Exercise Among Blue-Collar Workers: Application of the Theory of Planned Behavior

By: Carolyn L. Blue, JoEllen Wilbur, Mary'Vesta Marston-Scott

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Abstract:

The purpose of this study was to identify cognitive predictors of blue-collar workers' (*N*=468) intention to exercise and their self-reported exercise behavior. The theory of planned behavior (TPB) provided the framework for the study. A cross-sectional sample of skilled and unskilled workers from the physical facilities department of a large, Midwestern state university completed a questionnaire containing measures of attitude, subjective norm, perceived behavioral control, intention, and self-reported leisure exercise behavior. Structural equation modeling demonstrated that workers' attitude toward exercise and perceived behavioral control explained 61.7% of the variance of intention, whereas intention and perceived behavioral control explained 51.3% of the variance of exercise behavior. Subjective norm was not a significant predictor of intention to exercise. The findings support the use of the TPB in identifying cognitive factors that explain exercise behavior and suggest that interventions to promote exercise behavior in blue-collar workers should address their attitude toward exercise and their perceptions of behavioral control.

Keywords: planned behavior; attitude; subjective norm; perceived control; intention; exercise; LISREL

Article:

The physical and psychological health benefits of regular physical activity are well documented (Bouchard, Shephard, & Stephens, 1994; U.S. Department of Health and Human Services [USDHHS], 1996). Yet despite such benefits, there is evidence to suggest that the number of people who engage in regular, sustained physical activity is relatively small (USDHHS). Greater leisure-time physical activity has been consistently related to adults with higher levels of education and income (Stephens & Caspersen, 1994; USDHHS). Blue-collar workers, particularly those with the lowest pay, have been less likely to participate in both unstructured and structured supervised exercise programs than have white-collar workers (Dishman, 1990; Gebhardt & Crump, 1990; Gottleib, Weinstein, Baun, & Bernacki, 1992; Stonecipher & Hyner, 1993; Tampson, 1988; Heaney & Inglish, 1995).

Understanding the psychological predictors of exercise in a blue-collar worker population is an important first step in designing a population-specific intervention to facilitate increased physical activity. One reason for blue-collar workers' low participation in work-site programs may be that available programs have not been designed specifically for target groups of workers (Campbell et al., 2000; Dishman, Oldenburg, O'Neal, & Shephard, 1998; King, Carl, Birkel, & Haskell, 1988; Niknian, Linnan, Lasater, & Carleton, 1991; Ritchie, Herscovitch, & Norfor, 1994). Therefore, the purpose of this study was to identify cognitive predictors of blue-collar workers' intention to exercise and their self-reported exercise behavior.

Data indicate that health-related behaviors of blue-collar workers are influenced by feelings of personal well-being rather than by health outcomes (Ritchie et al., 1994). In one study it was found that blue-collar workers did not know whether cardiovascular disease could be pre-vented (Niknian et al., 1991). Weitzel (1989) found that perception of poor health was a powerful predictor of lack of exercise for blue-collar workers. Female workers believed it was difficult to enjoy aerobic exercise unless their bodies were already in shape (Ritchie et

al., 1994). In addition, the health of significant others rather than the health of self influenced blue-collar workers' health-related behaviors (Stonecipher & Hyner, 1993; Weitzel).

For blue-collar workers, personal responsibility for health-risk behaviors was important, but they believed that taking responsibility was not an attainable goal (Ritchie et al., 1994). Health was viewed as a predetermined destiny that was outside the individual's personal control (Ritchie et al., 1994; Stonecipher & Hyner, 1993). Perceived barriers to exercise such as shift work, having a second job, responsibilities at home, and perceptions of being too old or too unfit to initiate a physical fitness program have also been found to negatively influence the physical activity behavior of blue-collar workers (Alexy, 1990). A qualitative study of female blue-collar workers revealed lack of time, shift work, family responsibilities, lack of willpower, and lack of support from others as barriers to physical activity and other health behaviors (Tessaro et al., 1998). Thus, blue-collar workers' attitude toward exercise, social influence, and perceived control are important factors to examine when predicting behavioral intentions for physical activity.

The theory of planned behavior (TPB; Ajzen, 1988) provided a framework to examine the influence of blue-collar workers' attitude, social norm, and perceived control beliefs on their intention to exercise and to engage in physical activity behavior. Reviews of accumulated studies found evidence to support the TPB for predicting exercise intentions and behavior among white-collar workers and the general adult population (Blue, 1995; Godin, 1993; Godin & Kok, 1996; Hausenblas, Carron, & Mack, 1997).

However, the TPB has not been used as a framework for identifying factors that exclusively predict the exercise behavior of blue-collar workers.

According to the TPB, the best single predictor of a person's behavior is the intention to perform the behavior. One's intention is a function of attitude toward the behavior and the subjective norm regarding the behavior (Ajzen & Fishbein, 1980). Attitude and subjective norm are ac-counted for by underlying beliefs. Attitude is a function of salient behavioral beliefs about the expected outcomes of performing the behavior weighted by the person's evaluation of the corresponding outcomes of performing that behavior. Subjective norm is a function of a person's normative beliefs about the perceived expectation that one or more referents think a person should or should not perform a behavior weighted by the person's motivation to comply with each of the referents.

The TPB also takes into account that some behaviors are not completely under the volitional control of the individual. Perceived behavioral control refers to a person's global perception of the ease or difficulty in carrying out a behavior and is proposed to influence behavior both directly and indirectly through its influence on behavioral intention (Ajzen, 1988). Perceived behavioral control is a function of a person's control beliefs, which are the facilitating and/or obstructing factors in carrying out a specific behavior. The relative significance of attitude, subjective norm, and perceived behavioral control in the prediction of behavior is important in determining appropriate strategies for influencing behavioral change (Ajzen; Ajzen & Fishbein).

The following hypotheses were tested: (a) workers' intention to engage in exercise will have a direct effect on self-reported exercise behavior; (b) attitude and subjective norm will have direct effects on workers' intention to engage in exercise; and (c) perceived behavioral control will have both a direct effect on the workers' exercise behavior and an indirect effect on their exercise behavior via their intention to engage in exercise.

METHOD

A descriptive cross-sectional survey design was used to examine the predictive capacity of blue-collar workers' attitude, subjective norm, perceived behavioral control, and intentions on their self-reported exercise behavior.

Sample and Setting

All 529 workers employed in the skilled crafts and in the service and maintenance departments of a large, Midwestern state university who held blue-collar jobs in construction, grounds and building maintenance, storage, transportation, and custodial services were eligible for the study. Questionnaires were distributed to the

522 workers who reported to work the day of data collection. Seven eligible workers did not receive the questionnaire because of illness, four questionnaires were incomplete, and 50 workers declined to participate. A total of 472 (90.4%) questionnaires were returned; of these, 468 had complete data.

When categorized based on the 1990 Standard Occupational Classification System developed by the U.S. Census Bureau (http://www.census.gov), 62.6% held skilled positions and 37.4% held unskilled positions. The top 5 of the 18 skilled positions were electricians (13.3%), carpenters (11.9%), electronics installers (11.1%), plumbers (11.1%), and environmental technicians (10.4%). Of those classified in the nine unskilled positions, the majority were custodians (88%). The majority (98.7%) of workers reported they were employ-ed full-time and that their job at the physical facilities department was their only job (71.7%). Consistent with full-time employment, 96.1% of workers reported they worked 40 or more hours a week. Slightly more than half (51.9%) worked the day shift.

The majority of participants were male (73.9%), married (67.4%), and Caucasian (94.7%), with a mean age of 44.1 years (*SD* = 11.2, range 20-69). All but 24 (10.4%) of the respondents reported completing high school, 20.3% reported some college, 19.0% reported completing a trade school, and 8.7% reported they were college graduates.

Measures

Model constructs and corresponding measures are shown in Table 1. Self-reported paper-and-pencil format was used for the questionnaire. According to Ajzen and Fishbein (1980) and Ajzen (1988), salient behavioral beliefs, normative beliefs, and control beliefs are the immediate determinants of or factors that underlie a person's attitude, subjective norm, and perceived behavioral control respectively. Therefore, measures for the behavioral, normative, and control beliefs were used as indirect measures of attitude, subjective norm, and perceived behavioral control. Guidelines from Ajzen and Fishbein and Ajzen were used to construct the behavioral belief, normative belief, control belief, attitude, subjective norm, and perceived behavioral control measures. General or global measures of attitude, subjective norm, and perceived behavioral control also have been recommended as measures of the direct determinants of intention to perform a behavior (Ajzen; Ajzen & Fishbein; Ajzen & Madden, 1986).

Table 1. Correspondence Between Model Constructs and Measures

Model Constructs	Measures	Description of the Measures
Attitude	Attitude—indirect	Behavioral beliefs that exercise leads to certain outcomes x outcome evaluations
	Attitude—direct	Positive or negative evaluation about performing exercise
Subjective norm	Norm—indirect	Beliefs that specific other referents think one should or should not exercise x motivation to comply with those referents
	Norm—direct	Perception of general social pressure to engage in or not engage in exercise
Perceived behavioral control	Control—indirect	Beliefs about factors that facilitate or inhibit exercise
	Control—direct 1	Perceived control over performing exercise
	Control—direct 2	Perceived ease or difficulty in performing exercise
Intention	Intention 1	Intention of engaging in exercise
	Intention 2	Likelihood of engaging in exercise
Behavior	Leisure exercise	Self-reported leisure activity measured in METs
	Sweating activity	Number of times activity results in sweating

Indirect measures. Consistent with Ajzen and Fishbein's (1980) and Ajzen's (1988) method of item development, a convenience sample of 21 blue-collar workers from the study population participated in an elicitation study to develop indirect belief measures for attitude, subjective norm, and perceived behavioral control. A free-response format was used to elicit the advantages and disadvantages of exercising in order to create the behavioral belief measures, which were used as the indirect measure of attitude. To elicit normative

beliefs, the indirect measure of subjective norm, the workers were asked to identify important referents who would think the respondent should or should not exercise. To elicit control beliefs, used as the indirect measure of perceived behavioral control, workers were asked to identify what factors would make exercising easy or difficult. For each indirect belief measure, comparable responses and the most frequent form of responses were grouped together into three ,'modal belief sets," for behavioral, normative, and control beliefs (Ajzen & Fishbein). Agreement from a panel of six judges who were experts in exercise research and developing measures for the TPB provided evidence for content and clarity of the modal belief sets. There were 12 statements for the behavioral beliefs, six for normative beliefs, and seven for control beliefs in each modal belief set.

Likert-type scales were developed from the belief statements representing each modal belief set, and corresponding scales also were constructed to measure the strength of each belief. Behavioral beliefs were weighted by the outcome evaluation to form the indirect measure of attitude. Normative beliefs were weighted by the motivation to comply with the referent to form the indirect measure of subjective norm. Weighting the behavioral beliefs and normative beliefs increases the explanatory value of the theory (Ajzen & Fishbein, 1980). Behavioral beliefs include both outcome expectancies and the value of those expectancies; normative beliefs include others who have social influence on the person (expectancy) and whether the person is motivated to comply with those other persons (value). At the time of instrument development, weighting of control belief items was not recommended. Therefore, unweighted control beliefs provided the indirect measure of perceived behavioral control.

The indirect measure of attitude consisted of 12 behavioral beliefs measured on a 5-point Likert-type scale (from 1 = *very unlikely* to 5 = *very likely*). The seven positive items (e.g., "gives me more energy") were scored from 1 (*very unlikely*) to 5 (*very likely*), whereas the five negative items (e.g., "is too time consuming") were reverse-scored. Thus, higher scores indicated a more positive behavioral belief. The corresponding 12 outcome evaluations also were scored on a 5-point Likert-type scale (from 1 = *extremely bad* to 5 = *extremely good*). Each behavioral belief was multiplied by its corresponding outcome evaluation, and the products were summed for a weighted belief score. For example, the response to the behavioral belief that moderate or vigorous exercise done for at least 20 min each time, for at least 3 days a week would "give me more energy" was multiplied by the response to the outcome evaluation "giving me more energy is good/bad." An average of the product scores was used to quantify behavioral beliefs. The possible scores for the behavioral belief measure ranged from 1 to 25. Item-to-total correlations for the belief items were between .30 and .75, and Cronbach's alphas for the behavioral belief, outcome evaluation, and composite scale were .74,.78, and .78, respectively.

The indirect measure of subjective norm was based on the six people the respondent from the elicitation study identified to be important referents who would think he/she should or should not exercise. The six referents were spouse, family, boss, coworkers, friends, and physician. The six items asked the respondent to circle the numbers under the words that best described what the respondent believed each person thinks he/she should or should not do about exercising. Responses were rated on a 5-point Likert-type scale (1 = *definitely should not* to 5 = *definitely should*). The corresponding six items measuring the motivation to comply with each referent were evaluated with the question "How strongly do you want to do what each of these people thinks you should do?" Responses were rated on a 5-point Likert-type scale (1= *not at all* to 5 = *very much*). Scores from the normative beliefs were multiplied by their corresponding motivation to comply and the products summed. An average of the product scores was used to quantify the normative beliefs. For example, the response to the item "Your family thinks you should/should not exercise" was multiplied by the response to the item "How strongly do you want to do what your family thinks you should/ should not do?" The possible scores for the normative belief measure ranged from 1 to 25, with higher scores indicating the participant was more influenced by referent others. Item-to-total correlations ranged from .60 to .74, and Cronbach's alpha for the normative belief, motivation to comply, and composite scales were .77, .88, and .86, respectively.

The indirect measure of perceived behavioral control consisted of seven beliefs measured on a 5-point Likert-type scale (1 = *very easy* to 5 = *very difficult*). An average of the scores was used to quantify control beliefs.

The possible scores for the control belief measure ranged from 1 to 5, with higher scores indicating more perceived control. Item-to-total correlations ranged from .56 to .71, and Cronbach's alpha was .86.

Direct measures. Ajzen and Fishbein (1980) recommended that attitude be measured directly using semantic differential scales. The direct measure of attitude toward physical activity used six bipolar adjectives from the evaluative dimension of the semantic differential scales developed by Osgood, Suci, and Tannenbaum (1957). The adjectives (*pleasant/unpleasant, interesting/ boring, good/bad, useful/useless, valuable/worthless, and helpful/harmful*) were measured on a 7-point scale. An average of the scores resulted in possible scores from 1 to 7, with higher scores indicating a more positive attitude toward exercise behavior. Item-to-total correlations for the six items ranged from .64 to .77, and Cronbach's alpha was .90.

Subjective norm was measured directly by items on a Likert-type scale. Participants were asked (a) whether most people important to the respondent think the respondent should or should not exercise (1 = *strongly do not agree* to 5 = *strongly agree*) and (b) whether the respondent wants to do what most of the important others think about the respondent's exercising (1 = *strongly do not agree* to 5 = *strongly agree*). Product scores for the two items were used as a general measure of subjective norm. Possible scores ranged from 1 to 25, with higher scores indicating respondents were generally influenced to exercise by others.

Perceived behavioral control was measured directly by two items on a Likert-type scale. Participants were asked how easy or difficult it would be to exercise (1 = *very difficult* to 5 = *very easy*) and how much control they had over performing exercise (1 = *absolutely no control* to 5 = *complete control*). The possible scores for each of the two items ranged from 1 to 5, with higher scores indicating more control.

Intention. Two items of intention to exercise were measured using a Likert-type scale. Participants were asked whether they intended to perform exercise for 20 min each time at least 3 times a week (1 =*definitely will not* to 5 = *definitely will*). The second item asked participants how likely or unlikely it was that they would exercise for 20 min each time at least 3 times a week (1= *not likely at all* to 10 = *extremely likely*).

Behavior. The two measures of self-reported exercise behavior came from the Godin Leisure Activity Questionnaire (Gionet & Godin, 1989; Godin & Shephard, 1985), designed to assess employee leisure activity. The measures of energy expended (METs) was the number of times the person engaged in strenuous (9 METs), moderate (5 METs), and mild (3 METs) physical activity that lasted 15 min each time over a usual 7-day period. The number of times spent in activity, weighted by the respective metabolic equivalents and divided by 10, was used to quantify exercise behavior. Respondents also were asked how often they engaged in regular activity long enough to work up a sweat (1 = *never/rarely*, 2 = *sometimes*, and 3 = *often*). Godin and Shephard reported 2-week test—retest reliabilities of .94, .46, .48, and .74, respectively, for the strenuous, moderate, light, and total dimensions of the energy expenditure measure and .80 for sweat-inducing expenditure. A 2-week test— retest reliability for the measure was .64, and concurrent validity was established with the measure's significant association with physical fitness criteria (Godin, Jobin, & Bouillon, 1986).

Procedure

Approval from the campus institutional review board was obtained to conduct the research according to federal regulations on the rights of human subjects. The investigator gave a 20-min explanation of the purpose of the study and assurance of confidentiality at three mandatory department policy meetings covering the day, evening, and night work shifts. Questionnaire packets that contained a cover letter explaining the purpose of the study, assuring confidentiality, and providing brief instructions for the completion of the self-administered questionnaire were distributed to the workers. Workers were given the option to complete the questionnaires at the end of the meeting or to return the questionnaire in the enclosed self-addressed envelope by campus mail. Five hundred and twenty workers took an average of 40 min to complete the questionnaire on site and place it in a drop box at the end of the meeting. Another nine questionnaires were received by campus mail. Chi square tests on nominal and ordinal data and t tests on continuous data (equal variances not assumed because of the difference in sample sizes) revealed no significant differences in demographic or study variables between the

nine participants who returned the questionnaire by campus mail and those who completed the questionnaire at the meeting.

Data Analysis

Data were analyzed by linear structural equation modeling using the LISREL 8 program (Jöreskog & Sörbom, 1993). LISREL computes two models: a measurement (confirmatory factor) model specifying the relationships between the unobserved model constructs (latent variables) and the measured variables (indicators) and a structural (path) model relating the theoretical constructs with one another.

Variances and covariances of the measured variables were used to estimate the model parameters. For each theoretical model, a series of models was estimated. Each construct in the model was provided a scale by linking it to one of its measured variables with a value of 1.0 so that the unobserved latent concepts would have the same units of measure. In the "baseline" model the error variances were "fixed" to their corresponding measures rather than allowed to be freely connected to other measures in order to allow a more precise representation of the connections between the measures and the constructs.

The proposed model was fitted simultaneously, rather than fitting the measurement model first, fixing it, and then estimating the structural equation model contingent on the measurement model. This baseline model was specified to test each of the theoretical models as proposed, with no added correlated measurement errors or structural paths. Indicators of overall fit of the model to the data were chi square (X2), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), root mean square residual (RMSR), and the standardized root mean square residual (SRMSR).

Models were refined by correlating error terms suggested in the LISREL diagnostic output and within the boundaries of behavioral theory. Other possible causal relationships were tested for the models, and the models were modified according to the information provided by the analysis. This was done by examining the fit in detail through looking at the normalized residual plots, the modification indices, and the expected change in χ^2. Squared multiple correlation coefficients (R^2) were used to determine the explained variance with intention to exercise and self-reported exercise behavior.

Table 2. Theoretical Constructs and Summary Statistics on Measured Variables in the Model

TPB Constructs	TPB Measures	No. of Items	Response Range	*M*	*SD*	Standardized α Coefficient
Attitude	Behavioral beliefs	12	2.1–21.7	13.00	3.13	.78
	Attitude	6	1–7	5.10	1.17	.90
Subjective norm	Normative beliefs	6	2–25	12.66	4.40	.86
	Subjective norm	2	1–25	11.36	7.00	
Perceived control	Control beliefs	7	1–5	3.73	0.77	.86
	Difficult	1	1–5	2.95	1.28	
	Control	1	1–5	3.38	1.25	
Intention	Intention	1	1–5	2.71	1.30	
	Likelihood	1	1–10	5.10	2.89	
Behavior	Leisure activity	1	0–272	30.02	29.82	
	Sweat activity	1	1–3	1.97	0.77	

RESULTS

Summary statistics for the measured variables are shown in Table 2. The mean score of 13.0 for the indirect measure of attitude indicated a fair amount of uncertainty that exercising regularly would lead to positive outcomes and/or that those outcomes would be good. However, the mean of 5.1 for the direct measure of attitude suggested that workers had a generally positive attitude toward exercise. The mean score of 12.7 for the indirect and 11.4 for the direct measures of subjective norm indicated only a modest amount of perceived social pressure to exercise. Means of 3.7, 2.9, and 3.4 for the indirect and direct measures of perceived behavioral control indicated only a modest amount of control over getting exercise. Means on the two measures of intention indicated that the workers had a moderate intention to exercise. The mean score for leisure activity, 30.02 (*SD* = 29.8), was skewed in a positive direction, indicating the workers were mostly sedentary.

Table 3. Intercorrelation Matrix for the Study Variables

Variable	Att1	Att2	SN1	SN2	PBC1	PBC2	PBC3	I1	I2	B1	B2
Attitude—indirect (Att1)	1.00										
Attitude—direct (Att2)	.56	1.00									
Subjective norm—indirect (SN1)	.45	.37	1.00								
Subjective norm—direct (SN2)	.35	.33	.48	1.00							
Perceived control—indirect (PBC1)	.57	.42	.34	.28	1.00						
Perceived control—direct (PBC2)	.34	.31	.17	.25	.28	1.00					
Perceived control—direct (PBC3)	.30	.26	.10	.22	.29	.55	1.00				
Intention (I1)	.50	.46	.34	.32	.30	.49	.36	1.00			
Intention as likelihood (I2)	.43	.44	.32	.29	.31	.50	.37	.76	1.00		
Behavior as leisure activity (B1)	.35	.36	.21	.14	.25	.40	.39	.54	.64	1.00	
Behavior as sweat activity (B2)	.33	.35	.24	.19	.26	.40	.41	.50	.57	.73	1.00

Note: Correlations $>.10$ are significant.

The Pearson correlation coefficients of the measured variables are presented in Table 3. The correlations among the two measures of attitude, subjective norm, perceived behavioral control, intention, and behavior were highly significant. In addition, the two measures of intention were strongly correlated with the two measures of self-reported exercise behavior.

Proposed Model

The proposed model for the TPB is illustrated in Figure 1. Greek symbols are used to denote the estimated model parameters. The ovals denote the constructs, and the rectangles denote the observed variables that are measured with error. Exogenous (independent) constructs are denoted by ξ (ksi), and endogenous (dependent) constructs are denoted by η (eta). Consequently, ξ_1 denotes attitude, ξ_2 denotes subjective norm, ξ_3 denotes perceived behavioral control, η_1 denotes intention, and η_2 denotes behavior. Arrows imply relations between the constructs and between the measures and constructs.

The measurement model includes seven *X* variables for the exogenous measured variables. Of these seven *X* variables, two are measures of attitude, two are measures of subjective norm, and three are measures of perceived behavioral control. In addition, there are four *Y* variables for the endogenous measured variables. The four *Y* variables are two measures of intention and two measures of behavior. The lambda coefficients (λ) link the constructs to the measured variables. The arrows directed toward the measured variables represent residuals or measurement error. Residuals (ε and δ) represent that portion of the variance of the observed variables (*Y* and *X*) that cannot be attributed to their respective constructs.

The structural model links the constructs to one another. Attitude, subjective norm, and perceived control are linked to intention (γ), and perceived control (γ) and intention (β) are linked to behavior. The curved lines represent the covariance between the constructs, denoted by ϕ (phi).

Measurement model Table 4 presents the maximum likelihood estimates of the parameters of the measurement model and *t* values for the loadings of the measured variables on the constructs.

The squared multiple correlation coefficients (R^2) ranged from .24 to .81, with the indirect measure of perceived behavioral control the smallest. The standardized lambda coefficients for the measures ranged from .49 to .90, with the indirect measure of perceived behavioral control the smallest. The LISREL modification indices and residual estimates suggest the indirect mea-sure of perceived behavioral control shared its origin with attitude and therefore did not indicate a distinct perceived control construct. Because of potential collinearity problems in the analysis, the indirect measure of perceived control was eliminated from the structural equation model.

The measurement properties of the remaining variables presented in Table 4 support significant relationships between each construct and their measures.

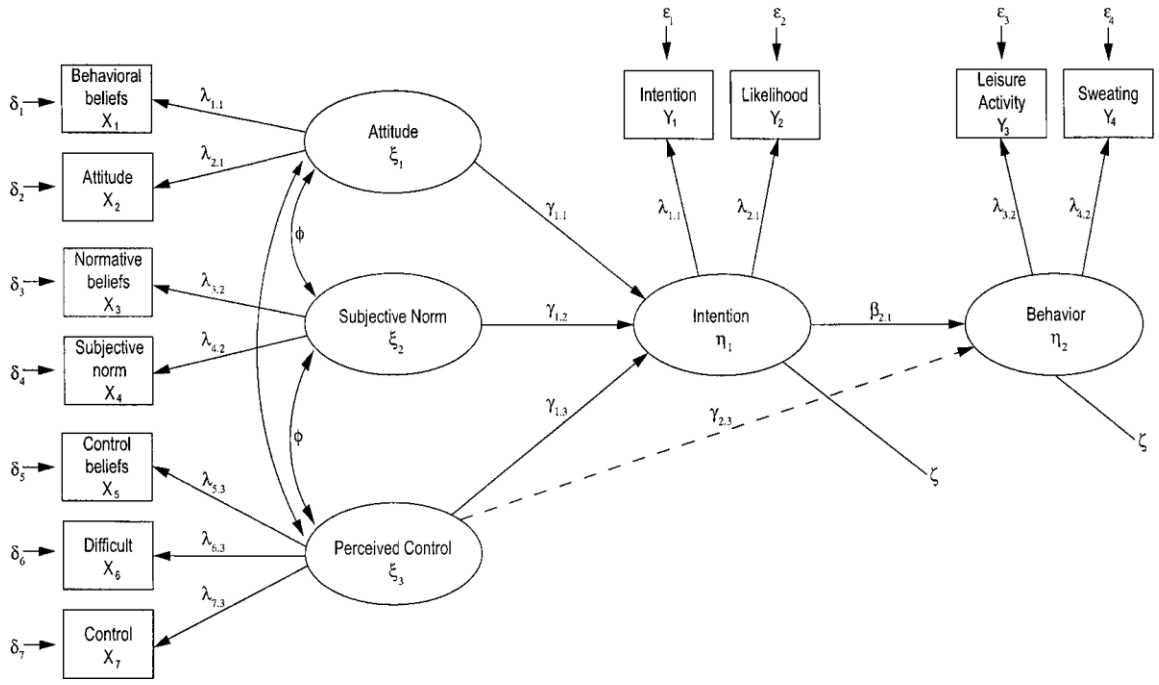

FIGURE 1. Proposed LISREL model for the theory of planned behavior.

Structural Model Sequence

The model tested was based on the TPB, in which exercise behavior is directly influenced by perceived control and intention to exercise and indirectly influenced by attitude, subjective norm, and perceived control via intention. The attitude, subjective norm, and perceived control constructs were allowed to correlate with each other. The goodness of fit results for a series of three models are shown in Table 5. Model 1, the baseline model, assumed that errors in measurement were uncorrelated. The χ^2 fit statistic was significant, indicating a rather poor fit of the model to the data. However, the goodness-of-fit indices were greater than .90. Because a person's intention to perform a behavior is closely linked to the behavior in question (Ajzen & Fishbein, 1980), it is not surprising that disturbances or error terms in the measures of intention and behavior would be correlated. The models were reestimated with relaxed parameters between the error terms involving likelihood and sweat activity measures (Model 2) and with an added relaxed parameter between errors involving likelihood (Intend 2) and the leisure activity measure (Model 3). Although the χ^2 fit statistic remained significant, other fit measures revealed a significantly better fit of the model to the data.

Structural Model

The structural equation model that relates the model constructs was examined next. Table 6 presents the standardized direct, indirect, and total effects of the independent variables on the dependent variables. The structural coefficients from the final model are shown in Figure 2.

The direct effects of attitude and perceived behavioral control on intention were significantly large. Perceived behavioral control (γ =.42) had a slightly greater influence on intention than did attitude (γ =.41). Subjective norm did not have a statistically significant direct effect on intention. Both perceived behavioral control (γ =.25) and intention (β =.52) had significant direct effects on behavior. Considering the total effects of the TPB concepts on behavior, perceived control contributed the greatest influence (.47) over the influence of attitude (.21). Workers' intention to engage in leisure time physical activity (.52) remained the predominant predictor of their self-reported exercise behavior. The amount of variance explained in intention was 61.7%, and 51.3% was the explained variance estimate for self-reported exercise behavior.

Table 4. Standardized Estimates of the Parameters of the Measurement Model: Theory of Planned Behavior

		Constructs				
				Subjective	Perceived	
		Attitude	Norm	Control	Intention	Behavior
Measured Variables	R^2	Estimates				
Attitude (indirect)[a]	.62	.79				
Attitude (direct)	.50	.71				
		(13.17)				
Subjective norm (indirect)[a]	.58		.76			
Subjective norm (direct)	.40		.63			
			(9.14)			
Perceived control (indirect)[a]	.24			.49		
Perceived control[b] (direct)	.55			.74		
				(8.96)		
Perceived control[c] (direct)	.44			.66		
				(8.65)		
Intend[a]	.72				.85	
Likelihood	.81				.90	
Leisure activity[a]	.78				(21.58)	.89
Sweating activity	.68					.82
						(18.20)

[a]Unstandardized parameter value fixed to 1.0.
[b]Difficult.
[c]Control.
Note: Critical value for *t*, shown in parentheses, is approximately ±1.96.

DISCUSSION

The purpose of this study was to identify cognitive predictors of blue-collar workers' intention to exercise and their self-reported exercise behavior. Overall, the results of the study provided support for the utility of the TPB in that the TPB fit the data. The results of this study are consistent with other studies of exercise using the TPB as a conceptual framework (see Blue, 1995; Godin, 1993; Hausenblas et al., 1997 for reviews). Workers' intention to exercise predicted their self-reported exercise behavior. Perceived behavioral control contributed to the prediction of both exercise intention and self-reported exercise behavior. Attitude was the most important predictor of intention, whereas subjective norm was not associated with intention.

Table 5. Comparative Goodness of Fit Among Three Theories of Planned Behavior Models

Goodness of Fit Measures	Model 1	Model 2	Model 3
Likelihood test (χ^2) (L^2)	65.755	53.642	47.412
df	27	26	25
p	<.001	.001	.004
Root mean square residual	.202	.193	.181
Standardized root mean square residual	.031	.028	.027
Goodness of fit index	.973	.978	.980
Adjusted goodness of fit index	.945	.954	.957
Increment in *LR*[a]		12.113	6.230
df		1	1
p		<.001	<.02

[a]Represents the likelihood ratio for the asymptotic χ^2 distribution calculated as the difference in χ^2 between two models.
Note: Model 1 assumed no correlated error; Model 2 assumed correlated errors between likelihood and sweat-activity measures; Model 3 assumed correlated errors between likelihood and sweat activity and between likelihood and leisure-activity measures.

Consistent with Ajzen and Fishbein's (1980) theory, attitude predicted intention. Blue-collar workers who had the strongest intentions to exercise had a more positive attitude toward exercise than did those with weaker intentions to exercise. This finding corresponds with other studies of exercise using the TPB (Courneya, 1995; Dzewaltowski, Noble, & Shaw, 1990; Godin & Gionet, 1991; Kimiecik, 1992).

Table 6. Decomposition of Effects for the Final Model: Theory of Planned Behavior

	Dependent Variables				
	Intention		Behavior		
Independent Variables	Direct Effect	Total Effect	Direct Effect	Indirect Effect	Total Effect
Attitude	.41	.41		.06	.21
	(3.80)	(3.80)		(3.31)	(3.31)
Subjective norm	.09	.09		.01	.05
	(1.02)	(1.02)		(1.01)	(1.01)
Perceived control	.42	.42	.25	.14	.47
	(6.01)	(6.01)	(3.45)	(5.02)	(6.65)
Intention			.52		52
			(6.99)		(6.99)

Note 1: Final model assumed correlated errors between likelihood and sweat activity and between likelihood and leisure-activity measures.
Note 2. Critical value for *t*, shown in parentheses, in approximately ±1.96.

Subjective norm did not predict intention to exercise, a finding that is also consistent with other TPB studies of exercise (Courneya & McAuley, 1995; Dzewaltowski et al., 1990; Godin & Gionet, 1991; Kimiecik, 1992). The finding that subjective norm was not associated with intention agrees with the premise of the TPB. Ajzen and Fishbein (1980) stated that the model is useful for understanding the underlying beliefs about a behavior so practitioners can design interventions to influence behavior. For some behaviors attitude will have more weight, whereas for other behaviors subjective norm will be important, and in some cases one of the factors may not have any weight in predicting a behavior in question. Interventions targeted to beliefs that have more influence on behavior will be more efficient in changing a behavior. The lack of influence of subjective norm on exercise behavior may have reflected the workers' beliefs that engaging in exercise is one's own responsibility. However, this finding also could reflect that blue-collar workers believe that taking personal responsibility is not an attainable goal, as Ritchie et al. (1994) found with health risk behaviors.

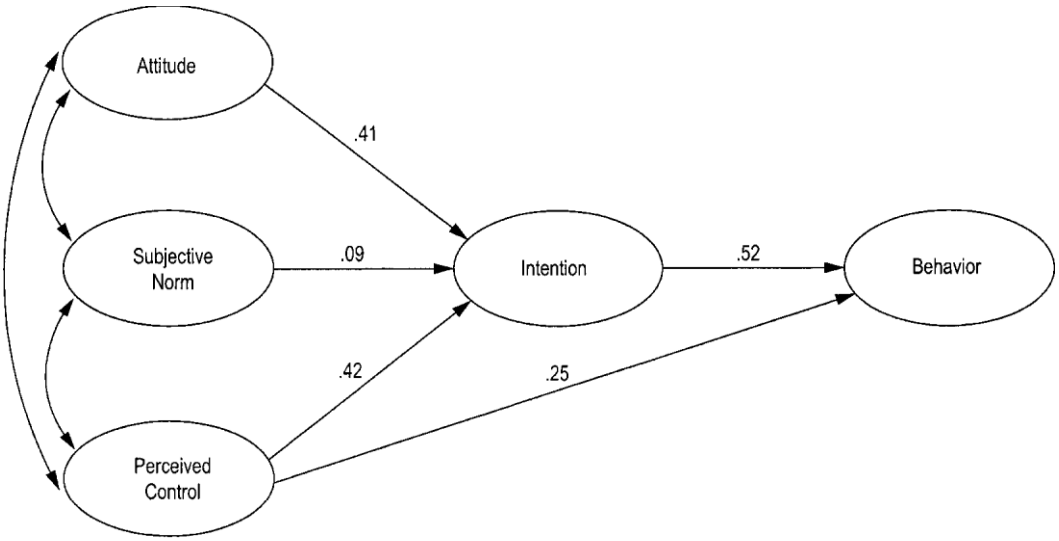

FIGURE 2. Final theory of planned behavior structural model relating constructs to each other.

Although attitude remained the predominant influence on intention to exercise in this sample of blue-collar workers, perceived behavioral control had a greater total effect on exercise behavior than did attitude. Findings in this study revealed that perceived control influenced behavior both directly and indirectly via intention, in accordance with Ajzen's (1988) proposition. These conclusions correspond to those of Courneya (1995), Horne (1994), and Kimiecik (1992) but differ from Dzewaltowski et al. (1990) and Godin, Valois, and Lepage (1993), who found that perceived behavioral control influenced exercise behavior only through intention. Perceptions of a lack of control have been found to be a barrier to blue-collar workers' health behaviors in past studies (Alexy, 1991; Lusk, Ronis, & Hogan, 1997; Ritchie et al., 1994). When perceptions of control correspond to realistic

opportunities and constraints that may exist for performing a particular behavior and the behavior is not volitional, perceived behavioral control emerges as an influence on intention as well as on behavior (Ajzen). The perceptions of control from the workers in this study most likely were congruent with real constraints on their engaging in regular exercise. Carrying out exercise behavior requires overcoming real or perceived inhibitors, resisting inconveniences, and confronting other external forces.

There are limitations to this study that warrant some caution in making inferences and generalizing the results. The study sample was limited to workers from the physical plant at a large, Midwestern university. Because of the location and type of work in which those individuals engage, the cognitive profile found of blue-collar workers in this study should be generalized with caution to other blue-collar workers, whose salient beliefs about exercise may be different.

This study relied exclusively on self-reported exercise behavior. Self-reports of physical activity may be subject to error. Other methods of determining leisure physical activity of the participants could have included physical activity diaries or structured interviews. However, these methods were not feasible given the resources associated with the present study.

In most studies of exercise using the TPB as a conceptual framework, including the present study, investigators have examined variables using cross-sectional study designs. Structural equation modeling with cross-sectional data does not provide the evidence for direction of causality among constructs that longitudinal data would provide. Examining the variables used in the present study over time also would provide answers to questions about the causative relationships among workers' beliefs about exercise, their intentions, and behavior.

The cognitive factors examined in the present study explained a little more than half of the variance in exercise behaviors of blue-collar workers. Obviously, there are other factors operating that contribute to workers' decisions about engaging in leisure-time exercise. Broader models that examine exercise participation of workers from an ecological perspective may provide additional information about blue-collar workers within the work-site. If the work-site is to be a mechanism for encouraging a more physical life-style, then the environment in which the worker is placed is also an important avenue for future study. Recognizing the interacting relationships between the work environment and individual cognitions that lead to exercise would allow for a more comprehensive approach to work-site physical fitness programs.

Because exercise behavior results in multiple health benefits, developing work-site strategies intended to increase worker exercise participation is a worthy goal. Results of this study provide an assessment of the workers' beliefs about exercise as a first step in targeting strategies aimed at changing their exercise behaviors. Interventions can be focused on manipulating attitude and perceived behavioral control. Workers' perceptions of positive outcomes are particularly important for program planning. A work-site campaign that fosters positive outcome beliefs about exercise (e.g., feeling good, getting more work done) and extinguishes negative outcome beliefs (e.g., is too time consuming, interferes with family plans) could be effective in changing salient outcome beliefs and attitude toward exercise. Increasing one's physical activity re-quires overcoming real or perceived constraints and resisting inconveniences. Work-site programs that are tailored to these blue-collar workers' perceived or real obstacles could diminish perceptions of lack of control over performing exercise behaviors.

The lack of influence on exercise intention by subjective norm in this study suggests that when designing an intervention to increase physical activity of blue-collar workers, the source of information (e.g., spouse, family, health professionals, or coworkers) may not be as important as the content of the information (e.g., positive outcomes of exercise behavior and the evaluation of those outcomes).

Models and conceptual frameworks for the study of exercise behavior need to be tested further and to be refined in order to discover the most efficient factors that can be used in successful work-site exercise interventions. The work site can be an avenue for reaching completely sedentary individuals and working with them to encourage the initiation and continuation of leisure-time exercise. Continued research pertaining to factors that

predict exercise behavior of blue-collar workers can provide important clues for tailoring more successful work-site interventions.

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