Psychology of Sport and Exercise 19 (2015) 23–32

Contents lists available at ScienceDirect

Psychology of Sport and Exercise

journal homepage: www.elsevier.com/locate/psychsport

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

Harry Prapavessis*, Anca Gaston, Stefanie DeJesus

Exercise and Health Psychology Laboratory, University of Western Ontario, London, Ontario, Canada

ARTICLE INFO

Article history:
Received 4 June 2014
Received in revised form
3 February 2015
Accepted 3 February 2015
Available online 12 February 2015

Keywords:
Sedentary behavior
Attitude
Subjective norm
Intention
Theory of Planned Behavior
Health psychology

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

* Corresponding author. 1151 Richmond Street, London, Ontario, N6A 3K7, Canada. Tel: +1 519 661 2111.
E-mail address: hprapave@uwo.ca (H. Prapavessis).

http://dx.doi.org/10.1016/j.psychsport.2015.02.001
1469-0292/

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.

47.8% of participants worked for pay between 31 and 40 h per week, 18.8% worked more than 40 h per week, 11.6% worked between 1 and 10 h per week, 8.6% did not work at all, 7.8% worked 11–20 h per week, and 5.4% worked 21–30 h per week.

Instruments

Sedentary Behavior Questionnaire. Sedentary behavior was assessed using a 12-item modified Sedentary Behavior Questionnaire (SBQ; Rosenberg et al., 2010). Participants selected the duration of time (none, 15 min or less, 30 min, 1 h, 2 h, …, 9 h or more) they spent per day in various forms of sedentary pursuits for weekdays and weekends separately. The modified SBQ included both volitional and non-volitional activities. Two items assessed 'non-volitional' activities: Sitting for work or school (including using the computer for work or school) and sitting in a motor vehicle in order to get to work or school. Ten items assessed 'volitional' sedentary activities: watching TV, using the computer for recreational purposes, reading for pleasure, listening to music, playing a musical instrument, doing arts and crafts, sitting in a motor vehicle for leisure-related transportation purposes, eating, socializing; and sitting for religious or spiritual pursuits. The SBQ was modified by including additional sedentary pursuits (i.e., eating and sitting for religious or spiritual pursuits) as these represent common activities. In addition, given that the average Canadian spends 36.6 h per week working (Human Resources and Skills Development Canada, 2013), we incorporated additional response options (i.e. 7 h, 8 h, or 9 h or more) to improve the sensitivity of sedentary behavior measurement. Finally, the segregation of volitional and non-volitional sedentary behaviors necessitated the discrimination of motor vehicle transportation for work/school and leisure purposes. A separate SBQ score was computed for each model. For the general model, an average daily score (in hours) was created using the following formula: $SBQ_{Model\ 1} = [(\sum 12\ \text{weekday items} \times 5) + (\sum 12\ \text{weekend items} \times 2)]/7$. For Models 2–5, only the items pertaining to the time frame (weekday or weekend) and type (volitional or non-volitional) of interest were used. The original SBQ demonstrated good internal consistency (α ranges from 0.48 to 0.93) and excellent test-retest reliability ($r = 0.64$ to 0.90 for weekdays and $r = 0.51$ to 0.93 for weekend days; Rosenberg et al., 2010).

Theory of Planned Behavior. A TPB questionnaire was constructed in accordance with published guidelines (Ajzen, 2006). Five versions of the questionnaire were created by using different stems for each question. For the non-volitional (i.e., work/school) questionnaires (weekday or weekend), the stem included the following text: "… sitting for work or school (e.g., using the computer for school or work, doing office work, etc.) …" For the volitional (i.e., leisure/recreation) questionnaires (weekday or weekend), the stem included the following text: "… sitting for personal, leisure, or recreational pursuits (e.g., watching TV, using the computer for recreational purposes, etc.) …" The stem for the general questionnaire included all (both volitional and non-volitional) behaviors. The behaviors listed in parentheses within each stem were taken directly from the SBQ to ensure correspondence between behavioral and cognitive measures (Ajzen, 2006). All items referred to *daily sitting*, and depending on group assignment included the words "per day" (general questionnaire), "per weekday" (weekday questionnaires), or "per weekend day" (weekend questionnaire).

Intention. Intention to engage in sedentary time was measured using the mean of three items (e.g. "How much time do you plan to spend [sitting for …] per [day/weekday/weekend day] in the coming week?"). The response options to these items were temporal in nature (none, 15 min or less, 30 min, 1 h, 2 h … 18 h) in order to correspond to the scale used in the SBQ. Reliability (Cronbach's alpha) was adequate for all five models ranging from $\alpha = .90 - 0.97$.

Attitude. Attitude towards sitting was assessed using three sets of five items for a total of 15 items: attitude towards sitting 0–4 h per day, attitude towards sitting approximately half the day, and attitude towards sitting 12–16 h per day. As sitting is a regular part of most individuals' waking hours, attitude was temporal in nature in order to ensure correspondence with the SBQ and uniform interpretation of time among participants. Responses were rated using five counterbalanced adjective scales (pleasant-unpleasant, relaxing-unrelaxing, enjoyable-unenjoyable, good-bad, useful-useless), scored from 1 (most negative attitude) to 7 (most positive attitude). As per Ajzen's (2006) recommendations, both instrumental and experiential attitudes were assessed. All questions included the aforementioned stems (e.g., "For you to [sit for …] for [0–4 h per day (i.e., none to one-quarter of your waking hours)] is (1) pleasant … (7) unpleasant") where the text in square brackets differed between the different versions of the questionnaire. A separate attitude score was computed for each time range by summing each set of five items and dividing by five.

Subjective norms. Subjective norms were determined by the mean of five statements that were rated by selecting the most appropriate duration of time (none, 15 min or less, 30 min, 1 h, 2 h … 18 h). Three items assessed injunctive norms (e.g. "Most people who are important to me think that I should [sit for …] for ___ per [day/weekday/weekend day]") and two items assessed descriptive norms (e.g. "Most people who are important to me [sit for …] for ___ per [day/weekday/weekend day]").

Perceived behavioral control. Three items were used to measure PBC (e.g., "If I wanted to I could spend more or less time [sitting for …] per [day/weekday/weekend day]") and were rated on a 7-point scale from 1 (definitely false) to 7 (definitely true).

Data collection procedures

Ethical approval was granted by the Research Ethics Board at the host university prior to commencing the study. Individuals were recruited between April and August 2013 by e-mail and invited to the study website (Survey Monkey, Palo Alto, CA, USA). Participation was voluntary and anonymity was preserved. After providing informed consent, participants completed the demographic and modified SBQ measures. Next, an internal computer-generated randomization scheme (via Survey Monkey) directed participants to one of three TPB groups: general, weekday, and weekend. Participants in the weekday and weekend groups completed items for work/school and leisure/recreation activities separately, resulting in five TPB models: general-1, weekday work/school-2, weekday leisure/recreation-3, weekend work/school-4, and weekend leisure/recreation-5.

Data analysis

Data analyses were conducted separately for each model. First, ANOVA and chi-square analyses were used to examine group equivalency with respect to demographic characteristics across models and between participants with complete vs. incomplete data. Then, the TPB questionnaire data were subjected to psychometric analysis after being inspected for factorability, or suitability for factor analysis, based on correlations ($r > 0.30$; Tabachnick & Fidell, 2007), Bartlett's test of sphericity ($p < .05$; Bartlett, 1954), and the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO; > 0.50; Kaiser, 1970, 1974). Unique factors were extracted using principal axis factor analysis with oblique rotation (Direct oblimin

method) as constructs were deemed to be related.[2] Factor retention was established based on eigenvalues (>1; Kaiser, 1960), visual inspection of Catell's scree test (Catell, 1966), and pattern matrix loadings. Cronbach's alphas (Nunnally, 1978) were then computed for items deemed to be one factor in order to measure each scale's internal consistency.

Pearson bivariate correlations were used to examine the relation between attitudes, subjective norms, PBC, intention, and behavior. After checking for the assumptions of linearity, homoscedasticity, and multicollinearity, TPB constructs that were significantly related to intention were entered in a linear regression model. Similarly, items that were significantly related to sedentary behavior were entered in a regression model with intention being entered in step 1 and the remaining related variables being entered at step 2. Each regression model was evaluated by examining the percent variance accounted for per criterion variable (i.e., adjusted R^2 values) and the standardized beta (β) associated with each individual item. A pairwise comparison of the structure of the five models was conducted using Hotelling's t. Finally, we tested for mediation by computing the indirect effect of the TPB constructs (attitudes, SN, and PBC) on behavior through intention. As recommended by Preacher and Hayes (2004), mediation was tested using the Sobel test as well as examining the bootstrapped sampling distribution. A significant Sobel test ($p < .05$, two-tailed) indicates a significant indirect effect. Because distributions are commonly skewed, Preacher and Hayes recommend following up any non-significant Sobel test with an inspection of the bootstrapped sampling distribution of the indirect effect. A significant indirect effect exists when the 95% confidence interval (CI) derived from 1000 bootstrap resamples do not cross zero. Hotelling's t was computed using Garbin's (n.d.) FZT.exe program. All other statistical analyses were conducted using SPSS (Version 20) and the level of significance was accepted at $p < 0.05$.

Results

Group equivalency

One-way ANOVA and chi-square procedures confirmed group equivalency through the randomization for all demographic variables ($ps = 0.11–0.73$). There also were no significant differences between participants with complete versus incomplete data ($ps = 0.23–0.78$) or between those in the third group (weekend non-volitional and volitional sedentary behavior) who were retained (n = 54) and those who were excluded (n = 102) due to the aforementioned programming error ($ps = 0.13–0.92$).

Factor analysis

The factor analysis pattern matrices for all five models are available as Supplementary Material. Item communalities were adequately related for all models. The KMO measure of sampling adequacy ranged from 0.70 for Model 5 to 0.84 for Model 3 and Bartlett's Test of Sphericity was significant for all five models (all $ps < .001$), indicating that the sets of variables were adequately related to conduct factor analysis. Analyses of eigenvalues, scree plots, and factor loadings revealed five (Models 1, 2, 3), six (Model 5) and seven (Model 4) factor solutions. With respect to Models 1–3, items loaded as expected, and were labeled attitude (0–4), attitude (half), attitude (12–16), SN, and PBC. With respect to Model 4, the five SN items produced two separate factors, one corresponding to injunctive norms and the other to descriptive norms. Based on the theoretical distinction between these two types of norms (Manning, 2009), two separate variables were created and labelled SN (injunctive; 3 items) and SN (descriptive; 2 items). In addition, two attitude items (i.e., usefulness/uselessness of sitting for approximately half the day and 12–16 h per day) loaded together and separate from the other attitude constructs. Based on the lack of time correspondence between these two items, they were excluded from further analyses, leaving a six-factor solution. In Model 5, these two attitude items also loaded as a separate factor and were similarly excluded from further analyses, leaving a five-factor model. The final models explained between 77.85 (Model 2) and 83.21% (Model 3) of the total variance for the entire set of variables.

Correlation analyses

Bivariate (Pearson) correlations between study variables are presented in Table 1. Intention was correlated with attitude (0–4) in only one model, but was related to attitude (half) and attitude (12–16) in three models. Subjective norms were associated with intention in four of the five models and PBC showed an association only in one model. For behavior, intention emerged as a significant correlate in all five models. Behavior was related with attitude (0–4) in one model, attitude (half) in three models, and attitude (12–16) in two models, SN in three models and PBC in a single model.

Linear regression analyses

Two linear regressions were conducted for each of the five models with intention and behavior serving as the criterion variables. Scatterplots of the standardized residuals suggested linearity and homoscedasticity were tenable assumptions in each regression model. Inspection of Variance Inflation Factor (Range = 1.05–1.41 & 1.02–2.43 for models predicting intention and behavior, respectively) and Tolerance (Range = 0.71–1.00 & 0.41–0.98 for models predicting intention and behavior, respectively) values indicated that multicollinearity was not an issue (Menard, 1995).

The summary findings for each regression model are presented in Tables 2 and 3. For intention, attitude (half) significantly predicted intention only in Model 5 (weekend leisure/recreation), SN was a significant contributor in three of the five models, and PBC was a significant predictor only in Model 2 (weekday work/school). The percent of variance explained ranged from 9% in Model 3 (weekday leisure/recreation) to 58% in Model 4 (weekend work/school). Post-hoc analyses using Hotelling's t revealed that significant differences existed among the structure of the models. Specifically, Models 3 and 4 differed significantly from Models 1, 2, and 5 as well as from each other.

For behavior, intention alone significantly predicted behavior in all five models and explained between 2% (Model 3 – weekday leisure/recreation) and 36% (Model 2 – weekday work/school) of the variance. The addition of TPB variables in Step 2 explained an additional 3–11% of the variance in behavior. Attitudes significantly predicted behavior only in Model 2 (weekday work/school) and Model 3 (weekday leisure/recreation) SN significantly predicted

[2] An exploratory factor analysis (EFA) was chosen over a confirmatory factor analyses (CFA) for several reasons. An exploratory approach is often recommended and followed during the early stages of scale development and testing (Schutz & Gessaroli, 1993) and the present study represents a novel examination of the applicability of TPB-based constructs for understanding sedentary time. Because EFA is not influenced by a researcher's expectations regarding the nature or number of constructs or factors (Thompson, 2004), it represents a more conservative and unbiased approach. In addition, our sample size was below the 200–400 cases typically recommended in order to ensure stable parameter estimates and adequate statistical power when using CFA (Hoyle, 2000; Tanaka, 1987.)

Table 1
Pearson correlations for the Theory of Planned Behavior variables and sedentary behavior.

Variable	Mean	SD	1	2	3	4	5	6	7	8
Model 1 (general)										
1. Attitude (0–4)	4.86	1.31	–	0.26***	−0.02	−0.09	−0.11	−0.03	−0.04	
2. Attitude (half)	4.08	1.49		–	0.52***	0.30***	0.03	0.35***	0.30***	
3. Attitude (12–16)	2.52	1.50			–	0.30***	0.19*	0.34***	0.29***	
4. SN	6.84	2.45				–	0.05	0.56***	0.28***	
5. PBC	4.06	1.55					–	0.03	−0.02	
6. Intention	8.64	3.51						–	0.43***	
7. SBQ – Average daily sedentary time (hours)	11.65	3.35							–	
Model 2 (weekday work/school)										
1. Attitude (0–4)	4.66	1.27	–	0.17*	−0.12	0.01	−0.04	0.07	−0.01	
2. Attitude (half)	3.36	1.47		–	0.41***	0.21**	−0.07	0.23**	0.30***	
3. Attitude (12–16)	1.94	1.17			–	0.19	0.14	0.16**	0.12	
4. SN	6.26	2.33				–	−0.08	0.56***	0.48***	
5. PBC	3.51	1.68					–	-0.20*	-0.28***	
6. Intention	6.56	3.10						–	0.61***	
7. SBQ – Weekday work/school sedentary time (hours)	6.18	2.43							–	
Model 3 (weekday leisure/recreation)										
1. Attitude (0–4)	5.21	1.30	–	0.36***	0.14	0.06	0.05	0.26**	0.01	
2. Attitude (half)	3.53	1.54		–	0.70***	0.16*	−0.05	0.12	0.16*	
3. Attitude (12–16)	2.37	1.56			–	0.25***	−0.12	0.01	0.26***	
4. SN	2.48	1.89				–	0.00	0.20*	0.07	
5. PBC	5.70	1.37					–	0.09	0.03	
6. Intention	2.26	1.34						–	0.16*	
7. SBQ – Weekday leisure/recreation sedentary time (hours)	5.99	2.81							–	
Model 4 (weekend work/school)										
1. Attitude (0–4)	4.38	1.52	–	0.55***	0.27	−0.12	0.03	−0.04	0.07	0.32*
2. Attitude (half) (4 items)	2.65	1.50		–	0.57***	0.03	0.03	0.03	0.09	−0.01
3. Attitude (12–16) (4 items)	1.47	0.77			–	0.15	−0.06	0.12	0.10	−0.11
4. SN (injunctive)	1.64	1.95				–	0.26	−0.21	0.75***	0.34**
5. SN (descriptive)	2.16	2.98					–	0.09	0.38**	0.11
6. PBC	5.01	1.81						–	−0.17	−0.24
7. Intention	1.68	2.21							–	0.40**
8. SBQ – Weekend work/school sedentary time (hours)	1.20	2.06								–
Model 5 (weekend leisure/recreation)										
1. Attitude (0–4)	5.52	1.34	–	0.34**	0.19	0.13	−0.01	0.09	0.01	
2. Attitude (half)	3.63	1.65		–	0.65***	0.26	−0.10	0.45***	0.19	
3. Attitude (12–16)	2.17	1.36			–	0.23	0.14	0.32*	0.09	
4. SN	3.09	2.66				–	0.12	0.16	0.04	
5. PBC	6.23	1.10					–	−0.02	−0.16	
6. Intention	2.88	1.68						–	0.52***	
7. SBQ – Weekend leisure/recreation sedentary time (hours)	8.59	4.36							–	

Note: PBC = Perceived behavioral control; SBQ = Sedentary behavior questionnaire; SN = Subjective norms.
*$p < .05$;**$p < .01$;***$p < .001$.

behavior in Models 2 (weekday work/school) and 4 (weekend work/school); and PBC significantly predicted behavior only in Model 2 (weekday work/school). Overall, the models explained between 8 and 43% of the variance in behavior. Post-hoc analyses using Hotelling's t revealed that the structure of Model 2 was significantly different from Models 3, 4, and 5 and Model 3 was also significantly different from Model 4.

Mediation analyses

The results of the Sobel tests and bootstrapped sampling distributions are displayed in Table 4. The analyses indicated that intention significantly mediated the associations between attitudes (half and 12–16) and SN and sedentary behavior in Model 1 (general), between attitudes (half and 12–16), SN, and PBC and behavior

Table 2
Linear regression analyses predicting intention.

Variable	Model 1 (general) (n = 162)		Model 2 (weekday work/school) (n = 155)		Model 3 (weekday leisure/recreation) (n = 155)		Model 4 (weekend work/school) (n = 55)		Model 5 (weekend leisure/recreation) (n = 54)	
	B (SE *B*)	β	*B* (SE *B*)	β	*B* (SE *B*)	β	*B* (SE *B*)	β	*B* (SE *B*)	β
Attitude (0–4)					0.26*** (0.08)	0.25				
Attitude (half)	0.34 (0.18)	0.15	0.19 (0.16)	0.09					0.43** (0.17)	0.42
Attitude (12–16)	0.28 (0.18)	0.12	0.14 (0.20)	0.05					0.06 (0.20)	0.05
SN (5 items)	0.68*** (0.10)	0.48	0.69*** (0.09)	0.52	0.13* (0.05)	0.19				
SN (injunctive)							0.79*** (0.10)	0.69		
SN (descriptive)							0.15* (0.07)	0.20		
PBC			−0.29* (0.13)	−0.16						
Adjusted R^2	0.35***$_a$		0.33***$_a$		0.09***$_b$		0.58***$_c$		0.17**$_a$	

Note: Only TPB variables which were significantly correlated with intention were entered in each regression model.
*$p < .05$; **$p < .01$; ***$p < .001$; PBC = Perceived behavioral control; SN = Subjective norms. Models that do not share a subscript are significantly different ($p < .05$) at the structural level using Hotelling's t.

Table 3
Hierarchical linear regression analyses predicting sedentary behavior.

Variable	Model 1(general) (n = 162)		Model 2 (weekday work/school) (n = 155)		Model 3 (weekday leisure/recreation) (n = 155)		Model 4 (weekend work/school) (n = 55)		Model 5 (weekend leisure/recreation) (n = 54)	
	B (SE *B*)	β	*B* (SE *B*)	β	*B* (SE *B*)	β	*B* (SE *B*)	β	*B* (SE *B*)	β
Step 1										
Intention	0.41*** (0.07)	0.43	0.48*** (0.05)	0.61	0.34* (0.17)	0.16	0.37** (0.12)	0.40	1.36*** (0.31)	0.52
Adjusted R^2	0.18***		0.36***		0.02*		0.14**		0.26***	
ΔR^2	0.18***		0.37***		0.03*		0.16**		0.27***	
Step 2										
Intention	0.32*** (0.08)	0.34	0.38*** (0.43)	0.43	0.35* (0.17)	0.17	0.19 (0.17)	0.20		
Attitude (0–4)							0.45 (0.17)	0.34		
Attitude (half)	0.26 (0.19)	0.12	0.24* (0.14)	0.14	−0.14 (0.20)	−0.08				
Attitude (12–16)	0.23 (0.19)	0.10			0.56** (0.20)	0.31				
SN (5 items)	0.04 (0.19)	0.03	0.20** (0.19)	0.19						
SN (injunctive)							0.24** (0.20)	0.23		
PBC			−0.25** (−0.17)	−0.17						
Step 2 ΔR^2	0.03†		0.08***		0.07**		0.11*		–	
Overall Adjusted R^2	0.20$^{***}{}_{abc}$		0.43$^{***}{}_{b}$		0.08$^{***}{}_{c}$		0.22$^{***}{}_{a}$		0.26$^{***}{}_{ac}$	

Note: Only TPB variables which were significantly correlated with behavior were entered in each regression model.
$^{*}p < .05$;$^{**}p < .01$; $^{***}p < .001$.PBC = Perceived behavioral control; SN = Subjective norms. Overall models that do not share a subscript are significantly different ($p < .05$) at the structural level using Hotelling's t.

in Model 2 (weekday work/school), between attitude (0–4) and behavior in Model 3 (weekday leisure/recreation), between SN (injunctive) and behavior in Model 4 (weekend work/school), and between attitudes (half and 12–16) and behavior in Model 5 (weekend leisure/recreation).

Discussion

This study provides further evidence that social cognitive constructs grounded in TPB have utility in understanding sedentary intention and behavior. Beyond this general observation the following issues warrant commentary. First, the factor analysis findings support the tenability of a five-factor TPB sedentary model representing the constructs attitude (0–4 h per day, approximately half the day, and 12–16 h per day), SN and PBC (see Supplementary Material). Although these five coherent and interpretable factors emerged in all five models, in Model 4 (weekend work/school) subjective norms split into two distinct factors representing injunctive and descriptive norms. All constructs demonstrated a high degree of internal consistency. It is recommended that the

Table 4
Mediation analyses examining the indirect effect of TPB constructs on behavior (sedentary time) through intention.

Model	Sobel test				95% CI for bootstrap indirect effect		
	Value	S.E.	z	p-value	Mean	S.E.	LL 95% CI
Model 1 (general)							
Attitude (0–4) → Intention → Beh.	−0.03	0.09	−0.39	0.70	−0.03	0.11	−0.23, 0.17
Attitude (half) → Intention → Beh.	0.29	0.09	3.37	0.00	0.29	0.09	0.14, 0.49
Attitude (12–16) → Intention → Beh.	0.28	0.09	3.32	0.00	0.28	0.09	0.09, 0.12
SN → Intention → Beh.	0.30	0.07	4.00	0.00	0.30	0.09	0.15, 0.49
PBC → Intention → Beh.	0.03	0.07	0.37	0.71	0.03	0.08	−0.11, 0.19
Model 2 (weekday work/school)							
Attitude (0–4) → Intention → Beh.	0.08	0.10	0.84	0.40	0.08	0.09	−0.11, 0.27
Attitude (half) → Intention → Beh.	0.21	0.08	2.71	0.01	0.22	0.09	0.06, 0.42
Attitude (12–16) → Intention → Beh.	0.20	0.10	1.99	0.05	0.21	0.11	−0.01, 0.44
SN → Intention → Beh.	0.29	0.06	5.09	0.00	0.30	0.09	0.15, 0.49
PBC → Intention → Beh.	−0.16	0.07	−2.37	0.02	−0.16	0.06	−0.30, −0.04
Model 3 (weekday leisure/recreation)							
Attitude (0–4) → Intention → Beh.	0.10	0.06	1.71	0.09	0.09	0.05	0.01, 0.20
Attitude (half) → Intention → Beh.	0.03	0.03	1.06	0.29	0.04	0.03	−0.01, 0.13
Attitude (12–16) → Intention → Beh.	0.00	0.03	0.15	0.88	0.01	0.03	−0.05, 0.07
SN → Intention → Beh.	0.05	0.03	1.45	0.15	0.05	0.04	0.00, 0.14
PBC → Intention → Beh.	0.03	0.03	0.87	0.38	0.03	0.03	−0.03, 0.11
Model 4 (weekend work/school)							
Attitude (0–4) → Intention → Beh.	0.04	0.07	0.51	0.61	0.04	0.07	−0.09, 0.23
Attitude (half) (4 items) → Intention → Beh.	0.05	0.08	0.62	0.54	0.03	0.07	−0.14, 0.17
Attitude (12–16) (4 items) → Intention → Beh.	0.11	0.16	0.68	0.50	0.09	0.26	−0.39, 0.71
SN (injunctive) → Intention → Beh.	0.11	0.05	2.08	0.04	0.16	0.15	0.02, 0.59
SN (descriptive) → Intention → Beh.	0.26	0.15	1.66	0.10	0.28	0.18	−0.03, 0.70
PBC → Intention → Beh.	−0.07	0.06	−1.11	0.27	−0.10	0.10	−0.36, 0.03
Model 5 (weekend leisure/recreation)							
Attitude (0–4) → Intention → Beh.	0.14	0.24	0.59	0.55	0.15	0.24	−0.29, 0.62
Attitude (half) → Intention → Beh.	0.65	0.24	2.67	0.01	0.66	0.18	0.33, 1.05
Attitude (12–16) → Intention → Beh.	0.56	0.27	2.08	0.04	0.60	0.25	0.16, 1.15
SN → Intention → Beh.	0.14	0.13	1.12	0.26	0.26	0.29	−0.08, 0.98
PBC → Intention → Beh.	−0.04	0.29	−0.13	0.90	−0.05	0.28	−0.61, 0.49

Note: Beh. = Sedentary time; PBC = Perceived behavioral control; SN = Subjective norms. Boldface indicates significant indirect effect.

emerging factor structure and composition of this measurement tool be cross-validated using different samples with confirmatory factor analysis (Pedhazur & Schmelkin, 1991).

Consistent with Ajzen's (1985) underlying theory, significant relationships in the expected direction were found between TPB constructs and intentions. In the present study, Model 4-weekend work/school explained the most amount of intention variance (58%) followed by Models 1-general and 2-weekday work/school (35 and 33%, respectively), whereas the least amount of variance was explained by Models 3-weekday leisure/recreation and 5-weekend leisure/recreation (9 and 17%, respectively). These results are similar to Rhodes and Dean (2009), who found that depending on the sedentary behavior examined, TPB constructs explained between 13% and 63% of the variance in intention. This indicates that cognitive/rational processes play an important role in sedentary behavior and that sitting is not solely a habitual behavior engaged in by 'default'. To put these results in perspective, in a recent meta-analysis, McEachan, Conner, Taylor, and Lawton (2011) found that TPB constructs explained 44% of intention variance across studies that included multiple health behaviors.

The wide discrepancy in sedentary intention being explained underscores the importance of separating non-volitional (work/school) and volitional (leisure/recreation) activities over weekdays and weekends. Our data show that relations between TPB constructs and sedentary intentions are stronger when questions are couched within non-volitional as opposed to volitional pursuits. One reason for this may be that engagement in volitional pursuits is often secondary to the completion of non-volitional tasks (e.g., an individual may feel justified in watching TV only after completing an outstanding school assignment). Thus, intention to engage in leisure/recreation may have more to do with an individual's amount of free time and emotional state (i.e., what do I *feel* like doing to relax?) than with rational cognitions. Furthermore, it may have been more difficult for our participants to accurately estimate the amount of time they intend to spend on these pursuits, the end result being a weaker relationship between TPB constructs and intention. Volitional behaviors have more variety and are more dynamic than traditional non volitional behaviors—and through extension are more difficult to assess.

Attitude (0–4) independently predicted intention in Model 3 (weekday leisure/recreation), attitude (half) made a significant and unique contribution to the prediction of intentions in Model 1 (general model) and in Model 5 (weekend leisure/recreation), and attitude (12–16) did not predict intentions. Subjective norms made a significant and unique contribution to the prediction of intentions in 4 out of the 5 models tested (failed to predict intentions only in Model 5-weekend leisure/recreation). Perceived behavioral control independently predicted intention in Model 2 (weekday work/school). These results highlight the importance of SN in understanding sedentary behavior intentions. This is inconsistent with research from the physical activity domain, where meta-analyses have reported large effect sizes between intention and attitude and intention and PBC but moderate effect sizes between intention and SN (Hagger et al., 2002; Hausenblas, Carron, & Mack, 1997). The role of others appears to be more important in encouraging sedentary than physical activity intentions. This is not surprising, as the majority of adults spend far more time being sedentary than being active. Thus, significant others are more likely to reinforce sedentary intention through their easily observable daily actions whereas they are less likely to reinforce physical activity intention because their daily actions are not as directly observable. Furthermore, decisions to be sedentary are likely more socially motivated, and socially motivated decisions enhance the recognition of normative perceptions, which in turn influence intention (Manning, 2009).

Significant relationships in the expected direction were found between sedentary behavior and intentions, attitude, SN, and PBC. These constructs, in combination or on their own, explained between 8% and 43% of the response variance in behavior. The amount of sedentary behavior variance explained by Model 1 (general; 20%) and Model 4 (weekend work/school; 22%) is in line with the McEachan et al. (2011) meta-analysis that showed TPB physical activity and diet models predicted 24% and 21% of the response variance, respectively. Of course, the variance of sedentary behavior explained by Model 2 (weekday work/school; 43%) and Model 5 (weekend leisure/recreation; 30%) exceeds whereas Model 3 (weekday leisure/recreation; 8%) falls short of the variance reported by McEachan et al. Once again, this discrepancy highlights the importance of separating out non-volitional and volitional activities over weekdays and weekends.

The predictive superiority of Model 2 (weekday work/school) may be explained in part because this model only assessed two sedentary behaviors leading to a high degree of compatibility between behavior elements and the cognitive assessment of those elements. This logic can be used to explain why Model 3 (weekday leisure/recreation), which included 10 sedentary behaviors, explained only 8% of behavior but cannot explain why Model 5 (weekend leisure/recreation) explained 30% of behavior. One reason for the superiority of Model 5 over Model 3 may stem from the fact that for most people, weekdays are dominated by work/school whereas weekends are reserved for leisure/recreation. Our participants spent 6.18 h per weekday engaged in work/school but only 1.20 h per day engaged in this same behavior on weekends. For leisure/recreation pursuits, an opposite trend emerged. In light of these differences, it is possible that weekend leisure/recreation sedentary activities require more planning and cognitive processes that are captured through TPB constructs than weekday leisure/recreation sedentary activities. A second reason may be reluctance among our participants to admit, even to themselves, highly positive cognitions and intentions for engaging in leisure/recreation sedentary pursuits during the week. An examination of the mean scores obtained for SN, perceived behavior control, and intentions (Table 1) reveals more positive cognitions and greater intentions to engage in leisure/recreation sedentary pursuits on weekends versus weekdays. This may stem from the fact that Western societies value academic and career success and weekdays are typically reserved for work, school, and/or family responsibilities. As a result, feelings of guilt over insufficient productivity are not uncommon among employees (Grant & Wrzesniewski, 2010; Hochwarter & Byrne, 2010).

Sedentary intentions made significant and unique contributions to the prediction of sedentary behavior in 4 of the 5 models tested. These findings are in line with TPB theory and those reported by Rhodes and Dean (2009). Attitude (0–4) independently predicted behavior in Model 4 (weekend work/school), attitude (half) made a significant and unique contribution to the prediction of behavior in Models 2 and 3 (weekday work/school and weekday leisure/recreation, respectively), and attitude (12–16) did not predict sedentary behavior. Subjective norms and PBC independently predicted behavior in Model 2 (weekday work/school). Taken together, these findings provide partial support for TPB theory (direct behavior effects should only be seen with PBC).

One reason sedentary intention was found to be a consistently strong predictor of sedentary behavior was the short time interval between behavioral intention (time one plans to sit per day in the upcoming week) and actual behavior. Evidence exists that the longer the time interval between intention and behavior, the more malleable intention will be to new information, which in turn, will diminish relations between the two constructs (Conner, Sheeran, Norman, & Armitage, 2000; Sheeran, Orbell, & Trafimow, 1999).

Another plausible reason was scale correspondence (i.e., intended and actual time sitting) between intention and behavior. Previous physical activity research has shown the intention-behavior relationship is stronger when there is scale congruence between the two measures (Courneya & McAuley, 1995; Maddison & Prapavessis, 2004).

Social approval of sedentary behavior may explain why SN was not related to sedentary behavior in 4 of the 5 models. Manning (2009) showed that relations between these two constructs are stronger when behaviors are not socially approved (e.g., smoking in public places). Sedentary behavior is considered a socially approved behavior, and likely attenuates relations between the behaviorally relevant social cues of significant others and the actual behavior. In addition, the utility of the behavior might influence whether direct or indirect relations exist between SN and the targeted behavior (Manning, 2009). For instance, behaviors engaged in for utilitarian ends are likely to evoke cognitive processes whereas those engaged in for more hedonic pleasure purposes involve less deliberation (Hirschman & Holbrook, 1986; Kidwell & Jewell, 2003). The latter are thought to bypass intentions allowing normative perceptions to have a more direct role on the targeted behavior. We found SN to be more strongly related to sedentary intentions than behavior which implies that sedentary behavior is considered a more useful rather than pleasant behavior.

In contrast to previous research on physical activity (Armitage & Conner, 2001; McEachan et al., 2011) but consistent with Rhodes and Dean (2009), PBC was found to be a poor predictor of both sedentary intentions and actual sedentary time. One reason may be that PBC was the only TPB construct that was not temporal in nature. For example, time was included in the attitude items and produced three distinct time specific attitude factors, two of which predicted both intentions and behavior in three out of the five sedentary models tested. Similarly, intention and SN items were rated on a temporal scale which included the same response options as the SBQ. Although the temporal nature of this response scale may not be consistent with the bulk of TPB research, Ajzen (2006) has pointed out that in order to optimize the predictive utility of the TPB, the behavior under investigation must be described in terms of its Target, Action, Context, and Time (TACT) elements. Since sedentary time was the target behavior in the current study, time had to be included within each item and it is recommended that future work couch PBC items within a similar time frame. This is likely to be particularly important in future intervention research where reducing sedentary time is the outcome of interest. For example, perceived behavioral control over sitting 30 fewer minutes per day versus sitting 5 fewer hours per day is likely to result in very large differences in responses. For this reason, future researchers should pay particular attention to the way in which this variable is assessed.

Our mediation analyses indicated that all TPB constructs were indirectly associated with sedentary time via their association with intention. Overall, these findings are not consistent with TPB theory, which stipulates that only PBC should affect behavior through intention. Attitude showed the strongest association with a significant indirect effect emerging in four out of the five models. The importance of attitude is in line with Rhodes and Dean (2009) findings. In their study, attitude was the only TPB variable which significantly influenced behavior through intention. In the present study, however, we also found evidence of indirect effects for SN, which impacted behavior through intention in three models, and PBC, which was significant in one model. This discrepancy may be a result of analytical differences. Whereas we used Preacher and Hayes' (2004) mediation recommendations, Rhodes and Dean followed Baron and Kenny's (1986) procedures. Unfortunately, the method described by Baron and Kenny has been shown to suffer from low statistical power and thus increasing the chances of a Type II error (Preacher & Hayes). In contrast, the Sobel test has been found to have greater statistical power and is thus considered a more powerful statistical method for testing mediation (Preacher & Hayes, 2004).

With respect to the SBQ, the present sample appears to sit an average of 12 h per day. In line with Rosenberg et al.'s (2010) recommendation that the SBQ be modified as new options for sedentary behaviors become available, we added sitting to eat and sitting for spiritual pursuits to create a more detailed picture of sedentary behavior. In addition, we deemed it necessary to expand the time spent sitting in these behaviors from 6 h or more to 9 h or more to assess total time spent sitting as precisely as possible. An exploratory examination of individual SBQ item frequencies revealed responses above 6 h for sitting for work and school, listening to music, watching television, and using the computer for leisure/recreation. Finally, an attempt was made to delineate volitional and non-volitional pursuits. Examining the measurement of agreement between this modified scale and an objective criterion (e.g., accelerometer inactivity minutes) warrants future research attention.

The present study is not without limitations. Sedentary behavior was assessed through self-report and referred to "typical sedentary behavior" rather than "actual or current sedentary behavior". It is recommended that future researchers incorporate objective measurement (e.g., accelerometers/inclinometers) and re-frame self-reported sedentary behavior questionnaires to reflect present behavior. The cross-sectional design prevented us from making causal inferences. A technical problem emerged for participants who were randomized to the weekend group (Models 4 & 5) that adversely affected the sample size. Despite this glitch, the models performed well with respect to factor validity, reliability and predictive validity. Nevertheless the findings should be interpreted more cautiously than the findings from Models 1–3. In addition, the five models represented three independent samples. Findings would have been stronger if independent samples represented each model tested. Only 46.7% of participants who started the survey were included in the final analysis and our recruitment strategy prevented us from knowing how many individuals received an invitation to participate. Hence, we were unable to calculate a response rate and draw conclusions about the representativeness of our sample. Finally, our data can only be used to shed light on the role social cognition variables play in the engagement of sedentary behavior and not their role in the restraint of sedentary behavior.

Conclusion

This paper explored TPB constructs as a guide for understanding sedentary intentions and sedentary time. Preliminary evidence now exists for the tenability of a five factor TPB sedentary model. Subjective norms appear to be a strong predictor of sedentary intentions whereas sedentary intentions appear to be a strong predictor of sedentary time. Attitudes consistently affected sedentary time through intention. The wide discrepancy in sedentary intention and sedentary time being explained underscores the importance of separating out non-volitional and volitional activities across weekdays and weekends. More evidence is needed before TPB can be used as a framework to drive intervention research to reduce sedentarism in the general population.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.psychsport.2015.02.001.

References

Ajzen, I. (1985). From intention to actions: a theory of planned behavior. In J. Kuhl, & J. Beckmann (Eds.), *Action-control: From cognition to behavior* (pp. 11–39). Heidelberg: Springer.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Ajzen, I. (2006). *Constructing a TPB questionnaire: Conceptual and methodological considerations*. Retrieved January 7, 2014 from http://www.uni-bielefeld.de/ikg/zick/ajzen%20construction%20a%20tpb%20questionnaire.pdf.

Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behavior: a meta-analytic review. *British Journal of Social Psychology, 40*(4), 471–499. http://dx.doi.org/10.1348/014466601164939.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173–1182.

Bartlett, M. S. (1954). A note on the multiplying factors for various chi square approximations. *Journal of the Royal Statistical Society, 16*(Series B), 296–298.

Caillot-Augusseau, A., Lafage-Proust, M. H., Soler, C., Pernod, J., Dubois, F., & Alexandre, C. (1998). Bone formation and resorption biological markers in cosmonauts during and after a 180-day space flight (Euromir 95). *Clinical Chemistry, 44*(3), 578–585. Available at: http://www.clinchem.org/.

Canadian Society for Exercise Physiology. (2012). *Statement on the standardized use of the terms "sedentary" and "sedentary behaviors"*. Retrieved December 21, 2013 from http://www.csep.ca/english/view.asp?x=724&id=385.

Catell, R. B. (1966). The scree test for number of factors. *Multivariate Behavioral Research, 1*, 245–276. http://dx.doi.org/10.1207/s15327906mbr0102_10.

Conner, M., Sheeran, P., Norman, P., & Armitage, C. J. (2000). Temporal stability as a moderator of relationships in the Theory of Planned Behaviour. *British Journal of Social Psychology, 39*(4), 469–493. http://dx.doi.org/10.1348/014466600164598.

Courneya, K. S., & McAuley, E. (1995). Cognitive mediators of the social influence-exercise adherence relationship: a test of the theory of planned behavior. *Journal of Behavioural Medicine, 18*(5), 499–515. http://dx.doi.org/10.1007/BF01904776.

Dunstan, D., Barr, E. L. M., Healy, G. N., Salmon, J., Shaw, J. E., Balkau, B., et al. (2010). Television viewing time and mortality: the Australian diabetes, obesity and Lifestyle study (AusDia). *Circulation, 121*(3), 384–391. http://dx.doi.org/10.1161/CIRCULATIONAHA.109.894824.

Dunstan, D. W., Kingwell, B. A., Larsen, R., Healy, G. N., Cerin, E., Hamilton, M. T., et al. (2012). Breaking up prolonged sitting reduces postprandial glucose and insulin responses. *Diabetes Care, 35*, 976–983. http://dx.doi.org/10.2337/dc11-1931.

Garbin, C. P. (n.d.). FZT Computator. Retrieved January 27, 2015 from http://psych.unl.edu/psycrs/statpage/FZT_backup.exe.

Grant, A. M., & Wrzesniewski, A. (2010). I won't let you down...or will I? Core self-evaluations, other-orientation, anticipated guild and gratitude, and job performance. *Journal of Applied Psychology, 95*(1), 108–121. http://dx.doi.org/10.1037/a0017974.

Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: predictive validity and the contribution of additional variables. *Journal of Sport & Exercise Psychology, 24*(1), 3–32. Retrieved from http://journals.humankinetics.com/jsep.

Hagstromer, M., Oja, P., & Sjostrom, M. (2007). Physical activity and inactivity in an adult population assessed by accelerometer. *Medicine and Science in Sports and Exercise, 39*, 1502–1508. http://dx.doi.org/10.1249/mss.0b013e3180a76de5.

Hamilton, M. T., Hamilton, D. G., & Zderic, T. W. (2004). Exercise physiology versus inactivity physiology: an essential concept for understanding lipoprotein lipase regulation. *Exercise and Sport Sciences Review, 32*, 161–166. Available at: http://journals.lww.com/acsm-essr/pages/default.aspx.

Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the theories of reasoned action and planned behavior to exercise behavior: a meta- analysis. *Journal of Sport & Exercise Psychology, 19*, 36–51. Available at: http://journals.humankinetics.com/jsep.

Healy, G. N., Dunstan, D. W., Salmon, J., Cerin, E., Shaw, J. E., Zimmet, P. Z., et al. (2007). Objectively measured light-intensity physical activity is independently associated with 2-h plasma glucose. *Diabetes Care, 30*, 1384–1389. http://dx.doi.org/10.2337/dc07-0114.

Healy, G. N., Dunstan, D. W., Salmon, J., Cerin, E., Shaw, J. E., Zimmet, P. Z., et al. (2008). Breaks in sedentary time: beneficial associations with metabolic risk. *Diabetes Care, 31*, 661–666. http://dx.doi.org/10.2337/dc07-2046.

Hirschman, E. C., & Holbrook, M. B. (1986). Hedonic consumption: emerging concepts, methods and propositions. *Journal of Marketing, 46*, 92–101. Available at: http://www.marketingpower.com/AboutAMA/Pages/AMA%20Publications/AMA%20Journals/Journal%20of%20Marketing/JournalofMarketing.aspx.

Hochwarter, W. A., & Byrne, Z. S. (2010). The interactive effects of chronic pain, guilt, and perfectionism on work outcomes. *Journal of Applied Social Psychology, 40*(1), 76–100. http://dx.doi.org/10.1111/j.1559-1816.2009.00564.x.

Hoyle, R. H. (2000). Confirmatory factor analysis. In H. E. A. Tinsley, & S. D. Brown (Eds.), *Handbook of Applied Multivariate Statistics and Mathematical modeling* (pp. 465–497). US: Academic Press.

Hu, F. B., Li, T. Y., Colditz, G. A., Willett, W. C., & Manson, J. E. (2003). Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. *Journal of the American Medical Association, 289*(14), 1785–1791. http://dx.doi.org/10.1001/jama.289.14.1785.

Human Resources and Skills Development Canada. (2013). *Indicators of well-being in Canada: Work - Weekly hours worked*. Available at: http://www4.hrsdc.gc.ca/.3ndic.1t.4r@-eng.jsp?iid=19.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*, 141–151. http://dx.doi.org/10.1177/001316446002000116.

Kaiser, H. (1970). A second generation Little Jiffy. *Psychometrika, 35*, 401–415. http://dx.doi.org/10.1007/BF02291817.

Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika, 39*, 31–36. http://dx.doi.org/10.1007/BF02291575.

Kidwell, B., & Jewell, R. D. (2003). The moderated influence of internal control: an examination across health related behaviors. *Journal of Consumer Psychology, 13*(4), 377–386.

Maddison, R., & Prapavessis, H. (2004). Using self-efficacy and intention to predict exercise compliance among patients with ischemic heart disease. *Journal of Sport & Exercise Psychology, 26*, 511–524. Available at: http://journals.humankinetics.com/jsep.

Maher, C., Olds, T., Mire, E., & Katzmarzyk, P. T. (2014). Reconsidering the sedentary Behaviour Paradigm. *PLoS ONE, 9*(1), e86403. http://dx.doi.org/10.1371/journal.pone.0086403.

Manning, M. (2009). The effects of subjective norms on behavior in the theory of planned behavior: a meta-analysis. *British Journal of Social Psychology, 48*(4), 649–705. http://dx.doi.org/10.1348/014466608X393136.

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviors with the Theory of Planned Behaviour: a meta-analysis. *Health Psychology Review, 5*(2), 97–144. http://dx.doi.org/10.1080/17437199.2010.521684.

Menard, S. (1995). *Applied logistic regression analysis: Sage university series on quantitative applications in the social sciences*. Thousand Oaks: CA: Sage.

Meyer, A. M., Evenson, K. R., Couper, D. J., Stevens, J., Pereria, M. A., & Heiss, G. (2008). Television, physical activity, diet, and body weight status: the ARIC cohort. *International Journal of Behavioural Nutrition and Physical Activity, 5*, 68. http://dx.doi.org/10.1186/1479-5868-5-68.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Owen, N., Sugiyama, T., Eakin, E. E., Gardiner, P. A., Tremblay, M. S., & Sallis, J. F. (2011). Adults' sedentary behavior: determinants and interventions. *American Journal of Preventive Medicine, 41*, 189–196.

Pedhazur, E. J., & Schmelkin, L. (1991). *Measurement, design, and analysis*. New Jersey, NY: Lawrence Erlbaum Associates, Publishers.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, and Computers, 36*, 717–731.

Prochaska, J., & DiClemente, C. (1983). Stages and processes of self changes of smoking: toward an integrative model of change. *Journal of Consulting and Clinical Psychology, 51*, 390–395. http://dx.doi.org/10.1037/0022-006X.51.3.390.

Rhodes, R. E., & Dean, R. N. (2009). Understanding physical inactivity: prediction of four sedentary leisure behaviors. *Leisure Sciences, 31*, 124–135. http://dx.doi.org/10.1080/01490400802685948.

Rhodes, R. E., Mark, R. S., & Temmel, C. P. (2012). Adult sedentary behavior: a systematic review. *American Journal of Preventive Medicine, 42*(3), e3–e28. http://dx.doi.org/10.1016/j.amepre.2011.10.020.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology: Interdisciplinary and Applied, 91*(1), 93–114. http://dx.doi.org/10.1080/00223980.1975.9915803.

Rosenberg, D. E., Norman, G. J., Wagner, N., Patrick, K., Calfas, K. J., & Sallis, J. F. (2010). Reliability and validity of the Sedentary Behaviour Questionnaire (SBQ) for adults. *Journal of Physical Activity and Health, 7*(6), 697–705. Retrieved from http://journals.humankinetics.com/JPAH.

Schutz, R. W., & Gessaroli, M. E. (1993). Use, misuse, and disuse of psychometrics in sport psychology research. In R. N. Singer, M. M. Murphey, & L. K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 901–917). New York: MacMillan.

Schwarzer, R. (2008). Modeling health behavior change: how to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology, 57*, 1–29. http://dx.doi.org/10.1111/j.1464-0597.2007.00325.x.

Sheeran, P., Orbell, S., & Trafimow, D. (1999). Does the temporal stability of behavioral intentions moderate intention-behavior and past behavior-future behavior relations? *Personality and Social Psychology Bulletin, 25*, 721–730. http://dx.doi.org/10.1177/0146167299025006007.

Smith, R. A., & Biddle, S. (1999). Attitudes and exercise adherence: test of theories of reasoned action and planned behavior. *Journal of Sports Sciences, 17*, 269–281. http://dx.doi.org/10.1080/026404199365993.

Stamatakis, E., Hamer, M., & Dunstan, D. W. (2011). Screen-based entertainment time, all cause mortality, and cardiovascular events: population-based study with ongoing mortality and hospital events follow-up. *Journal of the American College of Cardiologists, 57*(30), 292–299. http://dx.doi.org/10.1016/j.jacc.2010.05.065.

Survey Monkey, Palo Alto, CA, USA.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*. Boston: Pearson Education Inc.

Tanaka, J. S. (1987). "How big is big enough?". Sample size and goodness of fit in structural equation models with latent variables. *Child Development, 58*, 134–146.

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC, US: American Psychological Association. Available online at: http://dx.doi.org/10.1037/10694-001.

Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometry. *Medicine and Science in Sports and Exercise, 40*, 181–188. http://dx.doi.org/10.1249/mss.0b013e31815a51b3.

Warren, T. Y., Barry, V., Hooker, S. P., Sui, X. M., Church, T. S., & Blair, S. N. (2010). Sedentary behaviors increase risk of cardiovascular disease mortality in men. *Medicine and Science in Sports and Exercise, 42*(5), 879–885. http://dx.doi.org/10.1249/MSS.0b013e3181c3aa7e.

Wilmot, M. G., Davies, M., Edwardson, C. L., Gorley, T., Khunti, K., Nimmo, M., et al. (2011). Rationale and study design for a randomized controlled trial to reduce sedentatry time in adults at risk of type 2 diabetes mellitus: project STAND (Sedentary Time ANd Diabetes). *BMC Public Health, 11*, 908. http://dx.doi.org/10.1186/1471-2458-11-908.

Zwart, S. R., Hargens, A. R., Lee, S. M., Macias, B. R., Watenpaugh, D. E., Tse, K., et al. (2007). Lower body negative pressure treadmill exercise as a countermeasure for bed rest-induced bone loss in female identical twins. *Bone, 40*(2), 529–537. http://dx.doi.org/10.1016/j.bone.2006.09.014.