

Testing the Efficacy of the Theory of Planned Behavior to Explain Strength Training in Older Adults

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The purpose of this study was to use the constructs of the theory of planned behavior (TPB) to gain a better understanding of the factors influencing older adults' participation in strength training. Two hundred men and women age 55 years and older were purposely sampled from seniors' centers in Ontario Canada. Participants completed a TPB questionnaire and reported their current physical activity participation. It was hypothesized that perceived behavioral control followed by attitude would be the strongest determinants of strength-training intentions and that intention would be the strongest determinant of strength-training behavior. Regression analyses revealed that subjective norm and perceived behavioral control explained 42% of the variance in intention and intention explained 40% of the variance in behavior. Gender and current strength-training participation did not significantly moderate the relationship between the TPB variables. The results suggest that interventions targeting subjective norm and perceived control might be helpful in promoting strength-training behavior among older adults.

Key Words: exercise, physical activity, social cognitive

Research has consistently demonstrated the beneficial effects that strength training can have on the health, functional status, and quality of life of older adults (Hunter, McCarthy, & Bamman, 2004; Seguin & Nelson, 2003). Strength training is the most effective way for older adults to increase and maintain muscle mass and strength in older age (Haff, 2005). Participation in strength training can also increase bone density, energy metabolism, insulin action, functional status, and overall levels of physical activity in older adults (Mazzeo et al., 1998; Seguin & Nelson).

Despite the benefits, rates of strength-training participation in the older population remain low. According to the U.S. National Health Interview Survey, only 10% of adults age 65–74 years and 7% of adults age 75 years and older participate in exercise designed to increase muscle strength and endurance (*Healthy People 2010 database*, 1998). A better understanding of the factors that influence strength

training in older adults is critical for developing interventions to promote higher levels of involvement.

The theory of planned behavior (TPB) (Ajzen, 1991) is an expectancy value model that was expanded from the theory of reasoned action (Ajzen & Fishbein, 1980). The TPB provides a theoretical framework to describe the ways in which attitude (i.e., overall evaluation of the behavior), subjective norm (i.e., perceived social pressures to engage in the behavior), perceived behavioral control (i.e., ability to perform the behavior), and intention (i.e., summary motivation to perform the behavior) combine to predict behavior. According to the theory, intention is the main determinant of behavior, and intention is formed by attitude, subjective norm, and perceived behavioral control (PBC). The theory also states that PBC can have a direct effect on behavior if the behavior is not under complete volitional control (Ajzen & Driver, 1992).

The TPB has been applied extensively to explain exercise behavior (Hagger, Chatzisarantis, & Biddle, 2002). Overall, attitude and PBC are the strongest predictors of general exercise intentions, with medium to large effect sizes, and subjective norm appears to play a smaller role in exercise intention, with a small to trivial effect (Godin & Kok, 1996; Hausenblas, Carron, & Mack, 1997; Symons Downs & Hausenblas, 2005). In addition, intention tends to be the strongest predictor of general exercise behavior, with a large effect, whereas PBC often has a small to trivial direct effect after intention is controlled for (Godin & Kok; Hausenblas et al.; Symons Downs & Hausenblas).

Ajzen (1991), however, proposed that the relative influence of each of the TPB constructs will change according to the behavior and the population under study. Accordingly, meta-analyses of the TPB have revealed that age moderates the intention–behavior relationship in exercise applications (Hagger et al., 2002). Therefore, studies of the TPB in different age groups are warranted.

To date, only a handful of studies have applied the TPB specifically to the exercise behavior of older adults (Benjamin, Edwards, & Bharti, 2005; Brenes, Strube, & Storandt, 1998; Conn, 1998; Conn, Libbus, Thompson, & Kelley, 1994; Conn, Tripp-Reimer, & Maas, 2003; Courneya, 1995; Lucidi, Grano, Barbaranelli, & Violani, 2006; Michels & Kugler, 1998). Although to our knowledge no studies have directly compared the TPB constructs between age groups, the findings of older adult studies provide evidence to suggest that the TPB variables might play different roles in influencing the exercise behavior of older adults compared with younger adults.

In addition to the influence of demographics on the relative contribution of the TPB variables, Ajzen (1991) states that the relationship between the variables is also specific to the behavior under study. Bryan and Rocheleau (2002) noted that the limitation of current exercise and TPB studies is that there has been no specification of the type of exercise under study. Instead, they suggest that the focus has concentrated on aerobic activity or “exercise” in general. Bryan and Rocheleau note that individuals who engage in aerobic activity versus strength training often have different goals, and the difficulty of performing these two activities might be quite different. For example, they suggest that a person might only have to own a pair of shoes in order to participate in aerobic activity, but strength training requires access to training facilities and equipment. As a result, it is important to determine whether and how the relationships between the TPB variables differ in different exercise applications.

Only two studies to date have applied the TPB specifically to strength training. Bryan and Rocheleau (2002) and Rhodes, Blanchard, and Matheson (in press) tested the TPB in aerobic- versus strength-training activities in prospective designs using samples of college students. The results of both studies revealed differences in the predictive validity of the model for aerobic- versus strength-training behavior. Both studies revealed that the fit of the model for strength training was better than that of aerobic exercise, with more variance explained in behavior. The stronger fit of the models to strength training was attributed to the stronger role of PBC. In other words, there appear to be more control factors influencing strength-training behavior. Rhodes, Blanchard, and Matheson also demonstrated that control beliefs such as access to facilities, knowledge of activity techniques, and social support were more predictive of strength-training behaviors than of aerobic behaviors. These findings demonstrate the need for different intervention foci to promote the two different types of physical activities.

Nonetheless, to our knowledge no studies to date have evaluated the TPB to explain strength training in an older population. Considering older adults' minimal involvement in strength training and the lack of information about the factors affecting participation, interventions to promote the activity are needed. The application of this well-established theory to this behavior, in this population, might provide a better understanding of the factors that influence participation and, therefore, guide interventions to promote strength-training activity among older adults.

Purpose and Hypotheses

The purpose of the present study was to test the efficacy of the TPB to explain strength-training behavior in older adults to gain a better understanding about the factors that influence their participation. As an exploratory purpose, the roles of gender and current strength-training participation were also explored as moderating variables between the TPB constructs and intention and behavior. Based on the prior literature, it was hypothesized that PBC, followed by attitude, would be the strongest predictor of intention, and intention would be the strongest predictor of behavior (Godin & Kok, 1996; Hausenblas et al., 1997; Symons Downs & Hausenblas, 2005). It was tentatively hypothesized that subjective norm might also be an important predictor of intention in this population, based on prior research (Michels & Kugler, 1998; Brenes et al., 1998). Gender was not expected to moderate the relationship between intention and behavior or between attitudes, PBC, and intention (Rhodes & Courneya, 2000). Current strength-training participation was also not expected to moderate the relationship between intention and the TPB variables (Norman, Conner, & Bell, 2000).

Method

Participants

Men and women age 55 years and older were recruited from locations hosting activities for older adults, such as community recreation centers, senior exercise classes, bowling leagues, churches, and mall-walking groups. Older adults were approached at a variety of locations to ensure participants with a range of physical

activity levels and experiences. As a result, it can be stated that purposeful sampling was used. Two hundred individuals participated in the study. Based on the guidelines of Miles and Shevlin (2001), our sample size was adequate to detect a medium effect size. The sample consisted of 52 men (26%), 147 women (73.5%), and one participant whose gender was unidentified (0.05%). Fifty percent of the sample were 75 years of age and younger, making this a young-old sample (Spiruso, Francis, & MacRae, 2005). Fifty-four percent of the sample were married or living common law, and 71% had completed at least a high school education. Fifty percent of the sample reported that they currently participated in strength training two or more times per week, and 56% reported that they currently participated in aerobic training three or more times per week.

Procedure

Letters were sent to a variety of seniors' organizations in Ontario, Canada, requesting permission to distribute a physical activity questionnaire at their locations. After permission was granted, the primary researcher traveled to these locations and approached participants either as a group or individually. Participants were provided with a verbal description of the study and asked to spare a few minutes of their time. Volunteers were provided with a 1-page cover letter describing the study information and a 6-page questionnaire designed to measure the TPB constructs pertaining to strength training, self-reported physical activity participation, and select demographics. Anyone 55 years of age and older who was willing and able to complete the questionnaire was included. Questionnaires were self-administered and took approximately 10 min to complete. Questionnaires were immediately returned to the researcher on completion.

Instrumentation

Participants were provided with definitions of strength training and aerobic training, and they were asked to refer to these definitions when responding to all questions on the questionnaire. Strength training was defined as repetitively working your muscles against moderate to heavy resistance (e.g., lifting a weight 8–15 times), done to improve or maintain muscle strength or muscle endurance, performed for all major muscle groups, with resistance gradually increased over time as strength improves. Examples include lifting weights, using machines or resistance tubing, and doing calisthenics (e.g., sit-ups). Aerobic training was defined as activity that increases breathing rate and heart rate, uses large muscle groups, might cause sweating or perspiration, and is done for at least 30 min. Examples include brisk walking, swimming, cycling, dancing, and tennis. These definitions were based on the American College of Sports Medicine (ACSM) and the Canada's Physical Activity Guides (CPAG) definitions of strength training and endurance training. The CPAG and ACSM definitions were combined to make them more comprehensive, and examples were added in order to add clarity.

The questions used to assess the TPB constructs were adapted from previous research using the TPB (Brenes et al., 1998; Bryan & Rocheleau, 2002; Courneya, 1995; Godin & Kok, 1996). Behavior was assessed by asking "How many days a week do you currently participate in strength training?" Responses were provided on a ratio-level scale ranging from 0 to 7 days/week.

Unless otherwise noted, all TPB constructs were measured on a Likert scale of 1 (*strongly disagree*) to 7 (*strongly agree*). Intention was assessed using two items: "I plan to strength train on a regular basis within the next 3 months" and "I will try to strength train at least two to three times a week within the next 3 months." An aggregated intention score was calculated with the mean of these two items. Internal consistency was acceptable at $\alpha = .97$.

Five items were used to assess attitude toward strength training. Participants responded to the statement "I believe strength training two to three times a week during the next 3 months would be . . ." and then rated strength training on a 1–7 scale as *useless* to *useful*, *harmful* to *beneficial*, *foolish* to *wise*, *unenjoyable* to *enjoyable*, and *unhealthy* to *healthy*. An aggregated attitude score was calculated using the mean of these five statements. Internal consistency was acceptable at $\alpha = .93$. Two items were used to assess subjective norm: "Most people who are important to me think I should strength train" and "Most people who are important to me would/do support my participation in strength training." An aggregated subjective norm score was calculated using the mean of these two statements. Internal consistency was acceptable at $\alpha = .85$.

To assess perceived behavioral control, both perceived control and perceived difficulty to do strength training were assessed using the following statements: "If I chose to, I could strength train any time I wanted to" and "Overall, for me to engage in strength training would be . . ." (1 = *extremely difficult*, 7 = *extremely easy*). An aggregated PBC score was calculated using the mean of these two statements. Internal consistency was acceptable at $\alpha = .76$. Demographic information such as age, gender, education, marital status, perceived health, and perceived fitness was also collected on the questionnaire. Participants were also asked how many friends they had who participated in strength training and aerobic training to help assess social factors that influence physical activity participation. The questionnaire was pilot tested on a convenient and representative sample of 5 individuals and assessed for clarity.

Data Analysis

All statistical analyses were conducted using SPSS 10.0 for Windows. An alpha level of .05 was used to determine statistical significance for all procedures. Following basic descriptive and bivariate correlations of the demographic and TPB variables, hierarchical ordinary least-squares regression analyses were conducted. The known predictors of behavior, including intention and PBC, were entered into the regression at Block 1 using forced entry. Attitude and subjective norm were entered into the equation in Block 2 using forced entry. A similar procedure was used to explain strength-training intention; however, attitude, subjective norm, and PBC were all entered together at Step 1 using forced entry.

As a part of our exploratory analysis, we also investigated the role of gender and current participation as moderators of the relationship between the TPB variables. Intention, attitude, subjective norm, and PBC were mean centered, and an interaction variable was created for each variable with gender and current strength-training participation. Forced, blockwise entry was used to enter all mean-centered TPB and interaction variables into the regression equation. To explain intention, the mean-centered attitude, subjective norm, and PBC variables were entered at Step 1, followed by gender and mean-centered strength-train-

ing participation at Step 2. The three TPB $\times$ Gender interaction variables were entered at Step 3, and the three TPB $\times$ Strength Training interaction variables were entered at Step 4.

The same procedure was used to explain strength-training behavior; however, only gender was investigated as a moderating variable. Mean-centered intention and PBC were entered at Block 1, followed by mean-centered attitude and subjective norm in Block 2. Gender was entered into block 3, followed by Intention $\times$ Gender and PBC $\times$ Gender in Block 4. Finally, Attitude $\times$ Gender and Subjective Norm $\times$ Gender were entered in Block 5.

Results

Ninety-five percent of participants rated their health as excellent to good, and 87% rated their fitness as excellent to good. Results illustrated that more individuals had friends who participated in aerobic training than strength training. Twenty-four percent of participants reported having no friends who participated in strength training versus 11% reporting no friends who participated in aerobic training. The mean number of days per week of aerobic-exercise participation was 2.6 ± 1.9 . The mean number of days per week of strength-training participation was 1.6 ± 1.7 .

Because of missing values and inconsistencies in self-reported physical activity participation, only 159 individuals were used in the final data analysis. The *t* test and chi-square analysis revealed that those who did not participate in strength training and those in the older age ranges were more likely to have missing values ($p < .05$). In addition, the attitude variable was negatively skewed, with 48% scoring 7 (i.e., strong attitudes toward strength training).

As illustrated in Table 1, attitude, subjective norm, and PBC were significantly correlated with intention at .35, .59, and .49, respectively ($p < .001$). Intention was significantly correlated with behavior at .63 ($p < .001$). Attitude, subjective norm, and PBC were significantly correlated with behavior at .17 ($p < .05$), .36, and .32, respectively ($p < .001$).

Ordinary least-squares regression analyses were conducted to determine whether the TPB is a useful model for explaining strength-training intention and behavior in the older population (see Table 2). Results revealed that subjective norm

Table 1 Correlations Between Constructs of the Theory of Planned Behavior

	2	3	4	5	6	<i>M</i>	<i>SD</i>
1. Behavior	.63***	.17*	.36***	.32***	-.03	1.8	1.7
2. Intention		.35***	.59***	.49***	.09	4.6	2.4
3. Attitude			.44***	.32***	.17*	6.1	1.4
4. Subjective norm				.44***	.21**	5.1	1.8
5. Perceived behavioral control						5.3	1.4

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2 Summary of Strength-Training Intention and Behavior Using Hierarchical-Regression Analysis (N = 159)

	<i>R</i> ²	<i>R</i> ² _{change}	<i>F</i> _{change}	<i>df</i>	β^1	β^2	95% CI
Exercise intention (Block #1)	.42	.42	36.84***	3,155			
attitude					.07		-.113 to .336
subjective norm					.44***		.401 to .783
perceived control					.27***		.221 to .654
Exercise behavior (Block 1)	.40	.40	50.92***	2,153			
intention					.62***	.64***	.343 to .546
perceived control					.02	.03	-.140 to .190
Exercise behavior (Block 2)	.40	<.01	0.36	2,151			
attitude						-.05	-.228 to .102
subjective norm						-.01	-.170 to .143

Note. *df* = degrees of freedom; β^{1-2} = standardized regression coefficients for Equations 1 and 2; CI = confidence interval.
p* < .01. *p* < .001.

($\beta = .44, p < .001$) and PBC ($\beta = .27, p < .001$), but not attitude ($\beta = .07$), explained 42% of the variance in intention, $F(3, 155) = 36.84, p < .001$. Furthermore, intention ($\beta = .62, p < .001$), but not PBC ($\beta = .02$), explained 40% of the variance in strength-training behavior, $F(2, 153) = 50.92, p < .001$.

Results of the exploratory analysis revealed that gender did not significantly moderate the relationship between intention and behavior (R^2 change = .020, F change = 0.072, n.s.) or between the TPB constructs and intention (R^2 change = .008, F change = 0.413, n.s.). Current strength-training participation also did not moderate the relationship between the TPB variables (R^2 change = .001, F change = 0.945, n.s.).

Discussion

To promote strength training in the older population, we must first identify the factors that influence participation. The TPB has proven useful in explaining aerobic exercise in the younger population, and, therefore the theory holds promise in explaining more specific forms of exercise such as strength training. Results of this study support the use of the TPB in explaining strength-training behavior in the older population because the constructs were able to explain 42% of the variance in strength-training intention and 40% of the variance in strength-training behavior.

The influence of each of the individual TPB constructs, however, differed from meta-analyses involving primarily young and middle-aged adults, and they were also slightly different from our original hypotheses. In contrast to our hypothesis, attitude was not a significant correlate of strength-training intention. Consistent with our hypotheses, PBC and subjective norm were significant determinants of strength-training intention; however, the influence of subjective norm was larger than expected. Consistent with our hypothesis, intention was the only significant predictor of strength-training behavior.

The most unique finding of this study was the significant role that subjective norm played as an independent correlate of strength-training intentions. Throughout the physical activity literature, subjective norm is generally the weakest predictor of intention compared with attitude and PBC (Godin & Kok, 1996; Hausenblas et al., 1997; Symons Downs & Hausenblas, 2005). The stronger influence of subjective norm in this application might be related to the motives that influence older adults' participation in physical activity versus younger adults. For example, older adults report exercising more often for social reasons than younger participants (Gill & Overdorf, 1994), and older adults report the social benefits as an important advantage of being physically active (Conn, 1998).

As noted earlier, more participants in this study reported having friends who participated in aerobic training versus strength training. Physical activity provides an opportunity for older adults to interact with others, and as a result, they might be more likely to participate in activities in which their friends are also involved. This is consistent with O'Brien Cousins (1996), who found that social reinforcement was one of the best predictors of late-life exercise. Future research should continue to investigate the contribution that socialization plays in influencing older adults' physical activity participation. In addition, direct comparisons between older adults and younger adults would provide more conclusive evidence about the different motives that influence strength-training participation in the two populations.

Contrary to our hypothesis, attitude was not a significant predictor of strength-training intention. The majority of the sample had positive attitudes toward strength training, suggesting that they already knew that it was a beneficial activity. In other words, there appears to be a ceiling effect with regard to attitude. These findings are consistent with those of O'Brien Cousins (2000) and O'Brien Cousins and Gillis (2005), who found that sedentary older adults knew that keeping active was important, yet they still did not participate. These findings suggest that health-promotion programs, which attempt to modify older adults' attitudes toward strength training, might not be enough to help facilitate participation in the activity. Ajzen (2002) noted that there must be room for change in the designated target variable in order for the intervention to be effective in influencing behavior. As a result, interventions would be better suited to target other TPB variables, such as subjective norm and PBC, to influence change.

The influence of PBC in this study was not a surprising finding, and it is consistent with the TPB and physical activity literature. As Bryan and Rocheleau (2002) and Rhodes, Blanchard, and Matheson (in press) previously demonstrated, the influence of PBC in strength-training applications might reflect control factors such as access to facilities, equipment, and knowledge about what exercises to perform. In addition, consistent with our hypothesis, intention was the strongest predictor of strength-training behavior. This finding is not consistent with the results of Bryan and Rocheleau or Rhodes, Blanchard, and Matheson, who found that PBC was also a predictor of strength-training intention. Our result is, however, consistent with other meta-analyses of the TPB in the exercise domain (Godin & Kok, 1996; Hausenblas et al., 1997; Symons Downs & Hausenblas, 2005). It is also of note that this study is based on a cross-sectional design, and future research should attempt to confirm its results through a prospective design.

An exploratory purpose of this study was to investigate the roles of gender and current strength-training participation as moderators of the relationship between the TPB variables. Consistent with our hypothesis, this study revealed no gender influence on the relationship between the TPB variables. A smaller proportion of men in this sample might have limited the statistical power of this analysis. Current participation in strength training also did not moderate the relationship between the TPB variables, suggesting that similar factors influence the intentions of current strength trainers versus those who do not participate.

Study Limitations

The questionnaire used in this study was adapted from a variety of previous TPB studies but has not itself been validated. Specific to the questionnaire, the principle of compatibility (Ajzen, 2002) was not met between the TPB measures, with intention, subjective norm, and PBC lacking a time element. In addition, scale correspondence was not met between the measures of behavior and intention; however, Rhodes, Matheson, and Blanchard (2006) revealed that an open-scale behavior measure such as the one used is appropriate. Finally, the measures of strength and aerobic training used in this study were brief, and results might differ using a validated physical activity measure such as the Physical Activity Scale for the Elderly (Washburn, Smith, Jette, & Janney, 1993) or objective measures.

In the present study, we modified the CPAG and ACSM definitions to make them more applicable to older adults, and although a short pilot study was per-

formed to ensure clarity, more work needs to be done to validate and support these definitions. It is also important to note that purposeful sampling was used with the intent of obtaining an array of participants ranging from sedentary to active strength trainers. A random sample of older adults might achieve better generalizability. In addition, information about the recruitment-to-participant rate was not tracked. Finally, the smaller number of men in this study and the lack of variability in the attitude variable make the results subject to Type II error and underestimation, respectively.

Implications for Practice

In this study, subjective norm and PBC were the strongest factors influencing strength-training intentions in older adults. As a result, interventions that target these constructs might be effective at increasing strength-training intention and subsequent behavior in older adults. For example, PBC could be improved by providing access to facilities and equipment or providing knowledge about what exercises to do and how to do them. On the other hand, increasing the social aspects of the activity and promoting strength training as a necessary component of all physical activity regimes could increase subjective norms. Further research using a prospective design is needed in order to assess the effectiveness of interventions targeting these constructs.

Conclusion

Overall, it appears that the constructs of the TPB are useful in explaining strength-training behavior in older adults. As a result, TPB-based interventions might hold promise for helping more older adults become involved in strength training. The promotion of strength training is important to help older adults to remain strong, functional, and independent in their later years.

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