-steps program (Steele, 2006). The survey was completed immediately post intervention and asked participants to rate on a Likert-type scale the satisfaction/usability of the intervention website. Items included the credibility and content of the information on the website as well as satisfaction of various components of the website with response options ranging from "strongly disagree" (1) to "strongly agree" (5).

Data Analysis

All analysis was conducted using SPSS (Version 12.0). Descriptive analysis (percentages and frequency counts) were conducted to assess recruitment, retention,

adherence and satisfaction of the internet as a mode of delivery for physical activity information in the population.

Chi-square tests were performed to examine group differences on pre-test categorical demographic scores. Where applicable, demographic, health and computer usage variables were dichotomized into a 2 X 2 table to ensure the 'minimum expected cell frequency' was not violated.

Repeated measures analysis of covariance (RM ANCOVA) to determine the efficacy of the NetPLAY intervention was conducted on physical activity levels and all 11 physical activity-related cognitions. The dependent variables for the primary outcome consisted of scores calculated on the modified Godin Leisure-Time Exercise Questionnaire (GLTEQ) to assess: (1) MET.minutes; and, (2) unweighted, combined moderate and vigorous minutes of physical activity. Participant baseline physical activity (GLTEQ) scores were used as a covariate in the above analyses. An examination of the diabetes literature suggests an association between BMI and physical activity behaviour in the type 2 diabetes population (Plotnikoff et al., 2006; Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007). For example, Plotnikoff and colleagues (2006) surveyed a sample of 1600 individuals with type 2 diabetes and found higher activity levels were associated with lower BMI ($p<0.001$), while Morrato and colleagues (2007) found that for those with diabetes the probability of being active incrementally declined with each increasing BMI category. For this reason, along with the significant differences between the two study groups at baseline, BMI was included as a covariate (with baseline physical activity) in a subsequent analysis for the primary behaviour outcomes (i.e., physical activity).

Exploratory Analyses

Exploratory analyses were conducted to investigate possible relationships between a number of demographic and computer usage variables at pre and post testing. Three sets of Pearson Product-moment correlations were employed to examine the association between website login frequencies with social-cognitive variables, physical activity behaviour (i.e., MET.minutes and unweighted minutes, and resistance training minutes/week) and selected demographic variables (employment status, income, residence, marital status and education) at the study's two time points. The first set of correlations utilized the total sample (n=49), while the second and third sets of analyses assessed the intervention group (n=25) and the per protocol group (n=15) (those participants who logged onto the website at least 75% of the time), respectively.

Results

Baseline characteristics

Table 1 presents the baseline data collected from a total of 49 participants (24 control, 25 intervention). The study groups did not statistically differ on any of the baseline characteristics measured with the exception of BMI ($p<0.05$) (See tables 1a, 1b).

Study Objective One: Study feasibility

The first objective of Diabetes NetPLAY was to determine the feasibility of the internet as a mode of delivery for diabetes related physical activity information by specifically examining study *recruitment*, *retention*, *adherence* and *satisfaction*. Regarding *recruitment*, approximately 185 individuals were mailed study information packages and another 50 packages were directly given to individuals attending diabetes

education classes at a local hospital. Of the 235 packages distributed, 78 individuals requested information about the study, representing a response rate of 33%. A total of 49 individuals consented to participate in the study, resulting in an overall recruitment rate of 21% (see Figure I.9 in Appendix I).

In terms of *retention*, two out of 25 participants from the intervention group did not complete the post-test questionnaire, representing a total attrition rate of 8%. A total of three participants from the control group did not respond to the post-test questionnaire, signifying an attrition rate of 12.5% for this group (see Figure I.9 in Appendix I).

In terms of *adherence*, of the 25 participants randomly assigned to the intervention group, 15 (60%) accessed the website at least once per week for a minimum of eight weeks (i.e., per protocol criteria). Every participant in the intervention group logged onto the website at least once throughout the study. Intervention group hits to the website ranged from one to 121 with an average of 33 hits per person during the course of the study. Login frequency decreased in 60% (n=15) of the sample by study midpoint, 8% (n=2) stayed the same while 32% of participants increased their frequency of website access. Of those participants who decreased their visits to the website in the latter six weeks of the study, only four individuals dropped off their usage by more than 50%. Subsequent analysis did not reveal any correlation between website adherence and physical activity behaviour among intervention participants. Email counselling participation varied among participants in the intervention group, with one respondent initiating contact over 10 times while another recorded no contact with the counsellor. 110 messages were received by the study counsellor over the 12 week intervention, representing an average of 4.4 messages per participant

The mean satisfaction scores on the 5-point Likert scales ranged from 4.50 (SD=0.60) to 3.41 (SD=1.05) on all 12 items. 86% of individuals either "strongly agreed" or "agreed" that the website was user friendly while 95.5% and 95.4%, respectively, found the information on the website to be easy to understand and credible. The various components of the website had more variability in satisfaction with 68.2% of participants reporting they either "agreed" or "strongly agreed" that the weekly activities were useful, and 77.3% stated the same for their satisfaction of the email counselling component. A detailed account of the satisfaction scores are presented in Table 5.

Study Objective Two: Preliminary efficacy

Intervention

RM ANCOVA (including baseline physical activity as a covariate), revealed a significant group x time interaction for unweighted moderate and vigorous minutes of physical activity [$F(1,45) = 4.00$, partial-eta squared=0.08, p=0.052] (see table 3), which according to Cohen (1988) represents a moderate effect size. However, RM ANCOVA physical activity behaviour did not reveal a significant group x time interaction for MET.minutes [$F(1,45) = 1.88$, partial-eta squared=0.04, p< 0.177]. The intervention group participated in more unweighted moderate and vigorous minutes than the control group with a mean difference of 47 minutes (95% CI=-.37-102.66, p<0.052) (see table 3a). In addition the intervention group participated in more MET.minutes then the control group with a mean difference of 164 MET.minutes (95% CI=-83.12-436.87, p<0.177). Although not included in our hypotheses, resistance training (including baseline RT as a covariate) was also examined. RM ANCOVA for these two variables did not reveal a significant group x time interaction (see table 3).

RM ANCOVA (using both baseline physical activity and BMI as covariates), revealed a significant group x time interaction for unweighted moderate and vigorous minutes [$F(1,44) = 7.33$, partial-eta squared=.15, p=0.010] and MET.minutes [$F(1,44) = 4.36$, partial-eta squared=.09, p<0.043] of total activity, which in both cases indicates a moderate-to-large effect size (Cohen, 1988) (see table 3). The intervention group participated in more unweighted moderate and vigorous minutes of physical activity than the control group with a mean difference of 50 minutes (95% CI=18.27 – 125.22, p<0.010) Further, the intervention group participated in more MET.minutes then the control group with a mean difference of 168 MET.minutes (95% CI=9.66 – 553.18, p<0.043) (see table 3a). Although not included in our hypotheses, resistance training (using both baseline resistance training and BMI as covariates) did not reveal a significant group x time interaction (see table 3).

Differences in social cognitive variables (see table 4), controlling for baseline difference, showed a significant interaction effect for behavioural capacity [$F(1,44) = 6.12$, partial-eta squared=0.12, p<0.05]. No other interactions were reported for the remaining social cognitive variables examined (i.e., self-efficacy, outcome expectations, outcome expectancies, self-regulation, situation, reinforcement, social support, emotional coping response, and observational learning).

Discussion

The first objective of this study was to determine the feasibility (recruitment, retention, adherence and satisfaction) of the internet in the delivery physical activity related information to individuals with type 2 diabetes. There is an increasing need to

deliver cost-effective physical activity interventions to large numbers of individuals living with this chronic disease. With internet and email becoming a primary mode of communication, an opportunity exists to utilize information technology to elicit physical activity behaviour change.

Recruitment for the Diabetes NetPLAY study did prove to be challenging. Various recruitment methods were employed to attract potential participants including, newspaper ads, posters, internet ads and in-person at Diabetes Education Centres. Recruitment covered a four month period with more than 200 study information packages distributed. A large proportion of individuals reported hesitation with using the internet or not having regular access to a computer. Although internet usage is continuing to rise, there are still a number of individuals with limited or no internet experience.

Results demonstrated that retention of participants to the Diabetes NetPLAY website was relatively high. Forty-four participants completed the post-test questionnaire, representing a 90% retention rate for this study. Similar studies have also demonstrated comparable retention rates. The D-Net intervention by McKay and colleagues (2001) revealed a retention rate of 87% at the 8-week follow-up point. Similarly, Napolitano et al., (2003) showed retention rates of 88% and 80% at one and three-month follow-ups, respectively. However, in a recent review of web-based physical activity studies by Vandelanotte et al.,(2007), the authors reported lower retention rates, with an overall average of 73% attrition. Of the five studies that reported objective data, all indicated a decline in website usage as the intervention progressed. In the Diabetes NetPLAY study, over half the intervention group (60%) showed a decline in

login frequency while interestingly, 32% of participants actually increased their usage of the intervention website after the study mid-point. Clearly, as with non-internet-based studies, adherence with this mode of delivery continues to be a challenge in promoting physical activity (Vandelanotte et al., 2007).

The diabetes self-management program (Glasgow et al., 2003), showed a significant decrease in login frequency (50%) during the 10 month intervention. The highest rates of website usage were recorded within the first three months of the program with a gradual drop-off over time. Leslie and colleagues (2005) reported on the engagement and retention of participants in the Active Living: Online study (Marshall, Leslie, Bauman, Marcus, & Owen, 2003). Over the 8-week intervention, only 46% of recruited participants visited the website with 77% of those hits recorded in the first 2 weeks of the intervention. The relatively low level of website interactivity may have contributed to the low adherence rates demonstrated in this study as many participants felt it unnecessary to continue visiting a static website.

In addressing study adherence, one might want to consider the interactive features of a physical activity website. Increasing the interactivity of these types of interventions has been suggested in the literature (Leslie et al., 2005; Napolitano, Fotheringham et al., 2003). Email, chat rooms, on-line logbooks and updated information may be simple features that aid in the adherence of participants to a physical activity website.

The Diabetes Net-PLAY study used several interactive techniques in attempts to keep study participants engaged. Individualized emails were sent on a weekly basis, providing general feedback on the specific topic of the week, progress and motivation. An on-line logbook allowed participants to track their progress and receive feedback

from their counsellor on how they were doing. The study website was also updated on a weekly basis, with past weeks being archived for future reference. The study message board had various topics posted by the study counsellor at which point, participants could share their thoughts and feelings with others involved in the study. These features may have given participants reason to continue visiting the website on a regular basis throughout the study.

Previous studies have reported a positive correlation between login frequency and behaviour change. Tate et al., (2001) found a significant correlation ($p<0.01$) between login frequency and weight change between 0 and 6 months time in both the intervention and control groups. Further, McKay et al., (2001) reported a significant relation between website usage and greater change in moderate-to-vigorous physical activity after an 8-week intervention. The Diabetes NetPLAY study did not find any relationships between login frequency and physical activity behaviour change. Perhaps, because of its dynamic nature, users were compelled to return to the site on numerous occasions for information however, login frequency did not translate into behaviour change.

Satisfaction among intervention participants for this mode of delivery was positive. Participants indicated they were more satisfied with the personal email counselling than the peer-to-peer support through the message board. A similar finding was also captured by McKay et al., (2001) with 88% of study participants indicating a preference for a personal coach versus 35% preferring for peer support. Additional promotion and encouragement may be needed to generate strong peer support systems with this mode of delivery.

Slightly less than half (49%) of our study participants reported using the internet on a daily basis while at the same time 43% reported using the internet less than 9 hours in the previous month. This may indicate that while individuals are accessing the internet on a regular basis, they are not spending comparative amounts of time surfing the web. This might be an important aspect to consider when developing further web-based studies as individuals may not be accustomed to spending the required time on study websites to take full advantage of their behaviour change potential.

The second study objective was to determine the preliminary efficacy of the internet as a mode of delivery for eliciting recommended changes in physical activity related cognitions and behaviours for individuals with type 2 diabetes. The results demonstrate the internet and interactive technology is an efficacious vehicle for promoting physical activity behaviour change among individuals with type 2 diabetes. The intervention group significantly increased their mean total physical activity levels whereas the control group demonstrated a decline in activity levels. Although not all participants in the intervention reached recommended guidelines within the parameters of this study, overall, participants did demonstrate a progression towards the clinical recommendations. The CDA recommends individuals with type 2 diabetes work their way up to 150 minutes of daily physical activity. The physical activity changes demonstrated in this study have both research and clinical significance. Despite the small sample size, the intervention revealed moderate to large effect sizes for changes in physical activity behaviour. Additionally, the average increase of 47 minutes in physical activity behaviour among the intervention group participants has very important practical and clinical implications for public health. The need for cost-effective physical activity

interventions that can reach large numbers of people is vital in the public health system; therefore, these results could be viewed as meaningful at a population health level.

A systematic review of the literature suggests modest effects for the efficacy of web-based physical activity intervention, with just over half of the studies reporting significant positive behavioural changes (Vandelanotte et al., 2007). Only a few studies have shown time x group effects on physical activity behaviour (Plotnikoff et al., 2005; Napolitano et al., 2003; Spittaels, Bourdeaudhij, & Vandelanotte, 2007) while others with (McKay et al., 2003) or without tailored feedback (Marshall et al., 2003; Tate et al., 2001; Harvey-Berino et al., 2002) have demonstrated only time effects (employing no control groups) on physical activity behaviour.

Plotnikoff et al. (2005) found similar results in a workplace context over a time period of 12 weeks. Although effect sizes were small, intervention participants showed an increase in total activity levels at time 2 while activity levels of control participants declined during the same time frame. Likewise, Napolitano and colleagues (2003), found that after one-month of exposure to an SCT grounded physical activity website and weekly email tip sheets, intervention participants exhibited higher levels of moderate physical activity and walking minutes compared to the control group. However, at the three-month time point, only walking minutes remained significant between the two groups (Napolitano et al. 2003).

Similar findings to the Diabetes NetPLAY study were also demonstrated in a study of 434 healthy adults (Spittaels, Bourdeaudhij, & Vandelanotte 2007). Researchers found a significant group x time interaction effect in favour of both intervention groups (with or without repeated feedback) for active transportation and leisure-time physical

activity compared with the control group. However, in contrast to Diabetes NetPLAY, Spittaels et al., (2007) were able to show behaviour changes over a longer study period of 6 months.

The Diabetes Network (D-Net) Active Lives Physical Activity Intervention (McKay et al., 2001) also demonstrated comparable findings to that Diabetes NetPLAY. Significant time effects in both walking and moderate-to-vigorous intensity physical activity were found at the end of the 8-week study. Unlike NetPLAY, however, McKay and colleagues (2001) failed to show a significant difference in physical activity behaviour between intervention and control groups over a shorter period of time. Interestingly, the D-Net study allowed the control group access to diabetes-specific articles in the web-site library in addition to real-time glucose tracking with graphic feedback for the duration of the 8-week study (McKay et al., 2001). Control participants could have been motivated and guided by information accessed through the virtual library and therefore may have increased their physical activity behaviour.

The significant changes in physical activity behaviour among intervention participants in the Diabetes NetPLAY study may be attributed to several factors. First, individuals may have already been motivated to participate in physical activity prior to study initiation. The simple fact that individuals were interested in participating in a physical activity study may speak to the stage of readiness that many of the participants were in prior to starting the intervention. Second, web-based interventions are still seen as a novel approach for the delivery of health-related physical activity and counselling. Therefore, participants could have been motivated to increase their physical activity

behaviour, in part, because of the novel mode of delivery and not the information, per se. This speaks to the importance of further research in this area.

The intervention group in our study also demonstrated an increase in behavioural capacity (i.e., self-reported ability to complete various physical tasks) over the course of the 12-week study. Participants in the intervention group felt they were better able to complete physical tasks like walking and jogging after taking part in the study.

However, there were no significant increases in any other physical activity related cognitions. These findings contrast similar, theoretically grounded studies. Plotnikoff and colleagues (2005) measured several physical activity-related cognitions from a variety of social cognitive theories. Following the 12 week study, participants in the intervention group were more efficacious in four out of the seven social-cognitive variables measured, including self-efficacy.

The fact that the majority of physical activity related cognitions did not significantly change in this study may be explained by the *response shift theory* concept. Borrowed from the quality of life domain, this concept proposes that an individual's self-perception and/or internal standards (e.g., self-regulation, outcome expectations) shift as the result of a change in a measurable behaviour (e.g., physical activity) (Sprangers & Schwartz, 1999). In other words, as an individuals behaviour changes (i.e., they become more active), they encounter new situations, barriers etc. as a result, causing a shift in their cognitions related to that particular behaviour (i.e., physical activity). Examination of the *response shift theory* has been primarily focused in the quality of life domain; therefore, additional research in the social cognitive field is needed to evaluate its true effectiveness in the physical activity domain.

A second explanation for the lack of change in behaviour-related cognitions could be attributed to elevated self-report measures at baseline. This could have produced a ceiling effect, leaving limited room for improvement for some of measured social cognitive variables.

There are some major strengths to this study. First, the comprehensive use of a theoretically-based framework in the design and composition of website tools is distinctive. The use of theoretically-based interventions may strengthen program outcomes and facilitate successful behaviour change (Green, 2000; Doshi, Patrick, Sallis, & Calfs, 2003). Second, the use of SCT in its entirety for the design of a web-based program is a unique feature as compared to a large portion of the programs which tend to operationalize only specific components of social cognitive theories. Finally, this study contributes to the growing body of literature of web-based mediums for the delivery of health information. The use of interactive features such as linked email messaging, message boards and logbooks were important tools in further development of knowledge in this area and deemed important for future exploration in the past.

This study, however, is not without its limitations. Although we were able to detect physical activity behaviour differences, the sample size may have prevented the detection of differences between social cognitive variables. The lack of objective measures and the dependence on self-report indicators is considered a limitation as this method of examination has been shown to lead to over-reporting in some cases (Warnecke, Johnson, Chavez, Sudman, O'Rourke, Lacey, & Horm, 1997). Furthermore, not all measurement tools used in assessing social cognitive scales have been specifically validated in the diabetes population. The generalizability of results to the broader

diabetes population presents another limitation of this study. The demographic characteristics of the study cohort are not necessarily a representative sample of the wider population, as participants were of relatively high income and education levels. Finally, the lack of follow-up did not allow for examination and interpretation of behaviour change beyond the 12-week study period, making it difficult to access the long-term efficacy of such an intervention.

In summary, this study revealed the web-based delivery of physical activity programs holds particular promise for behaviour change in the diabetes population. The expanding availability of the internet allows such programs to reach large numbers of individuals while at the same time providing instantaneous support and feedback. Although in its infancy, web-based physical activity interventions, such as NetPLAY, are important in the development and expansion of future research in this area.

Table 3-1 Baseline socio-demographic and behavioural characteristics of study participants

Variable	Control Baseline M (SD)	N	Intervention Baseline M (SD)	N	t	p
Current Age	54.5 (10.8)	23	53.7 (9.8)	25	-0.3	0.805
Age when diagnosed	47.5 (11.0)	24	46.5 (10.0)	25	-0.3	0.746
Time (in months) living with diabetes	86.6 (90.8)	23	86.9 (100.8)	25	0.0	0.992
BMI	31.1 (5.6)	23	36.6 (9.1)	25	2.5	**0.016**
MET Minutes (per/wk)	501 (582)	24	483 (620)	23	-0.1	0.987
Unweighted Minutes (per/wk)	111 (123)	24	105 (140)	23	-0.2	0.769
RT minutes (per/wk)	8 (23)	24	32 (62)	25	1.3	0.080
Disability	2.2 (1.5)	24	2.8 (1.9)	25	1.1	0.261

Table 3-2 Socio-demographic characteristics of study participants

Variable		Control	Intervention	X^2	p
Marital Status	Partner	20 (83.3%)	13 (52.0%)	4.14	0.042
	No Partner	4 (16.7%)	12 (48.0%)		
Residence	City	20 (83.3%)	16 (64.0%)	1.46	0.227
	Not city	4 (16.7%)	9 (36.0%)		
Education	No degree completed	5 (21.7%)	9 (36.0%)	0.59	0.442
	Degree completed	18 (78.3%)	16 (36.0%)		
Gross Family Income	<$20,000-$59,000	7 (30.4%)	12 (48.0%)	0.90	0.343
	$60,000 - <$100,000	16 (69.6%)	13 (52.0%)		
Employment status	Not employed	7 (29.2%)	9 (37.5%)	0.09	0.759
	employed	17 (70.8%)	15 (62.5%)		
Computer usage	Less than once/week	10 (66.7%)	5 (33.3%)	0.60	0.440
	More than once/week	9 (47.4%)	10 (52.6%)		
Computer usage	Less than 20hrs/month	18 (64.3%)	10 (35.7%)	4.78	0.030
	More than 20 hrs/month	6 (28.6%)	15 (71.4%)		

Table 3-3 Baselines social cognitive variables

Social Cognitive Variable	**α (or r*) (# of items)**	**Control n=24 Baseline M (SD)**	**Intervention n=25 Baseline M (SD)**	**t**	**p**
self-efficacy	0.94 (12)	3.0 (0.7)	3.0 (0.7)	-0.1	0.947
outcome expectations	0.97 (17)	4.6 (0.3)	4.5 (0.9)	-0.8	0.041
outcome expectancies	0.88 (17)	2.7 (0.3)	2.7 (0.3)	0.2	0.810
self regulation	0.74 (3)	3.9 (0.5)	3.8 (0.5)	-0.9	0.392
situation	0.88 (17)	2.1 (0.5)	2.4 (0.7)	1.7	0.120
reinforcement	0.78 (4)	2.5 (0.8)	2.7 (0.7)	0.7	0.501
social support	0.83 (2)*	4.5 (1.9)	5.1 (1.5)	1.0	0.350
emotional coping resp.	0.71 (6)	2.7 (0.6)	2.9 (0.8)	0.8	0.450
behavioral capacity	0.85 (4)	3.2 (0.9)	3.1 (1.2)	-0.5	0.632
environment	0.77 (7)	3.6 (0.9)	3.5 (0.9)	-0.4	0.699
observational learning	0.29 (2)*	3.8 (1.3)	4.1 (0.8)	1.0	0.331

Table 3-4 Time 1 and time 2 physical activity behaviour by group

	Control Group n=24		**Intervention Group n=23***				
Variable	**Time 1 M (SD)**	**Time 2 M (SD)**	**Time 1 M (SD)**	**Time 2 M (SD)**	**F**	**p**	**eta^2**
MET minutes (per/wk)	501 (582)	490 (562)	483 (620)	654 (659)	1.88	0.177	0.04
adjusted for BMI					4.37	**0.043**	0.09
Unweighted mod & vig min (per/wk)	111 (123)	92 (93)	105 (140)	140 (138)	4.00	**0.052**	0.08
adjusted for BMI					7.33	**0.010**	0.15
RT minutes (per/wk)	8 (23)	15 (25)	32 (62)	26 (56)	3.60	0.064	0.07
adjusted for BMI					3.70	0.061	0.08

* two individuals did not complete baseline Godin measures, therefore, not allowing Last Observation Carried Forward to be employed

Table 3-5 Physical activity change Scores

Variable	**Change score** (between group)	**95% Confidence Interval**		**t**	**p**	**eta^2**
		Lower Bound	Upper Bound			
MET.minutes (per/wk)	164 (97)	-83.12	436.87	1.37	0.177	0.04
adjusted for BMI	168 (85)	9.66	553.18	2.09	**0.043**	0.09
unweighted mod. & vig min (per/wk)	47 (45)	-0.370	102.00	2.00	**0.052**	0.10
adjusted for BMI	50 (44)	18.27	125.22	2.71	**0.010**	0.15

Table 3-6 Time 1 and time 2 social cognitive variables by group

Variable	Control Group n=24		Intervention Group n=25				
	Time 1 M (SD)	**Time 2 M (SD)**	**Time 1 M (SD)**	**Time 2 M (SD)**	**F**	**p**	**eta^2**
Self-efficacy	3.01 (0.71)	2.82 (0.84)	3.00 (0.74)	2.99 (0.84)	1.05	0.311	0.02
Outcome expectations	4.62 (0.37)	4.57 (0.42)	4.46 (0.87)	4.57 (0.54)	0.92	0.763	0.00
Outcome expectancies	2.71 (0.34)	2.65 (0.36)	2.73 (0.29)	2.69 (0.39)	0.07	0.799	0.00
Self-regulation	3.94 (0.53)	3.75 (1.05)	3.81 (0.54)	3.56 (0.91)	0.36	0.550	0.00
Situation	2.11 (0.55)	2.16 (0.59)	2.41 (0.66)	2.35 (0.67)	0.71	0.406	0.02
Reinforcement	2.58 (0.84)	2.70 (0.91)	2.73 (0.66)	2.83 (0.74)	0.00	0.961	0.00
Social support	4.58 (1.99)	4.27 (2.05)	5.06 (1.52)	4.18 (2.10)	1.69	0.201	0.04
Emotional coping resp.	2.78 (0.67)	2.90 (0.67)	2.93 (0.76)	2.90 (0.67)	0.12	0.733	0.00
Behavioural capacity	3.25 (0.98)	2.97 (0.98)	3.10 (1.18)	3.23 (1.32)	7.63	**0.001**	0.14
Observational learning	3.83 (1.32)	3.31 (1.31)	4.14 (0.78)	3.96 (0.92)	3.05	0.087	0.06

Table 3-7 Satisfaction with intervention program

Variables	**Intervention Group N=22 Mean (SD)**
Website was user friendly	4.27 (0.70)
Overall presentation	4.14 (0.71)
Able to find way around	4.23 (0.75)
Information was easy to understand	4.45 (0.60)
Information was credible	4.50 (0.60)
Activities were useful	3.86 (0.94)
Message board was useful	3.64 (1.03)
Logbook was useful	4.23 (0.87)
Navigation links were easy	4.05 (0.72)
I liked the personal login	4.27 (0.63)
I liked being able to communicate with others	3.41 (1.05)
I liked the email counselling	4.14 (0.89)

Response scale: 1=strongly disagree, 5=strongly agree

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Chapter 4 – Conclusions

This chapter presents the main conclusions for the two study aims. The study strengths and limitations in addition to future directions for research are presented.

4.1 Main Conclusions

4.1.1 Research Objective One

The increasing need to deliver cost-effective physical activity interventions to large numbers of individuals living with chronic disease is increasingly important. With internet and email becoming a primary mode of communication, an opportunity exists to utilize information technology to elicit physical activity behaviour change.

The first objective of the Diabetes NetPLAY study was to determine the feasibility (recruitment, retention, adherence and satisfaction) of the internet in the delivery of physical activity related information to individuals with type 2 diabetes.

Recruitment of individuals to this particular study did prove to be challenging. Eligibility criteria only permitted those with internet and email access to participate in this study; therefore, web access was a limiting factor for a number of individuals. It should be noted, however, recruitment difficulties are not unique to this study, as it is often experienced in the randomized controlled trials (Ross, Grant, Counsell, Gillespie, Russel, & Prescott, 1999).

Results indicate that the retention of participants in this web-based study were relatively high with participants appearing to be engaged and committed throughout the duration of such an intervention.

Adherence to web-based interventions has proved to be challenging in other studies (Vandelanotte, Spathonis, Eakin, & Owen, 2007), however, this study showed

relatively positive adherence throughout the program. Although more than half of intervention participants demonstrated a decline in login frequency over the course of the study, over 30% actually showed an increase in web-site usage after week six. Frequent communication via email, the use of various interactive features on the website and dynamic information may have contributed to the strong adherence rates demonstrated in this study.

Feedback from participants in the intervention group resulted in positive feedback for the web-based delivery of physical activity information. It appears that individuals in this population are interested in receiving information that is both credible and easily understood. Interactive features, including the logbook and email communication with the counsellor were rated positively while weekly activities and message board postings were viewed as less favourable. This could be a result of varying interests of participants with the majority looking for personal support and accountability through on-line tracking methods.

4.1.2 Research Objective Two

The second objective of this study was to determine the preliminary efficacy of the internet as a mode of delivery for eliciting recommended changes in physical activity related cognitions and behaviours for individuals with type 2 diabetes. The results of this study demonstrate that the internet can be an efficacious vehicle for promoting physical activity behaviour change in this population.

The physical activity changes demonstrated in this study have practical implications for public health and future research that should be acknowledged. The change in physical activity behaviour demonstrated in this study could also have very meaningful clinical effects in the management of type 2 diabetes. Further development

and exploration of public health programs that have potential to reach large pockets of the population is crucial within the structure of the current public health system.

The Diabetes NetPLAY intervention, however, did not appear to have a large impact on physical activity related cognitions. The intervention group did demonstrate a significant increase in behavioural capacity as compared to the control group; however, all other cognitions examined did not produce a significant result. The lack of such significant change in cognitions may be explained through a number of mechanisms as discussed in Chapter 3.

4.2 Study Strengths

This study had several notable strengths including the use of a theoretically-based framework in the development of website messaging. First, material was developed based on current knowledge and interpretation of social cognitive constructs available in the health promotion domain. This is of particular importance because the grounding of physical activity websites in a theoretical framework is limited and evidence suggests doing so may strengthen intervention outcomes (Doshi, Patrick, Sallis, & Calfas, 2003).

The second study strength is the Diabetes NetPLAY study is the first of its kind to comprehensively opertationalize and measure all components of the Social Cognitive Theory in the physical activity domain. SCT has been recognized as one of the more dominant health behaviour theories in the physical activity domain (Marcus, King, Clark, Pinto, & Bock, 1996; Keller, Fleury, Gregor-Holt, & Thompson, 1999; Allen, 2004) and has been an important framework for the design of physical activity interventions (Keller et al., 1999) however; it is often not used in its entirety.

4.3 Study Limitations

There were several limitations of this study that should be noted. First, the measurement of physical activity was based on self-report; no objective measures were utilized. Self-report measures are beneficial when collecting data from numerous study participants who may not be available for objective assessments to be collected (Sallis & Saelens, 2000). However, in previous studies, self-report measures have been shown to lead to over-reporting of physical activity due to social desirability bias (Warnecke, Johnson, Chavez, Sudman, O'Rourke, Lacey, & Horm, 1997), in which participants report what they believe is socially acceptable. Baranowski (1998) also reported that recalling physical activity is a highly complex task, making it difficult for some individuals to process the information correctly.

Second, not all measurement tools for select social cognitive constructs were designed for use in the diabetes population. For example, measures for emotional coping response and situation were originally used with breast cancer survivors. In addition, measures for outcome expectancies and outcome expectations were developed for use in low income populations. Assessing the true reliability and validity of these measures is difficult if they have not been exhaustively tested in the diabetes population.

A third limitation to this study was the small sample size. The power of a statistical test is dependent on a study's sample size, and will identify if, in fact, there is a difference between the intervention and control groups (Pallant, 2005). With a small study sample (e.g., 20), it is important to be aware that a non-significant result may be due to a lack of power (Stevens, 1996).

A forth limitation was the lack of follow-up after the conclusion of Diabetes NetPLAY. Without long-term follow-up it is not known if the targeted behaviours were

sustained. Therefore, it is difficult to conclude if such interventions have benefit beyond their duration.

A final limitation of this study is the generalizability of study results to participants of varying demographic backgrounds. The Diabetes NetPLAY participants tended to be better educated and of middle-to-upper class status, with 70% indicating completion of university/college, graduate or technical school and over 50% reporting a household income great than $70,000. Therefore, the generalizability of these results to individuals of lower income and education may not be appropriate.

4.4 Implications for Future Research

The results of this study demonstrate that a website and e-counselling program could increase the physical activity behaviour of individuals with type 2 diabetes. Web-based physical activity interventions hold promise such a program has the potential to reach large numbers of people and can provide immediate feedback and support for participants.

Future research should explore the use of web-based interventions to sustain long-term behaviour change within a broad range of demographic categories. Researchers should attempt to recruit and engage larger samples of individuals with type 2 diabetes over the longer-term. Further exploration in the grounding of messages and information in specific health behaviour change theories and models is an important step likely to improve the success of such interventions. The use of other social cognitive theories and models as frameworks for further web-based interventions should be considered in future research. The examination of integrated ecological models may further enhance the

ability of web-based mediums to elicit physical activity behaviour change in this population.

Tailored messaging and interactive website features should be examined to further determine if such elements can maintain long-term engagement and adherence to programming. Increasing the usage of various internet items (i.e., message board, logbook) should be explored in further detail to examine their effects on successful behaviour change in this population.

Examining the use of algorithms in the design of web-based physical activity interventions would also be of value. Allowing participants to receive instantaneous, tailored feedback may increase adherence and physical activity behaviour change. In addition, the use of graphs or charts to provide visual feedback on behaviour change may appeal to and further motivate participants.

Finally, the use of the internet to deliver behaviour change interventions could present additional barriers for some individuals. Therefore, it would be beneficial for researchers to determine how to better relate with participants and understand the barriers-to-use, so as to better appeal to more individuals.

4.5 Conclusion

As the number of individuals diagnosed with type 2 diabetes grows, the need for cost-effective, large-scale physical activity interventions is vital. Research on web-based behavioural interventions is in its infancy. This pilot study contributes to the growing body of literature on the feasibility and preliminary efficacy of such interventions. It suggests that a website and email counselling intervention grounded in the Social

Cognitive Theory to increase the physical activity behaviour of those living with type 2 diabetes shows promise.

Additional research is needed to explore the effectiveness of web-based interventions on long-term physical activity behaviour change and various electronic elements that will engage participants. The Diabetes NetPLAY study will help guide further development of web-based interventions for people with type 2 diabetes.

4.6 References

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Appendices

Appendix I – Comprehensive Methods

The purpose of this Appendix is to provide 1) further detail of the methods used in the Diabetes NetPLAY study (Chapter 3); and, 2) provide details of data diagnostic procedures and data analysis. Information regarding the subjects, measurement tools employed and procedures is reported as a detailed account of the Methods sections from the previous manuscript, and therefore, may be repetitive in some sections.

I.1 Study Design

This study employed a two-group randomized controlled design, in which participants were randomly assigned to either control or intervention conditions. Baseline information was collected prior to study commencement and included demographic, BMI, computer variables, social cognitive and behaviour measures. Measurements were then collected immediately post- intervention and included BMI, social cognitive, computer usage and behaviour measures along with a satisfaction measure for intervention participants only. The intervention was conducted between May and July 2006.

Ethical clearance for this study was obtained from the Faculty of Physical Education and Recreation Research Ethics Board (see Appendix V) at the University of Alberta. Prior to participation, potential participants received a Study Information Sheet detailing the Diabetes NetPLAY program (see Appendix IV). Participants were then required to complete an Informed Consent form and Physical Activity Readiness Questionnaire (PAR-Q) (Canadian Society for Exercise Physiology, 2002) (see

Appendix IV). Participants who answered yes to any of the questions on the PAR-Q were required to obtain consent from their physician in order to be eligible for this study.

I.2 Sample Size

The aim was to randomize 25 individuals to each study arm. This number was predetermined based on logistic factors to provide information regarding the feasibility and preliminary efficacy for this type of intervention.

I.3 Participants

Participants were recruited through four avenues. The first strategy recruited individuals who had previously participated in the Alberta Longitudinal Exercise and Diabetes Research Advancement (ALEXANDRA) Study (Plotnikoff et al. 2006). Participants in the ALEXANDRA study who expressed interest in participating in future research projects were mailed letters outlining the Diabetes NetPLAY study and instructed to contact the study coordinator for further information. Second, participants from an existing research pool who were initially recruited for the Alberta Diabetes and Physical Activity Trial (ADAPT; Plotnikoff, Sigal, Johnson, Courneya, Raine & Lau, in progress), and had decided not to participate in the ADAPT study but had expressed interest in participating in future research projects were contacted via mail. Interested participants were instructed to contact study coordinators to receive further information. Third, study participants were recruited through health care professionals such as registered nurses and dietitians working in Diabetes Education Centres and health units in urban and rural Alberta. Study packages and information were given to these health

professionals to pass along to potential participants (see Appendix IV). The study coordinator also attended several diabetes classes at a local hospital. A brief outline of the study was presented and interested participants were then given study packages to take home. Finally, potential participants were also recruited via local newspaper, information flyers and a commercial radio station (see Figure I.9). Eligibility included being over 18 years of age, having been diagnosed with type 2 diabetes and having access to the internet and email.

Upon the expression of study participation, potential study recruits received (either through email or in person) a study information letter detailing the study, time commitment and expectations. A study information package was also sent (either by mail or in person), which included study consent forms, the Physical Activity Readiness Questionnaire (PAR-Q) and a postage-paid return envelope (see Appendix IV). Participants were asked to mail back one completed copy of each form and a physicians clearance if needed.

Potential study recruits were sent two reminder emails if study forms were not received within a three week period and a final phone call was made after one month in an attempt to solidify the participants (see Appendix IV). Participants were also given the option to participate in further research studies, should Diabetes NetPLAY not be appropriate.

A total of 78 participants responded to the recruitment mediums. A total of 27 were excluded for the following reasons (i) were not interested when given the details of the study (n=10), (ii) did not return consent forms (n=9), or (iii) other commitments

(n=8). A total of 49 participants were randomized into one of two groups (Intervention = 25) and (Control = 24). Baseline data were collected on all 49 individuals.

I.4 Randomization

Participants were randomly assigned to a list of computer generated numbers ranging from 1 - 2 (University of California Los Angles) with each number representing one of the groups. Randomization occurred immediately after a pre-determined enrolment cut-off date and the required number of participants had completed baseline questionnaires. Upon randomization, participants were notified of their group designation via email. Participants and study coordinator were not blinded to group allocation.

Along with group allocation information, participants were emailed a letter detailing the NetPLAY website address, User ID, and website password. Information detailing the background of the study, what to expect and the relative features of the respective websites (i.e., control website; intervention website) was also included in this letter.

I.5 Instrumentation

I.5.1 Demographic and health variables

Baseline demographic variables were included based on various socio-demographic measures from Statistics Canada (2001). Participants were asked *age, gender, marital status* (options include never married, married, common law, separated or divorced, and widowed), *English as first language* (yes/no), *education* (categories

ranging from some grade school to completed graduate school) *current employment status* (options include homemaker, full-time paid, part-time paid, retired, temporarily unemployed, volunteer), and *gross annual family income* (categories ranging from <$20,000 to >$100,000 in $20,000 increments) (see Appendix II, Baseline Questionnaire, Final Section).

Health status was assessed using previously published self-report measures (Plotnifoff, et al., 2006). *Perceived physical disability for physical activity* was assessed by asking participants the extent their participation in physical activity was limited by a health condition, injury, or disability in the last month using a 6-point Likert-type scale with response options ranging from 1 (not at all) to 6 (completely). Participants were also asked to indicate if a doctor or nurse had ever told them they have/had the following: type 2 diabetes, high blood pressure, angina, heart attack, stroke or cancer (yes/no format) (see Appendix II, Baseline Questionnaire, Section M). Finally, participants were asked to report their height (in feet/inches or meters/centimetres) and weight (in pounds or kilograms), in order to calculate BMI (kg/m^2) (see Appendix II, Baseline Questionnaire, Final Section).

I.5.2 Leisure-Time Physical Activity Behaviour

Physical activity classification is based on mode, frequency, duration and intensity and can be assessed using a variety of methods including, direct observation, questionnaires, heart rate monitors, diaries, pedometers and accelerometers.

Self-report measures, such as questionnaires, are popular when assessing the physical activity behaviour of populations. The accepted benefits of self-report measures include their ability to remain relatively low-cost when surveying large cohorts of

people; wide range of use within various populations and; small altering effects on the particular behaviour being studied (Sallis & Saelens, 2000). However, self-report is not without its limitations. It has often been criticised for its lack of objectivity and recall bias (Tudor-Locke & Myers, 2001; Sallis & Saelens, 2000).

The Godin Leisure-Time Exercise Questionnaire (GLTEQ) is a self-report physical activity instrument that has been validated and used in a number of research studies (Godin & Shepard, 1997). In a study conducted by Miller, Freedson & Kline (1994), self report and objective measures of physical activity were compared. The GTLEQ was found to be strongly correlated with personal electronic motion sensors. The GTLEQ's validity was also tested by Gionet and Godin (1989) in an employee sample of Canadian workers and was found to be highly correlated with physiological fitness data.

Leisure-time physical activity (LTPA) was assessed using a modified version of the validated GLTEQ (Godin & Shepard, 1997) (see Appendix II, Baseline Questionnaire, Section A). In this instance, LTPA was defined as a physical activity session longer than 10 minutes in duration and was not part of employment or household chores. Based on an average of the past month, participants were asked to report: 1) frequency (times per week), and 2) duration (average time per session), of activity in each intensity category (strenuous, moderate or mild). The reliability of the GLTEQ has been independently evaluated and found to compare favourably to nine other measures of self-reported exercise including test-retest scores, objective activity monitors, and fitness indices (Jacobs, Ainsworth, Hartman & Leon, 1993). Participation responses were then converted into 1) MET minutes by multiplying weekly minutes of mild activity by 2.5

METS (Ainsworth et al. 2000), moderate activity by 4 METS and vigorous activity by 7.5 METS (Brown & Bauman, 2000) and 2) *unweighted* minutes by summing weekly minutes of moderate and vigorous physical activity.

For data analysis purposes, LTPA was calculated using only the moderate and vigorous activity levels, producing a 1) MET.minutes per week value and 2) *unweighted* minutes per week value. Mild activity levels were not included in either calculation for three reasons: 1) all psychosocial variables are based on a definition of physical activity of moderate or greater intensity; 2) population-based MET values have only been defined for moderate activity or greater (Brown & Bauman, 2000); and, 3) the Canadian Diabetes Association Clinical Practice Guidelines (2003) state that moderate to high levels of physical activity are associated with substantial decreases in mortality and morbidity in individuals with type 2 diabetes.

A resistance training (RT) measure was also incorporated into the GLTEQ in which participants were asked to report on average in the past month, frequency (times per week), and duration (average times per session) they had engaged in resistance training activities. Participation responses were captured by multiplying frequency by duration to produce a final RT score (see Appendix II, Baseline Questionnaire, Section B).

Social cognitive measures[1]

When examining Social Cognitive Theory constructs, valid and reliable measures must be employed. However, varying degrees of validity and reliability have been demonstrated within the literature when examining SCT constructs (Marcus, Selby,

[1] Items for each of the following social cognitive measures were summed and averaged to calculate the final composite score. All reported Cronbach's alpha's reflect the study sample size of n=49.

Niauri & Rossi, 1992; Plotnikoff et al., 2001; Schuster, Petose & Petosa, 1995; Petosa, Suminski & Hortz, 2003). Within the general population, self-efficacy and social environment have been subject to the greatest amount of validity and reliability testing (Castro, Sallis, Hickman, Lee & Chen, 1999; Wallace, Buckworth, Kirby & Sherman, 2000). SCT constructs within the diabetes population have not been extensively validated. In a literature review conducted by Allen (2004), it was revealed that instrument reliability among those studies that reported internal consistencies were mixed and widespread.

I.5.3 Self-efficacy

Physical activity self-efficacy was assessed using a five point Likert-type scale, which asked individuals to rate their confidence to perform regular physical activity in a variety of circumstances from "not at all confident=1" to "extremely confident=5" (e.g. 'I am confident I can participate in regular physical activity when I am a little tired', 'I am confident I can participate in regular physical activity when the weather is bad'). The self-efficacy scale consisted of 12 items, two of which were specific to diabetes (see appendix II, Baseline Questionnaire, Section C). The 12 item scale had good internal consistency, with a baseline Cronbach alpha of .94. This self-efficacy scale has been used in the past within a diabetes population by Plotnikoff et al., 2001 and is based upon the Self-Efficacy Exercise Questionnaire developed by Marcus et al., 1992.

I.5.4 Outcome expectations/Outcome expectancies

Outcome *expectations* was assessed using a 5 point Likert-type scale (ranging from "strongly disagree=1" to "strongly agree=5") which had participants rate their agreement with 17 given positive expectations of engaging in regular physical activity

(e.g., 'I will feel better physically if I get regular physical activity', I will have better blood sugar control if I get regular physical activity') (see Appendix II, Baseline Questionnaire, Section D). The outcome *expectations* measure was adapted from two sources: 1) the decisional balance scale originally designed by Marcus, Rawkoski, & Rossi (1992), and adapted for a Canadian population by Plotnikoff et al. (2001) and 2) the physical activity expectations scale used in the PARR project (Lewis, Raczynski, Heath, Levinson, Hilyer, & Cutter, 1993). The baseline Cronbach's alpha was .97.

Outcome *expectancies* were parallel items to the outcome *expectations* items in this questionnaire. Participants were asked to rate on a three point Likert-type scale (ranging from "unimportant=1" to "very important=3") the perceived importance of the 17 previously stated outcome expectations (e.g., 'How important is feeling better physically to you?', 'How important is having better blood sugar control to you?') (see Appendix II, Baseline Questionnaire, Section D). The outcome expectancies scale was adapted from the PARR project (Lewis et al., 1993) which had originally been created, tested and utilized with a low income population. The baseline Cronbach's alpha was .88.

I.5.5 Self-regulation

The self-regulation measure was adapted from a subscale of the Behavioural Regulation in Exercise Questionnaire (BREQ-2) (Mullan, Markland, & Ingledew, 1997) questionnaire for identified exercise regulation. Participants were asked to rate of a 5 point Likert-type scale (ranging from "not at all true=1" to "very true=5") how true a variety of reasons were for them participating in regular physical activity (e.g., 'I value the benefits of exercise') (see Appendix II, Baseline Questionnaire, Section E). The

three-item scale was summed and averaged to produce the self-regulation composite score. The baseline Cronbach's alpha was .74.

I.5.6 Situation

Situation was assessed by having participants rate on a 5 point Likert-type scale (ranging from "never=1" to "very often=5") in the past three months how often various situations prevented them from getting regular physical activity (e.g. 'lack of interest in physical activity', 'lack of fitness equipment', 'fear of injury') (see Appendix II, Baseline Questionnaire, Section F). This 17-item scale was adapted from a previous physical activity scale used in a study of breast cancer survivors by Rogers, Shah, Dunnington, Greive, Shanmugham, Dawson, & Courneya, (2005). The baseline Cronbach's alpha was .88.

I.5.7 Reinforcement

Reinforcement was measured using a 5-point Likert type scale. Participants were asked to specify how often ("never=1" to "always=5") in the last three months they rewarded themselves and set realistic goals (e.g., 'I reward myself when I am physically active', 'I try to set realistic goals for myself rather than setting myself up for failure by expecting too much') (see Appendix II, Baseline Questionnaire, Section G). This four item scale has been reported previously by Marcus, Rossi et al., 1992). The reported baseline Cronbach's alpha was .78.

I.5.8 Social Support

Social support was assessed using two items on a 7-point Likert type scale. Participants were asked to rate ("strongly disagree=1" to "strongly agree=7") how likely over the next three months someone in their social network would help them participate

in regular physical activity or provide them with the support needed to get regular physical activity (see Appendix II, Baseline Questionnaire, Section H). These items have been used previously by Courneya, Plotnikoff, Hotz & Birkett (2000). The baseline correlation between the two social support items was r=.83 (p<.01)

I.5.9 Emotional Coping Response

Emotional coping response was assessed using six items on a 5-point Likert-type scale in which participants were asked to rate ("not at all=1" to very much=5") how they felt about their diabetes in the last four weeks (e.g.. 'I feel sad about having diabetes', 'I worry about diabetes complications', I am proud of how I'm coping with my diabetes') (see Appendix II, Baseline Questionnaire, Section I). These items were adapted from the emotional well-being subscale of the Functional Assessment of Cancer Therapy for Breast Cancer Survey (Yellen, Cella, Webster, Blendowski & Kaplan, 1997) , previously tested for reliability and validity in a breast cancer population. In this case, the items were adapted for the diabetes population and responses were summed for analysis. The reported baseline Cronbach's alpha was .71.

I.5.10 Behavioural Capability

Behavioural capacity was measured using four items on a 5-point Likert-type scale in which participants were asked to rate ("never=1" to "always=5") how confident they were in performing specific tasks within the last three months (e.g., 'I can walk briskly for 20 minutes without stopping', 'I can climb 3 flights of stairs without stopping') (see Appendix II, Baseline Questionnaire, Section J). The behavioural capacity scale was developed by Roger, Humphries, Davis, & Gutin (1998) for patients

with chronic disease and used to assess task self-efficacy. The baseline Chronbach's alpha was reported at .85.

I.5.11 Environment

The environment was assessed using an adapted form of the International Physical Activity Prevalence Study: Environmental Module (2002). Seven items asked participants to rate on a 5-point Likert type scale ("strongly disagree=1" to "strongly agree=5") how best various statements described the area in which they lived (e.g., 'there are many interesting things to look at while walking in my local area', there are sidewalks on most of the streets in my local area') (see Appendix II, Baseline Questionnaire, Section K). The seven item scale was summed and averaged to produce the environment composite score with a Cronbach's alpha of .77.

I.5.12 Observational Learning

Observational learning was measured using two items previously used by (Plotnikoff et al., 2006) on a 5-point Likert type scale in which participants were asked to rate ("never=1" to "very often=5") how often they observed others being active in the last three months (e.g. 'people who are important to me' and 'my partner') (see Appendix II, Baseline Questionnaire, Section L). Items were then summed and divided by the total number of responses. The baseline correlation between the two observational learning items was $r=.29$ ($p<.01$).

I.5.13 Computer Usage Variables

Computer usage was determined using items from Statistics Canada's Household Internet Use Survey (2002). One item asked participants to rate ("not at all=1" to "at least daily=5") how many times in the previous month they had accessed the internet

from home. A second question asked participants to rate ("not at all" to "over 40hrs/month") how much time they had spent accessing the internet from home in the previous month. A final question asked participants to indicate (yes/no) if they had searched the internet in the past month for diabetes specific information (e.g. 'physical activity', 'nutrition', 'medications', 'diabetes research') (see Appendix II, Baseline Questionnaire, Section N).

I.5.14 Satisfaction Survey

Participants randomized to the treatment group completed a 15-item satisfaction survey adapted from the Health *e*-steps program (Steele, 2006). The survey was completed immediately post intervention and asked participants to rate on a 5 point Likert-type scale ("strongly disagree=1" to "strongly agree=5") the satisfaction/useability of the intervention website. Items included the credibility and content of the information on the website as well as satisfaction of various components of the website. Three open-ended questions were asked to assess the likes and dislikes and recommended changes to the website (see Appendix II, Post-test Questionnaire for Intervention Group, Final Section).

I.6 Intervention

Treatment Group

The Diabetes NetPLAY program was designed based on Bandura's (1997) Social Cognitive Theory (SCT) and aimed to provide participants with the education and skills important for long term behaviour change. The website was comprised of five main sections (weekly topic, education, research, fitness tips and physical activity myths)

which were updated and archived on a weekly basis. The website also contained several interactive features to engage participants through the duration of the study. These features included a physical activity logbook, message board and email counselling from the study coordinator. Participants in the treatment group also received links to the Canadian Diabetes Associations Clinical Practice Guidelines (2003) for physical activity in addition to Health Canada's Physical Activity Guide.

The Diabetes NetPLAY website was updated on a weekly basis at which time the study coordinator would contact treatment group participants via email indicating the update and a reminder to log on using the link embedded in the email. Participants were encouraged to browse the website at their leisure.

Each week featured a new theme based on a specific construct of SCT. This weekly topic aimed to operationalize the SCT construct in a way that would be meaningful to the participant. As a way of invoking thoughts and actions around the various constructs, participants were asked to complete an activity and email responses to their counsellor. Goal setting and time management were some of the activities discussed.

Physical activity logbook: Participants in the intervention group were encouraged to log their physical activity minutes using the on-line logbook section of the website. The logbook allowed for participants to track the date, length and type of physical activity they engaged in. This feature also allowed them to write in comments beside their activity sessions and track their progress from day to day (see Appendix III).

Message board: The message board feature was launched in the second week of the study. The study coordinator posted weekly topics based on the social cognitive

construct featured that week. Participants could respond and view postings at their leisure. This allowed participants a forum in which to exchange ideas and receive support from other study participants (see Appendix III).

Email counselling: The email counselling feature of the website allowed participants the opportunity to communicate with their counsellor (study coordinator) in a simple and efficient way. Beginning in the first week, participants were asked to email their counsellor with responses to the relevant topic discussed. For example, in week 1, participants were asked tell their counsellor a little more about themselves along with any relevant information they felt might be important (see Appendix III).

Control Group

The control group only received static links to the Canadian Diabetes Association's Clinical Practice Guidelines (2003) for physical activity and Health Canada's Physical Activity Guide (as standard care material) for the duration of the study. Upon completion of the post-test questionnaire, control group participants were given full access (minus email counselling feature) to the study website. As the website was no longer being maintained and updated, these participants were directed to the archived items to review each of the 12 weeks at their leisure.

Incentives: Incentives were offered to control participants upon completion of the post-test questionnaire. Incentives included full access to the study website and a choice of a pedometer and water bottle or a $25 gift certificate to a national bookstore chain.

I.7 Data Screening

I.7.1 Procedures

The following data screening procedures outline by Tabachnick and Fidell (2001) were employed to minimize the risk of statistical errors: 1) Inspect univariate descriptive statistics for accuracy of data input (i.e., out of range values, plausible means and standard deviations, and univariate outliners); 2) Evaluate amount and distribution of missing data and deal with problem; 3) Identify and deal with non-normal variables (i.e., check skewness, kurtosis, and 4) Evaluate social cognitive variables for multicollinearity.

I.7.2 Missing data

Analysis was completed using the last observation carried forward (LOCF) method. This method is commonly used in order to produce a complete data set which can then be analyzed using standard statistical analysis (Myers, 2000). The LOCF takes the last available response (i.e., baseline) of a particular item and substitutes this value into all subsequent missing responses (i.e., post-test) (Myers, 2000). This protocol assumes no change in participant variables from baseline to post-test. This can be problematic, however, if the outcome variable is expected to change over time as it could result in biased treatment comparisons (Myers, 2000).

I.7.3 Socio-demographic variables and health

The majority of the socio-demographic variables were categorical in nature, therefore permitting only certain responses. Frequency checks were run to ensure the data were within the appropriate ranges in both categorical and continuous variables. Missing data were not transformed as it appeared to be random.

I.7.4 Social Cognitive Variables

The construction of the social-cognitive scales (i.e., Likert-type scales) permitted only certain responses; data were in the appropriate ranges. The means and the standard deviations of the variables appeared to be plausible.

For missing data at the construct level, participants that responded to at least one item in the construct were given a mean score that was calculated based on the completed responses for that construct (Plotnikoff, personal discussion).

SCT constructs were screened for normality. It was revealed that skewness and kurtosis ranged from -3.3 to .806 and -1.05 to 15.8, respectively. Within the correlation matrices, there were no values above 0.70, therefore, excluding multicollinearity as a limiting factor.

I.7.5 Physical Activity Behaviour

For the modified GLTEQ, data were screened in each of the three intensity categories and all values were within reasonable ranges for duration and frequency. Calculated means and standard deviations of the variables appeared to be plausible. Missing cases were subject to last observation carried forward analysis. If data were not available to carry forward (i.e., missing data at baseline), the *exclude cases pairwise* option for missing data was employed, in which the case is only excluded if the missing data is required for a specific analysis (Pallant, 2005).

Physical activity scores were calculated as strenuous and moderate weekly MET.minutes. Physical activity composite scores were screened for normality. Skewness and kurtosis at baseline were 2.70 and 8.63, respectively, while post-test skewness and kurtosis were calculated to be 1.46 and 1.97, respectively. *Unweighted*

minutes of physical activity were calculated as products of strenuous and moderate composite scores with a reported baseline skewness and kurtosis of 2.07 and 5.01, respectively. Post-test skewness and kurtosis of *unweighted* minutes of physical activity were calculated to be 1.11 and 0.30, respectively.

In order to identify outliers, multivariate box plots were produced. Upon examination, it was evident that two participants had extreme values in both baseline values and one post-test value. Tabachnick and Fiddell (2001) state that cases above 3.29 standard deviations are considered potential outliers and it was, therefore, decided to truncate these two cases to 3.29 standard deviations to reduce their impact. Upon truncation, skewness and kurtosis of MET.minutes at baseline were reduced to 1.82 and 3.64, respectively while post-test skewness and kurtosis were reduced to 1.09 and 0.07, respectively. Skewness and kurtosis of *unweighted* minutes of physical activity at baseline were reduced to 1.81 and 3.88, respectively. 'Normal' distribution of scores is often not observed in the social sciences field, with many measures reported to be positively or negatively skewed (Pallant, 2006). This does not necessarily indicate a problem with the scales being employed, but instead, reflects the underlying nature of the item being measured (Pallant, 2006). For example, a large majority of individuals with type 2 diabetes are not physically active, therefore, physical activity measures may be negatively skewed or a wide distribution of scores could be reported.

I.8 Data Analysis

I.8.1 Study Objective 1

Descriptive analysis (percentages and frequency counts) were conducted to assess recruitment, retention, adherence and satisfaction of the internet as a mode of delivery for physical activity information in this population.

I.8.2 Study Objective 2

Chi-square tests for independence were performed to examine group differences on pre-test categorical demographic scores. When applicable, demographic, health and computer usage variables were dichotomized into a 2 X 2 table to ensure the minimum expected cell frequency was not violated.

Independent-samples t-tests were used to compare the baseline means of the social cognitive, GLTEQ, BMI and age-related scores of the intervention and control groups. SPSS automatically calculates the homogeneity of variance using the Levene's test for equality. Ensuring homogeneity of variance is essential as the analysis of covariance (ANCOVA) statistical test assumes equal variances between groups. Homogeneity of variance was supported for all variables except for the outcome expectations, observational learning and BMI scores. However, given the values were not severe, parametric analyses were conducted with these variables as the ANCOVA is a relatively robust test (Pallant, 2005).

An analysis of covariance (ANCOVA) was conducted to compare the efficacy of the NetPLAY intervention designed to increase physical activity levels in individuals with type 2 diabetes. The dependent variables for the primary outcome consisted of scores calculated on the modified Godin Leisure-Time Exercise Questionnaire (GLTEQ)

to assess: 1) MET.minutes and 2) unweighted combined moderate and vigorous minutes of physical activity. Changes on social cognitive variables between the two study groups were also examined by ANCOVA. Participants' baseline GLTEQ scores were used as the covariate in this analysis. An examination of the diabetes literature suggested an association between BMI and physical activity behaviour (Plotnikoff et al., 2006; Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007). For example, Plotnikoff and colleagues (2006) surveyed a sample of 1600 individuals with type 2 diabetes and found higher activity levels were associated with lower BMI ($p<0.001$), while Morrato and colleagues (2007) found that for those with diabetes the probability of being active incrementally declined with each increasing BMI category. For this reason plus the significant BMI differences between groups at baseline, it was decided to covariate for BMI in the analysis of physical activity behaviour.

I.8.3 Subsidiary Analyses

Subsidiary analysis was conducted to investigate possible relationships between a number of variables at pre and post testing. Three sets of Pearson Product-moment correlations were used to examine the association between website login frequencies, social cognitive variables, physical activity behaviour and selected demographic variables (employment status, income, residence, marital status and education) at two time points. The first set of correlations utilized the total sample (n=49), while the second and third sets assessed the intervention group (n=25) and the per protocol group (those who had logged onto the website at least once per week for a minimum of 8 weeks through the duration of the study) (n=15), respectively (see tables 5-1 through 5-6).

Figure I.9: Study Flow Diagram

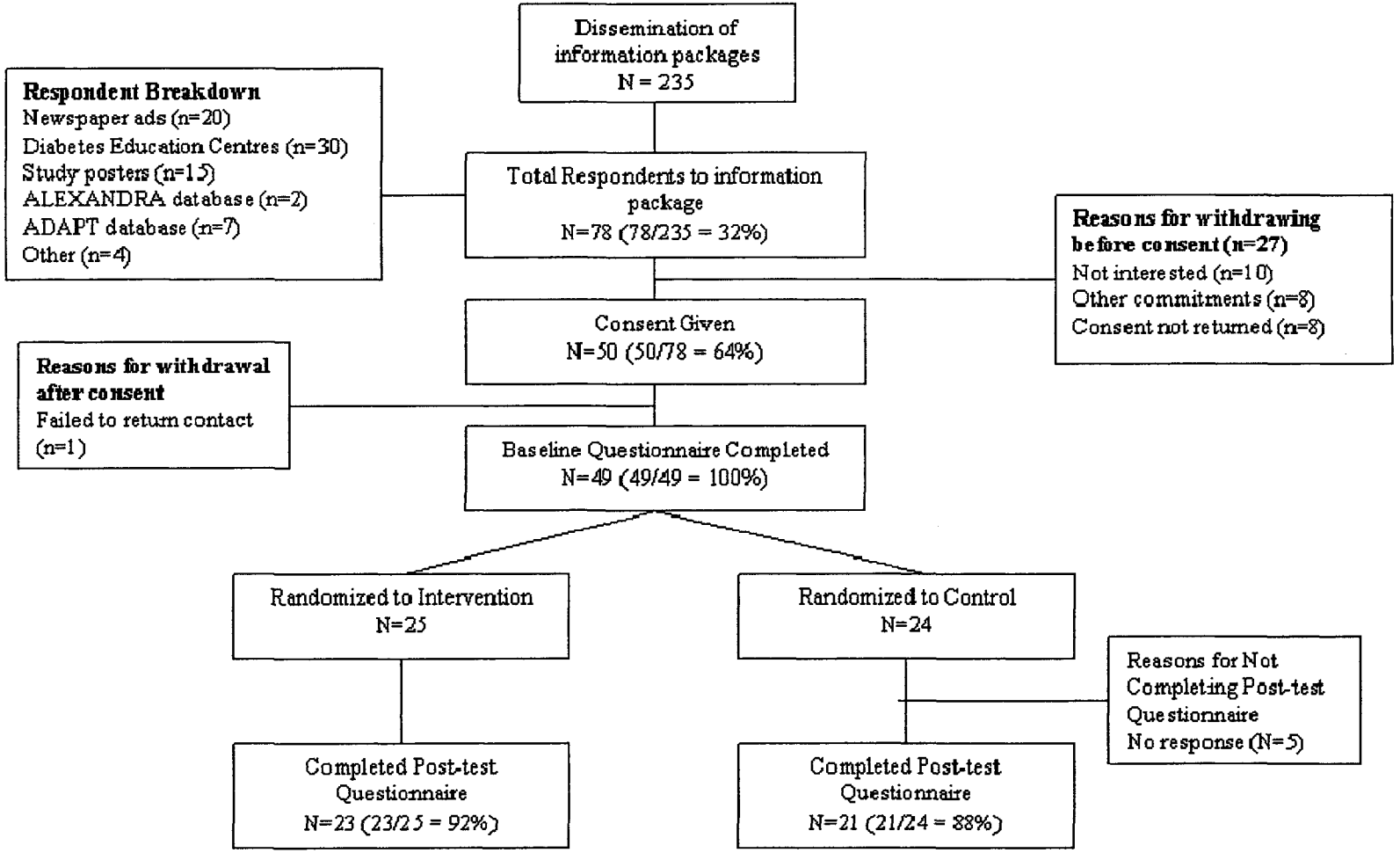

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Table 5-1 Demographics

	Employment status	Income	Residence	Marital status	Education
Login frequency	-.241	-.232	-.084	-.261	-.010
All participants N	**48**	**48**	**49**	**49**	**48**
Login Frequency	-.329	-.204	.059	-.114	.130
Intervention grp only N	**25**	**25**	**25**	**25**	**25**
Login Frequency	-.229	-.329	.251	-.388	-.277
Per protocol grp N	**15**	**15**	**15**	**15**	**15**

Table 5-2 Correlations using Time 1 Godin

	RT training	MET mins	unweighted mins
Login Frequency	-.010	.001	.045
All participants N	**49**	**47**	**47**
Login Frequency	-.136	.066	.123
Intervention grp only N	**25**	**23**	**23**
Login Frequency	-.104	0.257	.191
Per protocol grp N	**15**	**14**	**14**

Table 5-3 Correlations using Time 2 Godin

	RT training	MET mins	Raw mins
Login Frequency	.046	.091	.177
All participants N	**49**	**47**	**47**
Login Frequency	-.033	.025	.089
Intervention grp only N	**25**	**23**	**23**
Login Frequency	-.104	0.70	.119
Per protocol grp N	**15**	**15**	**15**

Table 5-4 Correlations using Time 1 social cognitive variables

	Self-efficacy	Outcome Expectations	Outcome Expectancies	Self-regulation	Situation	Reinforcement	Social support	Emotional coping response	behavioral capacity	Observational learning	Environment	Disability
Login Frequency	.090	.097	.085	-.174	-.024	-.006	.236	-.061	-.037	.342*	.142	.015
All participants												
N	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**
Login Frequency	.149	.216	.108	-.171	-.253	-.112	.304	-.201	-.002	.492*	.302	-.118
Intervention grp only												
N	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**
Login Frequency	.234	.496	.429	.253	-.043	.059	.442	-.075	-.151	.599*	.382	-.237
Per protocol grp												
N	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**

* correlation significant at the 0.05 level

Table 5-5 Correlations using Time 2 social cognitive variables

	Self-efficacy	Outcome Expectations	Outcome Expectancies	Self-regulation	Situation	Reinforcement	Social support	Emotional coping response	behavioral capacity	Observational learning
Login Frequency	.213	.068	.049	.143	-.115	.039	.064	.009	.059	.342*
All participants										
N	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**
Login Frequency	.258	.103	.024	.360	-.321	-.014	.127	-.025	-.008	.380
Intervention grp only										
N	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**
Login Frequency	.075	.337	.337	.405	-.043	.044	.075	-.031	-.210	.401
Per protocol grp										
N	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**

* correlation significant at the 0.05 level

Appendix II: Instrumentation

A) Treatment and Control Groups - Baseline
B) Control Group – Post-test
C) Treatment Group – Post-test

A) Diabetes NetPLAY – Baseline Questionnaire *(both groups)*

1. About This Study

This confidential questionnaire helps us determine what people who are living with diabetes think, feel and do about physical activity. While getting *any* activity is good for your health, this questionnaire is *only* measuring activities you do *outside* of work and daily living. For example, physical labor on the job, shoveling snow, cleaning house, grocery shopping, chores, etc. are *not* being assessed.

There are no right or wrong answers to any of these questions. Please read the questions carefully and answer each one according to what is true for you. This is a very thorough questionnaire and some questions may appear similar to each other. This questionnaire is made up of several short sections to help us determine your physical activity behaviour. It should take you approximately 15-20 minutes to complete.

Please answer each question to the best of your ability and please do not skip any questions. If you have any questions while completing this questionnaire, or would like to fill it out over the telephone, don't hesitate to call us (780) 492-6315. Please remember to call collect if calling long distance (0+780-492-6315).

2. Section A - This section asks you about your physical activity PLEASE READ CAREFULLY:

We would like you to recall your average weekly participation in Aerobic Activity over the *past month.*

Aerobic Activity is brisk physical activity that requires the heart and lungs to work harder to meet the body's need for oxygen. Aerobic activity promotes the circulation of oxygen through the blood.

Examples of Aerobic Activity include walking, swimming, cycling, dancing, jogging, recreational sports, aerobic dance classes, skiing, tennis, martial arts.

When answering these questions, please:

- Only count activity sessions that lasted 10 minutes or longer in duration.

- Do not count activity that was done as part of your employment, yard work or household chores.

- Please write the average amount of times per week in the first column and the average length of time in the second column for each category of strenuous, moderate, mild physical activity.

** *Please fill in all 6 spaces below. Mark a "0" if a category does not apply to you.* **

1. Strenuous physical activity (heart beats rapidly, sweating)

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

Average times per week _____
Average minutes per session _____

2. Moderate physical activity (not exhausting, light perspiration)

(e.g., fast walking, baseball, tennis, water aerobics, easy bicycling, volleyball, badminton, easy swimming, popular and folk dancing, hiking).

Average times per week _____
Average minutes per session _____

3. Mild physical activity (minimal effort, no perspiration)

(e.g., easy walking, tai chi, yoga, archery, fishing, bowling, lawn bowling, horseshoes, golf, gardening)

Average times per week _____
Average minutes per session _____

3. Section B - This section asks you about strength training

Now think about Strength Training:

Strength training is designed to increase the body's strength, power, and muscular endurance. Also known as "weight training" or "resistance training".

Examples of Strength Training include: Lifting or pushing dumbbells and/or barbells, using elastic exercise bands or therabands, using your own body weight as resistance (for example: pushups, squats, lunges, leg lifts, stomach crunches), weight machines

Again, considering your average over the past month, indicate how many times per week you engaged in strength training, if any. Next, indicate the average time per session (in minutes).

Mark a "0" in each column if you did not do any strength training over the last month.

1. Strength training activity

Average minutes per session _____

Average times per week _____

4. Instructions

PLEASE READ CAREFULLY:

For sections C to L in this questionnaire we ask about your beliefs and behaviours for doing **regular physical activity** .

Regular physical activity is defined as doing at least 150 minutes of moderate intensity physical activity each week. *In this study moderate intensity physical activity is defined as Aerobic activity performed at a level where a person begins to lightly sweat, but can still carry on a conversation. This level is different for everyone.*

For example, in order to get *regular physical activity:*

- you could do brisk walking for 30 minutes 5 days per week.

- activities must last for at least 10 minutes (e.g., three 10 minute walks in the same day is the same as one 30 minutes walk).

- only activities that are done at a moderate intensity of a brisk walking pace (or faster) should be counted (see definition above)

This includes activities such as brisk walking, swimming, dancing, tennis, judo, cross country skiing, hiking, roller skating, recreation and sporting activities (e.g., jogging, swimming, bicycling) at a moderate intensity. These activities should make you feel warm and increase your breathing rate.

This study is not measuring household chores, yard work or physical labor on the job, so those activities are not included in the definition of regular physical activity.

5. Section C

The next questions ask you how confident you are about doing ***regular physical activity*** over the next 3 months in different circumstances. For each question, click the phrase that best matches your answer.

I am confident that I can participate in ***regular physical activity***:

1. When I am a little tired

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

2. When I am in a bad mood or feeling depressed

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

3. When I have to do it by myself

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

4. When it becomes boring

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

5. When I can't notice any improvements in my fitness

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

6. When I have many other demands on my time

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

7. When I feel a little stiff and sore

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

8. When the weather is bad

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

9. When I have to get up early, even on weekends

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

10. When I have diabetes complications (problems related to eyes, kidneys, heart and feet)

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

11. When I have to find different activities due to diabetes complications

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

12. When I feel a little ill

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

6. Section D

The next set of questions list a number of things which **may or may not impact your physical activity habits** over the next 3 months.

For each question, first click how much you agree with each statement and then rate how important each statement is to you.

1. I will feel better physically if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

2. How important is feeling better to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

3. I will be in a better mood generally

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

4. How important is being in a better mood to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

5. I will feel less tired if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

6. How important is feeling less tired to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important

3 - Very important

7. I will have stronger muscles if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

8. How important is having stronger muscles to you?

1 - Unimportant
2 - Somewhat important
3 - Very important

9. I will have a sense of personal accomplishment if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

10. How important is having a sense of personal accomplishment to you?

1 - Unimportant
2 - Somewhat important
3 - Very important

11. I will be more alert mentally if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

12. How important is being more alert mentally for you?

1 - Unimportant
2 - Somewhat important
3 - Very important

13. I will improve my endurance in performing my daily activities

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

14. How important is it for you to improve your endurance?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

15. I will reduce tension and manage stress if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

16. How important is reducing tension and managing stress for you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

17. I will feel more confident about my health if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

18. How important is feeling more confident about your health for you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

19. I will decrease my chances of having further diabetes complications (problems related to eyes, kidneys, heart and feet) if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

20. How important is reducing the chances of diabetes complications for you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

21. I will have better blood sugar control if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

22. How important is having better blood sugar control to you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

23. I will better control my weight if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

24. How important is controlling your weight for you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

7. Section E

There are a variety of reasons why individuals get regular physical activity. Consider the following behaviours and indicate **how true each of these reasons is for you**.

1. It's important to me to make the effort to get regular physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5

2. I value the benefits of physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5

3. I get restless if I don't get regular physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5

8. Section F

The next set of questions ask you how often the following **have prevented you** from getting ***regular physical activity*** in the last 3 months. For each statement, click on the number that best reflects your answer.

1. Self-conscious or embarrassed about my looks when I am physically active

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5

2. Lack of interest in physical activity

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5

3. Lack of time

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5

4. Lack of family support

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

5. Lack of enjoyment from physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

6. Lack of fitness equipment

Never	Rarely	Sometime	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

7. Weather

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

8. Lack of skills

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

9. No facilities or space to be physically active

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

10. Poor health

Never	Rarely	Sometimes	Often	Very often

1	2	3	4	5
◡	◡	◡	◡	◡

11. Lack of transportation to get to a place to get physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

12. Pain or discomfort

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

13. Fear of injury

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

14. Cost of physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

15. Physical activity is too strenuous

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

16. Physical activity is too boring

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

17. Family responsibilities

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

9. Section G

Indicate how often you have done the following in the last 3 months. Click on the statement that best corresponds to your answer.

1. I reward myself when I am physically active

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

2. I do something nice for myself for making efforts to be physically active more

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

3. When I am physically active, I tell myself that I am being good to myself by taking care of my body

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

4. I try to set realistic goals for myself rather than setting myself up for failure by expecting too much

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

10. Section H

How much do you **agree or disagree with each statement**, click the statement that matches your answer. *If people in your social network (i.e., family and friends) don't seem to care what you do for activity, mark a '1' for strongly disagree.*

Over the next 3 months:

1. People in my social network are likely to help me participate in regular physical activity

Strongly disagree	Moderately disagree	Slightly disagree	Neither disagree or agree	Slightly agree	Moderately agree	Strongly agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. I feel that someone in my social network will provide me with the support I need to get regular physical activity

Strongly disagree	Moderately disagree	Slightly disagree	Neither disagree or agree	Slightly agree	Moderately agree	Strongly agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

11. Section I

The next set of questions asks how you feel about diabetes. Indicate you response to each item thinking in terms of the last 4 weeks. Click on the statement that best reflects your answer.

1. I feel sad about having diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
○	○	○	○	○

2. I am losing hope in the fight against diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
○	○	○	○	○

3. I feel nervous about having diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
○	○	○	○	○

4. I worry about diabetes complications (problems related to eyes, kidneys, heart and feet)

Not at all	A little a bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
○	○	○	○	○

5. I worry that my diabetes will get worse

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
○	○	○	○	○

6. I am proud of how I'm coping with diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
○	○	○	○	○

12. Section J

The following questions ask **how confident** you are about *performing specific tasks*. Rate how confident you are that you can perform the following activities over the next 3 months.

1. I can walk briskly for 20 minutes without stopping

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
○	○	○	○	○

2. I can run or jog for 10 minutes without stopping

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
○	○	○	○	○

3. I can climb 3 flights of stairs without stopping

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

4. I can exercise for 20 minutes at a level hard enough to cause a large increase in my breathing and heart rate

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

13. Section K

We would like to find out more information about your local area. Please click the answer that best describes your local area.

Your local area is about a 10-15 minute walk from your home.

1. There are many shops or places to buy things I need within easy walking distance of my home

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

2. It is within a 15-minute walk to a public transit stop from my home

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

3. There are many four-way intersections in my local area

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

◡	◡	◡	◡	◡

4. There are sidewalks on most of the streets in my local area

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

5. There are many interesting things to look at while walking in my local area

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

6. My local area has several free or low cost recreation facilities, such as parks, walking trails, biking paths, playgrounds, and recreation centres

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

7. The level of crime in my local area makes it unsafe to go on walks at night

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

14. Section L

How often have you experienced the following in the last 3 months

1. I have observed people who are important to me engaging in regular physical activity

Never	Seldom	Occasionally	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

2. I have observed my partner engaging in regular physical activity

Never	Seldom	Occasionally	Often	Very often	Not applicable
1	2	3	4	5	6
○	○	○	○	○	○

15. Section M
Health Status

1. In the past month , to what extent was your participation in physical activity limited by a health condition, injury, or disability

Not at all	Slightly	A little	Somewhat	Quite a lot	Completely
1	2	3	4	5	6
○	○	○	○	○	○

2. Has a doctor or nurse ever told you that you have/had the following? (click those that apply)

type 2 diabetes	high blood pressure	angina	high blood pressure	heart attack	stroke	cancer
☐	☐	☐	☐	☐	☐	☐

3. At what age were you diagnosed with type 2 diabetes? _____

16. Section N
The following questions are related to your home computer usage

1. How many times in the last month did you access the internet from your home?

Not at all	Less than once a week	A few times per week	Almost every day	At least daily
1	2	3	4	5
○	○	○	○	○

2. How much time did you spend accessing the internet from you home in the last month?

Not at all	Less than 5hrs/month	5 - 9 hrs/month	10 - 19 hrs/month	20 - 29 hrs/month	30 - 39 hrs/month	Over 40 hrs/month

1	2	3	4	5	6	7
◡	◡	◡	◡	◡	◡	◡

3. Please indicate the type of diabetes specific information searched on the internet in the past month

- ☐ Physical activity
- ☐ Nutrition
- ☐ Medications
- ☐ Complications
- ☐ Diabetes related products
- ☐ Mental health
- ☐ Diabetes research
- ☐ I didn't search diabetes specific info

17. Final Section
Demographic and Biomedical

1. Age _____

2. Gender

- ◡ Male
- ◡ Female

3. Marital status

- ◡ Never married
- ◡ Married
- ◡ Common law
- ◡ Widowed
- ◡ Separated or divorced

4. Where do you live in Canada

- Urban town
- Urban city
- Rural non-farm
- Rural farm

5. Is English your first language?

- Yes
- No

6. Highest Education Obtained:

- Some Grade School
- Some High School
- Completed High School
- Some College/University
- Completed College/University
- Some Graduate School
- Completed Graduate School
- Some Technical Training
- Completed Technical Training

7. Gross annual family income.

Gross annual income is the total amount of income made in a year by yourself and/or your partner before any deductions are taken off. Do your best to estimate if you are uncertain

*****Please note we ask about income to determine whether future physical activity***

programs need to be cost-effective for the Diabetes population

- ◡ <$20,000
- ◡ $20,000-$39,000
- ◡ $40,000-$49,000
- ◡ $50,000-$59,000
- ◡ $60,000-$69,000
- ◡ $70,000-$79,000
- ◡ $80,000-$99,000
- ◡ Over $100,000

8. Employment status

- ◡ Homemaker
- ◡ Full-time paid
- ◡ Part-time paid
- ◡ Retired
- ◡ Temporarily unemployed
- ◡ Volunteer

9. Weight in
pounds or _____
kilograms _____

10. Height in
feet/inches or _____
centimeters _____

B) Control Group – Post-test

B) Diabetes NetPLAY – Post-test (*control group*)

1. About This Study

This confidential questionnaire helps us determine what people who are living with diabetes think, feel and do about physical activity. While getting *any* activity is good for your health, this questionnaire is *only* measuring activities you do *outside* of work and daily living. For example, physical labor on the job, shoveling snow, cleaning house, grocery shopping, chores, etc. are *not* being assessed.

There are no right or wrong answers to any of these questions. Please read the questions carefully and answer each one according to what is true for you. This is a very thorough questionnaire and some questions may appear similar to each other. This questionnaire is made up of several short sections to help us determine your physical activity behaviour. It should take you approximately 15-20 minutes to complete.

Please answer each question to the best of your ability and please do not skip any questions. If you have any questions while completing this questionnaire, or would like to fill it out over the telephone, don't hesitate to call us (780) 492-6315. Please remember to call collect if calling long distance (0+780-492-6315).

2. Section A - This section asks you about your physical activity PLEASE READ CAREFULLY:

We would like you to recall your average weekly participation in Aerobic Activity over the *past month.*

Aerobic Activity is brisk physical activity that requires the heart and lungs to work harder to meet the body's need for oxygen. Aerobic activity promotes the circulation of oxygen through the blood.

Examples of Aerobic Activity include walking, swimming, cycling, dancing, jogging, recreational sports, aerobic dance classes, skiing, tennis, martial arts.

When answering these questions, please:

- Only count activity sessions that lasted 10 minutes or longer in duration.

- Do not count activity that was done as part of your employment, yard work or household chores.

- Please write the average amount of times per week in the first column and the average length of time in the second column for each category of strenuous, moderate, mild physical activity.

** *Please fill in all 6 spaces below. Mark a "0" if a category does not apply to you.* **

1. Strenuous physical activity (heart beats rapidly, sweating)

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

Average times per week _____
Average minutes per session _____

2. Moderate physical activity (not exhausting, light perspiration)

(e.g., fast walking, baseball, tennis, water aerobics, easy bicycling, volleyball, badminton, easy swimming, popular and folk dancing, hiking).

Average times per week _____
Average minutes per session _____

3. Mild physical activity (minimal effort, no perspiration)

(e.g., easy walking, tai chi, yoga, archery, fishing, bowling, lawn bowling, horseshoes, golf, gardening)

Average times per week _____
Average minutes per session _____

3. Section B - This section asks you about strength training

Now think about Strength Training:

Strength training is designed to increase the body's strength, power, and muscular endurance. Also known as "weight training" or "resistance training".

Examples of Strength Training include: Lifting or pushing dumbbells and/or barbells, using elastic exercise bands or therabands, using your own body weight as resistance (for example: pushups, squats, lunges, leg lifts, stomach crunches), weight machines

Again, considering your average over the past month, indicate how many times per week you engaged in strength training, if any. Next, indicate the average time per session (in minutes).

Mark a "0" in each column if you did not do any strength training over the last month.

1. Strength training activity

Average minutes per session _____

Average times per week _____

4. Instructions

PLEASE READ CAREFULLY:

For sections C to L in this questionnaire we ask about your beliefs and behaviours for doing **regular physical activity** .

Regular physical activity is defined as doing at least 150 minutes of moderate intensity physical activity each week. *In this study moderate intensity physical activity is defined as Aerobic activity performed at a level where a person begins to lightly sweat, but can still carry on a conversation. This level is different for everyone.*

For example, in order to get *regular physical activity:*

- you could do brisk walking for 30 minutes 5 days per week.

- activities must last for at least 10 minutes (e.g., three 10 minute walks in the same day is the same as one 30 minutes walk).

- only activities that are done at a moderate intensity of a brisk walking pace (or faster) should be counted (see definition above)

This includes activities such as brisk walking, swimming, dancing, tennis, judo, cross country skiing, hiking, roller skating, recreation and sporting activities (e.g., jogging, swimming, bicycling) at a moderate intensity. These activities should make you feel warm and increase your breathing rate.

This study is not measuring household chores, yard work or physical labor on the job, so those activities are not included in the definition of regular physical activity.

5. Section C

The next questions ask you how confident you are about doing ***regular physical activity*** over the next 3 months in different circumstances. For each question, click the phrase that best matches your answer.

I am confident that I can participate in ***regular physical activity***:

1. When I am a little tired

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

2. When I am in a bad mood or feeling depressed

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

3. When I have to do it by myself

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

4. When it becomes boring

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

5. When I can't notice any improvements in my fitness

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

6. When I have many other demands on my time

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

7. When I feel a little stiff and sore

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

8. When the weather is bad

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

9. When I have to get up early, even on weekends

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

10. When I have diabetes complications (problems related to eyes, kidneys, heart and feet)

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

11. When I have to find different activities due to diabetes complications

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

12. When I feel a little ill

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

6. Section D

The next set of questions list a number of things which **may or may not impact your physical activity habits** over the next 3 months.

For each question, first click how much you agree with each statement and then rate how important each statement is to you.

1. I will feel better physically if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

2. How important is feeling better to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

3. I will be in a better mood generally

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

4. How important is being in a better mood to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

5. I will feel less tired if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

6. How important is feeling less tired to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important

3 - Very important

7. I will have stronger muscles if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

8. How important is having stronger muscles to you?

1 - Unimportant
2 - Somewhat important
3 - Very important

9. I will have a sense of personal accomplishment if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

10. How important is having a sense of personal accomplishment to you?

1 - Unimportant
2 - Somewhat important
3 - Very important

11. I will be more alert mentally if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

12. How important is being more alert mentally for you?

1 - Unimportant
2 - Somewhat important
3 - Very important

13. I will improve my endurance in performing my daily activities

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

14. How important is it for you to improve your endurance?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

15. I will reduce tension and manage stress if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

16. How important is reducing tension and managing stress for you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

17. I will feel more confident about my health if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

18. How important is feeling more confident about your health for you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

19. I will decrease my chances of having further diabetes complications (problems related to eyes, kidneys, heart and feet) if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

20. How important is reducing the chances of diabetes complications for you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

21. I will have better blood sugar control if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

22. How important is having better blood sugar control to you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

23. I will better control my weight if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

24. How important is controlling your weight for you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

7. Section E

There are a variety of reasons why individuals get regular physical activity. Consider the following behaviours and indicate **how true each of these reasons is for you**.

1. It's important to me to make the effort to get regular physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5

◡	◡	◡	◡	◡

2. I value the benefits of physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5
◡	◡	◡	◡	◡

3. I get restless if I don't get regular physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5
◡	◡	◡	◡	◡

8. Section F

The next set of questions ask you how often the following **have prevented you** from getting ***regular physical activity*** in the last 3 months. For each statement, click on the number that best reflects your answer.

1. Self-conscious or embarrassed about my looks when I am physically active

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

2. Lack of interest in physical activity

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

3. Lack of time

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

4. Lack of family support

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

5. Lack of enjoyment from physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

6. Lack of fitness equipment

Never	Rarely	Sometime	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

7. Weather

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

8. Lack of skills

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

9. No facilities or space to be physically active

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

10. Poor health

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

◡	◡	◡	◡	◡

11. Lack of transportation to get to a place to get physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

12. Pain or discomfort

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

13. Fear of injury

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

14. Cost of physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

15. Physical activity is too strenuous

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

16. Physical activity is too boring

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

17. Family responsibilities

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

9. Section G
Indicate how often you have done the following in the last 3 months. Click on the statement that best corresponds to your answer.

1. I reward myself when I am physically active

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

2. I do something nice for myself for making efforts to be physically active more

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

3. When I am physically active, I tell myself that I am being good to myself by taking care of my body

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

4. I try to set realistic goals for myself rather than setting myself up for failure by expecting too much

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

10. Section H
How much do you **agree or disagree with each statement**, click the statement that matches your answer. *If people in your social network (i.e., family and friends) don't seem to care what you do for activity, mark a '1' for strongly disagree.*

Over the next 3 months:

1. People in my social network are likely to help me participate in regular physical activity

Strongly disagree	Moderately disagree	Slightly disagree	Neither disagree or agree	Slightly agree	Moderately agree	Strongly agree
1	2	3	4	5	6	7
◡	◡	◡	◡	◡	◡	◡

2. I feel that someone in my social network will provide me with the support I need to get regular physical activity

Strongly disagree	Moderately disagree	Slightly disagree	Neither disagree or agree	Slightly agree	Moderately agree	Strongly agree
1	2	3	4	5	6	7
◡	◡	◡	◡	◡	◡	◡

11. Section I

The next set of questions asks how you feel about diabetes. Indicate you response to each item thinking in terms of the last 4 weeks. Click on the statement that best reflects your answer.

1. I feel sad about having diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
◡	◡	◡	◡	◡

2. I am losing hope in the fight against diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
◡	◡	◡	◡	◡

3. I feel nervous about having diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

4. I worry about diabetes complications (problems related to eyes, kidneys, heart and feet)

Not at all	A little a bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

5. I worry that my diabetes will get worse

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

6. I am proud of how I'm coping with diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

12. Section J

The following questions ask **how confident** you are about *performing specific tasks*. Rate how confident you are that you can perform the following activities over the next 3 months.

1. I can walk briskly for 20 minutes without stopping

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

2. I can run or jog for 10 minutes without stopping

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

3. I can climb 3 flights of stairs without stopping

Never	Seldom	Occasionally	Often	Always

1	2	3	4	5
◡	◡	◡	◡	◡

4. I can exercise for 20 minutes at a level hard enough to cause a large increase in my breathing and heart rate

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

13. Section K
How often have you experienced the following in the last 3 months

1. I have observed people who are important to me engaging in regular physical activity

Never	Seldom	Occasionally	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

2. I have observed my partner engaging in regular physical activity

Never	Seldom	Occasionally	Often	Very often	Not applicable
1	2	3	4	5	6
◡	◡	◡	◡	◡	◡

14. Section L
Health Status

1. In the past month , to what extent was your participation in physical activity limited by a health condition, injury, or disability

Not at all	Slightly	A little	Somewhat	Quite a lot	Completely
1	2	3	4	5	6
◡	◡	◡	◡	◡	◡

15. Section M
The following questions are related to your home computer usage

1. How many times in the last month did you access the internet from your home?

Not at all	Less than once a week	A few times per week	Almost every day	At least daily
1	2	3	4	5

2. How much time did you spend accessing the internet from you home in the last month?

Not at all	Less than 5hrs/month	5 - 9 hrs/month	10 - 19 hrs/month	20 - 29 hrs/month	30 - 39 hrs/month	Over 40 hrs/month
1	2	3	4	5	6	7

3. Please indicate the type of diabetes specific information searched on the internet in the past month

- Physical activity
- Nutrition
- Medications
- Complications
- Diabetes related products
- Mental health
- Diabetes research
- I didn't search diabetes specific info

16. Final Section

9. Weight in
pounds or _____
kilograms _____

10. Height in
feet/inches or _____
centimeters _____

Thank you for your time and participation today!

You will be notified in the next couple of days of your new password and ID to gain full access to the study website

Funding for this project has been provided by the:

Alberta Diabetes Institute

*** 1. As a way of recognizing your participation in Diabetes NetPLAY, we would like to offer you a thank-you gift. Please indicate your choice from the two options below. It will be mailed to your residence in the upcoming weeks.**

- Water bottle and Pedometer (step counter)
- $25 Gift Certificate to Chapters Books

C) Treatment Group – Post-test

C) Diabetes NetPLAY – Post-test (*intervention group*)

1. About This Study

This confidential questionnaire helps us determine what people who are living with diabetes think, feel and do about physical activity. While getting *any* activity is good for your health, this questionnaire is *only* measuring activities you do *outside* of work and daily living. For example, physical labor on the job, shoveling snow, cleaning house, grocery shopping, chores, etc. are *not* being assessed.

There are no right or wrong answers to any of these questions. Please read the questions carefully and answer each one according to what is true for you. This is a very thorough questionnaire and some questions may appear similar to each other. This questionnaire is made up of several short sections to help us determine your physical activity behaviour. It should take you approximately 15-20 minutes to complete.

Please answer each question to the best of your ability and please do not skip any questions. If you have any questions while completing this questionnaire, or would like to fill it out over the telephone, don't hesitate to call us (780) 492-6315. Please remember to call collect if calling long distance (0+780-492-6315).

2. Section A - This section asks you about your physical activity PLEASE READ CAREFULLY:

We would like you to recall your average weekly participation in Aerobic Activity over the *past month.*

Aerobic Activity is brisk physical activity that requires the heart and lungs to work harder to meet the body's need for oxygen. Aerobic activity promotes the circulation of oxygen through the blood.

Examples of Aerobic Activity include walking, swimming, cycling, dancing, jogging, recreational sports, aerobic dance classes, skiing, tennis, martial arts.

When answering these questions, please:

- Only count activity sessions that lasted 10 minutes or longer in duration.

- Do not count activity that was done as part of your employment, yard work or household chores.

- Please write the average amount of times per week in the first column and the average length of time in the second column for each category of strenuous, moderate, mild physical activity.

** *Please fill in all 6 spaces below. Mark a "0" if a category does not apply to you.* **

1. Strenuous physical activity (heart beats rapidly, sweating)

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

Average times per week _____
Average minutes per session _____

2. Moderate physical activity (not exhausting, light perspiration)

(e.g., fast walking, baseball, tennis, water aerobics, easy bicycling, volleyball, badminton, easy swimming, popular and folk dancing, hiking).

Average times per week _____
Average minutes per session _____

3. Mild physical activity (minimal effort, no perspiration)

(e.g., easy walking, tai chi, yoga, archery, fishing, bowling, lawn bowling, horseshoes, golf, gardening)

Average times per week _____
Average minutes per session _____

3. Section B - This section asks you about strength training

Now think about Strength Training:

Strength training is designed to increase the body's strength, power, and muscular endurance. Also known as "weight training" or "resistance training".

Examples of Strength Training include: Lifting or pushing dumbbells and/or barbells, using elastic exercise bands or therabands, using your own body weight as resistance (for example: pushups, squats, lunges, leg lifts, stomach crunches), weight machines

Again, considering your average over the past month, indicate how many times per week you engaged in strength training, if any. Next, indicate the average time per session (in minutes).

Mark a "0" in each column if you did not do any strength training over the last month.

1. Strength training activity

Average minutes per session _____

Average times per week _____

4. Instructions

PLEASE READ CAREFULLY:

For sections C to L in this questionnaire we ask about your beliefs and behaviours for doing **regular physical activity** .

Regular physical activity is defined as doing at least 150 minutes of moderate intensity physical activity each week. *In this study moderate intensity physical activity is defined as Aerobic activity performed at a level where a person begins to lightly sweat, but can still carry on a conversation. This level is different for everyone.*

For example, in order to get *regular physical activity:*

- you could do brisk walking for 30 minutes 5 days per week.

- activities must last for at least 10 minutes (e.g., three 10 minute walks in the same day is the same as one 30 minutes walk).

- only activities that are done at a moderate intensity of a brisk walking pace (or faster) should be counted (see definition above)

This includes activities such as brisk walking, swimming, dancing, tennis, judo, cross country skiing, hiking, roller skating, recreation and sporting activities (e.g., jogging, swimming, bicycling) at a moderate intensity. These activities should make you feel warm and increase your breathing rate.

This study is not measuring household chores, yard work or physical labor on the job, so those activities are not included in the definition of regular physical activity.

5. Section C

The next questions ask you how confident you are about doing ***regular physical activity*** over the next 3 months in different circumstances. For each question, click the phrase that best matches your answer.

I am confident that I can participate in ***regular physical activity***:

1. When I am a little tired

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
○	○	○	○	○

2. When I am in a bad mood or feeling depressed

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

3. When I have to do it by myself

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

4. When it becomes boring

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

5. When I can't notice any improvements in my fitness

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

6. When I have many other demands on my time

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

7. When I feel a little stiff and sore

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5

◡	◡	◡	◡	◡

8. When the weather is bad

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

9. When I have to get up early, even on weekends

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	

10. When I have diabetes complications (problems related to eyes, kidneys, heart and feet)

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

11. When I have to find different activities due to diabetes complications

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

12. When I feel a little ill

Not at all confident	Not very confident	Moderately confident	Very confident	Extremely confident
1	2	3	4	5
◡	◡	◡	◡	◡

6. Section D

The next set of questions list a number of things which **may or may not impact your physical activity habits** over the next 3 months.

For each question, first click how much you agree with each statement and then rate how important each statement is to you.

1. I will feel better physically if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

2. How important is feeling better to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

3. I will be in a better mood generally

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

4. How important is being in a better mood to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

5. I will feel less tired if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

6. How important is feeling less tired to you?

◡ 1 - Unimportant
◡ 2 - Somewhat important

3 - Very important

7. I will have stronger muscles if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

8. How important is having stronger muscles to you?

1 - Unimportant
2 - Somewhat important
3 - Very important

9. I will have a sense of personal accomplishment if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

10. How important is having a sense of personal accomplishment to you?

1 - Unimportant
2 - Somewhat important
3 - Very important

11. I will be more alert mentally if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

12. How important is being more alert mentally for you?

1 - Unimportant
2 - Somewhat important
3 - Very important

13. I will improve my endurance in performing my daily activities

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

14. How important is it for you to improve your endurance?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

15. I will reduce tension and manage stress if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

16. How important is reducing tension and managing stress for you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

17. I will feel more confident about my health if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

18. How important is feeling more confident about your health for you?

◡ 1 - Unimportant
◡ 2 - Somewhat important
◡ 3 - Very important

19. I will decrease my chances of having further diabetes complications (problems related to eyes, kidneys, heart and feet) if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

20. How important is reducing the chances of diabetes complications for you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

21. I will have better blood sugar control if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

22. How important is having better blood sugar control to you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

23. I will better control my weight if I get regular physical activity

Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1	2	3	4	5

24. How important is controlling your weight for you?

- 1 - Unimportant
- 2 - Somewhat important
- 3 - Very important

7. Section E

There are a variety of reasons why individuals get regular physical activity. Consider the following behaviours and indicate **how true each of these reasons is for you**.

1. It's important to me to make the effort to get regular physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5

◡	◡	◡	◡	◡

2. I value the benefits of physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5
◡	◡	◡	◡	◡

3. I get restless if I don't get regular physical activity

Not at all true	A little true	Somewhat true	Quite true	Very true
1	2	3	4	5
◡	◡	◡	◡	◡

8. Section F

The next set of questions ask you how often the following **have prevented you** from getting ***regular physical activity*** in the last 3 months. For each statement, click on the number that best reflects your answer.

1. Self-conscious or embarrassed about my looks when I am physically active

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

2. Lack of interest in physical activity

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

3. Lack of time

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

4. Lack of family support

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

5. Lack of enjoyment from physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

6. Lack of fitness equipment

Never	Rarely	Sometime	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

7. Weather

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

8. Lack of skills

Never	Rarely	Sometimes	Often	Very Often
1	2	3	4	5
◡	◡	◡	◡	◡

9. No facilities or space to be physically active

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

10. Poor health

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

11. Lack of transportation to get to a place to get physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

12. Pain or discomfort

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

13. Fear of injury

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

14. Cost of physical activity

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

15. Physical activity is too strenuous

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

16. Physical activity is too boring

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5

17. Family responsibilities

Never	Rarely	Sometimes	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

9. Section G
Indicate how often you have done the following in the last 3 months. Click on the statement that best corresponds to your answer.

1. I reward myself when I am physically active

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

2. I do something nice for myself for making efforts to be physically active more

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

3. When I am physically active, I tell myself that I am being good to myself by taking care of my body

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

4. I try to set realistic goals for myself rather than setting myself up for failure by expecting too much

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

10. Section H
How much do you **agree or disagree with each statement**, click the statement that matches your answer. *If people in your social network (i.e., family and friends) don't seem to care what you do for activity, mark a '1' for strongly disagree.*

Over the next 3 months:

1. People in my social network are likely to help me participate in regular physical activity

Strongly disagree	Moderately disagree	Slightly disagree	Neither disagree or agree	Slightly agree	Moderately agree	Strongly agree
1	2	3	4	5	6	7
◡	◡	◡	◡	◡	◡	◡

2. I feel that someone in my social network will provide me with the support I need to get regular physical activity

Strongly disagree	Moderately disagree	Slightly disagree	Neither disagree or agree	Slightly agree	Moderately agree	Strongly agree
1	2	3	4	5	6	7
◡	◡	◡	◡	◡	◡	◡

11. Section I

The next set of questions asks how you feel about diabetes. Indicate you response to each item thinking in terms of the last 4 weeks. Click on the statement that best reflects your answer.

1. I feel sad about having diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
◡	◡	◡	◡	◡

2. I am losing hope in the fight against diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5
◡	◡	◡	◡	◡

3. I feel nervous about having diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

4. I worry about diabetes complications (problems related to eyes, kidneys, heart and feet)

Not at all	A little a bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

5. I worry that my diabetes will get worse

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

6. I am proud of how I'm coping with diabetes

Not at all	A little bit	Somewhat	Quite a bit	Very much
1	2	3	4	5

12. Section J

The following questions ask **how confident** you are about *performing specific tasks*. Rate how confident you are that you can perform the following activities over the next 3 months.

1. I can walk briskly for 20 minutes without stopping

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

2. I can run or jog for 10 minutes without stopping

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5

3. I can climb 3 flights of stairs without stopping

Never	Seldom	Occasionally	Often	Always

1	2	3	4	5
◡	◡	◡	◡	◡

4. I can exercise for 20 minutes at a level hard enough to cause a large increase in my breathing and heart rate

Never	Seldom	Occasionally	Often	Always
1	2	3	4	5
◡	◡	◡	◡	◡

13. Section K
How often have you experienced the following in the last 3 months

1. I have observed people who are important to me engaging in regular physical activity

Never	Seldom	Occasionally	Often	Very often
1	2	3	4	5
◡	◡	◡	◡	◡

2. I have observed my partner engaging in regular physical activity

Never	Seldom	Occasionally	Often	Very often	Not applicable
1	2	3	4	5	6
◡	◡	◡	◡	◡	◡

14. Section L
Health Status

1. In the past month , to what extent was your participation in physical activity limited by a health condition, injury, or disability

Not at all	Slightly	A little	Somewhat	Quite a lot	Completely
1	2	3	4	5	6
◡	◡	◡	◡	◡	◡

15. Section M
The following questions are related to your home computer usage

1. How many times in the last month did you access the internet from your home?

Not at all	Less than once a week	A few times per week	Almost every day	At least daily
1	2	3	4	5

2. How much time did you spend accessing the internet from you home in the last month?

Not at all	Less than 5hrs/month	5 - 9 hrs/month	10 - 19 hrs/month	20 - 29 hrs/month	30 - 39 hrs/month	Over 40 hrs/month
1	2	3	4	5	6	7

3. Please indicate the type of diabetes specific information searched on the internet in the past month

- Physical activity
- Nutrition
- Medications
- Complications
- Diabetes related products
- Mental health
- Diabetes research
- I didn't search diabetes specific info

16. Section N
Demographic and Biomedical

9. Weight in
pounds or _____
kilograms _____

10. Height in
feet/inches or _____
centimeters _____

17. Final Section

This section relates to your satisfaction with the study website and its components

1. I think the website was user-friendly

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

2. I liked the overall presentation of the website

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

3. I was able to find my way around the website

Strongly disagree	Disagree	Netural	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

4. The information provided in the website was easy to understand

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1		3	4	5
◡	◡	◡	◡	◡

5. I think the information on the website was credible

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

6. The activities (interactive features) for each week were useful and relevant (e.g., goal setting, outcomes, barriers etc.)

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

7. The message board was useful and relevant

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

8. The logbook was useful and relevant

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

. The navigation links were easy to use

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

10. I liked the personal login

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

11. I liked being able to communicate with other participants through the message board

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

12. I liked the email counselling

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5
◡	◡	◡	◡	◡

13. What did you like best about the Diabetes NetPLAY website?

14. What did you like least about the Diabetes NetPLAY website?

15. What would you change if you could?

Thank you for your time and participation today!

You will be emailed a brief summary of your results in the upcoming weeks.

Funding for this project has been provided by the:

Alberta Diabetes Institute

Appendix III: Website Content

Diabetes NetPLAY Weekly Topics

Diabetes NetPLAY Weekly Topic	Week
Self-efficacy Participants were introduced to the website and individuals who had made positive lifestyle changes that had impacted their outlook on life	**1**
Outcome expectations/Outcome expectancies Participants identify specific outcomes related to physical activity participation and place a value on those outcomes	**2**
Self-regulation Participants learn the importance of setting realistic short and long term goals and identify goals they would like to achieve	**3**
Situation Participants brainstorm situations that present barriers to being active and identify solutions to those barriers	**4**
Reinforcements Participants learn the value of positive reinforcements and to connect it with the accomplishment of goals	**5**
Social Support Participants are introduced to the value of support systems and identify those individuals around them that can encourage (and join in) their lifestyle changes	**6**
Emotional coping response Participants learn the negative impact stress can have on their diabetes and how to identify stressors in their own lives	**7**
Behavioural capacity Participants are reminded about the Canadian Diabetes Associations Clinical Practice Guidelines for physical activity and how they can begin to meet those recommendations	**8**
Environment Participants identify environmental barriers to being physically active and brainstorm solutions to those barriers	**9**
Observational learning Participants learn the importance of being around others who are active and identify individuals who they can count on for motivation	**10**
Relapse prevention Participants learn relapse prevention strategies and are encouraged to come up with a plan for the future	**11**
Wrap-up Participants were encouraged to celebrate small successes and to be proud of what they had accomplished	**12**

Week 1 – Intervention Group

Welcome to Diabetes NetPLAY!

Message from the Project Coordinator: Tanis Liebreich

I want to thank you again for participating in this important research project. As you remember the goal of Diabetes NetPLAY is to help people like you get regular physical activity. If, at anytime during the next 12 weeks, you have questions or concerns, please do not hesitate to contact myself or your counsellor. I look forward to working with you over the next couple of months. I wish you continued success and encouragement.

This website will be updated on a weekly basis. However, your participation is completely voluntary. It's up to you how often you access the website. At the beginning of every week you will receive an email message indicating the website has been updated and a reminder to log on.

The main page will display a different topic each week along with a variety of fitness tips, myths and educational resources. You will notice at the end of each topic of discussion, an activity you can complete and a link to your counsellor. By simply clicking on that link, you will be connected to your counsellor to discuss the weekly topic.

Take this opportunity to browse the website and become familiar with its many features.

Log Book
One component of this website is the logbook. This is a useful tool to help you track your physical activity over the next 12 weeks. Simply choose the type of physical activity you did from the drop down list. Type in the correct date and the amount of time in minutes you spent doing the activity in the appropriate fields. Record any comments you feel are necessary (for example, felt really energized or my knee hurt etc.) and then click the 'add entry' button. You will notice the entry is recorded at the bottom.

Only you and your counsellor will be able to see the activity you are doing. Everyone will be at their own level so do what is best for you! Try and work your way gradually up to 150 minutes of activity per week. And if you're already there, try and maintain those levels through a variety of activities.

Keep track of your progress and successes with this great tool!

Main Page Construct:
In order to become comfortable with doing physical activity, you have to practice!

If you haven't been active over the years, it's important to start out slow and gradually work your way up. This way you'll be less likely to be overwhelmed and give up before

you even get started. Your body needs time to adapt to activity so it's a good idea to start at a pace that is comfortable for you.

One of the best ways to build up your confidence is to try and do things you will accomplish. For example, start out by walking around the block before you commit to walking 5km. If you are just starting out, think small. There is plenty of time to move up to bigger and better things. When you have accomplished what you have set out to do, give yourself credit. It is because of you that your goal is achieved!

The following are true stories of people who never thought they would or could do physical activity, but have come to see it as part of their lives.

Joe, 64 years old, lung disease and type 2 diabetes:
I always worked hard and I was always independent. I never thought the day would come where I would have to quit work because of my health. I had been told by my doctor that I got asbestosis (a type of lung disease) from my job. I wasn't taking care of myself, I was stressed and I wasn't active. Two months later I had a heart attack. On top of that, during my stay in the hospital I was diagnosed with diabetes. My life had really gone downhill.

Part of my recovery involved taking an exercise class at the hospital that I found un-enjoyable at first. We would walk on the treadmill, ride bikes, life weights and go into the community for exercise. After a while and a lot of effort, I had my strength back. I could breathe better. I couldn't bounce back like I did when I was a kid, but the important thing was that I DID bounce back. At first I did it so I could be there for my grandkids. Now I also do it for me.

Today I walk with friends that I met at the rehab program. We all have similar health concerns and we all have been through a lot. But, I won't forget how I thought my life was ending. I won't forget how bad I felt. Most importantly, I won't forget that I was the one who changed things for the better.

Elsie, age 73, severe osteoarthritis, foot problems and type 2 diabetes. Takes insulin:
I walk with two canes because I have so much pain from my arthritis. When I first got diagnosed with arthritis I stopped being active. I sat and I ate and soon I was 300 pounds, which just made the pain in my legs worse. I decided I needed help, but I didn't know what to do or where to start. I always thought that I was too big to exercise, plus I was always stiff and sore.

One day I asked an exercise specialist who came to do a presentation for our diabetes program what activities would work for me. She recommended a water exercise program for people with severe arthritis. She also recommended that I do some seated weight training at home to build up my muscles. I was surprised to find out that she could come to my home to teach me a program. She came over a couple of times before I got the hang of things.

I was scared at first that I would hurt myself. I was also scared to be seen in a bathing suit! However, everyone who helped me was very supportive and soon enough I was feeling better.

I will always walk with my canes, but my blood sugar has gone down. I'm getting circulation back in my feet. I've also lost a bit of weight. We had to start out very slowly with my condition, but all the small improvements have made my life much less painful and much more enjoyable. Simply put: The way it should be.

Margie, 45 years old, type 2 diabetes:
I am a very busy lady. I work full time as a manager, am a volunteer on several committees and run a crazy household.

I have always been pretty healthy, but my diagnosis of diabetes scared me. I went to a diabetes education program and started eating a bit better. I also decided I would go back to the gym just 2 days a week. That's more time than what I had, but I decided to go on my lunch hour anyway.

I found that the people in my life were proud of me for getting healthy. I let other help me with things like cooking and cleaning...things I'd never do before because I had to be in control. However, I felt like now was the time to take care of me, not only for me but for my family.

Six months have passed and I go to the gym 4 days a week. I also do really fun things like golfing and swimming with my husband. Things I used to do when I was younger, but stopped because I was too busy running the 'rat race'. Life can pass by so quickly....I decided to slow it down.

As a great ice breaker exercise, email your counsellor and get to know them a bit better. What types of activities have you done in the past? What would you like to do in the future? Is there anything important you feel the counsellor should know?

Research Section:
Canadian Diabetes Association Clinical Practice Guidelines for Exercise and Type 2 Diabetes Link
http://www.diabetes.ca/Files/physical_activity.pdf

Health Canada Link
http://www.phac-aspc.gc.ca/pau-uap/fitness/pdf/guideEng.pdf

Myth Busting Section:

Myth: If I didn't exercise when I was younger, it's too late.
You are never too old to start exercising even if you weren't active in previous years - you can reap benefits at any age. As you age, exercise can help reduce the risk of

osteoporosis and other muscle diseases and help enhance daily functionality. Regardless of age and medical history, you should always consult a doctor before starting any exercise program.

Education Section:

Walking Programs

Here are examples of two walking programs. The first program is designed for individuals who have not been walking regularly. The second program is designed for individuals who have been active on a regular basis for some time and are looking for something a bit more challenging. These are just examples that you can modify to better fit your schedule and fitness level.

Example Beginner Walking Program

This walking program that starts with 10 minute walks, and works up to 30 minutes in 12 weeks. By week 12 you will be getting 150 minutes of moderate physical activity per week.

Your warm-up and cool down are ***not*** included in the minutes. Be sure to take 5 minutes at the beginning and at the end of your walk to warm up and cool down. An example of a warm up and cool down would be walking slowly and gently stretching at the beginning and end of your walk.

	SUN	MON	TUE	WED	THU	FRI	SAT	TOTAL
Week 1	*OFF*	10 min	10 min	10 min	10 min	*OFF*	10 min	50 min
Week 2	*OFF*	10 min	10 min	12 min	12 min	*OFF*	12 min	56 min
Week 3	*OFF*	12 min	12 min	12 min	15 min	*OFF*	15 min	66 min
Week 4	*OFF*	15 min	15 min	15 min	15 min	*OFF*	15 min	75 min
Week 5	*OFF*	15 min	15 min	15 min	20 min	*OFF*	20 min	85 min
Week 6	*OFF*	15 min	15 min	20 min	20 min	*OFF*	20 min	90 min
Week 7	*OFF*	15 min	20 min	20 min	20 min	*OFF*	25 min	100 min
Week 8	*OFF*	20 min	20 min	20 min	25 min	*OFF*	25 min	110 min
Week 9	*OFF*	20 min	25 min	25 min	25 min	*OFF*	25 min	120 min
Week 10	*OFF*	25 min	25 min	25 min	25 min	*OFF*	30 min	130 min
Week 11	*OFF*	25 min	25 min	30 min	30 min	*OFF*	30 min	140 min
Week 12	*OFF*	30 min	30 min	30 min	30 min	*OFF*	30 min	150 min

Example Intermediate Walking Program

This walking program starts with 10-15 minute walks, and works up to 40 minute walks in 12 weeks. By week 12 in this program, you will be getting 180 minutes of moderate physical activity per week.

Your warm-up and cool down are ***not*** included in the minutes. Be sure to take 5 minutes at the beginning and at the end of your walk to warm up and cool down. An example of a warm up and cool down would be walking slowly and gently stretching at the beginning and end of your walk.

	SUN	MON	TUE	WED	THU	FRI	SAT	TOTAL
Week 1	*OFF*	10 min	12 min	15 min	15 min	*OFF*	15 min	67 min
Week 2	*OFF*	15 min	15 min	15 min	15 min	*OFF*	20 min	80 min
Week 3	*OFF*	15 min	15 min	15 min	20 min	*OFF*	20 min	85 min
Week 4	*OFF*	20 min	20 min	20 min	20 min	*OFF*	20 min	100 min
Week 5	*OFF*	20 min	20 min	20 min	20 min	*OFF*	25 min	105 min
Week 6	*OFF*	20 min	20 min	25 min	25 min	*OFF*	25 min	115 min
Week 7	*OFF*	20 min	25 min	25 min	25 min	*OFF*	30 min	125 min
Week 8	*OFF*	25 min	25 min	25 min	30 min	*OFF*	30 min	135 min
Week 9	*OFF*	25 min	30 min	30 min	30 min	*OFF*	30 min	145 min
Week 10	*OFF*	30 min	30 min	30 min	30 min	*OFF*	35 min	155 min
Week 11	*OFF*	30 min	30 min	35 min	35 min	*OFF*	35 min	165 min
Week 12	*OFF*	35 min	35 min	35 min	35 min	*OFF*	40 min	180 min

Weekly Fitness Tip:

Foot care for walking and other physical activities

Foot care is a very important consideration when maintaining an active lifestyle. Wearing a good pair of comfortable shoes is a must for activities such as walking, which requires you to be on your feet. Be sure to wear thick, absorbent socks and dry your feet well after bathing and swimming, paying special attentions to the toes. Nails should be cut regularly, straight across the toe. Examine your feet regularly and address areas such as sores, blisters, irritation, and cuts as soon as they are noticed. Problems that cause discomfort such as bunions and hammertoes should be evaluated by your doctor or foot specialist.

Week 2

Main Page Construct:

There are many positive benefits to being active.

For those with diabetes, physical activity can help to:

- Lower blood sugar levels
- Lower blood pressure
- Reduce insulin resistance
- Lower cholesterol levels and
- Help to maintain a healthy body weight.

Physical activity can also be great for your mental health as well. It can help you have a positive outlook on life and deal with stress more effectively.

If you are just beginning an exercise program it's important to know what to expect. It isn't uncommon to feel a little stiff and sore a day or two after exercise; however, this will go away and will continue to be less noticeable as you progress.

What do you see as the positive benefits of physical activity in managing your diabetes? Are there any negative consequences you can think of?

1. Make a list of 5 positive outcomes you would like to see as a result of being active; they don't have to be directly related to your diabetes. Keep the list posted where it will reminder you of what you want to accomplish.

We all expect different results from being physically activity. In many cases we value certain results more than others. For example, some people place a greater importance on lowering their blood sugar levels compared to losing weight. Often that value or desire is what motivates us to accomplish our goals. Therefore it is important to have physical activity goals that are important to you and that you value.

It is important to remember what it is that YOU value and not necessarily what others want you to value.

2. From the list of positive outcomes you developed earlier, place a value beside them indicating how important they are for you to accomplish; with 5 being extremely valuable and the highest priority to 1 being valued but low priority.

3. Think about why you value these outcomes the way you do. Share these with your counsellor and keep this list in mind as you set out your physical activity routine.

Research Section:

Diet and Exercise Can Help Prevent Future Heart Problems

Impact of intensive lifestyle and metformin therapy on cardiovascular disease risk factors in the Diabetes Prevention Program, by the Diabetes Prevention Program Research Group. *Diabetes Care* 28:888–894, 2005.

What is the problem and what is known about it so far?

About 10 million people in the U.S. have blood glucose levels that are higher than normal. This can make someone more likely to get diabetes and to have heart disease, high blood pressure, and high cholesterol (a waxy fat-like substance that builds up in the blood vessels). Many studies have shown that exercise and certain drugs can help these people prevent diabetes and heart disease.

Why did the researchers do this particular study?

People who have diabetes or are likely to get diabetes are also likely to have high cholesterol and to get heart disease. Researchers for the Diabetes Prevention Program (http://www.preventdiabetes.com/) showed that diet and exercise is the best way to help prevent type 2 diabetes. The drug metformin, which helps control blood glucose, was also shown to help prevent type 2 diabetes. Because of this, these researchers wanted to see whether changing diet and exercise habits or taking metformin could also help prevent heart disease.

Who was studied?

A total of 3,234 people with high blood glucose made up the study group. These people took part in the Diabetes Prevention Program.

How was the study done?

The people in the study were given metformin or a placebo (a drug that has no effect), or they were told to exercise and diet to lose weight and improve their health. When the study began, the researchers measured each person's blood pressure and cholesterol and did tests to check the health of their hearts. Every year for about 3 years, the researchers again measured the patients' blood pressure and cholesterol and checked to see if they had any heart problems.

What did the researchers find?

By the end of the study, blood pressure was higher in the group of patients who were given metformin. It was higher also in the group that was given a placebo. But blood pressure was lower in the group that started exercising and dieting.

Total cholesterol and LDL cholesterol (the "bad" cholesterol) was about the same in all three groups, but HDL cholesterol (the "good" cholesterol) was much better in the group who started exercising and dieting.

Over the 3 years, the three groups had only a small number of heart attacks or strokes.

What were the limitations of the study?

This study lasted only 3 years, which probably explains why there were so few heart attacks or strokes in all three groups. A longer study will give researchers a better idea of how the different types of treatment affect the long-term health of the heart.

What are the implications of the study?

This study showed that changing your lifestyle by eating better, exercising more, and losing weight lowers the chances of getting problems that could lead to heart disease, such as high blood pressure and high cholesterol.

Myth Busting Section:
Myth: If I can't exercise regularly then I shouldn't bother at all
It does take about 10 weeks of regular exercise to see improvements in fitness however; even a single bout of exercise can improve your health. For example, take a 50-year-old man who is somewhat overweight and typically has moderately elevated blood sugar, triglycerides, or blood pressure. A single bout of exercise of moderate intensity—like 30 to 40 minutes of brisk walking—will lower those numbers."

Educational Section:
You Now Know That Physical Activity is Beneficial, But How Exactly Does it Help?

Convincing Evidence:
Blood sugar control: If you have type 2 diabetes, physical activity can improve your blood sugar control. As your muscles contract and relax during exercise, they use sugar for energy. To meet this energy need, your body uses sugar supplies in your blood during and for a period after exercise, reducing your blood sugar level. The duration and intensity of activity determines how much your blood glucose is reduced.

Physical activity can also increase your insulin sensitivity if you have type 2 diabetes. That means your body requires less insulin to escort sugar into your cells, which also reduces your blood sugar level.

Cardiovascular health: Cardiovascular disease is the leading cause of death among people with diabetes. In addition to improving your overall fitness and conditioning, physical activity can help counteract the risk of developing cardiovascular disease by improving the flow of blood through small blood vessels and increasing your heart's pumping efficiency. By controlling or reducing high blood pressure and cholesterol your chance of having further complications decreases substantially.

Weight loss: Physical activity can help you shed a few pounds by burning calories and increasing your metabolism to burn more calories even while you are sitting still. For optimal weight loss, research shows a program including both regular aerobic and resistance training is most effective when combined with a healthy diet.

Psychological Health: The psychological and emotional benefits from physical activity are numerous. Either brief periods of intense training or prolonged aerobic workouts can raise the levels of certain chemicals in the brain, such as endorphins, adrenaline,

serotonin and dopamine that are associated with a feeling of well-being. Rhythmic aerobic and yoga exercises help combat stress and anxiety. And, of course, weight loss and increased muscle tone from strength training can boost self-esteem.
A 1999 review of multiple studies found that physical activity advances the treatment of clinical depression and anxiety, enhances moods, and improves self-esteem. Some studies are also reporting that physical activity is as effective as antidepressant agents in relieving depression and it may even be better in maintaining normal mood over time.

Independence: Regular physical activity will enable you to do activities of daily living, such as grocery shopping, household chores, playing with grandchildren and being able to move about freely as you age. All of these things are so important, yet we can sometimes take them for granted when we feel healthy.

Weekly Fitness Tip:
When it comes to getting active and burning calories, every little bit counts. The following chart shows approximately the number of calories per hour an average person would burn doing various activities.

Activity	Calories Burned
Dancing	370 calories/hour
Gardening	324 calories/hour
Playing with the kids/grandkids	216 calories/hour
Brisk walking	297 calories/hour
Swimming	603 calories/hour
Yoga	360 calories/hour
Biking (flat surface)	441 calories/hour

* Note: Numbers estimated for 150 lb person and will vary depending on weight, body composition and intensity.

Adapted from American Cancer Society

Week 3

Main Page Construct:

It may be helpful to set personal goals when it comes to physical activity.
Some people find it easier to accomplish something if they have something to work towards. The key is setting short-term and long-term goals that are manageable. A short-term goal is a goal that can be achieved within the next couple of weeks while a long-term goal is a goal that could take months. Several short-term goals often help to accomplish long-term goals. It's important to set goals that are appropriate for you.

Some examples of short-term goals are:

- I will increase my walking time 5 minutes by next week or
- I will start swimming once a week by the end of this month.

Long-term goals can include things like:

- I will lose 5 pounds by mid summer or
- I will enter into a 5km walk for my favourite charity before October.

The next step is to come up with a plan to help you accomplish these goals. Try and make this part as detailed as possible. Plan out when you are going to do activity, where you will do it, and what kind of activity you will do, how often and how long you plan to do it. This may help you to determine if the goals you set out for yourself are practical and realistic. It's important not to set yourself up for failure at the beginning, so be sure to think your physical activity goals through.

The physical activity logbooks are a great tool for you to track your progress and keep on task. They will help you to examine how much or how little activity you are really doing and provide you with a visual guide towards your goals

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1. Over the next couple of days, sit down and write out 3-5 short term goals you would like to work towards, as well, come up with 1-2 long term goals.

2. Discuss these with your counsellors to be sure they are realistic. Post them somewhere visible so you can remind yourself of the commitment you have made.

Research Section:

Regular Physical Activity Lowers the Chances of Dying From Heart Disease

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Physical activity, cardiovascular risk factors, and mortality among Finnish adults with diabetes, by G. Hu and colleagues. *Diabetes Care* 28:799–805, 2005.

What is the problem and what is known about it so far?
Type 2 diabetes often leads to cardiovascular (heart) disease, which causes heart attacks and strokes. More than 75% of people with diabetes die from heart disease. People who

are obese (seriously overweight), have high blood pressure, or have high cholesterol (a waxy, fat-like substance that builds up in the blood vessels) are more likely to die from heart disease.

Why did the researchers do this particular study?
Smoking, a high BMI (a measure of weight in relation to height), high blood pressure, and high cholesterol put people at risk of death from heart disease. The researchers wanted to see if regular physical activity could lower that risk among people with type 2 diabetes.

Who was studied?
A total of 3,708 patients with type 2 diabetes. The patients were from Finland, and their ages ranged from 25 to 74 years.

How was the study done?
In this study, patients filled out a form that asked questions about how physically active they were. Physical activity doesn't necessarily mean an exercise program or working out. It refers to daily routines that boost activity levels, like walking the dog or taking the stairs instead of the elevator. The patients in this study were asked about the types of physical activity they get while working, while going places, and during their free time. The patients also answered questions about whether they smoked, their level of education, and their medical history. Nurses measured the patients' blood pressure, height, and weight and took blood samples. The researchers then looked at the patients' medical records for the next 18 years to check on the patients' health and to see if and how they died.

What did the researchers find?
Patients who had higher levels of physical activity had a lower chance of dying from heart disease, regardless of their age, weight, blood pressure, cholesterol level, or smoking habits.

What were the limitations of the study?
The researchers did not have information about the patients' blood glucose levels or the types of drugs they took to treat their diabetes. Both of these things could affect a person's health.
Because of the design of the study, the patients filled out the forms themselves. Sometimes this isn't a very reliable method.

What are the implications of the study?
Patients with type 2 diabetes who are physically active are less likely to die from heart disease than patients who are not physically active. Regular physical activity should be considered an important part of treatment for patients with type 2 diabetes.

Myth Busting Section:
Myth: Weight gain is inevitable as we age

Gaining weight as people get older is so common in North America that it has been culturally accepted as an inevitable part of the aging process. In fact, that common weight gain is due to getting less exercise resulting in a loss of muscle mass that lowers the metabolic rate. Starting in their 20s and 30s, adults begin to lose muscle mass gradually if they do not get enough exercise. By age 40, this can be a loss of 6-8% of muscle mass per decade.

But don't feel bad if you can no longer fit into those jeans you wore 20 years ago. What is important is that you keep active. After only two months of strength-training, women can recover a decade of muscle loss and men can recover two decades! That's with three sessions of weight training done properly each week.

Education Section:
There are many different aspects to physical activity and they are all important to keep in mind. Listed below are basic definitions of the various components to physical activity.

#1 – Aerobic Fitness is:The ability of the body's heart and lungs to supply fuel during physical activity. To improve your aerobic fitness, try activities that keep your heart rate up at a safe level for a continued length of time such as walking, swimming, or bicycling for 150 minutes per week at a moderate intensity. The activity you choose does not have to be strenuous to improve your aerobic fitness.

IMPORTANT: Before starting a new physical activity routine, visit your doctor and discuss your physical activity. This will help ensure that your activity program will be safe and appropriate for you!

#2 – Muscular Strength is:The ability of the muscle to use force during an activity, like carrying groceries, climbing up stairs and lifting up your grandkids or children. The key to making your muscles stronger is working them against resistance, whether that be from weights or gravity. If you want to gain muscle strength, try exercises such as lifting weights, joining a fitness strength training class, using exercise bands or taking the stairs.

If you want to begin a resistance training program, be sure to get instruction and supervision from a qualified exercise specialist. Improper resistance training can result in injury. Ask your doctor if there is a program in your community for people living with Type 2 Diabetes. You can also find exercise specialists at local recreation centres, YMCA's, and fitness centres. There is often instruction classes offered at these places for a range of ages and abilities.

#3 – Muscular Endurance is:The ability of the muscle to continue to perform without getting tired. To improve your muscular endurance, try aerobic activities such as walking, bicycling, climbing stairs, swimming or dancing on a regular basis.

#4 – Body Composition is: The amount of muscle, fat, bone, and other vital parts of the body. A person's total body weight (what you see on the bathroom scale) may not change over time. But the bathroom scale does not assess how much of that body weight is fat

and how much is *lean* mass (muscle, bone, tendons, and ligaments). Body composition is important to consider for health and managing your weight! If you have a healthy body composition you can better control your blood sugar and you are at a decreased risk for several other health issues (high blood pressure, cholesterol, cardiovascular disease…the list goes on!). Regular physical activity can help you obtain and maintain a healthy body composition.

#5 – Flexibility is: The range of motion around a joint. Good flexibility in the joints can help prevent injuries, stiffness and soreness through all stages of life. If you want to improve your flexibility, try activities that lengthen the muscles such as swimming or a basic stretching program. You can find stretching programs on TV, on exercise videos, from fitness specialists (at gyms, fitness classes, universities or colleges) and from physiotherapists.

Weekly Fitness Tip

You can use this scale to help determine how moderate physical activity feels. In order to be doing moderate physical activity, you want to be exercising anywhere from **4** to **6** on this scale.

1	Very Light	I'm relaxing watching TV, reading
2	Minimal effort	I'm comfortable and could maintain this pace all day long; e.g., easy walking, light biking with no resistance, light housework
3	Slight effort	I'm still comfortable, but am breathing a bit harder; e.g., walking at a comfortable pace, biking with a small resistance
4	Light moderate effort	I'm sweating a little, but feel good and can carry on a conversation effortlessly; e.g., brisk walking, biking with a comfortable resistance
5	Moderate effort	I'm just above comfortable, am sweating more but can still talk easily; i.e., this feels challenging, but I feel like I can continue
6	Moderately hard effort	I can still talk, but am slightly breathless; i.e., this feels more strenuous but I feel like I can continue
7	Hard effort	I can still talk, but I don't really want to; i.e., I am really sweating and feel like I can not continue this pace for long

8	Very hard effort	I could only grunt in response to a question and can only keep this pace for a short time period
9	Extremely hard effort	I do not feel comfortable and am completely out of breath, almost maximum effort
10	Maximum effort	This is my maximum effort; i.e., my hardest physical exertion that I can do

Week 4

Main Page Construct:

In order to be successful it's important to plan ahead!

You may find it helpful to identify situations that cause you to miss out on physical activity. For instance, the days are shorter, the weather can be unpredictable and you make have family commitments that take up your weekends...what situations make it difficult for you to keep up with your goal of being active?

1. Make a list of situations that prevent your from getting regular physical activity. Remember there is no correct answer; people's situations are different.

Next, it is important to develop an action plan of at least three solutions to the situations that may prevent you from getting activity. For instance, you may want to go for walks with the whole family, try an indoor fitness class, schedule your time at the gym at lunch or in the morning, or do your exercise before company arrives.

Remember that progress is gradual and we all have occasional setbacks. By having a 'back up plan' for these setbacks, you will be well on your way to succeeding with physical activity!

For example:

I don't have time
Solutions:
I will walk 15 minutes during my lunch break
I will get up 20 minutes earlier and do stretching and strength training
I will cut out one of my TV programs and instead take the dog for a walk

I don't like going to the gym
Solutions:
I will walk around the neighbourhood or in the local mall
I will purchase a couple exercise videos and do them at home

Take a moment to work through your *personal* situations that may prevent you from being active. Be honest with yourself and what really prevents you from getting regular physical activity.

2. Brainstorm ways to overcome those barriers. This may help you deal effectively with situations you encounter.
3. Discuss your personal barriers with your counsellor. They may be able to help you come up with creative solutions to overcome the situations that are preventing you from getting active.

Research Section:

Being Fit Reduces Risk of Heart Disease

Wessel TR, Arant CB, Olson MB, et al.: Relationship of physical fitness vs. body mass index with coronary artery disease and cardiovascular events in women. *JAMA* 292:1179-1187, 2004.

What is the problem and what is known about it so far?

Obesity is linked to a higher risk of coronary heart disease (CHD). Most studies of obesity don't do a good job of linking physical activity and fitness. And many studies of physical fitness have not studied women.
Researchers wanted to look at the relationship between physical fitness and obesity with women's risk of heart disease.

Who was studied?
A total of 936 women in the Women's Ischemia Syndrome Evaluation (WISE) study, conducted by the National Heart, Lung, and Blood Institute, were chosen for this study. From 1996 to 2000, women were enrolled at four U.S. medical centers. All the women had been examined for chest pain or suspected heart disease.

How was the study done?
At the start of the study, researchers collected information about each woman, including symptoms, overall health, and results from lab tests. The researchers figured each woman's body mass index (BMI). BMI is a measure of weight in relation to height. The women filled out questionnaires, and researchers used their answers to estimate how active the women were.
The women were followed for an average of four years. Researchers kept track of heart disease,heart attack, hospitalization, stroke, heart failure, and other things.

What did the researchers find?
During the four years, 337 women, or 36%, had a health event. Overweight women were more likely to have heart disease. Women who were less fit were more likely to have one of these health problems.
Women who were more fit had fewer heart disease risk factors or other health problems.

What were the limitations of the study?
Women filled out the questionnaires themselves, so their answers may not have been completely correct. Also, it isn't clear if not being physically active leads to heart disease, or if heart disease causes people not to be active. Researchers did not use the best ways to figure out body fat, and they did not collect information on the women's eating habits.

What are the implications of the study?
Fitness may be more important for a woman's risk of heart disease than overweight or obesity. Doctors should recommend that women with heart disease be more active.

<u>Myth Busting Section:</u>
Myth: No pain means no gain when it comes to exercise
Physical activity does not have to hurt in order to be beneficial. In fact, if you feel pain when doing your activity, it could actually be doing more bad than good! Moderate aerobic activity should make you break a light sweat and breath faster, but it should be comfortable enough for you to carry on a conversation. Proper resistance exercise with weights will cause a mild burning sensation in your muscles while doing the exercise, but it should not cause pain.

Education Section:

You Now Know That Physical Activity is Beneficial, But How Exactly Does it Help?

Cancer: Studies have shown that physical activity reduces the risk of colon cancer by 30-40% and breast cancer by 20-30%. Recent studies are also starting to show beneficial gains in the battle against prostate, endometrial and lung cancer. For people with cancer, preliminary studies suggest that exercise has a positive physical, mental and emotional effect. It can improve physical strength, functional capacity and the ability to battle the negative side effects of chemotherapy, including nausea and fatigue.

Lung Disease and Asthma: Physical activity can help your body use your oxygen much more efficiently, therefore, making you feel less tired and less out of breath. Great activities involve walking, biking, fitness classes *at your own pace*, along with strength training. You may find that you can only do a little bit before you feel tired and out of breath. That's okay. Try doing the activity for 5 minutes or until you get moderately out of breath, sit for 5 minutes and breathe through pursed lips, then try walking again for 5 minutes. You will improve!

Osteoporosis: Strength training and weight-bearing activities like walking can reverse age-related losses in bone density. People who are regularly active have much better balance and increased muscle mass, both of which reduce the risk of having a fall, as well as making it less likely to suffer fall-related fractures.

Rheumatoid Arthritis/Arthritis: In the past, most patients with arthritis were told to rest and take it easy. Pain, inflammation and fatigue prevented many people from activities such as brisk walking. However, there are alternative activities that can help. Activities such as swimming, exercising in a pool, stretching and chair aerobics are extremely beneficial in reducing muscle fatigue and in increasing flexibility and endurance. Strengthening exercises can also help prevent some muscle weakness caused by inflammation and some of the medications used to treat arthritis. Physical activity can prevent arthritis from getting worse. A special cautionary note: during an arthritis flare-up, rest is advised. When the flare up has gone down, you may resume exercise.

Stomach and Intestinal Health: Experts suggest that moderate regular exercise may reduce the incidence and symptoms of some digestive disorders such as ulcers, irritable bowel syndrome, indigestion and constipation. For example, in one study, exercise was associated with a lower risk for ulcers in men. In addition, older people who exercise moderately may have a lower risk for gastrointestinal bleeding.

Weekly Fitness Tip:

Keep a pair of walking shoes in your car or at work, so they are ready whenever you are!

Week 5

Main Page Construct

It's important to reward yourself when you have accomplished a goal you set out to achieve.

Sometimes that's what keeps you going. There are two kinds of reinforcements or rewards: intrinsic (or internal) and extrinsic (or external). It's important to identify both as they are both important. For example, when you achieve a goal, you can reward yourself with a new shirt (extrinsic) or reward yourself with the satisfaction that you have accomplished something important (intrinsic). Remember to set realistic goals that you CAN achieve, it's not about setting yourself up for failure.

Rewards can have a positive impact on your motivation but something as simple as keeping positive can also have a big influence. Practicing positive self-talk is an important concept that many overlook. Don't be so hard on yourself; train that little voice in your head to be encouraging and positive. Tell yourself you are doing something good for your body and your diabetes. If you're constantly putting yourself down it will eventually overcome your best intentions force you to give up. Everyday is a new day which means a new day to start being positive.

Rewards are an excellent tool to keep you motivated but another great incentive is having someone to be active with! Making physical activity a social event is a way to keep it fun and engaging. Look to those around you for support and encouragement.

1. What motivates you? Identify rewards or incentives for each of the goals you have identified two weeks ago. Be honest in what will motivate you. Everyone is different and there is no right answer, but also be realistic, this isn't a free ticket to splurge. When you accomplish those goals, reward yourself, you deserve it!

2. Let your counsellor know the rewards you have chosen. Perhaps they can give you ideas for additional motivation.

Research Section:

Pedometers May Help Patients Measure Their Physical Activity

Relationship between pedometer-registered activity, aerobic capacity and self-reported activity and fitness in patients with type 2 diabetes, by M. Bjørgaas and colleagues. Diabetes Obes Metab 7:737–744, 2005.

What is the problem and what is known about it so far?

Maintaining a good level of physical activity helps control blood glucose levels and therefore reduces a person's chances of getting diabetes. But many people with diabetes do not exercise at all.

Why did the researchers do this particular study?

Researchers wanted to find ways for people with diabetes to increase their physical activity. But measuring how much physical activity a person gets throughout a typical day is difficult to measure. Pedometers are small devices that measure how many steps a person takes, but it isn't known how well pedometer readings match up with levels of physical activity.
Researchers wanted to study whether pedometers are a useful way to measure the levels of physical activity in people with diabetes.

Who was studied?
The study included 29 overweight men with type 2 diabetes who were 57 years old on average.

How was the study done?
Participants underwent exercise testing and were given pedometers. Fifteen of the men were put in an exercise group; these men exercised twice a week for 12 weeks. The remaining 14 men kept to their usual routines. At the end of the study period, they had exercise testing again, had blood drawn for lab tests, and had their pedometers read.
What did the researchers find?

Researchers found that pedometer readings matched up fairly well with levels of physical activity. Men in the exercise group lost an average of 2.7% of their body weight, increased their fitness by more than 10%, and reduced their blood pressure and glucose levels.

What were the limitations of the study?
The study only included men. Therefore, the study might have different results if women were studied. The number of participants was fairly small, and the study period was not very long.

What are the implications of the study?
Pedometers may be a convenient, simple, and inexpensive way for people with diabetes to keep track of their physical activity

<u>Myth Busting Section:</u>
Myth: If I do resistance exercises with heavy weights my muscles will get too bulky.
Often big muscles and a body builder physique are associated with weight training. For some, especially women, this association can make them avoid lifting heavier weights, or even exercising with weights at all, thus limiting them from getting the great benefits of a proper resistance exercise routine. Don't be fooled by this common myth. Those bulky muscles are obtained by extremely intense training and diet programs, along with hormones like testosterone. Women do not have enough of the muscle building hormones in their bodies to get bulky muscles. These levels also vary in men.

Education Section:

There is growing evidence that shows resistance training is very helpful for managing type 2 diabetes! And it's a great activity that can fit in to almost anyone's physical activity routine. Just look at some of the benefits resistance training can bring to you!

Increased:	muscle strength, power, and endurance; bone density and strength; metabolism (burning more calories when at rest)
Lowered:	heart rate and blood pressure after exercise
Enhanced:	balance and stability; performance of everyday tasks
Prevention or improvement:	of medical conditions such as diabetes, arthritis, and osteoporosis

Regular resistance training involves you working against a resistance such as a dumbbell, weight machine, or body weight. Your muscles will adapt to the resistance over time by developing better nerve control and increasing in size and/or density.

Basic principles:

- **Type of exercise** – Your workout should have at least 1 exercise for each of the major muscle groups (i.e., legs, back, chest, arms, and stomach).
- **Volume** – Doing each exercise 3 times during your workout is a good rule of thumb. Also aim to do your routine 2-3 times per week.
- **Variety** – You must change your workout routine regularly as your body adapts quickly to the exercises. You can do this by changing the exercises you do about every 6 weeks.
- **Progressive overload** – If you want to continue to improve, gradually increasing the weight that you use will get your muscles to grow stronger.
- **Rest** - You need to rest between each exercise for about 30 – 60 seconds to let your muscle recover. That way, you can get the most out of each exercise.
- **Recovery** – Your muscle needs time to repair and adapt after a workout. Rest the muscle group for at least 24 - 48 hours before working the same muscles again.

How Much Weight? An easy way to determine how much weight to use for each exercise is to start light and work up from there.

1. Start with a light weight and do the exercise, aiming for about 10 to 15 repetitions.
2. For the next set, increase the weight. If you can do more than your desired number of reps, increase the weight again for your 3rd set.
3. You want to lift enough weight so that you can ONLY do the desired reps. You should be struggling by the last rep, but still able to finish it with good form.
4. In general, you can use heavier weights for larger muscle groups such as chest, back and legs, and smaller weights for your arms.

Things to consider:

- Only use safe and well-maintained equipment.

- Warm up and cool down thoroughly.
- Don't forget to breathe - exhale as you lift the weight rather than holding your breath.
- Control the weights at all times - don't use momentum to 'swing' the weights.
- Make sure you use correct technique. Consult with a qualified exercise specialist.
- Stretching after your workout will help reduce muscle soreness and improve your flexibility.
- ***Consult with your doctor before starting any new exercise program, especially if you are overweight, over 40 years, have a pre-existing medical condition or haven't exercised in a long time!***

Fitness Tip

Can't find time to fit in activity? Try doing physical active during the commercial breaks of your favourite TV show. Gradually work your way up and do activity throughout the whole show.

Week 6

Main Page Construct:

Physical activity doesn't have to be something you do alone.

You may find it more motivating if you had some company. Turn a social gathering into a physical activity one just by going out for a walk instead of meeting for coffee. Great conversation can happen over a meal or a walk. By combining social activity with physical activity, you can stay connected with family and friends and committed to your physical activity goals.

Let others in your life know about your physical activity goals. If others know the goals that are important to you, they can offer support. Encourage others to support you in your plans. Better yet, ask if they would like to join you! Participating in physical activity with someone else is a great way to stay motivated and committed. Ask a friend, family member or co-worker to join you in being active and reap the benefits of physical activity and good company.

Your doctor can also act as a support for you. Talk with your doctor about your physical activity plans. Many doctors encourage their patients to get physically active as part of their disease management routine. Your doctor may also know of activity programs or educational sessions in your area that may be useful.

1. Can you think of one or two people in your immediate circle of family or friends that you could be active with?
2. What types of activity can you do together? Remember it doesn't have to be anything formal; simply going for a walk together is a great activity.
3. Make a commitment within the next week to contact those on your list and together come up with a concrete plan to be active together. For example, agree to meet every Wednesday at 5:00 to go for a 30 minute walk. Give it an honest try for at least a month and make modifications if necessary to continue on.
4. Share your plan or any thoughts with your counsellor.

Research Section:

Lifestyle Changes Improve Erectile Function

Esposito K, Giugliano F, Di Pal C, et al.: Effect of lifestyle changes on erectile dysfunction in obese men: a randomized controlled trial. *JAMA* 291:2978–2984, 2004.

What is the problem, and what is known about it so far?

Men with erectile dysfunction (ED) have trouble getting and maintaining an erection. Obese men are more likely to get erectile dysfunction. Healthy men who follow a healthy lifestyle (by eating healthy foods and getting exercise) have fewer problems getting and maintaining erections.

Researchers wanted to find out if losing weight and getting more exercise improved erectile function in obese men.

Who was studied?
A total of 110 obese men between the ages of 35 and 55 years who did not have diabetes, hypertension (high blood pressure), or hyperlipidemia (excess fats in the blood) were studied and followed for 2 years.

How was the study done?
The men in the study were put into two groups of 55 men each. One group (called the intervention group) received detailed advice on how to reduce their total body weight by 10% or more. This advice included how to eat fewer calories, set goals and keep track of what they ate and drank. They also took part in monthly support groups. Each member of the intervention group also got advice on how they could personally get more exercise and had monthly meetings with a nutritionist and exercise trainer during the first year of the study.
The other group (called the control group) received general information about healthy food choices and exercise and had group meetings every other month. They did not have individual counselling like the other group did.

What did the researchers find?
After 2 years, the men in the intervention group ate more complex carbohydrates, protein, and monounsaturated fat ("good" fat); increased their fiber intake; and ate fewer calories, saturated fat ("bad" fat), and cholesterol. Their exercise also increased. The men in this group also weighed less, had better blood pressure, and better levels of blood glucose and insulin. In addition, almost one-third (17 of the 55) of the men in this group regained their ability to get and maintain an erection.
The control group, however, showed no major changes in these measurements. Also, only 3 of the 55 men in this group improved their ability to get and maintain an erection.

What were the limitations of the study?
Because feelings (like stress, anxiety or depression) may affect men's' ability to get and maintain an erection, it is possible that the men in the intervention group showed better erectile function because of their better self-image from losing weight and becoming more physically active.
Also, because the study required a great deal of support and care that others might not get, it is possible that the study results may not apply to all men.

What are the implications of the study?
They study shows that lifestyle changes, like eating fewer calories and doing more exercise, improves erectile function for obese men.

<u>Myth Busting Section:</u>
Myth: You can lose fat from specific parts of your body by exercising those spots.
There's no such thing as "spot reduction." When you exercise, you use energy produced by burning fat in all parts of your body - not just around the muscles that are doing most of the work. In fact, your genes may dictate where you will lose fat from more easily.

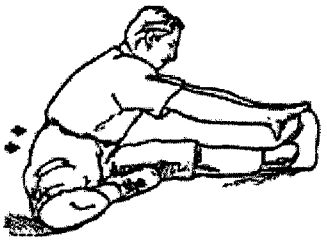
However, working a specific region like the belly still has benefits. Building strong muscles is important for posture, mobility and independence.

Education Section:
Flexibility!
Plain old stretching can improve your flexibility, which in turn makes it easier to do other exercises. If you feel stiff and tired after winter then stretching can help get you active. Stretching can help reduce the risk of injury by increasing the length of your muscles and giving you more range of motion.

Stretching is peaceful and quiet and can help your mind as much as your body. Just what you need to get rid of the winter cobwebs.

It's important when stretching to pay attention to your body and how it is feeling. Do not stretch farther then you are able. Take calm, even breathes into your belly and as you exhale stretch a bit farther each time. Hold each stretch for at least 15 seconds.

Here are some simple stretches to help improve you health:



While sitting on the floor stretch one leg out in front and place the sole of your other foot on the inside of you thigh. Keeping your back nice and straight, lean forward slightly until you can feel the tension in the back of your leg. Hold and repeat with the other leg.

Link your fingers together and raise your arms above your head. Stand as straight as possible and stretch towards the ceiling. Lean slightly to one side then the other to target side muscles.

Stand next to a wall or chair in order to balance yourself. Bend one leg and hold on to your foot with the opposite hand. You should feel the stretch in the front of your leg. Hold and repeat with the other leg.

While sitting on the floor, place the soles of your feet together. With your back nice and straight, lean your upper body forward over your feet. This stretches the inside of your legs.

Lie on the floor with your legs out straight. Bring one knee to your chest and hold it there. You should feel a stretch in your lower back and the back of your leg. Repeat with your other leg.

Fitness Tip:
Try and devote at least 8 hours a night to sleep. Having enough rest will give you the energy you need to be active throughout the day!

Week 7

Main Page Construct:

Having diabetes can affect not only your physical health but also your mental health.

You may have and continue to experience many different feelings and emotions when it comes to diabetes. It's important to know that you're not alone. Try to establish networks with others who have diabetes. Share your thoughts and feelings and learn from the successes of others. In many cases you can find the support you're looking for in others and even become a support for someone else.

Many people with diabetes may feel nervous, anxious or even scared about their health. It is very normal for you to experience those feelings; the key is learning how to deal with those mixed emotions. Diabetes will impact you for the rest of your life but it's up to you to help make that impact more positive. There are a variety of ways to deal with the emotional rollercoaster you may be experiencing. For some people it may be a support group and for others it may be family. Physical activity can also be a great way to help you deal with the emotional impact of diabetes. Next time your feeling nervous, overwhelmed or anxious, try going doing some physical activity to ease your mind and body.

Stress can have a major impact on one's health. As an individual with diabetes, stress can play a role in the management of your blood sugars. Stress can also affect how one carries out normal daily activities. In stressful situations one might not make time to exercise, eat right or get the rest they need. Therefore, it is important for you to recognize stressful situations and try to deal with them in constructive ways.

Stress management can be a difficult skill to perfect, but it's all about doing activities that work for you and that you enjoy. For example, some individuals find meditation useful in dealing with stress while others find comfort in a hot bath. The key is finding strategies to help you deal with both the emotional and physical stressors in your life.

Physical activity can be an excellent stress management technique. Going for a long walk or doing a yoga video in your home can be a great way to relax both your body and mind. Use this time to gather your thoughts and leave the stresses of the day behind.

1. Make a list of the stressors in your life that may prevent you from carrying out your normal activities. Do these stressors interfere with your physical activity habits?
2. Now, brainstorm a list of ways you can begin to manage these stressors and actively try practicing this list of solutions.

Research Section:

Exercising and Eating Right Can Help Prevent Loss of Bladder Control

Lifestyle intervention is associated with lower prevalence of urinary incontinence: the Diabetes Prevention Program, by J.S. Brown and colleagues. Diabetes Care 29:385–390, 2006.

What is the problem and what is known about it so far?
Urinary incontinence means that you can't always control when you urinate. Women who have type 2 diabetes are at a 50-70% higher risk for urinary incontinence.

Why did the researchers do this particular study?
The researchers wanted to see if losing weight by diet and exercise could help lower the risk for urinary incontinence.

Who was studied?
Almost 2,000 women who took part in the Diabetes Prevention Program. For more information on the Diabetes Prevention Program, visit http://www.preventdiabetes.com. On average, the women were 50 years old, overweight or obese, and had pre-diabetes.

How was the study done?
One-third of the women were given a diabetes drug (metformin) to treat their pre-diabetes, one-third were told to diet and exercise to treat their pre-diabetes, and one-third were given lifestyle advice and a placebo (a pill that has no effect). The women followed this routine for almost three years.

What did the researchers find?
The women who changed their diet and exercised had a lower risk for urinary incontinence. The researchers believe this is because they lost more weight than the women in the other groups. The women in the diet and exercise group also had a lower risk for type 2 diabetes.

What were the limitations of the study?
The researchers did not have information on how many women had urinary incontinence when the study started. As a result, they couldn't tell if eating right and exercising improved symptoms of urinary incontinence.

What are the implications of the study?
Eating right and exercising can help women avoid urinary incontinence, and this may be a powerful motivator to eat better and exercise more.

Myth Busting Section:
Myth: When you stop exercising, your muscles turn to fat.
If you stop working out, muscle will turn into fat. Many people believe that if they stop working out, their muscle will turn into fat. Muscle and fat are two different tissues, however, and one can never be converted to the other. If you stop exercising, muscle tissue will shrink, so you may feel flabbier. Also, when muscles get smaller, they do not need as many calories, so your metabolism slows. With a slower metabolism, if you eat the same amount of calories, you may gain body fat.

Education Section:

Question: Why should I warm-up?

A couple of important changes occur during warm-up. First, the internal temperatures of the muscles increases, making them more elastic and second, heart rate and breathing increase providing greater blood flow to working muscles. You should warm up for at least 5 minutes (10 minutes over the age of 50) and even more on cold days. The warm-up helps to prepare the body both mentally and physically for exercise. You are at greater risk for injury if you don't take the time to warm your muscles. It's a similar concept to letting your car run in the wintertime before taking it out on the road.

Question: Why should I cool-down?

The cool-down is the final part of your workout. The cool-down allows for you to safely bring your body back to its resting state. A good cool down should last at least 5 minutes (10 minutes age 50+) and should bring your heart rate down to a pre-exercise level. Cooling down ensures that the blood does not pool in the legs. Pooling blood can make you feel dizzy and can result in a headache. Begin your cool-down by doing the same activity you performed during the main part of your workout but at a lower intensity. For example, a leisurely walk would be a great cool-down following a brisk walk. Stretching while you cool down when the muscles are warm from the workout is also ideal.

Fitness Tip:

Feeling bored with your physical activity routine? Try listening to music, asking a friend to join you or changing scenery next time. Your favourite music or good conversation with a friend can make time fly by. By simply changing the route you normally walk or the location your exercise can make it that more enjoyable and interesting! Give it a try.

Week 8

Main Page Construct:
The Canadian Diabetes Association recommends those with diabetes try to get at least 150 minutes of moderate activity every week, trying not to go more than two days without being active.

There are a variety of ways you can achieve this goal. For example, try walking for 30 minutes a day, 5 days of the week, you can even break it up into 10-minute bouts throughout the day Walking is an activity that almost everyone can do, however, choose an activity that you enjoy or have access to. If you enjoy swimming and have access to a pool, try that. Don't force yourself to do something you won't enjoy you will find it will be much harder to stick with it.

The activities you choose don't have to be strenuous or uncomfortable. Start out slow and work your way up. Go at a pace that is comfortable for you, we were all beginners once. A good pace to work at is one that makes you sweaty and warm but not exhausted and fatigued. Give yourself time to adjust to an activity and keep at it.

Your health care team can be an excellent resource for safe activity ideas. If you are unsure about doing certain types of activity, consult your physician to get their advice on the best activities for you.

1. What types of activities have you enjoyed doing in the past or are currently doing right now?
2. What is it about those activities that make them enjoyable?

Research Section:
The effect exercise on glycemic control and body mass in type 2 diabetes

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Boule NG, Haddad E, Kenny GP, Wells GA & Sigal RJ.: Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: A meta-analysis of controlled clinical trials. *JAMA* 286:1218–1227, 2001.

What is the problem, and what is known about it so far?
Physical activity is known to be helpful for blood glucose control and weight loss in individuals with type 2 diabetes, but, studies on the effects of physical activity in individuals with type 2 diabetes have had some inconsistent results. Researchers set out to review and compile studies that have been done on physical activity and type 2 diabetes thus far.

Who was studied?
A number of medical databases were searched to identify physical activity and type 2 diabetes studies.

How was the study done?

Studies were selected if they evaluated the effects of physical activity interventions greater than 8 weeks in adults with type 2 diabetes. A total of 14 studies were included in the review.

What did the researchers find?
Researchers found that HbA1C levels were lower in the people who received the physical activity intervention compared with the people who did not receive any physical activity. However, they also found that there was no major difference in body weight between people in the exercise group and people who were in the non-exercise group.

What were the limitations of the study?
Many of the research studies looked at younger participants, therefore, it is uncertain that their finding would be applicable to people over the age of 65.

What are the implications of the study?
It is apparent that physical activity reduces HbA1C by an amount that is thought to decrease the risk of diabetes complications; however, there are indications that people may not see a major loss in weight. It is, therefore, important to rely on other predictors of health other than simply weight.

Myth Busting:
Myth: The best time to exercise is early in the morning.
Not necessarily true. There is no one best time to exercise. The best time is the time that appeals to you and fits into your schedule. Some folks love to jump-start their day with a morning workout, while others swear that exercising after the workday is over is a great way to energize for the evening and eliminate stress. Remember only you can say what works best for you!

Education Section:
It's important to change up your physical activity routine every so often. Your body is very efficient and can adapt to a routine within 3 months. Every 3 months or so try to change one of the following:

1. Intensity – change your pace, the amount of weight, the number of hills you climb, the resistance on the bike, try interval training
2. Duration – exercise for a longer period of time
3. Type – try a new type of cardiovascular exercise. For example, try substituting aquasize for two of your weekly walking sessions

When changing from your normal routine, you may find your new workout more challenging. This is normal; it will take time for your body to adapt to your new routine. Stick with it and monitor your progressions!

Fitness Tip:
Be sure to drink at least 8 glasses of water every day. Your body is made up mostly water and functions best when you are hydrated. How do you know if you're drinking enough? Take the pee test; when you go to the washroom, look at the color of your

urine. If you are drinking enough it should be almost clear, if you're dehydrated it will be yellow.

Week 9

Main Page Construct:
You might not be aware of it, but the environment that surrounds you can influence how active you are. Try to make the best of what is around you and work with what you have.

With creative thinking and some determination, you should be able to overcome many of the barriers that are getting in your way.
Little things can help make a difference.

Try including the following tips into your day:

- take the stairs instead of the elevator or escalator
- park at the back of the parking lot instead of parking close to the entrance
- get off the bus 2 stops early and walk the rest of the way
- walk whenever possible instead of driving
- do something active during commercial breaks
- try and fit in a 20 minute walk during your lunch break

1. Are there obstacles in your surroundings that are inhibiting you from being active?
2. List them in one column and then list possible solutions beside them. Be sure to keep your solutions practical and easy. Solutions that are too hard or impractical will only set you up for failure.

Here is an example:
I am afraid to walk outside because of all the ice and snow
Possible solution: Try going to a mall close to my house to walk indoors

Need some help overcoming those barriers, talk to your counsellor and get their perspective?

Research Section:
Walking Toward Better Health

Walking for exercise—does three times per week influence risk factors in type 2 diabetes? by T. Fritz and colleagues. Diabetes Res Clin Pract 71:21–27, 2006.

What is the problem and what is known about it so far?
Healthy muscles are important for good health, particularly for people with type 2 diabetes. High levels of physical activity help improve the body's ability to handle glucose and insulin as well as lower a person's chance of getting diabetes or cardiovascular disease (disease of the heart and blood vessels).

Not all people are able to do strenuous exercise, however. For some, walking is about all they can manage. It's not known for sure how much of an effect simple walking has on one's health.

Why did the researchers do this particular study?
Researchers wanted to study people with type 2 diabetes and how low-impact walking affected their ability to handle glucose and insulin, as well as prevent conditions that lead to heart and blood vessel disease.

Who was studied?
The study included 52 people with type 2 diabetes. The participants were recruited at a single primary care medical office

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How was the study done?
Half of the participants were instructed to walk for 45-60 minutes three times per week for four months. The other participants, who had similar conditions, were given no exercise instructions.
All participants had a physical examination, which measured their blood pressure and weight. Their body mass index (a measure of weight compared to height) was also calculated and blood was drawn for lab tests. The exams and tests were done at the beginning and end of the four-month study period.

What did the researchers find?
Regular walking improved blood pressure, body mass index, and cholesterol levels in the participants' blood. However, there was no difference between the two groups in their ability to handle glucose and insulin.

What were the limitations of the study?
There was no way of measuring the intensity of walks, so there could be important differences in how the participants exercised. Also, there weren't that many people in the study.

What are the implications of the study?
Increasing physical activity to a level of at least 45 minutes of walking three times a week results in some health improvements for people with type 2 diabetes. More research is needed to determine whether different people need different exercise regimens.

Myth Busting Section:
Myth: The only way to burn calories is by doing cardiovascular exercises like walking and jogging.
Although, activities like walking and jogging are efficient ways to burn calories, a person also burns calories by just existing (eating, sleeping, digesting food etc.). In fact, activities like strength and resistance training are excellent ways to burn calories and build more muscle. The bonus here is that muscle actually burns more calories than fat, so the more muscle mass you have, the more calories your body will burn naturally. For

best results, aim for a well balanced workout including cardiovascular exercise, strength and stretching activities.

Education Section:
Body Composition

It's important to be aware of the various components that make up your body. Here are the basics made easy to understand.

Your body is composed of fat-free mass and fat mass.

Fat-free mass includes: muscle, bone, body fluids and organs.
Muscles are further classified as lean-body mass or muscle mass.

Fat mass is classified as either essential fat or storage fat.

Essential fat is required in order for your body to function normally. It is stored in major body organs and tissues including heart, muscles, intestines, bones, lungs, liver, spleen, and kidneys and throughout the central nervous system. Females have additional fat mass in their breasts and pelvic region for child bearing purposes.
Storage fat is the extra fat that accumulates in fat cells around internal organs and below the surface of the skin to help insulate, pad and protect the body from injury and extreme cold.

You need a combination of all the above in order to be healthy and keep your vital organs adequately protected. This does not mean, however, that excess fat is better. Having too much body fat can lead to many health problems including cardiovascular disease and high blood pressure. Keep in mind that many factors influence body composition including genetics, so, it is not realistic to expect to have the same body composition as people seen in magazines and on television. Be honest with yourself, talk with your doctor about what is appropriate for you to expect and work towards. Don't be discouraged if you cannot look exactly like the images promoted most often.

Fitness Tip:
Another great way to measure the intensity of your workout is a method called the 'talk test'. Use the following criteria to figure out how hard you're working. A person who is active at a *light* intensity level should be able to sing while doing the activity. One who is active at a *moderate* intensity level should be able to carry on a conversation comfortably while engaging in the activity. If a person becomes winded or too out of breath to carry on a conversation, the activity can be considered *vigorous*.

Week 10

Main Page Construct:

A great way to stay motivated and learn new skills is by watching others. You may not realize it, but, observing others perform activities is a common way for us to learn and perfect skills we may have not yet mastered.

Observing doesn't mean you can't participate. We often observe and participate at the same time without knowing it. By interpreting subtle clues from other we learn more about the activity. Observing others will help develop skills but it can also give you cues about how long and how often to engage in an activity. For example: you may observe your neighbour walking for 40 minutes three times a week. This observation may help you form similar behaviours (walking).

Being in an environment that allows you to be exposed to others being active is another great way to learn. Simply being surrounded by others being active can have a positive effect on your physical activity behaviour. For example, it would be difficult to attend an aquasize class at the local pool and not participate. Being surrounded by others participating in the class would probably motivate you enough to want to follow suit.

Use this technique to your advantage!

1. Can you think of three situations where you could either observe or be around others being active?
2. Can you come up with two people you know, whose activity levels are similar to what you want to achieve?
3. Make a plan to join those individuals and participate in activity with them. Discuss these with your counsellor and get their feedback.

Research Section:

Medication Works Best With Diet and Exercise

Randomized trial of lifestyle modification and pharmacotherapy for obesity, by T.A. Wadden and colleagues. N Engl J Med 353:2111–2120, 2005.

What is the problem and what is known about it so far?

Weight loss drugs such as sibutramine (Meridia, Abbott Laboratories) and orlistat (Xenical, Roche) are supposed to be taken as part of an overall treatment plan that includes diet, exercise, and behavioral changes. But in real life, primary care doctors often just prescribe the drugs and drop the ball on the other parts of treatment. Not surprisingly, people often fail to drop weight and keep it off with medication alone.

Why did the researchers do this particular study?

The researchers wanted to compare the effectiveness of medication alone, diet and lifestyle changes alone, and the two approaches in combination. They predicted that the combination would work better than either approach.

Who was studied?
The study included 224 obese adults, ranging from 18 to 65 years old. There were 180 women and 44 men who were overweight or obese. None of the participants had diabetes, disease of the heart and blood vessels, or other major medical problems.

How was the study done?
Participants were put into four different treatment groups. Fifty-five people took 15 mg of sibutramine each day; 55 people attended weekly group meetings that focused on diet, exercise, and healthful lifestyle changes; 60 people took sibutramine and attended weekly group meetings; 54 people took sibutramine and had brief counseling from primary care doctors.

What did the researchers find?
Over a one-year period, participants who received the combination of medication and group visits lost more weight than those who had medication or lifestyle changes alone. People who had the combination lost an average of 27 pounds (12.1 kg), while those treated with drug therapy alone lost an average of 11 pounds (5 kg) and those who had weekly lifestyle group visits lost an average of 15 pounds (6.7 kg). People who took sibutramine and had brief therapy lost an average of 16.5 pounds (7.5 kg).

What were the limitations of the study?
Researchers don't know what parts of the lifestyle changes are responsible for weight loss. Several patients dropped out of the study for a variety of reasons, which could affect the results. A study for a longer time period, such as two years, might find different results.

What are the implications of the study?
Medication works best when used in addition to lifestyle changes that include diet, exercise, and other healthful choices. But even a brief counselling session by a primary care doctor is better than just prescribing medication alone.

Myth Busting:
Myth: Home Workouts Are Fine, But Going to a Gym Is the Best Way to Get Fit.
Research has shown that some people find it easier to stick to a home-based fitness program. In spite of all the hype on trendy exercise programs and facilities, the "best" program for you is the one you will stick with and enjoy. Many feel intimidated going to the gym. Physical activity shouldn't feel this way. Do what you feel comfortable with and makes you happy.

Education Section:
What's your body shape?
The shape of your body and more specifically the location of excess fat on your body are considered risk factors for many common diseases.

Apple shape - fat is located mostly in the abdominal or belly area. This type of abdominal obesity is linked to an increased risk for coronary heart disease, high blood pressure, high cholesterol, diabetes and breast cancer

Pear shape – fat is located mostly in the lower extremities, around the hips, buttocks, and thighs. This type of fat distribution does present risk because it may be in excess but does not present as great a risk as abdominal obesity.

These two types of fat also act differently. Abdominal fat has much more enzyme activity, depositing more fatty acids into the blood stream while hip-thigh fat tends to be less active. Hip-thigh fat also appears to be more difficult to lose compared to abdominal fat.

There is no magic formula to changing your body type but it is important to be aware of the risk factors that are associated with it.

Fitness Tip:
Place 'reminders' in key places to remind you to do physical activity. For example, put a sticky note on your refrigerator, computer or bathroom mirror reminding you to do physical activity. You could also include motivational tips as an added bonus.

Week 11

Main Page Construct:
Physical activity is a lifestyle change that may, at times, seem like it takes more effort than it's worth. Changing habits is not an easy task but the rewards and benefits of being active and healthy far out way the inconveniences you may face.

In today's society of quick fixes and modern conveniences it may be tempting to look for that easy fix. Just remember that it's normal to feel frustrated at times and even have setbacks. It is actually normal for people relapse, we're all human and life gets in the way even if we have the best intentions. The key is to not get discouraged and get back on track as soon as possible. Instead of giving up, try to learn from those experiences.

Sticking to your physical activity routine will take flexibility, planning and problem solving. Don't be afraid to re-evaluate your plan and make adjustments if you think it's not working the way it should. Change is not always a bad thing.

One of the most important aspects of relapse prevention is planning! This doesn't necessarily mean you have to come up with a plan and put it on paper but rather planning ahead for the incorporation of physical activity into your daily life. For example, if you know you have a busy week coming up, you might have to plan alternate times for your activity. You may have to wake up a little earlier before the day starts to fit your activity in. Planning will help you stick to your lifestyle change!

Finally, remember to give yourself credit for the positive results you experience. We too often criticize ourselves when we fail and forget to compliment ourselves when we succeed. The results you see and experience are because of you and your persistent efforts!

1. Discuss any concerns you may have with counsellor around relapsing or not being able to continue on with being physically active.
2. Brainstorm a plan to deal with relapse prevention, in other words come up with a plan to keep you on track.

Research Section:
Caffeine, Exercise, and Glucose

Lee SJ, Hudson R, Kilpatrick K, et al.: Caffeine Ingestion Is Associated With Reductions in Glucose Uptake Independent of Obesity and Type 2 Diabetes Before and After Exercise Training. *Diabetes Care* 28:566–572, 2005.

What is the problem and what is known about it so far?
We all have glucose in our blood because the body uses glucose for energy. Normally, the body breaks food down into glucose and sends it into the bloodstream.
Insulin, a hormone made by the pancreas, helps get the glucose from the blood into the cells to

be used for energy. This is known as "glucose uptake." In people with type 2 diabetes, the pancreas doesn't make enough insulin or the insulin doesn't work very well. As a result, blood glucose rises, and high blood glucose can result in long-term diabetes complications, such as heart disease, stroke, nerve damage, and kidney or eye problems. Eating (Eating what?) and drinking caffeine have been linked to an increase in blood glucose. Although exercise can lower blood glucose levels, it is unknown whether it reverses the harmful effects of caffeine on blood glucose levels.

Why did the researchers do this particular study?
The researchers wanted to study the effect of caffeine on lean and obese men with and without type 2 diabetes. They also wanted to study whether exercise changed the way caffeine affected blood glucose.

Who was studied?
Eight lean men, 7 obese men with type 2 diabetes, and 8 obese men without type 2 diabetes from Kingston , Ontario , Canada. All were white nonsmokers who did not exercise regularly and whose weight had not changed for 6 months before the study. None of the subjects regularly drank much caffeine.

How was the study done?
Researchers studied the participants for 4 weeks without exercise and then during a 13-week exercise program. Researchers studied their body weight, body fat, and glucose levels during both periods. Before and after the exercise program, researchers measured the subjects' glucose levels after they were given either caffeine or a placebo (a "fake" pill).

What did the researchers find?
The researchers found that, in all groups, taking a pill with the same amount of caffeine as 2–3 cups of coffee resulted in a significant decrease in glucose uptake, which caused a rise in blood glucose levels. After exercise, glucose uptake was slightly better, but eating or drinking caffeine was still linked with a significant decline in glucose uptake.

What were the limitations of the study?
The researchers studied a small group of white, middle-aged men with similar lifestyles. Because the subjects were similar, it is difficult to apply the study's findings to other people.

What are the implications of the study?
Caffeine is linked with a decline in the body's ability to turn glucose into energy, regardless of exercise, obesity, or type 2 diabetes.
In this study, caffeine was taken in a pill. The results of this study do not apply to coffee, which contains many other substances (potassium, antioxidants, and magnesium) that seem to help people with type 2 diabetes. More studies are needed to look at the long-term effects of caffeine, taken in any form, on the body's use of glucose and blood glucose levels

Myth Busting Section:

Myth: If You Exercise, You Can Eat Anything You Want

If you try to make up for poor nutrition by exercising, you are going to be disappointed. Having an active lifestyle does not allow you to neglect your diet. It is important to practice a well-rounded healthy lifestyle including a proper diet. In many cases, being physically active and feeling good about yourself will influence your eating habits in a positive way!

Education Section:

Interested in joining a fitness centre? It's easy to be intimidated. Keep the following tips in mind.

Making the fitness centre less scary: If you would like to try out a public fitness centre but feel uncomfortable, here are a few tips to help get you started:

- Choose a facility that is convenient for you, and suits you. If it is too inconvenient, it will be harder to get motivated to go.
- Make an appointment with the exercise specialist on site and have them teach you some basic exercises.
- When in doubt ask the exercise specialist on site. Don't go by what you see other people doing, as they may not be doing the exercise correctly!
- Try out a fitness class. Many places offer a variety of classes tailored to different needs.
- Try to go often. The more you go, the more comfortable you will feel.
- Ask what times the centre is less busy, and try to go at those times.
- Remember that most people are focused on their own workout, and do not pay attention to others.
- Remember that everyone is a beginner once.

Fitness Memberships too expensive?

The cost of a gym membership can be enough to deter even the motivated person. Be sure to explore all the options in your community before closing the door on the fitness centre completely! Many city-owned facilities have reduced payment options for lower income individuals and families. Organizations like the YMCA often have similar programs where assistance can be provided if there is a need.

Fitness Tip:

For many people, the most convenient time to fit physical activity into their daily routine is in the morning. Try sleeping in your exercise clothes so all you have to do is jump out of bed and go. You could also try laying out your clothes the night before so everything is ready when you are. These can also be great motivators to help you roll out of bed in the morning.

Week 12

Congratulations! This week brings us to the close of the study. I want to compliment each and every one of you for sticking with the program! I hope that you were able to take away knowledge, skills and motivation to keep at it. At the end of this week we will be emailing you a link to the study questionnaire. This questionnaire is similar to the first and it should only take you 20-30 minutes to complete.

For the remainder of the year this website will continue to hold all the information you had access to, minus the counsellor and message board. Please continue to access the site if you would like to refresh your memory or just brush up on what you learned.

As a final thought, I would like you to email your counsellor with your success story. At the beginning of the study we shared several testimonials of people who have benefited from including physical activity into their lives. Do you have something similar? Share it with your counsellor and celebrate your successes!

Thanks again for your participation. You will be receiving a final summary of the results via email in the next few months.

Research Section:
Diabetes Is a Family Matter

Long-term (1- and 2-year) effects of lifestyle intervention in type 2 diabetes relatives, by H.K. Brekke and colleagues. Diabetes Res Clin Pract 70:225–234, 2005.

What is the problem and what is known about it so far?
Following a healthy diet and exercising are important factors for staying healthy and warding off type 2 diabetes. What's more, improving one's diet and adopting other healthy lifestyle habits can improve a person's control over their diabetes.
It's also known that first-degree relatives (parents, children, or siblings) of people with diabetes are more likely to get the disease themselves. However, it isn't known if -- or how much -- a healthy lifestyle benefits first-degree relatives of people with diabetes.

Why did the researchers do this particular study?
The researchers wanted to study the long-term effects of diet and exercise in individuals closely related to people with diabetes.

Who was studied?
The study included 77 people, between 25 and 55 years old, who are first-degree relatives of people with diabetes. All the participants were healthy and didn't have diabetes or other problems related to how the body handles glucose in the blood.

How was the study done?
Participants were put into one of three groups. One group was put on a diet aimed at reducing saturated fats, increasing monounsaturated fats from fish and vegetables, and

increasing consumption of fresh fruits and vegetables. The diet also encouraged participants to eat foods that slowly release glucose into the blood (foods with a low glycemic index) and discouraged participants from eating foods that rapidly release glucose into the blood (foods with a high glycemic index), which is believed to reduce the chance of getting diabetes.
A second group's participants were put on the same diet and were also encouraged to increase their physical activity to at least 30 minutes a day four or five days per week. The third group, for comparison, was told to keep to their usual eating habits and level of physical activity. At the end of one year, some of these participants were put on the same diet as the first group.
All of the participants were followed for two years.

What did the researchers find?
The dietary changes showed healthful benefits that remained for the entire two-year study period. Participants in the second group also benefited from getting more exercise, and lost an average of 2.5% of their body weight. The improvements were greater among people who changed both their diet and exercise routines, compared to those who followed only the diet.

What were the limitations of the study?
Since the participants who followed their usual routines were put on a diet after one year, there wasn't a group to compare to at the end of two years.

What are the implications of the study?
Relatives of people with diabetes can help avoid getting the disease by adopting healthy eating habits and increasing their physical activity.

Education Section:
Physical activity in not only good for your body it's great for you mind as well! The psychological and emotional benefits from physical activity are numerous. Either brief periods of intense training or prolonged aerobic workouts can raise the levels of certain chemicals in the brain, such as endorphins, adrenaline, serotonin and dopamine that are associated with a feeling of well-being. Rhythmic aerobic and yoga exercises help combat stress and anxiety. And, of course, weight loss and increased muscle tone from strength training can boost self-esteem.

A 1999 review of multiple studies found that physical activity advances the treatment of clinical depression and anxiety, enhances moods, and improves self-esteem. Some studies are also reporting that physical activity is as effective as antidepressant agents in relieving depression and it may even be better in maintaining normal mood over time.

Aerobic exercise is also linked with improved mental vigor, including reaction time, acuity, and math skills. Exercising may even enhance creativity and imagination. According to one study, older people who are physically fit respond to mental challenges just as quickly as unfit young adults. In fact, a 2001 study reported that older people who

regularly exercised had lower rates of mental deterioration, Alzheimer's and dementia of any type.

Myth Busting Section:

Myth: Doing housework is just as good as doing aerobic exercise like brisk walking, swimming, or biking.

Doing housework such as laundry, taking out the garbage and vacuuming does get you up and moving, but does not normally provide the important health benefits of an aerobic activity such as a brisk 20 minute walk. This is because household chores do not normally get your heart and lungs working at a moderate intensity. Also, such activities are often intermittent and so do not keep your heart rate elevated for a long enough time. In order to improve the health of your heart, you must work towards doing aerobic activity for a minimum of 10 minutes at a time at a moderate intensity.

So it's important to value household work as moving more but also aim to include more intense cardiovascular activities into your day.

Fitness Tip:

Try scheduling physical activity into your daily planner. If you are someone who uses a day planner of some sort, schedule physical activity just as you would a meeting. Block off a section of time and give it the same importance you would anything else at work. This way you will have made time for the activity and are less likely to skip it. If you don't work or don't use scheduling as part of your job, you can still take advantage of this technique. Block off time to be physically active in your day. Post it on a sticky not on the fridge or your work station and don't let other commitments take away from that time. Again, treat it like you would any other important scheduled meeting or appointment.

Week 1 – Control Group

Message from the Project Coordinator: Tanis Liebreich

I want to thank you again for participating in this important research project. As you remember the goal of Diabetes NetPLAY is to help people like you get regular physical activity. By being a part of the control group, you will help us to assess the effectiveness of our study. A control group serves as a standard comparison against the intervention group, we wouldn't know if our study was effective if we didn't have anything to compare it to. Therefore, your continued participation is critical in the success of this study!

Please take the time to browse the links provided on this website. Both contain physical activity recommendations for improving and maintaining a healthy lifestyle.

In 12 weeks, I will be sending you an email message with a link to the study post-test questionnaire. Once you have submitted the completed questionnaire, you will be provided with full access to the study website.

Again, I would like to thank-you for your participation. If you have any questions or concerns over the next 3 months, please do not hesitate to contact me via email at tanisl@ualberta.ca or by phone at (780) 492-1019 (please call collect if calling long distance).

Post-Intervention Access for Control Group

Welcome to Diabetes NetPLAY!

Message from the Project Coordinator: Tanis Liebreich

I want to thank you again for participating in this important research project. The goal of Diabetes NetPLAY is to help people like you get regular physical activity.

As you know, the website portion of the study is complete; you can continue to view all information on this website, log your activity and use the message board to communicate with one another for the reminder of the year. However, the email counselling function will no longer be active and the message board and logbooks will not be monitored by study staff and is, therefore, available for personal use only!

There are three main sections to this website:

- Learning Centre
- Message board
- Log book

Click on the appropriate tab on the left side of this page to find out more information on each section.

Take this opportunity to browse the website and become familiar with its many features.

Log Book
One component of this website is the logbook. This is a useful tool to help you track your physical activity. Simply choose the type of physical activity you did from the drop down list. Type in the correct date and the amount of time in minutes you spent doing the activity in the appropriate fields. Record any comments you feel are necessary (for example, felt really energized or my knee hurt etc.) and then click the 'add entry' button. You will notice the entry is recorded at the bottom.

Only you will be able to see the activity you are doing. Everyone will be at their own level so do what is best for you!

Keep track of your progress and successes with this great tool!

Learning Centre
The learning centre contains all information from the various sections of this website featured in the past. All past information will be archived here for the remainder of the year.

There are five main areas of information in the Learning Centre:

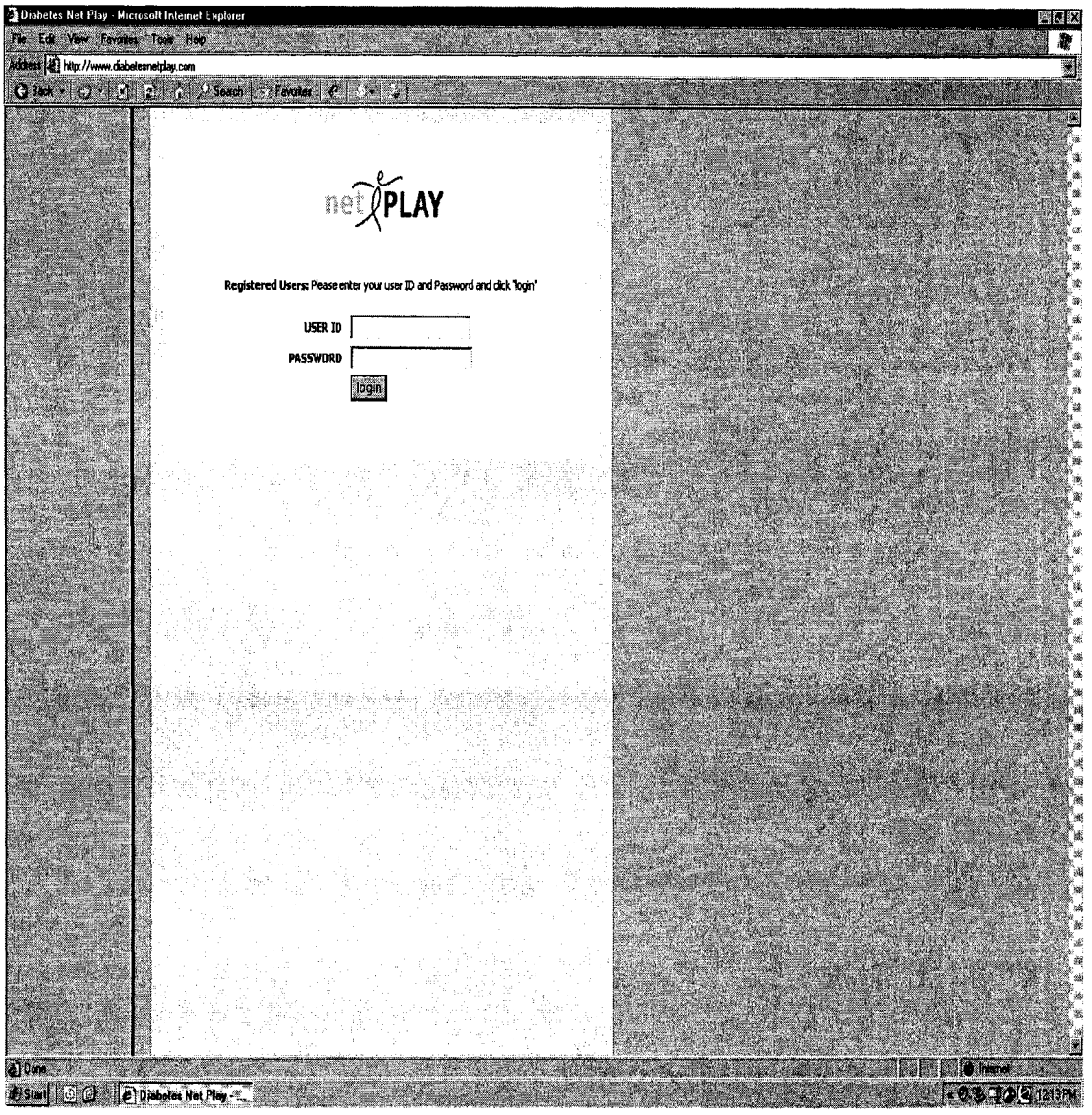
- Weekly topics
- Fitness tips

- Research
- Education
- Myth busting

Should you need to refer to any of the past information, click on the appropriate topic and find the corresponding week. This will ensure you access to the information at all times during the study.

Message Board

The message board can be used as a tool to interact with one another on topics posted. The main page displays the various topics that will be posted and discussed. To view the specific discussions, click on the desired topic on the left. You will be taken to a new page which displays all the posted responses by other participants. Scroll down the page and you will see an area where you can post your own reply. Type in your message and hit the 'post reply' button. Your response will now appear so others can read it. Please note that no personal information will be disclosed on this site. Others will only know you by your login name.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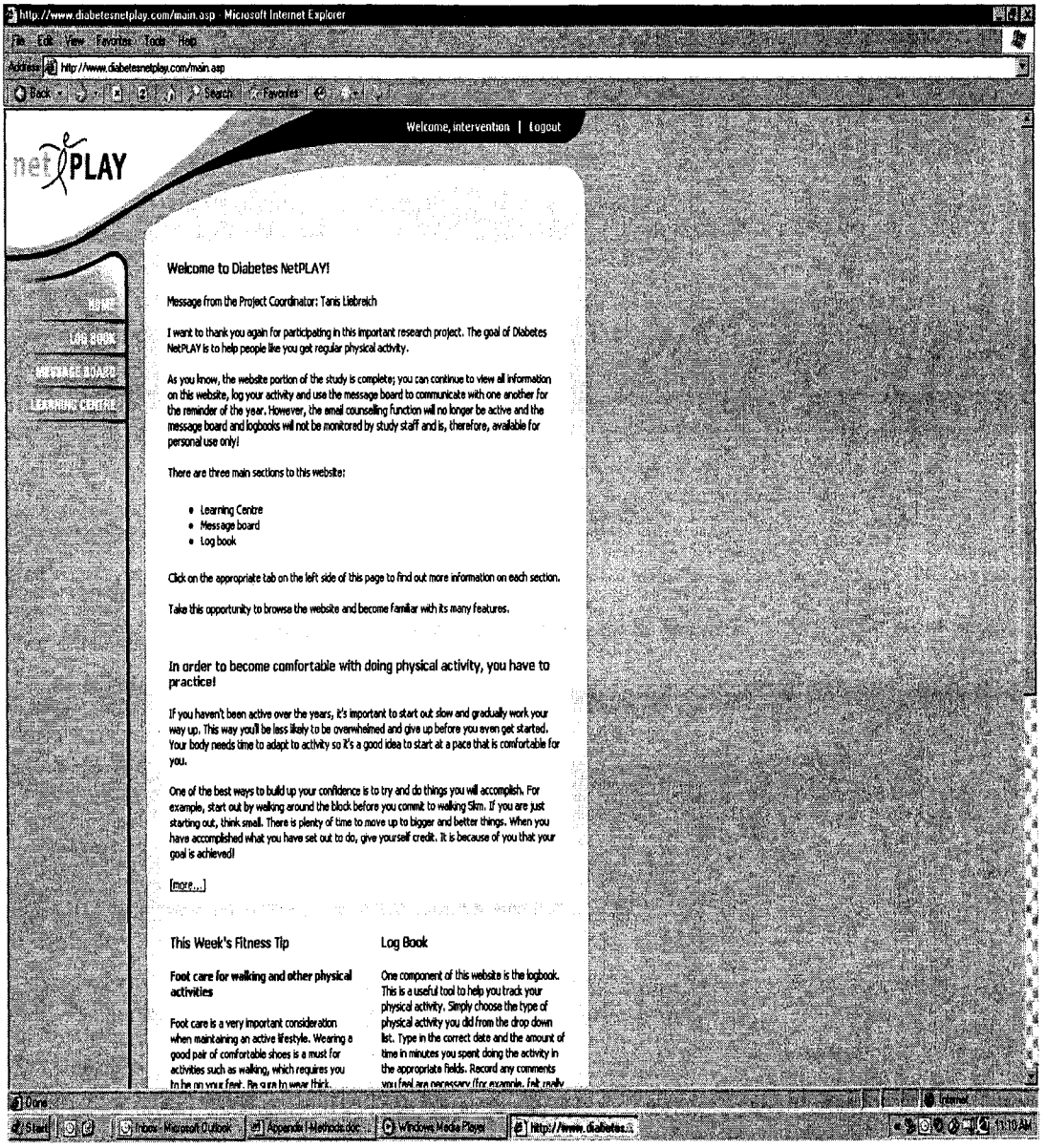
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There are three main sections to this website:
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Message board
Log book
Click on the appropriate tab on the left side of this page to find out more information on each section.
Take this opportunity to browse the website and become familiar with its many features.
In order to become comfortable with doing physical activity, you have to practice!
If you haven't been active over the years, it's important to start out slow and gradually work your way up. This way you'll be less likely to be overwhelmed and give up before you even get started. Your body needs time to adapt to activity so it's a good idea to start at a pace that is comfortable for you.
One of the best ways to build up your confidence is to try and do things you will accomplish. For example, start out by walking around the block before you commit to walking 5km. If you are just starting out, think small. There is plenty of time to move up to bigger and better things. When you have accomplished what you have set out to do, give yourself credit. It is because of you that your goal is achieved!
[more...]
This Week's Fitness Tip
Foot care for walking and other physical activities
Foot care is a very important consideration when maintaining an active lifestyle. Wearing a good pair of comfortable shoes is a must for activities such as walking, which requires you to be on your feet. Be sure to wear thick
Log Book
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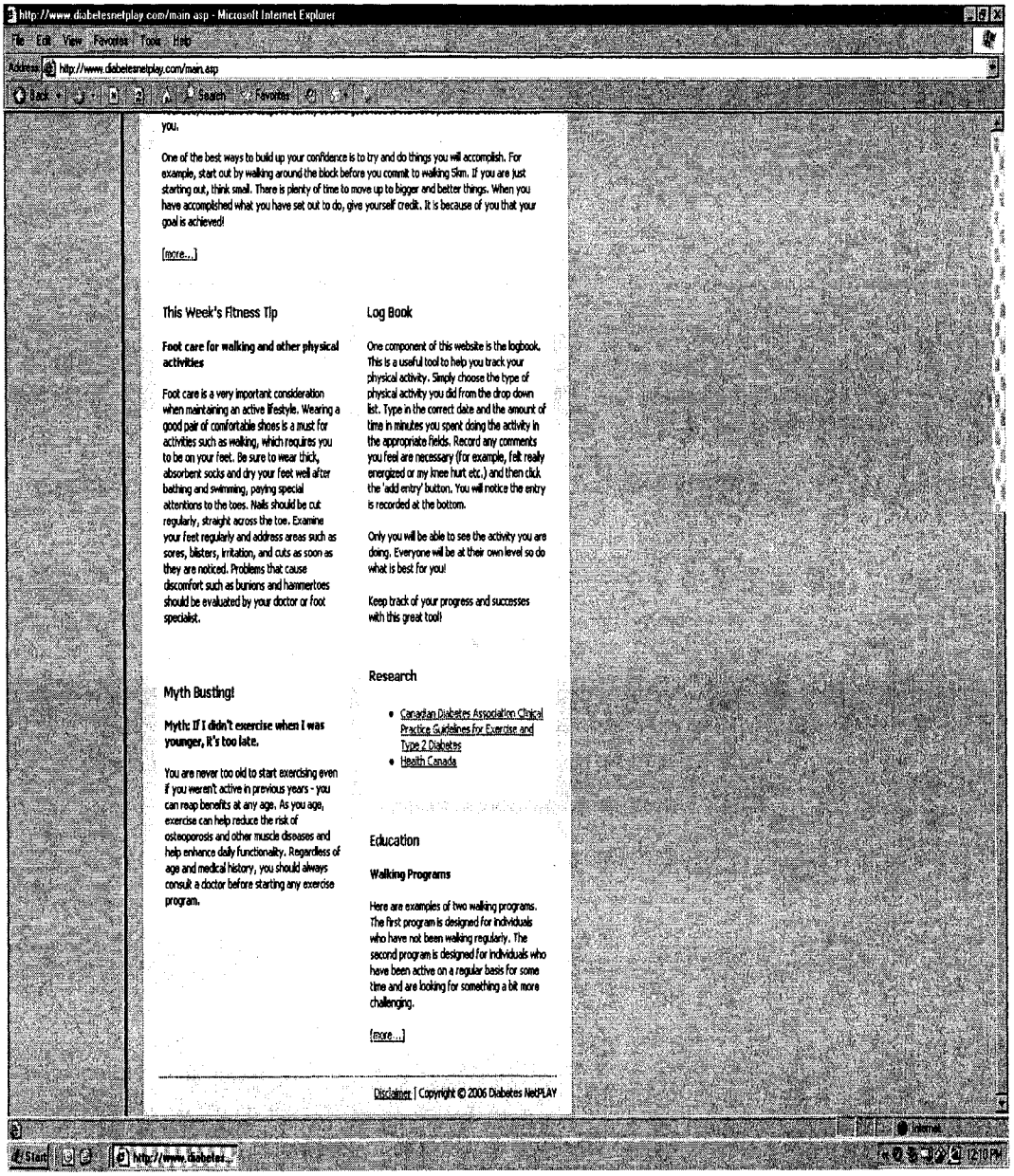
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[more...]
This Week's Fitness Tip
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Foot care is a very important consideration when maintaining an active lifestyle. Wearing a good pair of comfortable shoes is a must for activities such as walking, which requires you to be on your feet. Be sure to wear thick, absorbent socks and dry your feet well after bathing and swimming, paying special attentions to the toes. Nails should be cut regularly, straight across the toe. Examine your feet regularly and address areas such as sores, blisters, irritation, and cuts as soon as they are noticed. Problems that cause discomfort such as bunions and hammertoes should be evaluated by your doctor or foot specialist.
Myth Busting!
Myth: If I didn't exercise when I was younger, it's too late.
You are never too old to start exercising even if you weren't active in previous years - you can reap benefits at any age. As you age, exercise can help reduce the risk of osteoporosis and other muscle diseases and help enhance daily functionality. Regardless of age and medical history, you should always consult a doctor before starting any exercise program.
Log Book
One component of this website is the logbook. This is a useful tool to help you track your physical activity. Simply choose the type of physical activity you did from the drop down list. Type in the correct date and the amount of time in minutes you spent doing the activity in the appropriate fields. Record any comments you feel are necessary (for example, felt really energized or my knee hurt etc.) and then click the 'add entry' button. You will notice the entry is recorded at the bottom.
Only you will be able to see the activity you are doing. Everyone will be at their own level so do what is best for you!
Keep track of your progress and successes with this great tool!
Research
Canadian Diabetes Association Clinical Practice Guidelines for Exercise and Type 2 Diabetes
Health Canada
Education
Walking Programs
Here are examples of two walking programs. The first program is designed for individuals who have not been walking regularly. The second program is designed for individuals who have been active on a regular basis for some time and are looking for something a bit more challenging.
[more...]
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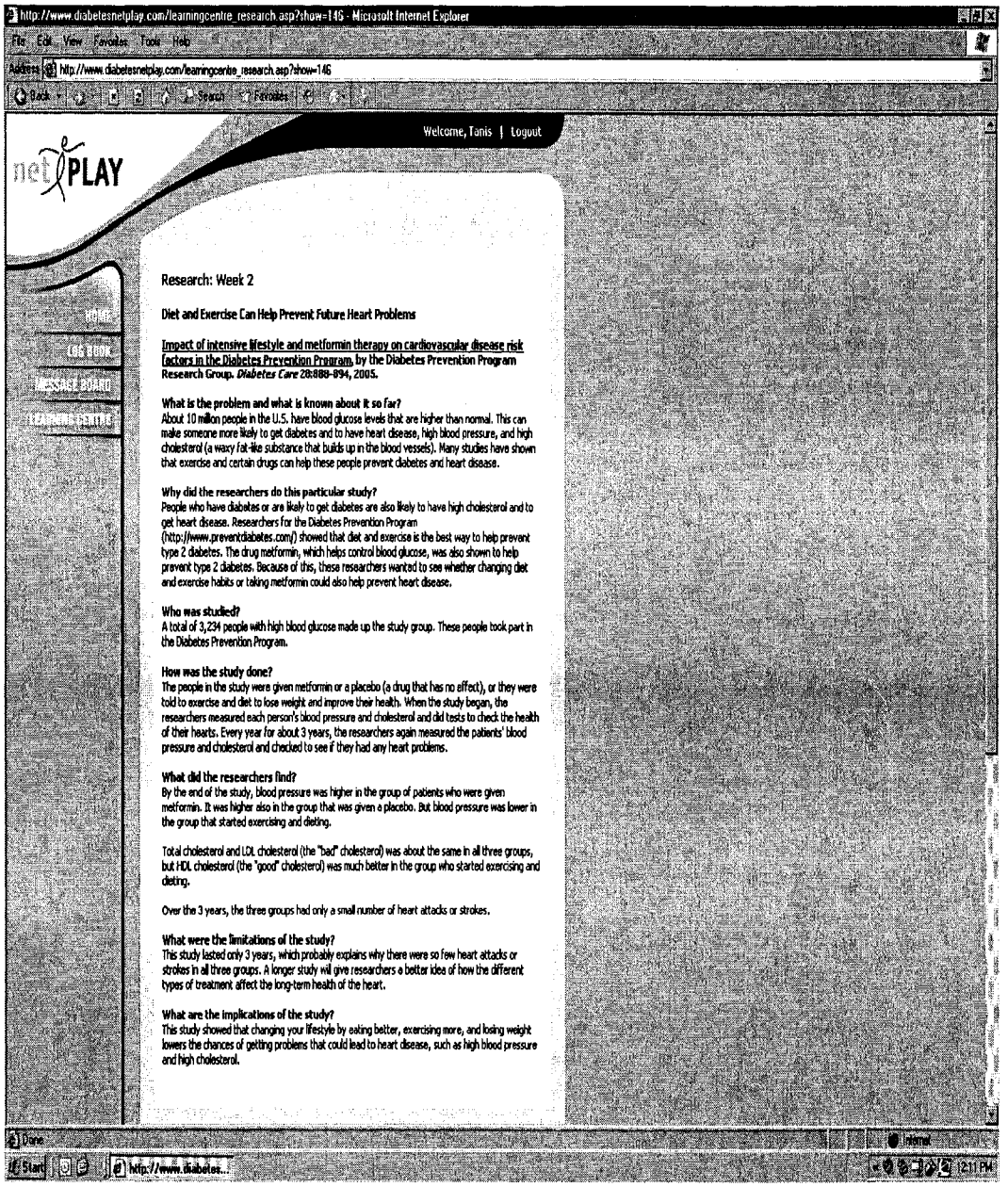
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Research: Week 2
Diet and Exercise Can Help Prevent Future Heart Problems
Impact of intensive lifestyle and metformin therapy on cardiovascular disease risk factors in the Diabetes Prevention Program, by the Diabetes Prevention Program Research Group. Diabetes Care 28:888-894, 2005.
What is the problem and what is known about it so far?
About 10 million people in the U.S. have blood glucose levels that are higher than normal. This can make someone more likely to get diabetes and to have heart disease, high blood pressure, and high cholesterol (a waxy fat-like substance that builds up in the blood vessels). Many studies have shown that exercise and certain drugs can help these people prevent diabetes and heart disease.
Why did the researchers do this particular study?
People who have diabetes or are likely to get diabetes are also likely to have high cholesterol and to get heart disease. Researchers for the Diabetes Prevention Program (http://www.preventdiabetes.com/) showed that diet and exercise is the best way to help prevent type 2 diabetes. The drug metformin, which helps control blood glucose, was also shown to help prevent type 2 diabetes. Because of this, these researchers wanted to see whether changing diet and exercise habits or taking metformin could also help prevent heart disease.
Who was studied?
A total of 3,234 people with high blood glucose made up the study group. These people took part in the Diabetes Prevention Program.
How was the study done?
The people in the study were given metformin or a placebo (a drug that has no effect), or they were told to exercise and diet to lose weight and improve their health. When the study began, the researchers measured each person's blood pressure and cholesterol and did tests to check the health of their hearts. Every year for about 3 years, the researchers again measured the patients' blood pressure and cholesterol and checked to see if they had any heart problems.
What did the researchers find?
By the end of the study, blood pressure was higher in the group of patients who were given metformin. It was higher also in the group that was given a placebo. But blood pressure was lower in the group that started exercising and dieting.
Total cholesterol and LDL cholesterol (the "bad" cholesterol) was about the same in all three groups, but HDL cholesterol (the "good" cholesterol) was much better in the group who started exercising and dieting.
Over the 3 years, the three groups had only a small number of heart attacks or strokes.
What were the limitations of the study?
This study lasted only 3 years, which probably explains why there were so few heart attacks or strokes in all three groups. A longer study will give researchers a better idea of how the different types of treatment affect the long-term health of the heart.
What are the implications of the study?
This study showed that changing your lifestyle by eating better, exercising more, and losing weight lowers the chances of getting problems that could lead to heart disease, such as high blood pressure and high cholesterol.
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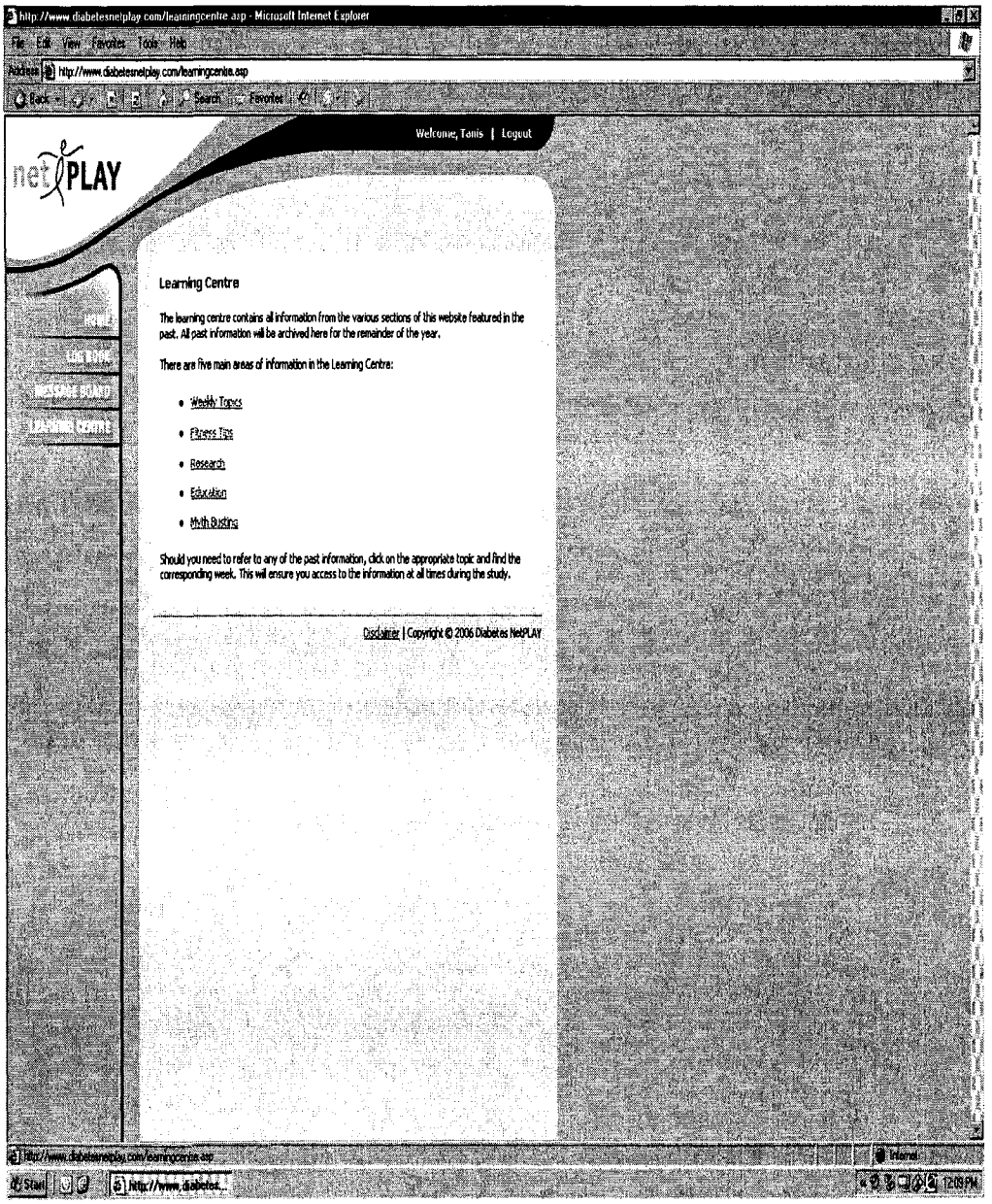
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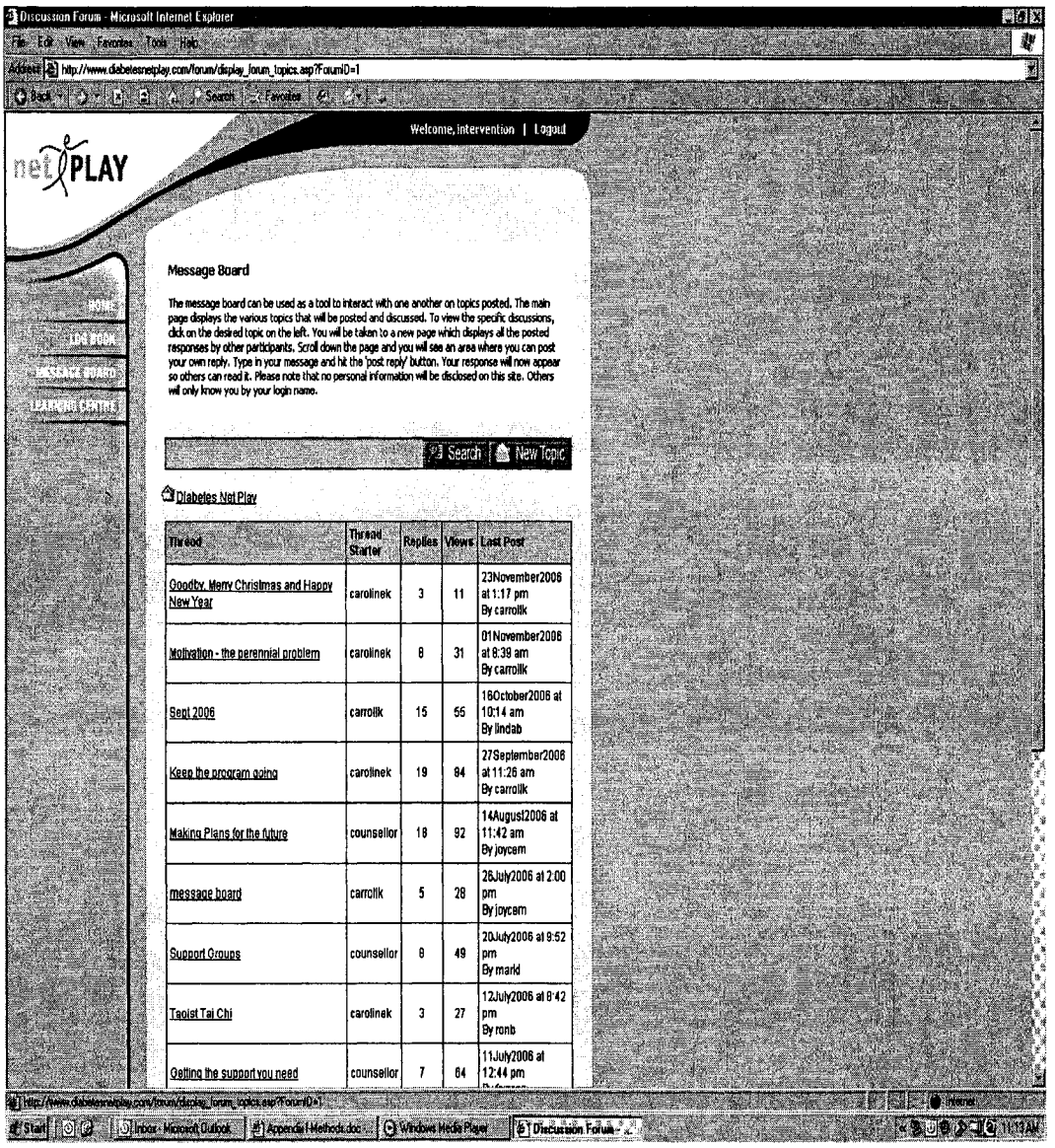
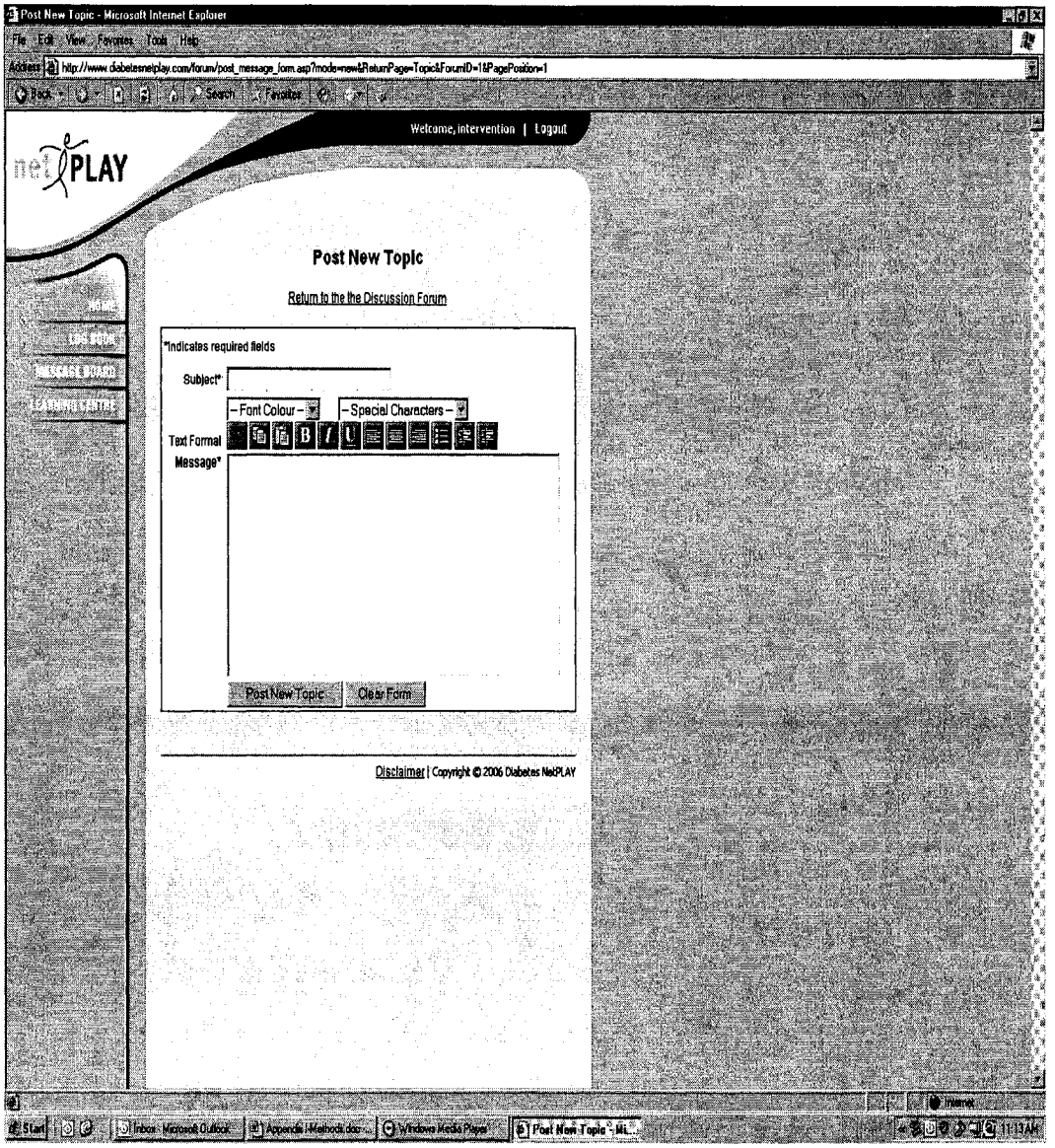
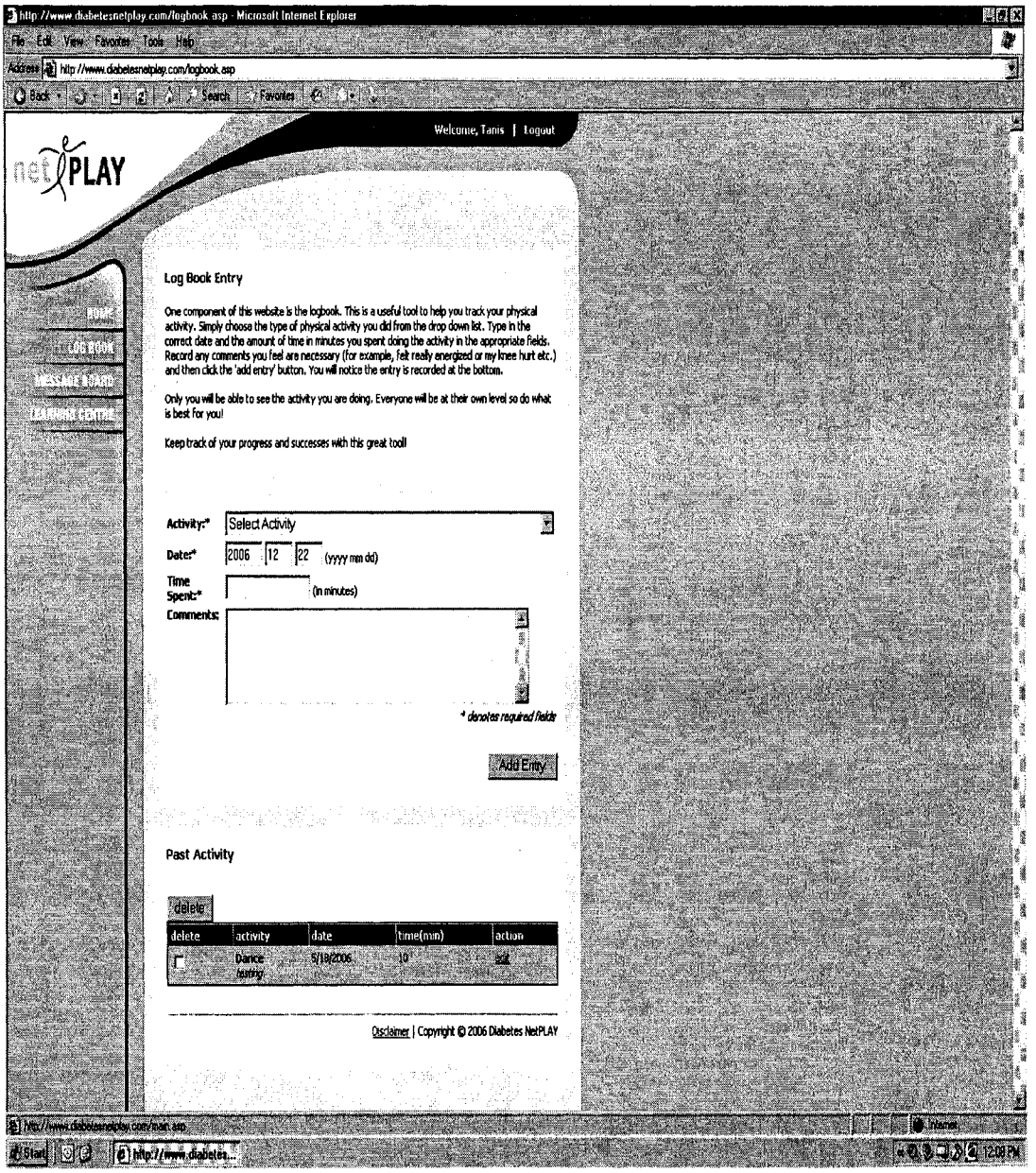
netPLAY
Learning Centre
The learning centre contains all information from the various sections of this website featured in the past. All past information will be archived here for the remainder of the year.
There are five main areas of information in the Learning Centre:
Weekly Topics
Fitness Tips
Research
Education
Myth Busting
Should you need to refer to any of the past information, click on the appropriate topic and find the corresponding week. This will ensure you access to the information at all times during the study.
Disclaimer | Copyright © 2006 Diabetes NetPLAY
Start
http://www.diabetes...
12:09 PM


Discussion Forum - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://www.diabetesnetplay.com/forum/display_forum_topics.asp?ForumID=1
Back Search Favorites
Welcome, intervention | Logout
netPLAY
HOME
LOG BOOK
MESSAGE BOARD
LEARNING CENTRE
Message Board
The message board can be used as a tool to interact with one another on topics posted. The main page displays the various topics that will be posted and discussed. To view the specific discussions, click on the desired topic on the left. You will be taken to a new page which displays all the posted responses by other participants. Scroll down the page and you will see an area where you can post your own reply. Type in your message and hit the 'post reply' button. Your response will now appear so others can read it. Please note that no personal information will be disclosed on this site. Others will only know you by your login name.
Search
New Topic
Diabetes Net Play
Thread
Thread Starter
Replies
Views
Last Post
Goodby, Merry Christmas and Happy New Year
carolinek
3
11
23November2006 at 1:17 pm By carrollk
Motivation - the perennial problem
carolinek
8
31
01November2006 at 8:39 am By carrollk
Sept 2006
carrollk
15
55
18October2006 at 10:14 am By lindab
Keep the program going
carolinek
19
94
27September2006 at 11:26 am By carrollk
Making Plans for the future
counsellor
18
92
14August2006 at 11:42 am By joycem
message board
carrollk
5
28
26July2006 at 2:00 pm By joycem
Support Groups
counsellor
8
49
20July2006 at 9:52 pm By markd
Taoist Tai Chi
carolinek
3
27
12July2006 at 8:42 pm By ronb
Getting the support you need
counsellor
7
64
11July2006 at 12:44 pm
Start
Inbox - Microsoft Outlook
Appendix Methods.doc
Windows Media Player
Discussion Forum -
11:13 AM


Post New Topic - Microsoft Internet Explorer
Welcome, intervention | Logout
Post New Topic
Return to the the Discussion Forum
*Indicates required fields
Subject*
– Font Colour –
– Special Characters –
Text Format
Message*
Post New Topic
Clear Form
Disclaimer | Copyright © 2006 Diabetes NetPLAY


http://www.diabetesnetplay.com/logbook.asp - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://www.diabetesnetplay.com/logbook.asp
Back Search Favorites
Welcome, Tanis | Logout
netPLAY
HOME
LOG BOOK
MESSAGE BOARD
TRAINING CENTRE
Log Book Entry
One component of this website is the logbook. This is a useful tool to help you track your physical activity. Simply choose the type of physical activity you did from the drop down list. Type in the correct date and the amount of time in minutes you spent doing the activity in the appropriate fields. Record any comments you feel are necessary (for example, felt really energized or my knee hurt etc.) and then click the 'add entry' button. You will notice the entry is recorded at the bottom.
Only you will be able to see the activity you are doing. Everyone will be at their own level so do what is best for you!
Keep track of your progress and successes with this great tool!
Activity:* Select Activity
Date:* 2006 12 22 (yyyy mm dd)
Time Spent:* (in minutes)
Comments:
* denotes required fields
Add Entry
Past Activity
delete
delete activity date time(min) action
Dance training 9/19/2006 10 edit
Disclaimer | Copyright © 2006 Diabetes NetPLAY
Start
12:08 PM

Appendix IV: Information Letters & Consent Forms

COVER LETTER - Cohort

Date

Dear

Re: Diabetes Net PLAY (PhysicaL ActivitY)

We would like to sincerely thank you for your interest in our research projects in the past and for consenting to be contacted for future research studies.

An exciting pilot project is being launched in February 2006 assessing the use of the Internet and email to help you get regular physical activity. We hope you find this study interesting and we would like you to consider participating in this very important research. We have attached an information sheet which describes the current project and what is required if you agree to take part. ***Please note that it does not matter how much physical activity you are doing right now in order to participate in this project.***

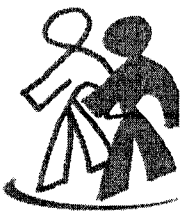
Attached is: 1 copy of the Information Sheet
1 copy of the Consent Form (please return completed and print a second off for your records)
Physical Activity Readiness Questionnaire (PAR-Q)

After reading the materials in this package, if you have any questions or concerns please contact us by telephone (780) 492-1019 or by email at tanisl@ualberta.ca

Thank-you for your time and consideration.

Sincerely,

Ronald C. Plotnikoff, PhD
Principal Investigator
Professor
University of Alberta
Centre for Health Promotion Studies &
Faculty of Physical Education and Recreation



COVER LETTER – New participant

Date, 2005

Dear name of recipient

Re: Diabetes Net PLAY (**Physica**L **Activit**Y)

Thank you for your interest in participating in our research study beginning in the February. This important study involves assessing the use of the Internet and email to help you get regular physical activity.

In this package you will find an information sheet which describes the study and what is required if you agree to take part.

Attached is: 1 copy of the Information Sheet
1 copies of the Consent Form (please return completed and print a second off for your records)
Physical Activity Readiness Questionnaire (PAR-Q)

After reading the materials in this package, if you have any questions or concerns please contact us by telephone at (780) 492-1019 or by email at tanisl@ualberta.ca

Thank-you for your time and consideration.

Sincerely,

Ronald C. Plotnikoff, PhD
Principal Investigator
Professor
University of Alberta
Centre for Health Promotion Studies &
Faculty of Physical Education and Recreation

INFORMATION SHEET – Health Professionals

Title of Project: Diabetes Net PLAY (PhysicaL ActivitY)

Principal Investigator: Dr. Ron Plotnikoff, Centre for Health Promotion Studies, Faculty of Physical Education and Recreation, University of Alberta (780) 492-6315.

Co-Investigators:

Name	Faculty	University of	Phone
Dr. Kerry Courneya	Physical Education	Alberta	(780) 492-1031
Dr. Normand Boule	Physical Education	Alberta	(780) 492-4695
Tanis Liebreich MSc (candidate)	Health Promotion	Alberta	(780) 492-1019

The goal of this study is to test the use of the internet and email counseling as ways to help people living with type 2 diabetes get regular physical activity. The findings of this study will provide valuable information about how to help adults living with type 2 diabetes meet Canadian Diabetes Association recommendations for physical activity.

Physical activity is defined as an activity that improves your physical fitness and/or health. Some examples are walking at a moderate pace, biking, or participating in a fitness class. ***Participants do not have to be doing physical activity right now in order to participate in this study.***

Participation in this 12-week project will require participants to:

1. Complete a questionnaire two times during the study (i.e., at the start of the study, and then at the end). Each questionnaire will take about 30 minutes to complete.

2. Participants will be randomly assigned to receive access to a physical activity website and email counselling intervention or access to standard physical activity information by the Canadian Diabetes Association and Health Canada. Participants in the physical activity website/email counselling group will receive full access to a study website designed to cover various topics related to physical activity. Additional features of the website include a message board to allow interaction between participants, updates on the latest physical activity research and activities that may motivate individuals to stay active. In addition, participants will be asked to report their physical activity minutes to the study coordinator at the end of each week. The control group will receive limited access to the study website which includes internet links to the Canadian Diabetes Association physical activity guidelines and Health Canada's Physical Activity Guide.

Summary of Diabetes Net PLAY activities

	Beginning Feb 06	12 weeks Apr 06
All Participants		
30 minute Questionnaire	√	√
Unique username and password given	√	√
Control Group Participants		
Physical Activity website (limited access)	Website will include internet links to the Canadian Diabetes Association's physical activity guidelines and Health Canada's Physical Activity Guide.	
Thank-you gifts	$25 value (choice of Chapter's Books gift certificate or pedometer and water bottle)	
Study Results	1-2 page summary of study results will be provided to each participant	
Intervention Group Participants		
Physical Activity Log Sheets	Physical activity minutes will be recorded and emailed to study coordinator at the end of each week	
Physical Activity website (full access)	Website will include topics on motivation, goal setting, time management, rewards, and information all related to physical activity. A message board will be available for participants to communicate and a research section will have information on the latest research related to physical activity and diabetes.	
Email Counselling	Counselling via email with participants, once per week for the duration of the study.	
Study Results	1-2 page summary of individual plus overall study results will be provided to each participant.	

Potential Risks to Participants:

Any abrupt change in physical activity behaviour may result in muscle soreness and/or injury. We will provide information about how to increase physical activity behaviour gradually and safely. We ask that participants complete the physical activity readiness questionnaire (PAR-Q), and if required, visit their doctor before agreeing to participate.

Benefits to Participants:

We know that physical activity has many benefits for those with type 2 diabetes including reducing the risk of cardiovascular disease, improving glycemic control and blood pressure. If successful, this study will help participants achieve a level of physical activity that has been shown to be beneficial to those living with type 2 diabetes.

Participant privacy and confidentiality will be protected. Only the research team will have access to research information. All information will be kept in a locked filing cabinet or in a password protected computer. Once the final report is written, the information will be kept for a period of seven years, after which it will be destroyed. Participant identity will not be revealed and no information will be associated with their name in any report or presentation resulting from this research.

Participants are free to withdraw from this study at any time without giving a reason. If knowledge gained from this study or any other study becomes available which could influence their decision to continue, they will be promptly informed. If you have any questions or concerns about any aspect of this study, you may contact me (780) 492-4372 or the Project Coordinator, Tanis Liebreich, at (780) 492-1019, tanisl@ualberta.ca.

If you have concerns about the ethical standards of this study, you may contact Dr. Brian Maraj, Chair of the Faculty Research Ethics Board, at 492-5910 or brian.maraj@ualberta.ca. Dr. Maraj has no direct involvement with this project.

We sincerely thank you for your time in this regard.

Ronald C. Plotnikoff, PhD
Principal Investigator
Professor,
Faculty of Physical Education and Recreation,
Centre for Health Promotion Studies
University of Alberta, Canada
Edmonton AB, T6G 2H9
Phone: (780) 492-4372 or 492-1358

INFORMATION SHEET - Participants

Title of Project: Diabetes Net PLAY (PhysicaL ActivitY)

Principal Investigator: Dr. Ronald Plotnikoff, Centre for Health Promotion Studies, Faculty of Physical Education and Recreation, University of Alberta (780) 492-6315.

Co-Investigators:

Name	Faculty	University of	Phone
Dr. Kerry Courneya	Physical Education	Alberta	(780) 492-1031
Dr. Normand Boule	Physical Education	Alberta	(780) 492-4695
Tanis Liebreich MSc (candidate)	Health Promotion	Alberta	(780) 492-1019

The goal of this study is to test the use of the Internet and email counselling as ways to help people living with type 2 diabetes get regular physical activity. The findings of this study will provide valuable information about how to help adults living with type 2 diabetes meet Canadian Diabetes Association recommendations for physical activity.

Physical activity is defined as an activity that improves your physical fitness and/or health. Some examples are walking at a moderate pace, biking, or participating in a fitness class. ***You do not have to be doing physical activity right now in order to participate in this study.***

Your participation in this 12-week project will require you to:

1. Complete a questionnaire two times during the study (i.e., at the start of the study, and then at the end). Each questionnaire will take about 30 minutes to complete.

2. As a participant you will be randomly assigned to receive access to a physical activity website and email counselling intervention or access to standard physical activity information by the Canadian Diabetes Association and Health Canada. The participants in the physical activity website/email counselling group will receive full access to a study website designed to cover various topics related to physical activity. Additional features of the website include a message board to allow interaction between participants, updates on the latest physical activity research and activities that may motivate you to stay active. In addition, participants will be asked to report their physical activity minutes to the study coordinator at the end of each week. The control group will receive limited access to the study website which includes Internet links to the Canadian Diabetes Association physical activity guidelines and Health Canada's Physical Activity Guide.

Summary of Diabetes Net PLAY activities

	Beginning Feb 06	12 weeks Apr 06
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Unique username and password given	√	√
Control Group Participants		
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Physical Activity website (full access)	Website will include topics on motivation, goal setting, time management, rewards, and information all related to physical activity. A message board will be available for participants to communicate and a research section will have information on the latest research related to physical activity and diabetes.	
Email counselling	Counselling via email with participants, once per week for the duration of the study.	
Study Results	1-2 page summary of individual plus overall study results will be provided to each participant.	

Potential Risks to Participants:

Any abrupt change in physical activity behaviour may result in muscle soreness and/or injury. We will provide information about how to increase your physical activity behaviour gradually and safely. We ask that you complete the physical activity readiness questionnaire (PAR-Q) in this package, and if required, visit your doctor before agreeing to participate.

Benefits to Participants:

We hope you will find that your participation in this study is both educational and enriching. You will be regularly provided with information about physical activity and type 2 diabetes.

As a participant your privacy and confidentiality will be protected. Only the research team will have access to research information. All information will be kept in a locked filing cabinet or in a password protected computer. Once the final report is written, the information will be kept for a period of seven years, after which it will be destroyed. Your identity will not be revealed and no information will be associated with your name in any report or presentation resulting from this research.

You are free to withdraw from this study at any time without giving a reason. If knowledge gained from this study or any other study becomes available which could influence your decision to continue, you will be promptly informed. If you have any questions or concerns about any aspect of this study, you may contact me (780) 492-4372 or the Project Coordinator, Tanis Liebreich, at (780) 492-1019, tanisl@ualberta.ca.

If you have concerns about the ethical standards of this study, you may contact Dr. Brian Maraj, Chair of the Faculty Research Ethics Board, at 492-5910 or brian.maraj@ualberta.ca. Dr. Maraj has no direct involvement with this project.

We sincerely thank you for your time in this regard.

Ronald C. Plotnikoff, PhD
Principal Investigator
Professor,
Faculty of Physical Education and Recreation,
Centre for Health Promotion Studies
University of Alberta, Canada
Edmonton AB, T6G 2H9
Phone: (780) 492-4372 or 492-1358

CONSENT FORM

Title of Project: Diabetes Net PLAY (PhysicaL ActivitY)

Principal Investigator: Dr. Ronald Plotnikoff, Centre for Health Promotion Studies, Faculty of Physical Education and Recreation, University of Alberta (780) 492-6315

Co-Investigators:

Name	Faculty	University of	Phone
Dr. Kerry Courneya	Physical Education	Alberta	(780) 492-1031
Dr. Normand Boule	Physical Education	Alberta	(780) 492-4695
Tanis Liebreich MSc (candidate	Centre for Health Promotion Studies	Alberta	(780) 492-1019

1. Do you understand that you have been asked to be in a research study? Yes ☐ No ☐
2. Have you read and received a copy of the attached information sheet? Yes ☐ No ☐
3. Have you completed the physical activity readiness questionnaire (PAR-Q), and discussed increasing your physical activity with your doctor if you answered yes to any of the questions, **and/or** you are over the age of 69 years? Yes ☐ No ☐
4. Do you understand the benefits and risks involved in taking part in this research study? Yes ☐ No ☐
5. Have you had the opportunity to ask questions and discuss this study? Yes ☐ No ☐
6. Do you understand that you are free to refuse to participate, or to withdraw from this study at any time, without consequence, and that your information will be withdrawn at your request? Yes ☐ No ☐
7. Has the issue of confidentiality been explained to you? Yes ☐ No ☐
8. Do you understand who will have access to your information? Yes ☐ No ☐

Please remember to complete the attached second page...

Please let us know if you would like to participate in this study by placing a mark by one of the choices below.

☐ **YES, I give consent to participate** in this study and agree to the above-mentioned terms.

☐ **NO, I do not want to participate** in this study, but would like to hear about future studies.

☐ **NO, I do not want to participate** in this study, or any other study.

_____ _____

Phone number Email address

How much physical activity (exercise) do you do on average each week right now?
*Remember, you **do not** have to be doing regular physical activity in order to participate in this study!*

_____

_____

_____

IMPORTANT: After completing this form, please e-mail one copy. Keep a copy for yourself for your records. If you have any questions about this form, please call 780-492-1019 (call collect if long distance) or email: tanisl@ualberta.ca. Thank-you!!

Please feel free to use this space for your comments.

Physical Activity Readiness
Questionnaire - PAR-Q
(revised 2002)

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
☐	☐	**1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?**
☐	☐	**2. Do you feel pain in your chest when you do physical activity?**
☐	☐	**3. In the past month, have you had chest pain when you were not doing physical activity?**
☐	☐	**4. Do you lose your balance because of dizziness or do you ever lose consciousness?**
☐	☐	**5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?**
☐	☐	**6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?**
☐	☐	**7. Do you know of any other reason why you should not do physical activity?**

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

→

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; or
- if you are or may be pregnant – talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME _____

SIGNATURE _____ DATE _____

SIGNATURE OF PARENT or GUARDIAN (for participants under the age of majority) _____ WITNESS _____

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

Supported by: Health Canada Santé Canada

Diabetes Net PLAY – Reminder Email

DATE

This is a reminder that we have not received your reply to the research information package sent to you DATE.

If for some reason you did not receive your package, or if you have any questions, please don't hesitate to contact Tanis Liebreich, Project Coordinator at (780) 492-1019 or at tanisl@ualberta.ca.

If you have sent your completed consent form and PAR-Q – Thank you! If you have yet to do so, please take the time to fill out the consent form and PAR-Q and forward it on to the project coordinator.

Thank you for your participation. Your time and efforts are sincerely appreciated.

Letter to Doctor (accompanying poster)

Date

Dear Dr.,

I am a Master's student at the University of Alberta's Centre for Health Promotion Studies under the supervision of Dr. Ronald Plotnikoff. I have a large research study starting in March where I will be testing the use of the internet and email counselling as ways to help people living with type 2 diabetes get regular physical activity. The findings of this study will provide valuable information about how to help adults living with type 2 diabetes meet Canadian Diabetes Association recommendations for physical activity. My study is funded by the Alberta Diabetes Institute, and has received ethical approval from the University of Alberta.

I would like people living with type 2 diabetes to know about my research study and have the opportunity to participate if interested. I would be most grateful if you could display the enclosed poster(s) in your clinic in a location where potential participants would have the opportunity to read the poster.

Thanks very much for your help! If you have any questions about my research, don't hesitate to contact myself, or my thesis advisor, Dr. Plotnikoff.

Sincerely,

Tanis Liebreich, MSc (candidate)
Project Coordinator, Diabetes NetPLAY
Centre for Health Promotion Studies
University of Alberta
(780) 492-1019
tanisl@ualberta.ca

Ron Plotnikoff, PhD
Professor
Director, Physical Activity and Population Health (PAPH) Research Lab
Health Scholar, Alberta Heritage Foundation for Medical Research

The Diabetes and Physical Activity Research Program needs you!

Dr. Ron Plotnikoff at the University of Alberta, is carrying out research in Alberta on diabetes and physical activity.

The goal of this research is to better understand how the internet can be used to help individuals with type 2 diabetes be more active. If you have type 2 diabetes and have access to the internet and email this may be the study for you.

To participate or find out more information please give us a call!

Contact our team at University of Alberta:

Phone: (780) 492 - 1019
if long distance call collect
or
Email: tanisl@ualberta.ca

Research funded by the Alberta Diabetes Institute

Diabetes Research Program
tanisl@ualberta.ca
(780) 492—1019 (call collect)

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tanisl@ualberta.ca
(780) 492—1019 (call collect)

Diabetes NetPLAY: A physical activity and e-counselling intervention for individuals with type 2 diabetes.

May 8, 2006

Dear [NAME],

Thank-you for completing the first questionnaire. We are now moving to the next step of this research project. But first, we would like to give you a little background on this important study.

Background:
There is strong scientific evidence to support the importance of physical activity in the treatment of type 2 diabetes. However, there is a lack of understanding of the best ways to encourage physical activity for adults living with type 2 diabetes. Potential ways to promote physical activity include using the internet. The internet is inexpensive, can reach large numbers of people, and can be read at one's convenience. One aim of this study is to test the internet and email counselling as ways to encourage physical activity.

What to expect next:
You have been randomly assigned to the intervention group. You will have full access to the study website for the duration of the study as well as access to a study counsellor. The website will be updated on a weekly basis. You will receive a reminder email at the beginning of every week with a message to log on and a link to the website. It is up to you how often you choose to access the website. You can access it as little or as much as you like. Please take the time to browse the website during the first week and become familiar with its many features.

Email Counselling:

Your study group will receive email counselling about physical activity. At the end of each weekly topic is an email link to your study counsellor. There is suggested activities and discussion topics for you to discuss with your counsellor should you choose to use this option but feel free to discuss any concerns or questions you may have. You can access your counsellor at any time simply by clicking on the counsellor tab to the left of the homepage.
Please note: Counsellors are not trained medical personnel and therefore cannot give any direct medical advice. Should have a medical concern, please consult your physician immediately.

Message Board

The message board component of the website will be activated in the second week of the study. This tool is used as a way to communicate with one another on various topics that will be posted by the study coordinator. I really encourage you to use this function as it

will allow you to learn from one another. A new topic will be posted by the study coordinator weekly. You can then respond to the postings throughout the week. You can post a message at any time and check back to see the responses at a later date.

Instructions on how to use the message board will be posted on the message board page. Take a minute to browse through it by clicking on the message board tab on the left hand side of the page.

Log Book

You will also have access to an on-line log book. The log book tab appears on the left side of the page, this will direct you to your personal log book web page. Instructions on how to use the log book appear at the top. Use this great tool to set goals and track your progress.

Study Website: www.diabetesnetplay.com
Your user ID is:
Your password is:

Please keep your username and ID in a safe place where you can refer to it if needed.

At the end of the study:
You will also be provided with a report of your results from your questionnaires. You will also have continued access to the study website for the remainder of the year (excluding the email counselling). If you have any questions or concerns about the study please call us at (780) 492-1019 (call collect if long distance), or email at tanisl@ualberta.ca.

Sincerely,

Tanis Liebreich MSc (candidate)
Study Coordinator, Diabetes NetPLAY

Diabetes NetPLAY: A physical activity and e-counselling intervention for individuals with type 2 diabetes

May 8, 2006

Dear [NAME],

Thank-you for completing the first questionnaire. We are now moving to the next step of this research project. But first, we would like to give you a little background on this important study.

Background:

There is strong scientific evidence to support the importance of physical activity in the treatment of type 2 diabetes. However, there is a lack of understanding of the best ways to encourage physical activity for adults living with type 2 diabetes. One potential way to promote physical activity is by using the internet. Internet based information is inexpensive, can reach large numbers of people, and people can read the information at their convenience. One aim of this study is to test the internet as a way to encourage physical activity.

What to expect next:

You have now been randomly assigned to the control study group. Your study group is provided with the standard physical activity information from the Canadian Diabetes Association and Health Canada. These documents are displayed as website links on the study webpage

As a participant in the control study group, you will receive the least amount of contact from us. Your continued participation, however, is very important to the success of this study. If you have any questions or concerns don't hesitate to contact the study coordinator, Tanis Liebreich at 780-492-1019 or email tanisl@ualberta.ca.

In 12 weeks you will receive an email with an internet link to access the study post-test questionnaire (similar to the pre-test). Once you have completed this questionnaire you will receive your choice of either a $25 gift certificate to Chapters Books or a pedometer and water bottle as a thank-you for completing the study.

Website: www.diabetesnetplay.com
Your user ID is:
Your password is:

Please keep your username and ID in a safe place where you can refer to it if needed.

At the end of the study:

You will be given full access to the study website, which includes the information received by the intervention group. Because the counsellors will no longer be functioning, this aspect of the website will not be operational; as well the message board will no longer be run and monitored by the study coordinator but will still display all previous information discussed.

If you have any questions or concerns about the study please call us at (780) 492-1019 (call collect if long distance), or email at tanisl@ualberta.ca.

Sincerely,

Tanis Liebreich MSc (candidate)
Study Coordinator, Diabetes NetPLAY

Control Group Gift Letters

Name
Address

October 31, 2006

Dear *Insert Name*

Thank you for participating in the Diabetes NetPLAY Research Project which took place this past summer. As a participant in the control group, your completion of the study contributed greatly to its overall success.

As promised, we are happy to send you the enclosed thank-you gift as a small token of our appreciation for your participation.

The research data collected during this study is currently being analyzed and a final copy of the results will be emailed to you shortly.

If you have any questions, please contact Tanis Liebreich, Project Coordinator by email at tanisl@ualberta.ca.

Thank you again for helping us with this important project.

Sincerely,

Ronald Plotnikoff, PhD
Associate Professor
Coordinator
Principal Investigator
Studies

Tanis Liebreich MSc (c)
Diabetes NetPLAY

Centre for Health Promotion

Appendix V: Ethical Approval

UNIVERSITY OF ALBERTA

Faculty of Physical Education and Recreation
Office of the Associate Dean (Research)

E-477 Van Vliet Centre
Edmonton, Alberta, Canada T6G 2H9

Tel: 780.492.5910
Fax: 780.492.6549

Faculty of Physical Education and Recreation
Research Ethics Board

Certificate of Ethics Approval for Fully-Detailed Research Proposal

Applicant(s):	**Tanis Rae Liebreich**
Supervisor:	**Dr. Ronald Plotnikoff**
Co-Investigators:	**Dr. K. Courneya, Dr. N. Boulé**
Faculty:	**Physical Education and Recreation**
Project Title:	***Diabetes NetPLAY: A physical activity website and e-counselling intervention for individuals with type 2 diabetes.***
Research Ethics Application #:	**2005-1215-06**
Research Ethics Approval Expiry Date:	**January 3, 2007**

Certification of Faculty of Physical Education and Recreation
Research Ethics Approval

I have received your application for research ethics review and conclude that your proposed research meets the University of Alberta standards for research involving human participants (GFC Policy Section 66). On behalf of the Faculty of Physical Education and Recreation's Research Ethics Board (FPER REB), I am providing **research ethics approval** for your proposed project.

This research ethics approval is valid for one year. To request a renewal after January 3, 2007 *(today's date + 1 year)* please contact me and explain the circumstances, making reference to the research ethics review number assigned to this project (see above). Also, if there are significant changes to the project that need to be reviewed, or if any adverse effects to human participants are encountered in your research, please contact me immediately.

Chair, Research Ethics Board
Faculty of Physical Education and Recreation

Print Name: Dr. Brian Maraj **Signature:**

Date: January 3, 2006