Physical Activity and Function in Older Adults: Theory of Planned Behavior

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Objective: To assess the theory of planned behavior (TPB) and TPB with functional ability to explain intention and self-reported physical activity (PA) behavior of older adults. *Methods*: A survey was mailed to 2056 retirees from a large Midwestern university. *Results*: Structural equation modeling revealed that the TPB plus functional ability explained an additional 11% variance than the TPB alone in older adult PA and functional ability was the best predictor of PA (β = .53, P<.05). *Conclusions*: Functional ability appears to be an important predictor of PA behavior and should be included when designing PA programs for older adults.

Key words: physical activity, functional ability, older adults, theory of planned behavior

The public health challenge is to increase physical activity (PA) among older adults as an important aspect of a healthy lifestyle. One half of 65- to 74-year-olds and two thirds of those over 75 are sedentary, resulting in increased dis-

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ability and risk for chronic disease and decreased quality of life.[1] A major problem for older adults is the ability to perform PA declines with age.[2] PA has been found to prevent or delay further decline in mobility and functional status.[3,4] The American College of Sports Medicine and Centers for Disease Control and Prevention have developed specific PA recommendations for older adults based on research findings that exercises that improve flexibility, strength, and endurance decrease risk for falls, increase independence in performing activities of daily living, increase individual perceptions of health, decrease depression symptoms, and improve quality of life.[5]

Conceptual models and theories related to older adults' functional ability and PA need to be applied and evaluated. The theory of planned behavior (TPB) was the conceptual framework used in this study (Figure 1). The TPB has been shown to explain and predict PA behavior.[6-12] The TPB postulates that intention to perform a given behavior is the immediate determinant and best independent predictor of

Figure 1
Proposed Measurement and Structural Model for the TPB with Functional Ability

Theory of Planned Behavior with Functional Ability

Theory of Planned Behavior
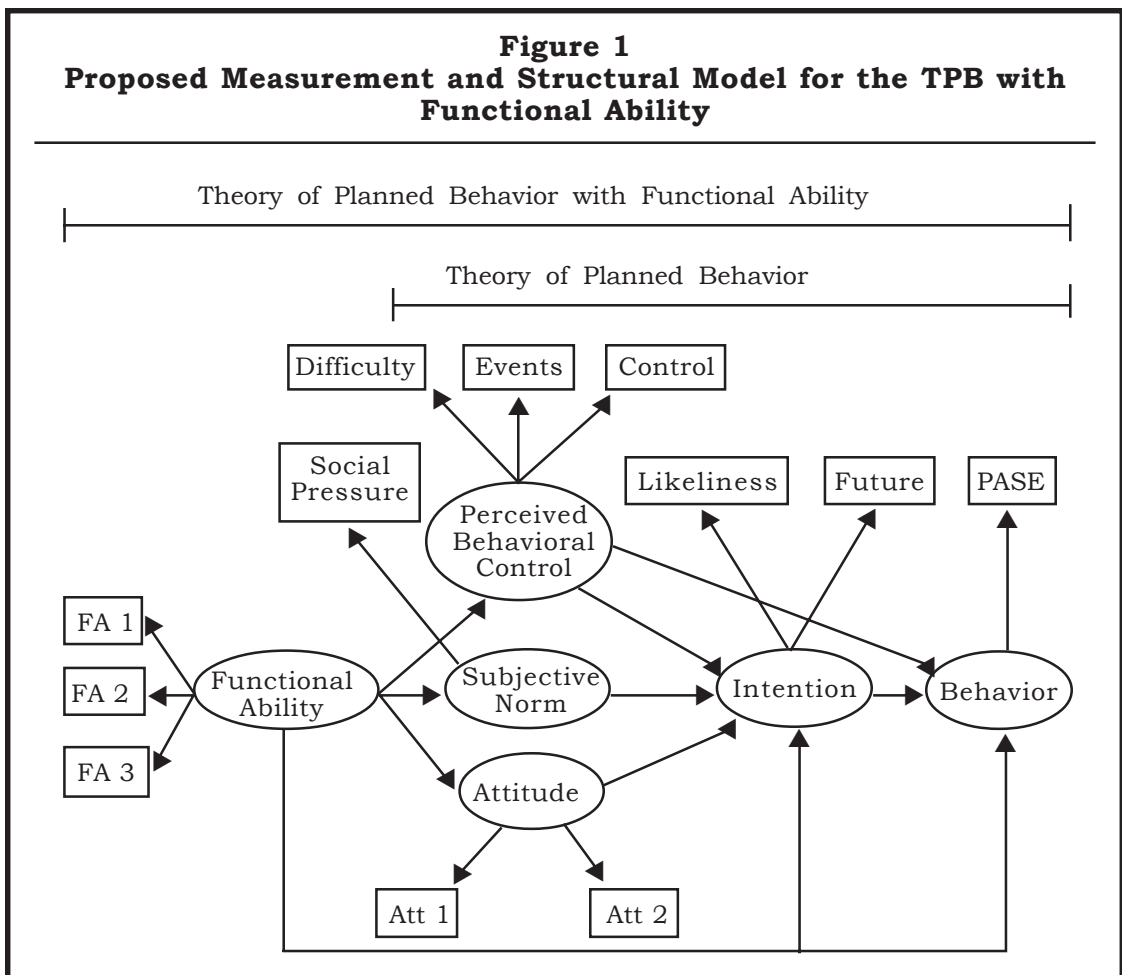
a person's behavior.[13-15] Behavioral intention represents the amount of willingness to try and the amount of effort an individual is planning to exert in order to perform a behavior. In general, the stronger an individual's intention, the more likely the behavior will be performed. The 3 independent determinants of intention are a person's attitude toward the behavior, subjective norm, and perceived behavioral control over performing the behavior. *Attitude* is defined as the positive (eg, good) or negative (eg, bad) evaluation of a behavior. *Subjective norm* is the perceived social pressure from important others to perform a behavior. *Perceived behavioral control* is the person's belief of the ease or difficulty in performing a given behavior based on past experiences, resources, opportunities, and barriers.[13,14]

Perceived behavioral control has an indirect effect on behavior through intention and also may have a direct effect on behavior when a person's perceived behavioral control is an accurate reflection of actual behavioral control. Ajzen and Fishbein[15] also indicated that external variables such as personality traits, attitudes toward people, and demographic characteristics such as age are not added directly to the theory since these external factors influence intention and behavior indirectly through attitude and subjective norm.

Findings from previous studies of PA using the TPB indicated that intention is consistently predictive of behavior, and that attitude and perceived behavioral control are often associated with and contribute significantly to intention to en-

gage in PA.[6,8,11] However, subjective norm has not strongly influenced intention toward PA behavior.[6,8] When subjective norm was found to be predictive of intention, it consistently had less influence than attitude.[6] These findings are based on younger populations.

In a recent meta-analysis[12] (n=111 studies) across all age-groups, attitude, perceived behavioral control and subjective norm (predictor variables) explained 30.4% of the variance in intention (outcome variable) to be physically active. Attitude (β=.34, P<.001) and perceived behavioral control (β=.27, P<.002) predicted intention whereas subjective norm (β=.13, P=.14) did not. In another regression analysis, intention and perceived behavioral control (predictor variables) explained 21% of the variance in PA behavior (outcome variable). Intention predicted PA (β=.42, P<.001) whereas perceived behavioral control (β=.08, P=.37) did not. These findings support the predictive validity of the TPB for PA behavior.

A small number of studies[9,18-22] have used the TPB to explain PA in a general population of older adults (>60 years of age), but results are varied. For example, Brenes and colleagues[21] found that intention was not a significant predictor of exercise behavior for older adults at 1, 3, and 9 months. Estabrooks and Carron[22] used the TPB to predict attendance in an exercise program for older adults and found that although intention predicted attendance, neither attitude nor subjective norm predicted intention or attendance in an exercise program. Benjamin and colleagues[20] found that highly active older adults had greater intention to continue exercising than did less active seniors. Courneya and colleagues[19] reported that older adults intended to exercise when they held a positive attitude toward exercise, had perceptions of control over their exercise, and perceived pressure from important others.

There are no published studies that have included functional ability in the TPB model. More variance may be explained in older adults' PA by adding functional ability to the model, because research[2] shows that physically active older adults have better health and greater functional ability compared to their more sedentary counterparts. Functional ability may have an impact on the range of activities individuals can engage in, and

the tasks of most importance for older adults are those associated with activities of daily living and the ability to live independently. Including functional ability in a theoretical framework related to PA in an older population is essential because the prevalence of limitations in functional ability rises steadily with age.[23]

This study fills a gap in the research literature by using the TPB with the addition of functional ability to examine older adults' PA. The study was conducted to address whether the TPB with functional ability added would explain more of the variance in older adults' intention and self-reported PA than would the TPB alone.

METHODS
Sample and Setting

Participants included staff members and/or spouses (65 years and older) recruited from a database of retirees receiving retirement health insurance benefits from a large Midwestern university. Participants held positions as educators, service workers, administrators, health care providers, technical support staff, scientists, industrial workers, administrative staff, and secretarial support staff. Slightly more females (53.8%) than males participated in this study. Participants were 65 - 98 years old (M age 75.5, SD = 6.7); most were married (64.3%), white (95.1%), had more than 12 years of education (61%), and lived in their own homes or apartments (88.5%). Twenty-one percent reported an annual income <$25,000, with 34% of the sample reporting income >$50,000. Although this sample was drawn from individuals receiving retirement benefits from the university, only 56.1% reported being fully retired whereas 43.9% reported they were currently salaried or were volunteers.

Measures

In order for participants to frame their responses in the appropriate context, physical activity was described as moderate or vigorous activities performed for at least 30 minutes/day at least 3 days/week. The PA could be accumulated in short bouts such as 10-minute intervals accumulated throughout the day or 30 minutes all at once. Examples of moderate activities included walking, bowling, yard work, gardening, or housework such as washing windows or vacuuming. Examples of vigorous activities included

dancing, jogging, swimming, or cycling.

The characteristics of the theoretical constructs described below are reported in Table 1. Attitude toward PA was measured using 7-point semantic differential bipolar adjective scales (from -3 to 3). The scales consisted of 8 adjective pairs that loaded on the evaluative dimensions of attitude. Five of the 8 items were used to represent the instrumental dimension (useful/useless, harmful/beneficial, good/bad, worthless/valuable, and healthy/unhealthy), and the remaining 3 items were used to assess the affective aspect of attitude (pleasant/unpleasant, interesting/boring, and enjoyable/unenjoyable).[15] An average score was calculated for the instrumental and affective domains with positive scores indicating a more optimistic attitude toward performing PA. Cronbach alpha for the scale was large at .94. Previous studies have reported Cronbach alphas of .72 to.90.[6,7]

A single item was used to quantify subjective norm. Participants rated their level of agreement with the statement "Most people who are important to me think I should perform PA regularly."[15] Subjective norm was scored from 1 to 5 on a Likert-type scale with a higher score representing greater influence by others to perform PA.

Perceived behavioral control was measured with 3 items. Participants rated their ease or difficulty and amount of control over performing PA for 30 minutes 3 days per week as well as number of events that prevented PA performance on 5-point Likert-type scales.[15] An average score was calculated with higher scores representing greater perceived control over performing PA. Cronbach alpha was acceptable at .70, although slightly lower than other PA studies (.71-.90).[6,7]

Functional ability was measured using the Physical Functioning Questionnaire.[23] Participants were asked, "How much difficulty do you have with each of these activities?" The areas of physical function assessed in the Physical Functioning Questionnaire included stair climbing, walking, getting up from a soft chair, doing light and heavy housework around the home, and lifting/carrying 10 pounds. Perceived difficulty in performing these activities was assessed using a hierarchy of difficulty coded as 0 (no difficulty), 1 (a little difficulty), 2 (moderate difficulty), 3 (a lot of difficulty), and 4 (unable to do).

For each functional ability category, scores were reverse scored, summed, and multiplied by 5.[22] Possible scores were from 0 to 100 with higher scores representing greater functional ability. Rejeski et al reported a Cronbach alpha of .90 for this scale.[23] The 6 areas of functional ability were grouped into 3 pairs for the structural equation analyses. Average scores were calculated for each pair as well as an overall average across all functional ability tasks. Cronbach alpha for the scale was .90, which is consistent with Rejeski and colleagues.[23]

Intention was measured with 2 items. First, participants rated the likelihood of being physically active for 30 minutes 3 days/week. A second item asked if the participants intended to perform PA for 30 minutes/day for at least 3 days/week in the next 2 months (future). Items were scored from 1 to 5 on Likert-type scales, and an average score was calculated.[15] A higher score reflects greater intention to participate in PA. Cronbach alpha for the intention measure was high at .91. Cronbach alphas of .73-.96 have been reported for intention in previous PA studies.[6,7]

Physical activity was measured with the Physical Activity Scale for the Elderly (PASE).[24] The PASE[25,26] is a brief instrument designed specifically to assess frequency and duration of recreational, leisure, and occupational PA in older adults over a 7-day period. Activities included in the PASE are walking outside the home; light, moderate, and strenuous sport and recreation; and muscle strengthening. Frequency was categorized as never, seldom (1-2 days/week), sometimes (3-4 days/week), and often (5-7 days/week); and duration was categorized as less than 1 hour, between 1-2 hours, 2-4 hours, or more than 4 hours. Occupational activity (paid or unpaid) that did not involve mostly sitting was recorded in total hours/week. Housework (light and heavy), lawn work/yard care, home repair, outdoor gardening, and caring for others were recorded as yes/no. The total PASE score was computed by multiplying the amount of time spent in each activity or participation (yes/no) by the empirically derived item weights and summing over all activities.[25] A higher PASE score represents greater PA behavior. The PASE has been validated against physiologic measures including 3-day motion sensor counts,

Table 1
Theoretical Construct Characteristics and Summary Statistics

Construct	Measurement	Anchors	Min-max Scores	Cronbach Alpha	# of Items	M (SD)
Functional Ability (n=1041)[a]	5-point Likert-type	0=Unable to do to; 1=Little difficulty	0 – 100	.90	30	77.16 (24.71)
FA[b] 1		2=Moderate difficulty; 3=A lot of difficulty			10	78.76 (26.69)
FA[b] 2		4=No Difficulty			10	73.12 (28.39)
FA[b] 3					10	79.56 (23.08)
Attitude (n=1037)	7-point		-3 – 3	.94	8	1.42 (1.45)
Instrumental (Att 1)	Semantic Differential	Useful/useless, harmful/beneficial, good/bad, worthless/valuable, healthy/unhealthy.			5	1.75 (1.41)
Affective (Att 2)		Pleasant/unpleasant, interesting/boring, enjoyable/unenjoyable			3	.84 (1.55)
Subjective Norm (n=1028)	5-point Likert-type	1=Strongly do not agree to 5=Strongly agree	1 – 5	NA	1	3.72 (1.38)
PBC[c] (n=1089)	5-point Likert-type		1 – 5	.70	3	4.07 (.99)
Number of Events		1=Numerous to 5=Very few			1	4.50 (.99)
Control		1=Absolutely no control to 5=Complete control			1	3.88 (1.30)
Difficulty		1=Very difficult to 5=Very easy			1	3.82 (1.37)
Intention (n =1082)	5-point Likert-type		1 – 5	.91	2	3.87 (1.36)
Likelihood		1=Not likely at all to 5=Very likely			1	3.84 (1.41)
Future		1=Definitely do not to 5=Definitely do			1	3.90 (1.41)
Physical Activity (n=1046)	Frequency and	0 (never), 1-2 (seldom), 3-4 (sometimes), or 5-7 (often) days/week	0 - 450.29	NA	21	119.97 (67.30)
PASE[d]	Duration	<1, 1-2, 2-4 or >4 hours/day				

Note.
a Items were reverse scored.
b FA = Functional ability
c PBC = Perceived Behavioral Control
d PASE = Physical Activity Scale for the Elderly.

grip strength, static balance, leg strength, and resting heart rate.[25,26] The PASE can be administered by telephone, mail, or face-to-face interview. Reliability has been evaluated in 254 subjects by repeated administrations 3 - 7 weeks apart.[25] Reliability for mail administration was higher ($r = .84$) than for telephone administration ($r = .68$).

Construct validity of the theoretical constructs was achieved through the use of well-established questionnaire items for the TPB, functional ability and PA behavior. Using items that have been validated in previous studies allows for comparison of study findings and consistent measurement of the theoretical constructs.

Design and Procedure
A cross-sectional survey design was used to test the 2 models, the TPB and TPB + functional ability. The psychosocial constructs that influence older adults' PA behavior also were examined. The university's human subjects review board approved the study. Dillman's Total Design Method[27] was used for data collection. A self-administered questionnaire, cover letter, and stamped addressed return envelope were sent to the addresses of all eligible retirees (n = 2056). A follow-up postcard was mailed to nonrespondents the second week following the initial questionnaire mailing. Four weeks following the initial mailing, nonrespondents were mailed a replacement questionnaire, cover letter, and stamped return envelope. Informed consent was implied with the return of a completed questionnaire. Of the 2056 questionnaires mailed, 1104 were completed and returned, and 66 were returned as "non-deliverable," which resulted in a 55.5% response rate. The investigators were unable to obtain data from the nonrespondents; therefore, comparisons between respondents and nonrespondents were impossible. Eight participants younger than age 65 were excluded from the analyses.

Data Analyses
Univariate statistics, factor analyses

of scales, and Cronbach alpha reliability analyses on all scales were conducted using SPSS 10.0.05.[28] Structural equation modeling was performed with EQS 6.1 (Build 50)[29] to assess measurement properties and to model the constructs. EQS 6.1 computes a measurement (confirmatory factor) model that identifies the relationships between the latent variables (unobserved model constructs) and the indicators (measured variables) as well as a structural (path) model that determines the relationship of the theoretical constructs with one another.[30] The 6 functional ability activities in the Physical Functioning Questionnaire had similar mean scores; therefore, were grouped into 3 parcels and used as indicators of the functional ability construct to be used in the structural equation modeling analyses. Two functional ability activities were combined for each parcel: FA 1 included walking and light housework; FA 2 included stair climbing and heavy housework; and getting out of a chair and lifting 10 pounds were combined for FA 3. Parceling reduces the number of indicators, which improves model fit.[31]

Subjective norm and PA each had one indicator and, therefore, were assumed to be measured without error. To standardize the measures, each construct in the model was provided a scale by linking it to one of its measured variables with a value of 1.0. Covariance matrices were analyzed using maximum likelihood procedures. The Satorra and Bentler[31,32] robust statistic was used as it is the most reliable test statistic for evaluating covariance structure models with various distributions and sample sizes by taking into account estimation methods and sample kurtosis values.

The structural equation model analyses were conducted in 2 stages. First, a confirmatory factor analysis was examined to test the measurement model. The R^2 and standardized coefficients were examined to assess the relationship between the model constructs and their measures. Next, the structural model was examined to assess the structural paths of the TPB and TPB plus functional ability. Squared multiple correlation coefficients (R^2) were used to determine the explained variance with intention to be physically active and PA behavior.

The measurement and structural models were examined for goodness of fit. In structural equation modeling, the chi-squared test (χ^2) should be nonsignificant indicating that the larger (less significant) the probability associated with the χ^2, the better the fit of the model to the data. However in studies with large sample sizes, such as this study, small differences between sample and estimated population covariance matrices can result in a significant difference.[32] As a result, additional fit indices are used to also evaluate the models for goodness of fit, which include the comparative fit index (CFI), Bentler-Bonnet's normed fit index (NFI), and non-normed fit index (NNFI),[33] and for misfit using the root mean square error of approximation (RMSEA). Fit indices above .90 and RMSEA below .06 indicate acceptable fit.[34]

Missing Data

The Physical Functioning Questionnaire and PASE had 5% and 3.4% missing data, respectively. Missing data also were noted for perceived behavioral control (2.4% - 3.5%), attitude (9.0%), and intention (2.7% - 4.4%). Data appeared to be missing at random. To determine the appropriate imputation method for missing data, separate analyses were conducted using list-wise deletion and imputation of missing values using the Jamshidian-Bentler EM algorithm.[35] The results for each method were very similar; therefore, the results are reported for analyses based on EM imputed covariance matrices.

RESULTS
Data Analyses

A descriptive statistics summary for model constructs is shown in Table 1. The participants had moderate self-reported functional ability (M = 77.16, SD = 24.71) and held a moderately positive overall attitude toward PA (M = 1.42, SD = 1.45) with the instrumental attitude scores approximately twice that of affective attitude scores. In addition, participants had moderately high perceptions of control over the facilitating or inhibiting factors for PA performance (M = 4.07, SD = .99) and had moderately high intention to engage in PA (M = 3.87, SD = 1.36). The mean PASE score was 119.71 (SD = 67.30), indicating the sample was mostly sedentary. This value is slightly higher than the normative values (M score = 102.9, SD = 64.1) established in a general popu-

Table 2
Intercorrelation Matrix for Theoretical Constructs

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Attitude: Instrumental	1.0											
2. Attitude: Affective	.70	1.0										
3. Subjective Norm	.49	.38	1.0									
4. PBC:[a] Events	.30	.29	.26	1.0								
5. PBC:[a] Control	.38	.38	.34	.28	1.0							
6. PBC:[a] Difficulty	.55	.54	.48	.41	.53	1.0						
7. Functional Ability 1	.41	.41	.30	.34	.44	.63	1.0					
8. Functional Ability 2	.43	.42	.32	.35	.45	.65	.87	1.0				
9. Functional Ability 3	.40	.40	.30	.33	.43	.62	.82	.85	1.0			
10. Intention: Likeliness	.61	.60	.41	.36	.46	.66	.48	.50	.47	1.0		
11. Intention: Future	.58	.57	.39	.34	.44	.63	.46	.47	.45	.84	1.0	
12. Physical Activity	.29	.28	.19	.21	.27	.38	.47	.48	.46	.37	.36	1.0

Note.
All correlations are significant at P<.05.
a   PBC = Perceived behavioral control

lation of older adults.[26] However, the results in this study are somewhat lower (M score = 131.4, SD = 71.1) in comparison to a population of older adults with knee pain.[27]

The Pearson correlation coefficients of the theoretical constructs appear in Table 2. The correlations among the theoretical constructs were significant. Each of the theoretical constructs was significantly related to PA with correlations between .19 (subjective norm) and .48 (functional ability 2). The 2 attitude measures were highly correlated (r = .70). The perceived behavioral control measures, difficulty, control, and number of events were moderately correlated (r = .53 and .41, respectively), whereas number of events and control had a low correlation (r = .28). Low to moderate correlations were observed among the functional ability measures and other theoretical constructs (r = .30 – .65). The functional ability measures (FA1, FA2, and FA3) were highly correlated with one another (r = .82 – .87).

Measurement Model
The measurement model is depicted in Figure 1. The measurement model maximum likelihood estimates and t values for the loadings of the variables on the constructs (Table 3) indicated significant relationships between the constructs and their measures. The squared multiple correlation coefficients (R^2) ranged from .22 to .89, with most of the R^2 greater than 0.6. The standardized coefficients for the measures were from .47 (perceived behavioral control to control) to .95 (functional ability to FA 2). The measurement model was acceptable with fit indices > .90 and the RMSEA <.06. The Satorra-Bentler scaled chi-square (χ^2) for the measurement model was 178.57, (df = 41, P< .001). The fit indices were .97, .96, and .98 for NFI, NNFI, and CFI, respectively and the misfit estimate, RMSEA, was .055, indicating a good fit of the model to the data.

Structural Model
The models estimated are depicted in Figure 1 and reflect the theoretical model of the TPB (Model 1) and the TPB with functional ability (Model 2). The first model tested the TPB with uncorrelated error terms. The attitude, functional ability, and perceived behavioral control constructs were allowed to correlate with one another. The fit statistic, χ^2, was significant, (129.97, df = 21, P< .001), the goodness-of-fit indices, NFI (.96), NNFI (.95), and CFI (.97), were all greater than .90, and the RMSEA was .07, indicating a moderately good fit. The direct effects of attitude (β = .36) and perceived behavioral control (β = .59) on intention were large

Table 3
Standardized Estimates of the Parameters of the
Measurement Model

Measured Variables	R^2	Functional Ability	PBC[b]	Subjective Norm	Attitude	Intention	Behavior
				Constructs			
Functional Ability 1 (FA1)	.85	.92					
Functional Ability 2 (FA2)	.89	.95					
Functional Ability 3 (FA3)	.80	.90					
		(16.23)[a]					
PBC: [b]Events	.37		.61				
PBC: [b]Control	.22		.47				
PBC: [b]Difficulty	.75		.87				
			(9.34)[a]				
Subjective Norm	.63			.79			
				(18.10)[a]			
Attitude Instrumental (Att 1)	.68				.82		
Attitude Affective (Att 2)	.71				.84		
					(12.93)[a]		
Intention: Likeliness	.88					.94	
Intention: Future	.80					.89	
						(22.27)[a]	
Physical Activity	.80						.89
							(13.65)[a]

Note.
a   t statistic, significant at P<.05 level.
b   PBC= perceived behavioral control

and significant, but subjective norm had a small and negative (β = -.08) nonsignificant effect on intention (Table 4). The variance explained by the TPB constructs on intention was 72%. The direct effects of perceived behavioral control and intention on PA behavior were significant at .37 and .15, respectively. The variance explained in PA behavior by the TPB constructs was 24%.

The second model tested the TPB with functional ability included as an exogenous variable. With the addition of functional ability, the model fit slightly improved: χ^2 = 183.46 (df = 43, P<.001), NFI = .95, NNFI = .94 and CFI = .96 and RMSEA = .055. The variance explained by the TPB plus functional ability constructs on intention was 74% (Figure 2). The direct effects of attitude (β = .36) and perceived behavioral control (β = .82) on intention were large and significant, but subjective norm had a small and negative (β = -.14) nonsignificant effect on intention (Table

4). Functional ability had a small but significant effect (β = -.23) on intention. The TPB plus functional ability (Model 2) explained an additional 11% in variance in PA behavior than the TPB (Model 1 R^2 = .35, P<.01 and R^2 = .24, P<.01 respectively). The direct effects of intention and functional ability on PA behavior were significant at .26 and .53, respectively. However, the direct effect of perceived behavioral control on behavior was nonsignificant and negative (β = -.14).

To determine if functional ability had a moderating effect, a 2-group structural equation modeling analysis was performed to compare the group with higher levels of functional ability (score >75) to those with lower functional ability (score <74.99). Results indicated that the magnitude, sign, and significance of the standardized coefficients and the variance explained were consistent between the 2 groups, suggesting that functional ability did not have a moderating effect.

Table 4
Standardized Coefficients and R² for the Theory of
Planned Behavior Models

Model	Intention					Behavior			
	FA[b]	PBC[c]	SN[d]	ATT[e]	R²	FA	PBC	INT[f]	R²
1. TPB[a]		.59*	-.08	.36*	.72	NA	.37*	.15*	.24
2. TPB with FA	-.23*	.82*	-.14	.36*	.74	.53*	-.14	.26*	.35

Note.
a   Theory of planned behavior
b   Functional ability
c   Perceived behavioral control
d   Subjective norm
e   Attitude
f   Intention
*   P<.05

For the final model, the direct and total standardized effects of each factor on the 2 outcomes, intention and behavior, are reported in Table 5. Perceived behavioral control had the highest significant total standardized effect on intention (β = .82), followed by functional ability (β = .56) and attitude (β = .36). The total effect of subjective norm was not significant (β = -.14). It is interesting that the total effect of functional ability on intention was positive and significant (.53), because the direct effect was significantly negative (-.23). For PA behavior, functional ability had the greatest influence (β = .57), followed by intention and attitude (β = .26

and.09, respectively), whereas perceived behavioral control and subjective norm (.08 and -.04 respectively) were not significant.

As indicated in Figure 2, large significant indirect effects were noted for functional ability through perceived behavioral control (β = .79), attitude (β = .53), and subjective norm (β = .42). It appears from the data that people's functional ability determines their PA behavior through the TPB variables. This finding supports the premise of the TPB in that external factors influence intention and behavior indirectly through attitude and subjective norm.[14]

Table 5
Decomposition of Effects for the Final Theory of
Planned Behavior Model

	Dependent Variables				
	Intention		Physical Activity Behavior		
Independent Variables	Direct Effect	Total Effect	Direct Effect	Indirect Effect	Total Effect
Functional ability	-.23*	.56*	.53*	.04	.57*
Attitude	.36*	.36*	NA	.09*	.09*
Subjective norm	-.14	-.14	NA	-.04	-.04
Perceived behavioral control	.82*	.82*	-.14	.21*	.08
Intention	NA	NA	.26*	NA	.26*

Note.
*P< .05

Figure 2
Final Structural Model with Standardized Beta Coefficients
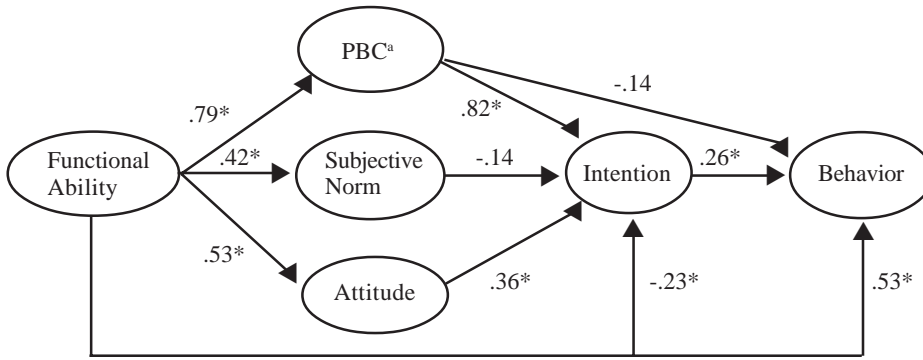
Note.
a   PBC = Perceived Behavioral Control
χ^2 = 183.46 (df = 43, P< .001); NFI = .95, NNFI = .94, CFI = .96 and RMSEA = .055.

DISCUSSION

This study of PA in an older adult population showed that the TPB model that included functional ability explained more variance in PA intention and behavior than did the TPB alone. These findings provide further support for the predictive validity of both models. The explained variance in intention was 72% (TPB) and 74% (TPB plus functional ability) which is slightly higher than previous studies.[6,8,12] In this study, attitude and perceived behavioral control were significant predictors of intention, indicating that older adults with more positive attitudes toward PA and less difficulty, more control and fewer events preventing PA performance had greater intention to perform PA. These findings are consistent with those of other PA studies.[6,8,12]

The TPB and TPB plus functional ability accounted for 24% and 35% of the variance respectively in PA behavior. These findings are similar to integrative reviews by Blue[6] and Godin[8] (R^2 .10 - .62) and a systematic review by Symons Downs and Hausenblas[12] (R^2 = .21). The finding that perceived behavioral control was not a significant predictor of PA behavior is interesting, although not inconsistent with other studies.[6,8] The participants in this study had a moderately high level of perceived behavioral control, and in ac-

cordance with theoretical assumptions, a high level of control would not be expected to influence behavior directly. Rather, according to Ajzen,[36] as the degree of volitional control increases, the more the behavior is guided by intention, and perceived behavioral control becomes less important. This is evident in that the total effect of perceived behavioral control was large and significant for intention and nonsignificant for PA behavior.

Although most older adults believe PA is beneficial, they are not easily influenced by others to change their PA behavior as evidenced by the nonsignificant small impact of subjective norm on intention and PA behavior. Blue[6] suggested that the lower predictive capacity of subjective norm in exercise behavior may indicate that the decision to exercise may be viewed more as an individual responsibility than influenced by referent others.

When functional ability was added to the TPB model, an increase in variance occurred supporting functional ability as an important predictor variable for older adult PA. Functional ability had a moderately large positive direct effect on PA as well as large indirect effects through attitude, subjective norm, and perceived behavioral control. Interestingly, functional ability had a significant negative direct effect on intention, indicating that

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those older adults reporting lower functional ability intended to participate in PA in the future. It may be that individuals with lower functional ability may be thinking more about beginning a PA program to limit the sequela associated with decreased functional status such as loss of independence, weakness, or decreased mobility.

Another possible explanation of the negative standardized coefficient of functional ability on intention may be related to a suppressor effect. This may be true because the Pearson correlation coefficient between functional ability and intention was positive and the structural equation modeling analyses indicated a negative effect.[33] It is possible that perceived behavioral control is a suppressor variable because the correlation between perceived behavioral control and intention and the coefficient were congruent. This may indicate that perceived behavioral control enhances the importance of functional ability by suppressing irrelevant variance.[34]

Knowledge of the predictors of PA can guide researchers and clinicians in the development of physical activity interventions that are tailored to the needs of older adults. Based on the findings of this study, improving attitude toward PA, facilitating intention to participate in PA, and incorporating activities that improve functional ability may be beneficial in promoting and implementing a PA program for older adults.

There are opportunities for future research. First, studies are needed to replicate the finding that functional ability improves the prediction of behavior to engage in PA in older adults. Second, it would be prudent to identify other factors to account for additional proportions of the variance to explain and predict PA in older adults. Last, it might be prudent to examine young adults as an initial attempt to ascertain if functional ability is an important variable that explains PA across the lifespan.

Limitations related to the study design, data collection, and analyses should be considered when making inferences and generalizing the results. In most PA studies using the TPB as a conceptual framework, including the present study, variables have been examined using a cross-sectional study design. Use of structural equation modeling with cross-sectional data does not provide evidence for causality among the theoretical constructs. A longitudinal design would provide opportunities to assess causative relationships among PA beliefs, intentions, and behaviors of older adults. Another limitation common to studies using a cross-sectional design with the TPB is that intention predicts future behavior whereas the behavior is actually a measure of past behavior (in this case the past 7 days). However, past PA is consistently related to activity measured at follow-up, and consequently, it is reasonable to expect that past PA behavior would be related to PA performed in the near future.[37] In this study, a moderate Pearson correlation was found between intention and PA. Lastly, the study sample consisted of predominantly white and well-educated retirees or spouses from a large Midwestern university; therefore caution should be exercised in generalizing the results to other populations in situations where knowledge and educational levels are different.

In summary, functional ability was an important predictor of self-reported PA and had the greatest influence on PA behavior. Functional ability also demonstrated significant direct and indirect effects on PA intention. Although functional ability can be considered an external construct to the TPB, it appears that functional ability is a key construct that should be included and investigated in future studies to predict PA in older adults. ∎

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