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The Theory of Planned Behavior as a model for understanding sedentary behavior

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ABSTRACT

Objectives: Sedentary time has emerged as an independent risk factor for numerous adverse health outcomes. However, little is known about the social-cognitive correlates of sedentary behavior. The purpose of this study was to provide preliminary evidence for the factor structure and composition of sedentary derived Theory of Planned Behavior (TPB) constructs and to determine the utility of these constructs in predicting sedentary intention and sedentary time.
Method: Twenty-three items were created to assess attitudes, subjective norms (SN), perceived behavioral control (PBC), and intention with respect to time spent being sedentary. Using a web-based survey, 372 adults completed a modified Sedentary Behavior Questionnaire and were then randomised to one of three TPB questionnaire packages: general, weekday, and weekend. Weekday and weekend participants completed items for work/school (less-volitional) and leisure/recreation (volitional) activities separately, resulting in five TPB models being analyzed: general, weekday work/school, weekday leisure/recreation, weekend work/school, and weekend leisure/recreation.
Results: Irrespective of model, items grouped into coherent factors consistent with TPB and explained 9–58% and 8–43% of the variance in intention and behavior, respectively. The strongest and most consistent predictor of intention and behavior were SN and intentions, respectively. Mediation analyses indicated that attitudes consistently affected sedentary time through intention.
Conclusions: There is growing evidence that the TPB is a useful framework for understanding sedentarism.

The term inactivity physiology was first coined in 2004 to describe the role sedentary behavior played in the development of metabolic risk and cardiovascular disease (Hamilton, Hamilton, & Zderic, 2004).There is mounting epidemiological evidence that adverse health consequences are uniquely caused by too much sitting. Sedentarism is defined as any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents (METs) while in a sitting or reclining position (Canadian Society for Exercise Physiology, 2012). Time spent in sedentary behavior has been shown to be associated with increased risk for all cause and cardiovascular disease related mortality in both men and women, independent of body mass index (BMI) and moderate-to-vigorous physical activity (Dunstan et al., 2010; Stamatakis, Hamer, & Dunstan, 2011; Warren et al., 2010). After adjusting for moderate-to-vigorous physical activity, greater time spent in sedentary behavior is also consistently associated with increased risk for obesity and weight gain (Hu, Li, Colditz, Willett, & Manson, 2003; Meyer et al., 2008) and a reduction in bone mineral health (Caillot-Agusseau et al. 1998; Zwart et al., 2007). More recent evidence suggests that the detrimental association between sedentary behavior and some cardio-metabolic biomarkers may be partially attenuated when analyses are adjusted for total physical activity (Maher, Olds, Mire, & Katzmarzyk, 2014).

Population based studies using accelerometers indicate that adults spend most of their waking time being inactive and/or sedentary (Hagstromer, Oja, & Sjostrom, 2007; Troiano et al., 2008). Furthermore, sedentary time and light intensity activity (i.e., incidental routine household activities such as cooking, cleaning, and washing the dishes), are inversely and highly correlated. Cross sectional studies have shown that light–intensity activity and

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breaks in sedentary time is beneficially related to 2-h plasma glucose levels (Healy et al., 2007; 2008). In a recent intervention study, Dunstan et al. (2012) showed that interrupting sitting time with 2-min bouts of light or moderate intensity walking every 20 min lowered postprandial glucose and insulin levels in overweight/obese adults.

Long-term intervention studies to reduce sedentary behavior have begun (e.g., Wilmot et al., 2011) without thoroughly identifying the factors that influence sedentarism. Researchers who have been interested in these factors have primarily followed an ecological model or approach (cf. Owen et al., 2011), where from an intrapersonal perspective, a premium is placed on the individual's perceptions of his/her environment that promote sedentarism. A shortcoming of this approach is that it fails to acknowledge the role psycho-social variables can play in explaining sedentary behavior. The absence of research focused on the relationship between social-cognitive factors and sedentary behavior has been commented on in a recent systematic review by Rhodes, Mark, and Temmel (2012). Social cognitive theories such as Theory of Planned Behavior (TPB; Ajzen, 1985), Health Action Process Approach (Schwarzer, 2008), Protection Motivation Theory (Rogers, 1975), and Transtheortical Model (Prochaska & DiClemente, 1983) have proven useful in furthering our understanding of salient conscious (reasoned) processes underlying the adoption of health-related behaviors including physical activity and exercise (Hagger, Chatzisarantis, & Biddle, 2002). Through extension, the constructs that are used to represent these theories have the potential to enhance our current understanding of sedentarism. This in turn has implications for how current and future interventions are developed.

Although any one of the theories mentioned above has the potential to shed valuable light on the relationship between psycho-social variables and sedentary behavior, to the best of our knowledge only the TPB has been examined in the context of sedentarism. According to the TPB, an individuals' intention to engage in sedentarism is the main determinant of actual sedentary time. The proximal determinants of intention to engage in sedentary behavior are attitude, subjective norms (SN), and perceived behavioral control (PBC). Attitude represents an individual's evaluation of the perceived benefits and costs of sitting, SN reflects the perceived expectations of significant others regarding sitting, and PBC is determined by the individual's perceptions of the amount of control they have over the time they spend being sedentary. A final tenet of the model is that PBC can also contribute to the prediction of sedentary time when this targeted behavior is not under volitional control.

Preliminary evidence has shown that TPB constructs are related to intentions to be sedentary (Smith & Biddle, 1999). Furthermore, and more relevant to the present study, Rhodes and Dean (2009) showed that intentions to perform four popular sedentary behaviors (television viewing, computer use, reading/listing to music, and socializing) were consistently related to these behaviors and that attitude influenced these behaviors through intention. These promising findings reported by Rhodes and Dean must be considered with several limitations in mind. First, the operational definition of sedentary behavior was accumulating at least 30 + minutes in the previous week and weekend. No previous validation evidence was provided for these scales and the scales failed to assess actual sedentary time for these targeted behaviors. The TPB constructs used the stem of "*engaging in the sedentary behaviors 7 days per week*", and also failed to assess cognitions related to actual sedentary time. Second, only reliability evidence was provided for the TPB constructs that were created. Findings would have been strengthened had factor validity evidence been shown. Third, and finally, only leisure-time sedentary behaviors were considered. Hence, no attempt was made to test leisure-time against non-leisure (e.g., work/school computer use) sedentary behavior TPB models. Non-leisure sedentary behavior represents a substantial portion of everyday sedentary time, but is considered less volitional. It would be inappropriate, at this early stage of investigation, to assume that TPB constructs only apply to leisure-time volitional sedentary behaviors. Furthermore, separating out week day and weekend volitional and non-volitional sedentary behaviors may improve correspondence between TPB constructs and behavior; hence improving the predictive utility of the TPB models tested.

The general purpose of the present study is to extend the work of Rhodes and Dean (2009) by addressing the above mentioned limitations. Five separate TPB models were developed and tested using a cross-sectional design: Model 1 was a general model combining volitional (leisure/recreation) and non-volitional (work/school) sedentary time with no distinction between weekday or weekend; Model 2 examined weekday work/school sedentary time; Model 3 examined weekday leisure/recreation sedentary time; Model 4 examined weekend work/school sedentary time; and Model 5 explored weekend leisure/recreation sedentary time.

Based on the previous TPB literature on sedentary behavior, we hypothesized that the theory's major tenets would be supported. We also hypothesized that Models 2–5, which assessed cognitions towards non-volitional and volitional sedentary time separately, as well as corresponded with respect to the time of assessment (i.e., weekday and weekend), would perform better than Model 1 (general model). The rationale behind this hypothesis stems from the fact that the TPB was "designed to predict and explain human behavior in specific contexts" (Ajzen, 1991, p. 181), and Models 2–5 demonstrate greater specificity than Model 1.

Methods

Participants

Seven hundred and ninety-seven adults from two post-secondary institutions and other places of employment in Ontario, Canada responded to an email invitation to participate in this study. Individuals were eligible to participate if they were between 18 and 64 years of age, fluent in English, and had internet access. Participants were excluded for the following reasons: being outside the pre-determined age range (n = 1), indicating that they suffered from a medical condition prohibiting them from being physically active (n = 28), providing implausible sedentary behavior data (i.e., their average daily SBQ score exceeded 24 h per day; n = 21), failing to complete the questionnaire (n = 273), and having incomplete data resulting from a programming error (n = 102).[1] The final sample consisted of 372 individuals (283 females, 88 males, and one who preferred not say). Participants ranged in age from 19 to 64 (M = 38.93 years; SD = 12.69); 80.4% of reported being either 'Caucasian' or 'Canadian' and 19.6% of self-identified as 1 of 31 other ethnic backgrounds; 32.8% of participants were graduate students, 22.0% administrative staff, 9.9% university faculty members, 7.3% other university staff, 5.4% undergraduate students, 1.6% post-doctoral fellows, and 21.0% 'other';

[1] A programming error in the survey's skip logic resulted in two-thirds of the participants in the third experimental group (weekend non-volitional and volitional sedentary behavior) being randomly directed to a question further in the survey than they should have been. Thus, even though these participants provided 'complete data' as far as they were concerned, their data was incomplete for the purposes of this study. Due to this error, the sample sizes for Models 4 and 5 are approximately one-third of those of Models 1–3.