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Predictors of aerobic physical activity and resistance training among Canadian adults with type 2 diabetes: An application of the Protection Motivation Theory

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ABSTRACT

Background: It is well established that both aerobic physical activity (PA) and resistance training are essential in the treatment and management of type 2 diabetes (T2D), but few studies have examined the determinants of both modes of PA in the same sample.

Purpose: The main objective was to investigate the utility of the Protection Motivation Theory (PMT) in predicting aerobic PA and resistance training in a population sample of T2D adults.

Methods: A total of 244 individuals completed self-report PMT constructs of vulnerability, severity, fear, response efficacy, self-efficacy and intention, and a 3-month follow-up that assessed aerobic PA and resistance training.

Results: PMT explained 19% ($p < .001$) and 20% ($p < .001$) of the variance respectively for aerobic PA and resistance training behaviour. Significant associations were found between self-efficacy ($\beta = 0.45$, $p < .001$) and gender ($\beta = 0.15$, $p < .05$) for aerobic PA, and self-efficacy ($\beta = 0.48$, $p < .001$) and age ($\beta = 0.17$, $p < .05$) for resistance training. PMT accounted for 43% ($p < .001$) and 56% ($p < .001$) of the variance respectively for aerobic PA and resistance training intentions. For aerobic PA, response efficacy ($\beta = 0.14$, $p < .05$) and self-efficacy ($\beta = 0.59$, $p < .001$) were significantly associated with intention, while response efficacy ($\beta = 0.23$, $p < .001$), self-efficacy ($\beta = 0.64$, $p < .001$) and age ($\beta = 0.10$, $p < .05$) were significantly related with resistance training intention.

Conclusions: None of the unique constructs of the PMT (i.e., perceived vulnerability, severity and fear) were significant with either aerobic and resistance training intention. These results may guide the development of effective PA interventions in people with T2D.

Introduction

Regular physical activity (PA) is essential for both the treatment and prevention of diabetes (Sigal, Kenny, Wasserman, Castaneda-Sceppa, & White, 2006). Aerobic PA reduces the risk of developing T2D (Diabetes Prevention Program Research Group, 2002; Gillies et al., 2007; Li et al., 2008; Lindstrom et al., 2006; Pan et al., 1997; Tuomilehto et al., 2001). Despite the established benefits of aerobic activity, less than 30% of the diabetic population participate in enough aerobic PA to meet the recommended guidelines of 150 min/week of moderate PA (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003; Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007; Plotnikoff et al., 2006; Sigal et al., 2006). Similar to aerobic PA, resistance training also greatly improves insulin sensitivity (Ivy, 1997), and glycemic control (Balducci, Leonetti, Di Mario, & Fallucca, 2004; Castaneda et al., 2002; Dunstan et al., 2002; Sigal et al., 2007). However, the majority of adults with T2D do not perform this behaviour (Plotnikoff et al., 2006) despite the resistance training recommendations endorsed by the American College of Sports Medicine

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(American College of Sports Medicine, 2000), American Diabetes Association (Sigal et al., 2006), and the Canadian Diabetes Association (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003).

With the increasing prevalence of diabetes in the population, given that 5.1% of Canadian adults living with diagnosed diabetes in 1999 (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003), a greater understanding of the factors that predict PA in adults with T2D is needed for the development of effective prevention and treatment strategies (Plotnikoff, 2006; Rathmann & Giani, 2004; Simmons et al., 2006). The adoption of a physically active lifestyle among individuals with T2D is the primary step in PA treatment, with resistance training possibly being a more attractive alternative than aerobic activities for part of this population (Plotnikoff, 2006). Since this population is likely to associate aerobic PA with shortness of breath, fatigue, and possibly pain, resistance training may be less overwhelming psychologically than a 30-min walk (Plotnikoff, 2006).

Theory-based interventions are more effective in influencing health-related behaviour compared to atheoretical approaches (Michie & Abraham, 2004), since they offer a means to inform the development of interventions as well as guide the evaluation of these interventions (The Improved Clinical Effectiveness through Behavioural Research Group, 2006). Rogers (1983) revised Protection Motivation Theory (PMT) is one such social cognitive theory that has the potential to account for the cognitive mediation process of behavioural change in terms of threat and coping appraisal.

The model's threat appraisal component encompasses: (1) the person's estimation of the severity of the disease (*perceived severity*); and (2) the person's estimation of the probability of contracting the disease (*perceived vulnerability*). The model's coping appraisal incorporates: (1) the individual's expectancy that implementing the recommendations can remove the threat (*response efficacy*); and (2) belief in one's ability to carry out the recommended plan of action successfully (*self-efficacy*).

PMT postulates that the motivation to protect oneself from danger is a positive linear function of four cognitive beliefs that the individual perceives: (1) the threat is severe; (2) one is personally vulnerable to the threat; (3) the coping response is effective in preventing the threat; and (4) one has the ability to execute the coping response. The emotional state of fear, through the appraisal of the severity of danger, theoretically impacts attitudes and behaviour change indirectly. The strength of Protection Motivation was initially assessed through measuring intentions to adopt the recommended behaviour (Rogers, 1983), but recent attention has been given to measuring observed or self-reported behaviour as the outcome variable (Floyd, Prentice-Dunn, & Rogers, 2000; Milne, Sheeran, & Orbell, 2000; Norman, Boer, & Seydel, 2005). This is based on the Theory of Reasoned Action which stipulates that intention is a major precursor to behaviour (Ajzen & Fishbein, 1980).

PMT has been moderately successful in predicting health and safety related intentions and behaviours in a variety of contexts (e.g., tooth flossing, alcohol consumption, breast cancer screening, dietary behaviour, smoking cessation) (Floyd et al., 2000; Milne et al., 2000). Research on PMT has been subjected to narrative reviews (e.g., Norman et al., 2005) and two meta-analyses (Floyd et al., 2000; Milne et al., 2000) that have summarized the findings from PMT studies across various behaviours. Overall, the results suggest that coping appraisal variables, especially self-efficacy, provide the strongest predictions of protection motivation (i.e., intention) and behaviour (Floyd et al., 2000).

To our knowledge, only seven studies have applied PMT to the prediction of PA. Of these studies, one study (i.e., Plotnikoff & Higginbotham, 2002) tested the PMT with a randomly selected community sample of Australian adults ($N = 800$) from areas with high incidence rates of coronary heart disease. Three studies (i.e.,Norman et al., 2005; Stanley & Maddux, 1986; Wurtele & Maddux, 1987) examined the utility of the PMT among 76, 195, and 160 university students respectively, and one study was conducted among 615 adolescents (i.e., Fruin, Pratt, & Owen, 1991). Further, two studies (i.e., Plotnikoff & Higginbotham, 1998; Tulloch et al., 2008) reported an application of PMT for the prediction of PA intentions and behaviour among 151 and 787 cardiac patients respectively.

PMT was chosen as a potential theoretical model in our study to explain PA behaviour in people with diabetes, as this theory was specifically developed to explain health behaviour motivation based on a disease prevention/health threat perspective. PMT's focus on threat appraisal establishes the way in which a fear-arousing communication can change attitudes, and subsequently, change behaviour (Rogers, 1983). As mentioned above, the PMT has been applied to other diseased populations including cardiac patients to predict PA behaviour (Plotnikoff & Higginbotham, 1998). There has been some evidence suggesting that perceived health threat is higher immediately after a life threatening myocardial infarction (i.e., during hospitalization) and post-hospitalization discharge (Oldenburg & Bryne, 1986). Thus, perceived threat arising just after the cardiac event may strongly initiate intentions and subsequent behaviours related to following recommended diet and exercise patterns. The same pattern may hold true for diabetes patients to prevent further diabetes complications.

With regards to resistance training, research on the psychosocial predictors of this behaviour has been very limited, with no published studies among people with T2D to our knowledge. Since resistance training is relatively novel in the PA and diabetes literature, further theoretical research is needed to examine other salient predictors that may be present to help guide interventions by operationalizing appropriate theoretical constructs (Plotnikoff & Eves, 2006).

In summary, both aerobic PA and resistance training are beneficial in T2D, and PMT may be a useful model to employ for the prediction of both modes of PA. Further, to our knowledge, no previous study has concurrently examined the cognitive predictors of aerobic PA and resistance training within a randomly selected population sample using PMT. The purpose of this study was therefore to examine the utility of the PMT in explaining intention and behaviour for both aerobic PA and resistance training in a population sample of T2D adults. Based on PMT (Rogers, 1983), we hypothesized that all four PMT constructs would have significant associations with aerobic PA intention and behaviour. However, no hypotheses were generated between the PMT constructs and resistance training behaviour as this part of the study remains exploratory. A secondary objective was to compare the mean scores of the PMT constructs between aerobic PA and resistance training.

Methods

Sample and recruitment

A random list of household phone numbers was generated to create a random national sample to recruit individuals from. The actual number of household telephone numbers for each Canadian province (with the exception of Quebec where predominately Francophone speaking communities were excluded from the sample) was proportionate to the list generated. The recruitment of individuals with T2D was conducted with a random digit dialing protocol.

The refinement of the questionnaire (e.g., question wording) was conducted with a pretest ($n = 7$). The baseline (time 1) questionnaires were mailed in March 2006. The time 2 follow-up questionnaires were mailed in June 2006 by a rolling mailout