The Predictive Capacity of the Theory of Reasoned Action and the Theory of Planned Behavior in Exercise Research: An Integrated Literature Review

By: Carolyn L. Blue

Blue, C.L. (1995). The predictive capacity of the theory of reasoned action and the theory of planned behavior in exercise behavior: An integrated literature review. *Research in Nursing & Health, 18,* 105 - 121.

Abstract:

Although the association between habitual exercise and health benefits has been well documented, physical activity levels in the United States are lower than is necessary to reach the nation's health potential. Beliefs that people hold can be a motivating factor in engaging in exercise. A critical review of the literature was conducted to assess the efficacy of using the Theory of Reasoned Action and the Theory of Planned Behavior with respect to exercise. Evidence for the predictive utility of the theories was found. The Theory of Planned Behavior is a more promising framework for the study of exercise because it includes beliefs about control of factors that would facilitate or inhibit carrying out exercise. Strategies for use of the theories in planning exercise programs are provided and suggestions for future research discussed.

Article:

An increasing number of studies have documented multiple physical and psychological benefits of exercise for both healthy and unhealthy adults (Berlin & Colditz, 1990; Bouchard, Shephard, Stephens, Sutton, & McPherson, 1990; Harris, Caspersen, DeFriese, & Estes, 1989; International Society of Sport Psychology, 1992; Melby, Melby, & Hyner, 1984; Powell, Caspersen, Koplan, & Ford, 1989). Although the benefits of exercise are becoming increasingly recognized, a great proportion of people do not exercise (Caspersen, Christenson, & Pollard, 1986; Powell, Spain, Christenson, & Mollenkamp, 1986). It has been estimated that only 20% of individuals who do exercise, do so regularly or at energy levels that are beneficial to health (U.S. Department of Health and Human Services, 1991). In addition to this low-level involvement are problems of adherence with an exercise regimen. Exercise is a part of "behavioral health" (American College of Sports Medicine, 1991); thus, motivating individuals to include health behaviors such as exercise into their lifestyle is a worthy goal for health professionals.

The health potential from regular exercise cannot be fully realized until the determinants of exercise behavior are established and managed. Dishman, Sallis, and Orenstein (1985) concluded from a review of the determinants of physical activity and exercise that there is a need for research which investigates hypotheses derived from theoretical models having implications for intervention programs. Two theories that appear promising for understanding exercise behaviors are the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (TPB) (Ajzen, 1982, 1985, 1987, 1988, 1989, 1991).

The TRA (Ajzen & Fishbein, 1980) and the TPB (Ajzen, 1988) have been used in past research to explain and predict exercise behavior. The TPB is an extension of the TRA, incorporating perceived behavioral control into the model (Ajzen, 1988). A critical review of research using the TRA and the TPB was completed to deter-mine the usefulness of the model constructs in explaining exercise behavior.

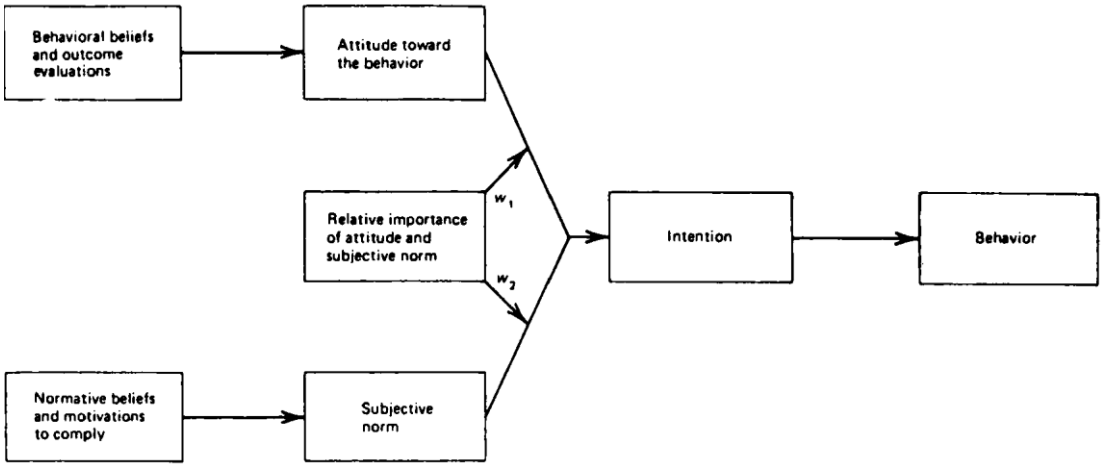

FIGURE 1. Theory of Reasoned Action. *Note.* From *Understanding attitudes and predicting social behavior* (p. 100) by I. Ajzen and M. Fishbein, 1980, Englewood Cliffs, NJ: Prentice-Hall. Copyright 1980 by Prentice-Hall. Reprinted by permission.

CONCEPTUAL FRAMEWORKS

Theory of Reasoned Action

The TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) is an expectancy value model with emphasis on attitudes, subjective norms, intentions, and behaviors directed to a specific focus. Expectancy-value models provide a framework for understanding the relationship between a person's attitudes and their underlying beliefs. Outcome expectancy is the belief that a given behavior will lead or will not lead to a given outcome, whereas outcome value is the person's evaluation or subjective value placed on that outcome (Ajzen & Fishbein, 1980; Eagly & Chaiken, 1993; McGuire, 1985). Algebraically, this relationship can be shown as Attitude = Σ Expectancy × Value. An individual is more motivated to perform a behavior that will result in an outcome that is highly valued. When one does not believe that an act will lead to a specific outcome or the outcome is not valued, the individual will be less motivated to perform a behavior. Because of the specific nature of the model, it offers an approach for understanding and predicting exercise intentions and/or behavior.

According to the TRA, behavioral intentions (BI) are the best single predictor of a person's behavior (B) (see Figure 1). Behavioral intentions are a function of attitude toward performing the behavior (A) and the subjective norm (SN) which expresses the person's perception of whether relevant others think one should or should not per-form the behavior (Ajzen & Fishbein, 1980). The relationship between behavior, behavioral intentions, attitude, and subjective norm can be represented algebraically as $B = BI = (A)w_1 + (SN)w_2$ where w_1 and w_2 are empirically determined weights showing differences of the effect on intention from attitude and subjective norm depending on the behavior in question. For some behaviors, the attitude component may be more important in determining behavioral intentions; for other behaviors, the normative component may be more important (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). In general, behavioral intentions remain stable over short time periods. Although intentions are more stable at the aggregate level, it is important that the time period between the measure of intention and behavior be short to ensure the prediction of behavior from intention (Ajzen & Fishbein, 1980).

Antecedent to attitude and subjective norm are behavioral and normative beliefs. Attitude toward a behavior is a function of a cognitive belief structure that uses two subcomponents: salient beliefs *(b)* that carrying out a behavior will lead to a specific outcome and the evaluation *(e)* of the outcome. An indirect measure of attitude, then, may be quantified by the sum of the products of beliefs about the behavioral outcome weighted by a respective evaluations of those outcomes. An algebraic representation of this relationship is $A = \Sigma\ (b \cdot e)$.

The subjective norm is a function of a person's perceived expectation that one or more referents think one should or should not perform the behavior *(nb)* and the motivation to comply *(mc)* with the referent(s). An indirect measure of subjective norm is derived by summing the products of salient normative beliefs about the

expectations of others and the motivation to comply with those respective expectations. A symbolic representation of this relationship is $SN = \Sigma\ (nb \cdot mc)$.

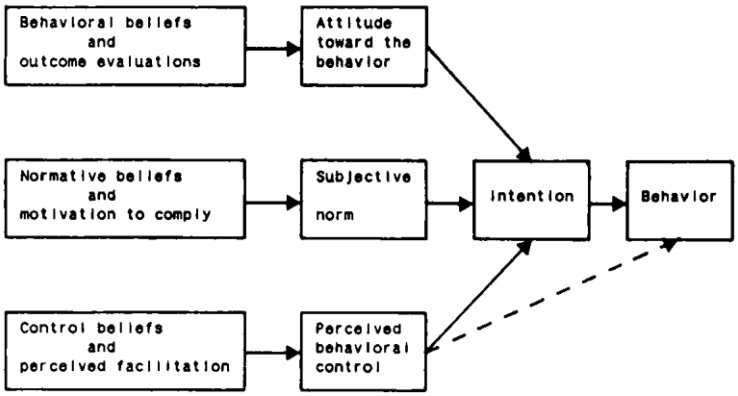

FIGURE 2. Theory of Planned Behavior. *Note.* From "Attitude Structure and Behavior" by I. Ajzen. In *Attitude structure and function* (p. 252) by A. R. Pratkanis, S. J. Breckler, & A. G. Greenwald (Eds.), 1989, Hillsdale, NJ: Lawrence Erlbaum. Copyright 1989 by Lawrence Erlbaum. Reprinted by permission.

The TRA is appropriate when the behavior being studied is under the volitional control of the individual (Ajzen, 1988; Ajzen & Fishbein, 1980). As proposed by Ajzen and Fishbein (1980), external variables are related to behavioral intentions and behavior only through their impact on the behavioral and normative beliefs. Thus, a person does not perform a particular behavior because of personality traits, attitudes toward people or institutions, or demographic characteristics such as cultural background. Instead, an individual will perform or not perform a particular behavior because of the constructs specified in the theory (i.e., behavioral and normative beliefs, attitude, subjective norm, and intention) (Ajzen & Fishbein, 1980).

Theory of Planned Behavior

A recent extension of Fishbein and Ajzens' (1975) TRA proposed by Ajzen (1985, 1987, 1988, 1989, 1991) and Ajzen and Madden (1986), the TPB, incorporates perceived behavioral control that has both an indirect effect through behavioral intentions and a direct effect on behavior (see Figure 2). Perceived behavioral control has been defined as the belief in how easy or difficult performance of the behavior is likely to be (Ajzen, 1985, 1988). The TPB is appropriate for use when the behavior being studied may not be completely under the control of the individual for a variety of reasons. Otherwise, the two models are similar.

Antecedent to perceived behavioral control (PBC) are the weighted sum of control beliefs (c.), which are the facilitating and/or obstructing factors, and the perceived power *(p)* of a particular control factor to facilitate or inhibit performance of the behavior (Ajzen, 1989; Ajzen & Driver, 1991). This relationship can be described algebraically as $PBC = \Sigma\ (c \cdot p)$. Perceived behavioral control is a reflection of actual control and may be considered a partial substitute for actual control (Ajzen, 1988). The TPB proposes that a positive attitude and/or subjective norm and perceptions of behavioral control will lead to a stronger intention to perform the considered behavior (Ajzen, 1988, 1989).

METHOD

A literature search was made of exercise studies using the TRA or TPB as a theoretical frame-work. Sources for the review included *MED-LINE, Cumulative Index to Nursing and Allied Health Literature, Sport & Leisure Index, Sociology of Leisure and Sport Abstracts, Physical Fitness/Sports Medicine, Psychological Abstracts,* and ancestry (tracking relevant citations in published articles). Key words used in the search were exercise, exercise behavior, attitude to health, attitude to exercise, exercise motivation, theory of reasoned action, theory of planned behavior, and intention to exercise. The review was restricted to articles published from 1980 to the present.

A data collection tool was developed to abstract elements from each study reviewed in a systematic way. Elements included are: author, year and purpose of the study, sample size and characteristics, sampling method, type of re-search design, measurement of the theory constructs, reliability of the measurement tools, threats to validity, definition of exercise behavior, relationships between the variables, and variance explained by the constructs. The validity framework developed by Cook and his associates (Campbell & Stanley, 1963; Cook & Campbell, 1979) was used to assess threats to validity of the studies. All published studies employing the theory-derived measures for constructs within the TRA and TPB framework with respect to exercise behavior were included in the review.

RESULTS

Twenty-three TRA and TPB studies were found. Sixteen of the studies using the TRA and seven studies using the TPB provided information about relationships among the theory constructs (see Table 1).

Sample Characteristics

The sample for the TRA studies included healthy adults (17), school-age children (2), pregnant women (2), persons with cardiovascular disease (1), and disabled persons (1). The sample sizes ranged from 56 to 698. In no study was the use of a statistical technique to determine sample size or statistical power reported. A retrospective sample size adequacy determination was done as part of this review. Using a significance criterion of .05, correlations, and sample sizes of the study, a table developed by Cohen (1988) was used to determine power. Only two studies (Godin, Colantonio, Davis, Shephard, & Simard, 1986; Theodorakis, Doganis, Bagiatis, & Gouthas, 1991) had statistical power of less than .80.

The majority of the studies were conducted with young to middle age adults. In only two of the TRA studies were samples of children used to examine the models (Godin & Shephard, 1986b; Theodorakis et al., 1991). Elderly persons were not included in any of the studies reviewed. There was an overall balance of male and female subjects in studies where gender was reported. Samples were obtained on a voluntary basis in over 70% of the studies reviewed.

Research Designs

Cross-sectional survey designs were used most frequently. A quasi-experimental design was used in only one TRA study (Godin, Cox, & Shephard, 1983). This finding was not surprising since the purpose of the studies were primarily to examine the constructs in the models with respect to exercise behavior.

Measurement of the Concepts

A strength of the theory is that an elicitation study forms the basis for instrument development. Ajzen and Fishbein (1980) specify guidelines to conduct an elicitation of beliefs for questionnaire development. Salient beliefs about a specified behavior are collected from a representative sample of interest. Using a free-response format, individuals are asked to list behavioral and normative beliefs. In addition, control beliefs are elicited to develop questionnaire items for use in examining the TPB. For example, behavioral beliefs with respect to exercise are elicited by asking "What do you believe are the advantages (and disadvantages) of engaging in exercise or vigorous physical activity for at least 20 minutes, three days a week between now and two months from today?" Instrument items based on the elicitation study must be specific to the target at which the behavior is directed, the action or specificity of the behavior under study, and the context and time in which the behavior is being carried out (Ajzen & Fishbein, 1980). Beliefs may be different depending on target, action, context, and time elements and the population of interest.

Beliefs from the elicitation study are grouped together into "modal belief sets" (Ajzen & Fishbein, 1980). Questionnaire items are developed into Likert-type scales from these modal sets. Likert-type scales corresponding to each modal set are also constructed to measure the strength of each belief. The grounding of the instrument in data increases content validity and ensures its appropriateness for a specific population.

In accordance with Ajzen and Fishbeins' (1980) protocol, elicitation studies were reported for constructing the instruments in all but two studies (Bentler & Speckart, 1981; Mullen, Hersey, & Iverson, 1987). Reliability and validity of the instruments are shown in Table 2. Twenty (87%) of the TRA and TPB studies reported either internal consistency or test—retest reliability of the measures. Measures of convergent validity were reported in two studies (Kimiecik, 1992; Schmelling, 1985). Kimiecik (1992) assessed the validity of his exercise measure by correlating it with an exercise activity questionnaire. Schmelling (1985) assessed the validity of measurements of attitude toward the act, subjective norms, and behavioral intention by determining correlations with different measures of the same constructs.

Table 1. Exercise Research Using the Theory of Reasoned Action and Theory of Planned Behavior

Study	Theory	Sample	Criterion Results							Intention R^2	Behavior R^2
			$b \cdot e - A$	$nb \cdot mc - SN$	$A - I$	$SN - I$	$PBC - I$	$PBC - B$	$I - B$		
Bentler & Speckart (1981)	TRA	n = 158 healthy adults college students[a]			r^c = .92***	r^c = .65[d]			r = .24[d]		
Dzewaltowski (1989)	TRA	n = 328 healthy adults college students[a]	r = .54*	r = .67*	r = .48*	ns			r = .22*	.34*	ns
Dzewaltowski et al. (1990)	TPB	n = 254 healthy adults college students[a]			r = .43*	ns	r = .40*	ns	r = .32***	.27*	.10[d]
Gatch & Kendzierski (1990)	TPB	n = 100 healthy adults college students			r^c = .30[d]	r^c = .23[d]	r^c = .25[d]			.30***	
Godin & Gionet (1991)	TPB	n = 444 healthy adults workers[a]			r = .38***	ns	r = −.41***			.43***	
Godin et al. (1986)	TRA	n = 62 lower-limb disabled adults[a]	r = .44***	r = .20[d]	r = .24*	r = .10[d]			r = .48***	.07*	.35***
Godin et al. (1983)	TRA	n = 172 healthy adults workers[a]	r = .41***	r = .37***	r^c = .50***	ns				.50***	
Godin & Shephard (1985)	TRA	n = 210 healthy adults married couples[b] (30% response)	males: r = .52*** females: r = .57***	ns	#	ns				males .49*** females: .27[d]	
Godin & Shephard (1986b)	TRA	n = 698 children[a]			r = .58***	r = .28***			r = .34***	.33***	
Godin & Shephard (1986a)	TRA	n = 90 healthy adults[a]			r = .51**	r = .36**			r = .41**	.36***	
Godin et al. (1993)	TPB	n = 152 pregnant women (32% response)	r = .55[d]	r = .31[d]	r = .55[d]	r = .47[d]	r = .47[d]	r = .11[d]	r = .30[d]	.64[d]	.32[d]
Godin et al. (1991)	TPB	n = 161 patients with heart disease[a]	r = .47***	r = .28***	r = .42***	ns	r = −.49***			.24***	

(*continued*)

Internal consistency for the belief components was assessed using coefficient alphas and ranged from .56 to .97. Internal consistencies were reported to be below .70 (α .56—α .69) for the belief measures used in two studies (Godin & Shephard, 1986a; Theodorakis et al., 1991). Direct measures for attitude and subjective norm had coefficient alphas ranging from .71 to .87. Perceived behavioral control was assessed in three of the six TPB studies, and internal consistencies for the measures were found to range from .81 to .87. Investigators reported internal consistencies ranging from .73 to .96 for behavioral intention measures. Although Dzewaltowski (1989) did not specify internal consistency measures, his measures ranged from .80 to .97. A coefficient alpha of .70 is generally acceptable for an immature scale and .80 is acceptable for a mature scale (Nunnally, 1978).

Table 1. (*Continued*)

Study	Theory	Sample	Criterion Results							Intention R^2	Behavior R^2
			b · e − A	*nb · mc − SN*	*A − I*	*SN − I*	*PBC − I*	*PBC − B*	*I − B*		
Godin et al. (1987)	TRA	*n* = 136 healthy adults workers[b] (72% response)	*r*[c] = .56[d]	*r* = .35[d]	*r* = .58***	ns		*r*[e] = .56*** *r*[f] = .68***	.66***	.67***[e] .64***[f]	
Godin et al. (1989)	TRA	*n* = 98 pregnant women[a]			*r* = .50***	ns				.54***	
Kimiecik (1992)	TPB	*n* = 332 healthy adults workers[b] (35% response)	*r* = .34[d]	*r* = .71[d]	*r* = .77[d]	*r* = .17[d]	*r* = .71[d]	*r* = .60[d]	.68[d]	.66***	.49***
Kristiansen & Eiser (1986)	TRA	*n* = 181 college students females only	*r* = .51***	*r* = .70***						.39***	
Madden et al. (1992)	TPB	*n* = 82 college students[a]								.50[d]	.44[d]
Mullen et al. (1987)	TRA	*n* = 326 healthy adults[b]								.18[d]	.57[a]
Pender & Pender (1986)	TRA	*n* = 377 healthy adults			*r* = .17**	*r* = .26**				.05**	
Riddle (1980)	TRA	*n* = 296 healthy adults joggers/ nonjoggers[a]	*r* = .76*	*r* = .72*	*r* = .73***	*r* = .43***			*r* = .82***	.55***	.62[d]
Schmelling (1985)	TRA	*n* = 135 healthy adults[b] (80% response)			*r*[c] = .76**	ns[c]			*r* = .65**	.59**	
Theodorakis et al. (1991)	TRA	*n* = 56 children[a]	ns	ns	*r* = .32*	ns			*r* = .36*	.19***	.09*
Valois et al. (1988)	TRA	*n* = 166 healthy adults[a]			#	ns	ns			ns	.32***

Note. *b · e* = behavioral belief × evaluation; *nb · mc* = normative belief × motivation to comply; *A* = attitude toward the behavior; *SN* = subjective norm; *PBC* = perceived behavioral control; *I* = intention; *B* = behavior.
Note. ns = not significant.
[a] Volunteers. [b] Random sample. [c] Standardized regression coefficient. [d] Significance not reported. [e] At 3 weeks. [f] At 2 months.
significant; *p* not reported. * $p < .05$. ** $p < .01$. *** $p < .001$.

Stability of the instruments was assessed by test—retest in seven studies. Test—retest re-liabilities ranged from .70 to .93. Test—retest re-liabilities for the belief measures were assessed in only two of the studies and ranged from .67 to .87 (Godin & Shephard, 1986b; Riddle, 1980).

In ten studies, the measure of intention was described and the intention—behavior correlation provided (see Table 3). Intention to perform exercise behavior was measured in two distinct ways. One way was to measure the extent to which a person "intends," "plans," "is determined," or "has decided" to perform the behavior (Dzewaltowski, 1989; Dzewaltowski, Noble, & Shaw, 1990; Theodorakis et al., 1991). The other way intention was measured was by inquiring about the "probability" or "likeliness" of per-forming the behavior (Godin et al., 1986; Godin & Shephard, 1986b; Godin, Valois, & Lepage, 1993; Godin, Valois, Shephard, & Desharnais, 1987; Kimiecik, 1992; Riddle, 1980; Schmelling, 1985). Although Dzewaltowski (1989; Dzewaltowski et al., 1990) included a probability measure as one of four measures of intention, the total score was an average that included three measures that were not a probability.

According to Warshaw and Davis (1985), subjective probabilities of performing a behavior are actually measures of expectations rather than intentions. The extent to which the individual intends or plans to perform a behavior is a measure of intention. With expectations, a person considers alternatives and a much greater range

of factors than the intention measure, such as their ability to perform the behavior, environmental factors that might prevent or facilitate the probability of performing the behavior, past behavior, and other factors in the present situation (Warshaw & Davis, 1985).

Table 2. Reliability and Validity of Concept Measures in the TRA and TPB

Study	Internal Consistency	Test–Retest		Convergent Validity
Dzewaltowski (TRA) (1989)	α .80–.97 (not specified)			
Dzewaltowski et al. (TPB) (1990)	PBC: α .87 *I*: α .96	*B*: *r* = .50–.76		
Gatch & Kendzierski (TPB) (1990)	*A*: α .79 *PBC*: α .81 *I*: α .93			
Godin et al. (1986)	*b*: α .71 *e*: α .74 *nb*: α .67 *mc*: α .72 *I*: α .73			
Godin et al. (TRA) (1983)	*b* · *e*: α .85 *nb* · *mc*: α .70 *A*: α .81 *SN*: α .71 *I*: α .73			
Godin & Gionet (TPB) (1991)	*A*: α .87			
Godin & Shephard (TRA) (1985)		*b* · *e*: *r* = .85 *nb* · *mc*: *r* = .70 *A*: *r* = .81 *SN*: *r* = .71 *I*: *r* = .73 *B*: *r* = .83		
Godin & Shephard (TRA) (1986b)		Child *b* · *e*: *r* = .75 *nb* · *mc*: *r* = .67 *A*: *r* = .86 *SN*: *r* = .75 *I*: *r* = .87 *B* r = .84	Adult .70 .70 .81 .71 .73	
Godin & Shephard (TRA) (1986a)	*b*: α .65 *e*: α .76 *nb*: α .65 *mc*: α .69			
Godin et al. (TRA) (1989)	*b* · *e*: α .76 *nb* · *mc*: α .69 *A*: α .74			
Godin et al. (TPB) (1991)	*b* · *e*: α .80 *nb* · *mc*: α .83 *A*: α .83 *PBC*: α .73			
Godin et al. (RA) (1987)	*b* · *e*: α .76 *nb* · *mc*: α .69 *A*: α .74			
Kimiecik (TPB) (1992)	*b* · *e*: α .86 *nb* · *mc*: α .85 *cb*: α .92 *PBC*: α .83			*B*: *r* = .82
Mullen et al. (TRA) (1987)		*B*: *r* = .71		
Pender & Pender (TRA) (1986)	*A*: α .87 *SN*: α .90	*A*: *r* = .78 *SN*: *r* = .82 *I*: *r* = .93		

(*continued*)

Warshaw and Davis (1985) tested this hypothesis and found that behavioral intention measured as the "probability of" performing a behavior was a more accurate predictor of behavior than behavioral intention measured as "intending to" or "planning to" perform a behavior. It is important to note that this only applies

when the behavior is not under volitional control. When predicting volitional behavior, there should be little difference between intention or expectation in predicting behavior (Warshaw & Davis, 1985).

Table 2. (*Continued*)

Study	Internal Consistency	Test–Retest	Convergent Validity
Riddle (TRA) (1980)		*b* · *e*: *r* = .87 *nb* · *mc*: *r* = .78 *A*: *r* = .72	
Schmelling (TRA) (1985)		entire instrument: *r* = .83	*A*: *r* = .78 *SN*: *r* = .74 *I*: *r* = .94
Theodorakis et al. (TRA) (1991)	*b* · *e*: α .56 *nb* · *mc*: α .64		
Valois et al. (TRA) (1988)	*A*: α .72	*B*: *r* = .71	

Note. *b* = behavioral beliefs; *e* = evaluation of beliefs; *n* = normative beliefs; *m* = motivation to comply; *cb* = control beliefs; *A* = attitude toward the behavior; *SN* = subjective norm; *PBC* = perceived behavioral control; *I* = intention; *B* = behavior.

Measurement of Exercise

All of the studies measured intention to engage in exercise. Fifteen of the 23 studies measured actual exercise behavior with intention to engage in exercise as an intervening variable. Measures of intention to exercise and actual exercise behavior were consistent with the target of the behavior, the action, the context of the behavior, and the time period as specified by Ajzen and Fishbein (1980).

Comparisons between studies reviewed is complicated by the fact that exercise has been defined in a wide variety of ways. A physical activity pattern is a comprehensive description of type, frequency, duration, and intensity of physical activity over a specified period of time (Bouchard et al., 1990). All of the studies included one or more of these components. Specific activities were assessed in two of the TRA studies (Bentler & Speckart, 1981; Mullen et al., 1987). Schmelling (1985) used specific activities to be done for 20 min, 4 days per week to qualify as exercise. Riddle (1980) only examined jogging behavior and qualified this as exercise if it were done at least three times a week for a distance of one mile or more.

More frequently, exercise measures were specific to type of activity, frequency, duration, and intensity. For example, Godin et al. (1983) de-fined exercise as "physical activity long enough to sweat and cause the heart to beat rapidly during leisure." A variation of this included sweating and specified frequency and duration of the activity (Godin, Desharnais, Jobin, & Cook, 1987; Godin & Shephard, 1986a). Dzewaltowski et al. (1990) determined energy expenditures for vigorous and moderate self-reported activities. Other investigators were not specific with respect to the type of activity and only indicated "physical activity" or "exercise" (Madden, Ellen, & Ajzen, 1992; Theodorakis et al., 1991; Valois, Desharnais, & Godin, 1988).

Findings

Seven TRA and one TPB studies used intention to perform exercise as the dependent variable, and eleven TRA and four TPB studies used exercise behavior as the dependent variable (see Table 1). Consistent with the TRA and TPB, intention was predictive of a person's performance of a specific behavior in most of the studies reporting this correlation. In the majority of studies, behavior was measured from 2 weeks to 2 months after intention was measured. These differences in time frames do not appear to affect the intention-behavior correlations. However, in the Mullen et al. study (1987), intention was a weak predictor of behavior after 8 months. Only 17.9% of the variance in behavior was explained by intention (Mullen et al., 1987). Godin and others (1986) found that for lower-limb disabled persons the intention variance explained by the variables in the TRA was very low, suggesting that exercise behavior for disabled persons may be affected by limited volitional control. In the one study measuring intention variance in a child sample, intention explained only 9% of the variance in exercise behavior (Theodorakis et al., 1991). Theodorakis and his colleagues (1991) measured self-reported cognitive study variables from the sample of children, but physical activity measures were from parent report of their children's activities.

In general, the higher correlations between intention to exercise and exercise behavior were found in the studies where intention was measured by "likeliness" or "probability" (see Table 3). Ajzen and Fishbein (1980) recommend a probability measure for intention. There are frequently real constraints that prevent individuals from performing exercise (e.g., lack of time). The probability measure of intention takes into account the existence of these realistic constraints. In studies reporting variance in behavior explained by the model constructs, the intention—behavior correlation was greater (see Table 3). It can also be seen in Table 1 that explained variance in behavior was the lowest in the three studies that used the intention rather than probability measure (Dzewaltowski, 1989; Dzewaltowski et al. , 1990; Theodorakis, 1991).

The antecedents of behavioral intention were also examined in the studies reviewed. The contribution of attitude to intention to engage in exercise was significant in all of the studies reporting this measure (see Table 1). The primary purpose of Bentler and Speckart's (1981) study was to examine the direct effect of attitude on behavior. Exercise was one of three behaviors examined. An analysis using linear structural equation modding revealed both a direct effect and an indirect effect via intention of attitude on self-reported exercise behavior. The direct effect of attitude on behavior, however, was weaker. The correlation of subjective norm with intention was positive but nonsignificant in all but five of the studies reporting this measure, suggesting the intention to exercise is a personal choice and is not influenced by social pressure. The relationship of subjective norm and intention was significant, but the beta weight nonsignificant, in one study involving children (Godin & Shephard, 1986b). In the other study involving children, Theodorakis et al. (1991) found a significant beta weight but nonsignificant relationship between subjective norm and intention. Because social influences and vulnerability to others' opinions are developing in the school-age child, it seems that subjective norm would have more influence on intention to engage in exercise behavior than was found in these two studies. The influence of subjective norm on exercise intention of children needs to be further explored in future research. Except for Pender and Pender's (1986) study, subjective norm had a lower correlation with intention than did attitude, even though both were significant.

Table 3. Measures of Intention and Their Effect on the Intention–Behavior Correlation

Study	Intention Measure	Type of Measure	*I-B* Correlations
Dzewaltowski (1989)	Likeliness of performing . . . I will try to . . . I have decided to . . . I am determined to . . .	intention	r = .22
Dzewaltowski et al. (1990)	Likeliness of performing . . . I will try to . . . I have decided to . . . I am determined to . . .	intention	r = .32
Godin et al. (1986)	Likeliness of performing . . .	expectation	r = .48
Godin & Shephard (1986b)	Likeliness of performing . . .	expectation	r = .34
Godin et al. (1993)	Probability out of 100 . . . Likeliness of . . .	expectation expectation	r = .27 r = .30
Godinn et al. (1987)	Likeliness of performing . . .	expectation	r = .55[a] r = .68[b]
Kimiecik (1992)	Likeliness to perform . . .	expectation	r = .68
Riddle (1980)	Probability out of 100 . . .	expectation	r = .82
Schmelling (1985)	Chances in 10 that . . .	expectation	r = .77
Theodorakis et al. (1991)	I intend to . . .	intention	r = .36

Note. *I* = intention; *B* = behavior
[a] At 3 weeks [b] At 2 months

Indirect measures of attitude (i.e., behavioral beliefs × evaluation) and subjective norm (i.e., normative beliefs × motivation to comply) were included in 11 studies. The behavioral belief component of the model was predictive of attitude in all but one (87%) of the studies, and this one study used a sample of children (Theodorakis et al., 1991). The normative belief component of the model was significantly correlated with subjective norm in 5 studies (83%) reporting significance.

A number of investigators examined behavioral beliefs with respect to intention to engage in exercise. These investigators found that beliefs were different between those who did and those who did not intend to exercise (Godin & Shephard, 1985; Godin & Shephard, 1986b; Pender & Pender, 1986; Riddle, 1980; Theodorakis et al.,

1991). Beliefs people held about exercise were also different between males and females (Godin & Shephard, 1985). Riddle (1980) found that health-related beliefs were not related to the decision to exercise.

Seven studies (Dzewaltowski et al., 1990; Gatch & Kendzierski, 1990; Godin & Gionet, 1991; Godin et al., 1993; Godin et al., 1991; Kimiecik, 1992; Madden et al., 1992) used the TPB with subjects in a variety of settings. Madden and others (1992) examined exercise as one of 10 other behaviors. Ajzen's (1988, 1989) perceived behavioral control construct, being in the early stages of development, was measured a number of different ways in the reviewed studies.

All of the investigators used similar items for a direct measure of perceived control. As a second measure, Godin and his colleagues (Godin, Valois, Jobin, & Ross, 1991; Godin et al., 1993) used the sum of probability scales to measure the influence of a number of perceived barriers. The correlation of the control beliefs and the direct measure of perceived behavioral control was .30 (Godin et al., 1993). Kimiecik (1992) was the only investigator to develop belief-based control measures from an elicitation study as Ajzen and Fishbein (1980) suggested for developing behavioral and normative belief measures. The correlation coefficient for the indirect (belief) measure and the direct measure of perceived behavioral control was significant *(r* = .62, p<.001) (Kimiecik, 1992).

In studies where the TRA was compared with the TPB, investigators found that significant predictors of intention to exercise were attitude and perceived behavioral control. Perceived behavioral control added to the prediction of intention beyond attitude and subjective norm (Dzewaltowski et al., 1990; Gatch & Kendzierski, 1990; Godin et al., 1993; Kimiecik, 1992; Madden et al., 1992). Researchers in one study (Dzewaltowski et al., 1990) found that perceived behavioral control did not add to the prediction of behavior. However, the results of the two other studies revealed that perceived behavioral control also added to the explained variance in exercise behavior (Kimiecek, 1992; Madden et al., 1992).

In two studies, barriers to engaging in exercise were examined as a control measure (Godin & Gionet, 1991; Godin et al., 1991) and, in one of these studies, a measure of difficulty that these barriers present was included (Godin et al., 1991). Godin and Gionet (1991) used the construct, perceived barrier control, which was borrowed from Triandis' (1977) theory. The construct is similar to perceived behavioral control of the TPB, evaluating environmental conditions that facilitate or hinder exercise behavior. Perceived barrier control correlated with intention to exercise *(r* = —-.41, p<.0001). The addition of perceived barrier control to variables in the TRA significantly increased the r^2 from .15 to .26 (p < .0001). When perceived difficulty (Triandis, 1977) was added to the variables in the TPB, the explained variance in intention to exercise increased from .24 to .41 (p < .0001) (Godin et al., 1991). The results from these two studies partially support Ajzen's definition of control beliefs as factors that make the behavior easy or difficult (Ajzen, 1989).

The findings from these seven TPB studies are
mixed. However, the results suggest that for studies of exercise behavior, the TPB may be superior to the TRA in that the TPB (a) has more predictive qualities for exercise intention and (b) does not make the assumption that control for exercise behavior rests solely in the individual. As Ajzen (1988) proposes, perceived behavioral control influences behavior through intention, but may influence behavior directly when perceptions of behavioral control are closely associated with actual control. In six studies (Dzewaltowski et al., 1990; Gatch & Kendzierski, 1990; Godin & Gionet, 1991; Godin et al., 1991; Godin et al., 1993; Kimiecik, 1992), perceived behavioral control added to the variance explained in intention to engage in exercise. In the study of cardiac patients' exercise, perceived barriers was a significant predictor of intention to exercise (Godin et al., 1991). Of the four studies where exercise behavior was the dependent variable, Kimiecik (1992) and Madden et al. (1992) were the only researchers reporting perceived behavioral control to influence behavior beyond the influence of intention. More TPB studies need to be done with respect to exercise behavior before conclusions can be reached. The evidence from these seven studies does, however, support the premise that exercise may be a nonvolitional behavior, since the prediction of intention is improved with the addition of perceived behavioral control.

Threats to Validity

Selection bias is a threat to studies that select subjects from volunteers (see Table 1). Volunteers for exercise studies may be individuals who are more health conscious and have higher income and educational levels than the general population (Dishman, Sallis, & Orenstein, 1985). Al-though selection bias is a plausible threat to internal validity in all of the studies using volunteers, selection bias is particularly suspect in the studies of Pender and Pender (1986) and Valois et al. (1988). The response rate (from the initial random selection of households in the community) was not reported in the Pender and Pender (1986) study, but 76% of the respondents had attended college or were college graduates, 71% had medium to high incomes, over half of the sample were within a normal weight range, and 91% reported that they were in good to excellent health. The response rate from an initial random sample in the Valois et al. (1988) study was only 38%. Godin and others (1987) had a response rate of 57% from subjects reporting an interest in exercise. Although Godin and his colleagues (1987) assessed the difference between respondents who completed the study and those who did not (and found no significant difference in attitude, subjective norm or intention), he did not assess the persons who did not respond to the study to determine differences between these persons and those who took part in the study (Godin et al., 1987).

Attrition bias or subject mortality can also affect study results. Since exercise behavior was assessed from several weeks to months after ad-ministering the questionnaire collecting antecedent measures, attrition is a plausible threat. Attrition was a problem for Kimiecik's (1992) and the Mullen et al. (1987) studies in which completion rates for the behavior measures were 67% and 47%, respectively. Godin and Gionet (1991) and Godin and others (1987) found no difference in the antecedent measures from persons who did and did not complete the behavior questionnaire. In general, completion rates for exercise behavior measurer were higher for those investigators who collected this information by telephone (Riddle, 1980; Schmelling, 1985) and for studies that used self-contained groups (Bentler & Speckart, 1981; Godin et al., 1993). For community samples, the completion rates were higher in studies where the behavior measure was taken at shorter time periods from the antecedent measures (Godin et al., 1986; Godin et al., 1987; Valois et al., 1988).

Although there are other reasons for threats to statistical conclusion validity, the possibility of unreliable measures and low statistical power are particularly important to the studies in this sample. It is plausible that in studies with small samples such as Theodorakis et al. (1991), the power of the statistical test was too low to find significance. The issue of statistical power was not ad-dressed in any of the studies examined. Statistical power, however, is especially relevant in studies examining social behavior such as those in this review.

Measurement error and other unknown factors often contribute to small effect size in psychosocial research. Exercise especially has been difficult to measure. Statistical power can be increased by appropriate sample size and by reliable measuring instruments. Since there is more control that can be given to sample size, a power analysis used to determine appropriate sample size could improve the outcome of studies. Although Theodorakis et al. (1991) did not report reliability for instruments, reliability for the behavioral and normative belief measures were low, possibly contributing to findings of poor predictive capacity of the TRA. In the study by Mullen and others (1987), attitude, subjective norm, and intention were not measured according to the recommendations of Fishbein and Ajzen (1975). This lack of attention to measures could have resulted in the negative conclusions from this study (Mullen et al., 1987).

The measurement of exercise by self-report has proven to be particularly problematic to researchers (Cowles, 1992; Montoye & Taylor, 1984). A physical activity pattern (and exercise, specifically) includes the frequency, duration, and intensity of a person's activities. Type of activity is also important when considering physical activity as a whole. Exercise is only one aspect of physical activity; occupational activity, leisure activities, and other activities such as household chores are also important considerations. Stephens (1987) recommends that intensity, frequency, duration, and type of activity be measured by energy expenditure units (METS) so that results of studies can be compared. When the measure of exercise is not specific to these components, people may interpret the construct differently. Godin and others (1986; 1987) and Kimiecik (1992) used an exercise-inducing sweat question which has been found to be a relatively valid and reliable measure of exercise

(Paffenbarger, Blair, Lee, & Hyde, 1993; Siconolfi, Lasater, Snow, & Carleton, 1985; Washburn, Smith, Goldfield, & McKinlay, 1991). Dzewaltowski et al. (1990) used MET values for the exercise behavior measure. In other studies, specific aerobic activities were used and other domains were not considered (Bentler & Speckart, 1981; Riddle, 1980; Schmelling, 1985). However, the specificity of activity was carried through the measurement of all the TRA constructs as recommended by Fishbein and Ajzen (1975). It is interesting to note that in studies that were not specific to type of physical activity (intensity) there were poorer results than in studies where more specific exercise measures were used (Dzewaltowski, 1989; Theodorakis et al., 1991). It may be that respondents had interpretational problems with the measure of physical activity in studies where exercise measures were not specific to type of activity, frequency, duration, and intensity.

Another threat to internal validity for exercise studies in general is social desirability with respect to exercise. Social desirability refers to a response set toward a particular subject that can influence scores (Crowne & Marlowe, 1960). The benefits of exercise are greatly publicized in our society as being positive. These positive response characteristics toward exercise could lead to responses that are biased toward higher levels of self-reported exercise than is actually performed. Only one study (Kristiansen & Eiser, 1986) considered the plausible threat of social desirability. Kristiansen and Eiser (1986) found social desirability to account for only a small pro-portion of variance in discrepancy scores of variables within the TRA.

Finally, seasonal variations in physical activity levels do occur, affecting measures of physical activity (Uitenbroek, 1993). No study in the sample addressed this possible threat to study outcomes, nor was seasonal variation in data collection phases reported. In studies where behavioral measures were collected at several months after antecedent measures results could have been affected by seasonal variations in true physical activity. This phenomenon could have contributed to the negative results from the study by Mullen and his colleagues, (1987) who collected data after an 8-month time period, and in the study of Dzewaltowski (1989), who measured behavior after 2 months. Although Godin et al. (1993) measured behavior after 8 to 9 months, the exercise behavior in question was done indoors in a structured setting and would not have been affected as greatly by seasonal variations.

DISCUSSION

The TRA and TPB provided a theoretical structure for examining exercise behavior in a number of settings and populations. The models include exercise predictors and suggest relationships between the person's beliefs, evaluation of those beliefs, and the influence of social pressure on decisions to exercise. The constructs from the TRA and TPB are behavioral beliefs, normative beliefs, attitude, subjective norm, intention, and behavior. Results from the studies reviewed showed that the behavioral belief component was positively correlated with attitude, while the normative belief component was positively correlated with the subjective norm. Attitude was predictive of intention in all of the studies. As Ajzen (1982) postulates, people do act in accordance with their attitudes via behavioral intention when the behavior is specific (such as exercise).

In most of the studies, correlations of subjective norm with behavioral intention were not significant. When this relationship was significant, the normative correlation was lower than the attitude—intention correlation. This is consistent with the TRA and TPB models that postulate that some intentions (behaviors) are likely to be under attitudinal control and therefore be predicted by attitude, whereas intentions to perform other behaviors are likely to be under normative control and be predicted by subjective norm (Ajzen & Fishbein, 1980). It appears that the influence of social pressure on exercise intentions, as defined by the TRA and TPB, is small. Where the intention—behavior component of the model was measured, intention was significantly predictive of exercise behavior in all but one study (Mullen et al., 1987).

The addition of perceived behavioral control significantly increased the prediction of intention to exercise, but there were mixed results in the prediction of exercise behaviors. These differences in studies may be a result of the early development of measures of control beliefs and perceived behavioral control. In addition, perceived behavioral control influences behavior directly when perceptions of control reflect actual control (Ajzen, 1988). People who do not have experience with trying to exercise may not be aware of their actual control abilities.

Implications for Future Research

From the results of this review of exercise re-search using the TRA and TPB as theoretical frameworks, several implications for directing future studies can be identified. One area for improvement of studies involves study design. The other area for improvement considers construct measurement.

Study design. The overall objective of all of the studies reviewed was to identify cognitive factors that influence intention to engage in exercise and self-reported exercise behavior. Two methodological issues that concern the research are generalizability of the results to other populations and methods for sample selection. Most of the studies were conducted with samples of middle class, healthy, adult volunteers. However, there are known factors that determine lower exercise levels in a variety of other subgroups. People who have a disease have been found to be more adherent to exercise programs than are healthy people (Oldridge, 1982). Blue collar workers are less likely to exercise than are their white collar counterparts (Dishman, 1990; King, Carl, Birkel, & Haskell, 1988; Stonecipher & Hyner, 1993; Tampson, 1988). Age has also been found to be a determinant of exercise. As people become older, the amount of time an individual spends in exercise declines, partly accounted for by psychological and sociological explanations (Biddle & Ashford, 1988; Wankel, 1988). Determinants of exercise in children may be different at different stages of their development (Dishman & Dunn, 1988). Quantitative and qualitative differences in physical activity levels have also been found to be related to socioeconomic status and ethnicity (Ford et al., 1991; Lewis, Raczynski, Heath, Levinson, & Cutter, 1993). Future studies are necessary to examine the cognitive determinants specified by the TRA and TPB with respect to differences of a person's age, ethnicity, health, occupational group, and socio-economic status.

The manner in which the samples were selected may bias some of the study results. It is plausible that people who volunteer to take part in exercise studies have different beliefs about exercise than do people who do not participate. A better sampling design is to randomly select subjects from a target population and then apply strategies that will promote a higher percentage of participation. The same efforts to encourage responses to the exercise measure are also needed since the testing of the TRA and TPB requires two waves of data collection. A shorter time frame (e.g. , 2 to 4 weeks) may result in a better return of questionnaires.

Cross-sectional designs were used most frequently in the reviewed studies. Longitudinal and experimental intervention studies need to be con-ducted to determine whether changes in exercise beliefs result in changes in levels of exercise behavior. Research using the TRA and TPB would add to current knowledge by identifying beliefs that people hold that contribute to the initiation as well as short-term and long-term exercise participation. Research is needed that results in successful interventions at each stage of exercise adoption through maintenance. The TRA and TPB could be used to design and evaluate such interventions. Examining cognitive determinants of different types and levels of activity (i.e., differences in frequency, duration, and intensity of activity) would also add to our existing knowledge base.

Construct measurement. Comparability of studies would be improved if measurement methods and variables (i.e. , attitude, subjective norm, perceived behavioral control, intention, and behavior) were standardized. Behavioral, normative, and control belief measures are constructed from an elicitation study from a sample from the population under investigation. Belief items reported in the reviewed studies are very similar. Although subjects included in the reviewed studies were similar, this finding leads one to question whether elicited beliefs are similar to the particular behavior or to the population under investigation. As beliefs elicitated from populations suggested in the previous discussion are identified, a comparative analysis of items could be used to determine whether (a) belief questionnaires are unique for different study populations or (b) beliefs that influence exercise behavior are unique to the behavior under study. If the second premise is true, belief measures could be standardized and evidence of reliability and validity of the measures determined. The same items could then be administered to different aggregates to determine what specific beliefs influence exercise behavior in those different subpopulations.

Measures of control beliefs may be better in future studies when they are developed from an elicitation study and include both facilitating and inhibiting factors with respect to exercise. Items should be constructed that

weight the facilitating and inhibiting factors with the power (or influence) that each factor has on one's decision to exercise.

Social desirability, or the tendency of individuals to respond to questionnaire items in a socially desirable manner, may be an important factor in responding to self-descriptive psychological questions (Osgood, Suci, & Tannenbaum, 1957) and self-reported behavior (Kazdin, 1974). In the U.S. and other developed countries, exercise is viewed as a socially desirable behavior. Although Kristiansen and Eiser (1986) examined the effect of social desirability and found it to be small, future studies should include a measure of social desirability to control for this potential study limitation.

The most practical method for measuring exercise behavior in population studies is self-report from study participants. Testing the TRA and TPB requires information about current behavior. It is therefore necessary when choosing an exercise measure that current rather than retrospective activity be measured. In addition, the influence of theoretical constructs could be affected by the way exercise is defined for the study participants. A recent report and recommendation from the American College of Sports Medicine (ACSM) (1990) includes moderate exercise done over a longer time frame as having similar health benefits as the previously recommended exercise of 20 min of vigorous physical activity. The predictive capacity of the TRA and TPB may improve with the inclusion of moderate physical activity as defined by the ACSM (1990).

Summary

The TRA and the TPB are useful in identifying psychosocial determinants of self-reported exercise behavior and could be useful for developing community and individual exercise programs. Based on the results of the studies reviewed, exercise programs would be more efficient when components that would encourage positive beliefs and the evaluation of those beliefs for the individual are included in the program design. Changing beliefs about exercise can improve attitude, which in turn affects intention. According to the results of the studies reviewed, people intend to exercise when they hold a positive evaluation of exercise. Exercise programs that offer a positive experience would enhance intention to exercise, which in turn influences exercise behavior. Positive behavioral beliefs and their evaluation may be enhanced if people could be given experiences with easy, enjoyable types of exercise and then later be encouraged to increase the intensity, duration, and frequency of the activity. The poor predictive capacity of subjective norm with respect to exercise behavior suggests that people view the decision to exercise as their own responsibility. This information is useful for designing exercise programs in that it is important to encourage people to be active participants in the program design. Perceived behavioral control is an important factor in intention to exercise. When individuals perceive exercise as difficult to do, intention will be low. Assisting people to overcome barriers such as time involvement, other obligations, or feelings of inability should enhance perceptions of control over carrying out exercise.

Motivating people to increase exercise behavior remains a challenge for clinicians. In its early stages of research, the TPB appears to be useful as a conceptual framework for predicting exercise behaviors. Knowledge pertaining to exercise behavior would be advanced if programs targeted to beliefs were designed and implemented. The TPB could then be used to assess and evaluate groups of persons trying to change behavior, and in designing and implementing exercise programs. Future studies might examine the effectiveness of such targeted programs with respect to the adoption and maintenance of exercise. The ultimate goal of identifying exercise determinants is to more effectively plan interventions that increase the levels of exercise in the population. The next step in research using the TRA and TPB is to determine whether belief-based programs will lead to increased levels of exercise and to determine whether beliefs about exercise behavior change as one initiates and continues to exercise.

REFERENCES

Ajzen, I. (1982). On behaving in accordance with one's attitudes. In M. P. Zanna, E. T. Higgins, & C. P. Herman (Eds.), *Consistency in social behavior: The Ontario symposium* (Vol. 2, pp. 3-15). Hills-dale, NJ: Lawrence Erlbaum.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action—control: From cognition to behavior* (pp. 11-39). Berlin: Springer.
Ajzen, I. (1987). Attitudes, traits, and actions: Dispositional predictions of behavior in personality and social psychology. *Advances in Experimental Social Psychology, 20,* 1-63.
Ajzen, I. (1988). *Attitudes', personality, and behavior.* Chicago: Dorsey Press.
Ajzen, I. (1989). Attitude structure and behavior. In A. R. Pratkanis, S. J. Breckler, & A. G. Greenwald (Eds.), *Attitude structure and function* (pp. 241— 274). Hillsdale, NJ: Lawrence Erlbaum.
Ajzen, 1. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50,* 179-211.
Ajzen, I., & Driver, B. L. (1991). Prediction of leisure participation from behavior, normative, and control beliefs: An application of the theory of planned behavior. *Leisure Sciences, 13,* 185-204.
Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior.* Englewood Cliffs, NJ: Prentice-Hall.
Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology,* 22, 453-474.
American College of Sports Medicine. (1990). Position stand: The recommended quantity and quality of exercise for developing and maintaining cardio-respiratory and muscular fitness in healthy adults. *Medicine and Science in Sports and Exercise, 22,* 265-274.
American College of Sports Medicine. (1991). *Guidelines for exercise testing and prescription.* Philadelphia: Lea & Febiger.
Bentler, P. M. , & Speckart, G. (1981). Attitudes "cause" behaviors. A structural equation analysis. *Journal of Personality and Social Psychology, 40,* 226-238.
Berlin, J. A., & Colditz, G. A. (1990). A meta-analysis of physical activity in the prevention of coronary heart disease. *American Journal of Epidemiology, 132,* 612-628.
Biddle, S. J. H., & Ashford, B. (1988). Cognitions and perceptions of health and exercise. *British Journal of Sports Medicine, 22,* 135-140.
Bouchard, C., Shephard, R. J., Stephens, T., Sutton, J. R., & McPherson, B. D. (Eds). (1990). *Exercise, fitness, and health.* Champaign, IL: Human Kinetics Books.
Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research.* Boston: Houghton Mifflin.
Caspersen, C. J., Christenson, G. M., & Pollard, R. A. (1986). Status of the 1990 physical fitness and exercise objectives-Evidence from NHIS 1985. *Public Health Reports, 101,* 587-592.
Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* 2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design & analysis issues for field settings.* Boston: Houghton Mifflin.
Cowles, M. (1992). *The assessment of physical activity by self report-A review and critical appraisal* (Report to the Ministry of Tourism and Recreation Sports and Fitness Branch). Ontario, Canada.
Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology, 24,* 349-354.
Dishman, R. K. (1990). Determinants of participation in physical activity. In C. Bouchard, R. J. Shephard, T. Stephens, J. R. Sutton, & B. D. McPherson (Eds), *Exercise, fitness and health: A consensus of current knowledge* (pp. 75-101). Champaign, IL: Human Kinetics Books.
Dishman, R. K., & Dunn, A. L. (1988). Exercise adherence in children and youth: Implications for adulthood. In R. K. Dishman (Ed.), *Exercise adherence: Its impact on public health* (pp. 155-200). Champaign, IL: Human Kinetics Books.
Dishman, R. K., Sallis, J. F., & Orenstein, D. R. (1985). The determinants of physical activity and exercise. *Public Health Reports, 100,* 158-171.
Dzewaltowski, **D.** A. (1989). Toward a model of exercise motivation. *Journal of Sport & Exercise Psychology, 11 ,* 251-269.

Dzewaltowski, D. A., Noble, J. M., & Shaw, J. M. (1990). Physical activity participation: Social cognitive theory versus the theories of reasoned action and planned behavior. *Journal of Sport & Exercise Psychology, 12,* 388-405.
Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes.* Philadelphia: Harcourt Brace Javanovich.
Fishbein, M., & Ajzen, I. (1975) *Belief, attitude, intention and behavior.* Boston: Addison-Wesley.
Ford, E. S., Merritt, R. K., Health, G. W., Powell, K. E., Washburn, R. A., Kriska, A., & Haile, G. (1991). Physical activity behaviors in lower and higher socioeconomic status populations. *American Journal of Epidemiology, 133,* 1246-1256.
Gatch, C. L., & Kendzierski, D. (1990). Predicting exercise intentions: The theory of planned behavior. *Research Quarterly for Exercise and Sport, 61,* 100-102.
Godin, G., Colantonio, A., Davis, G. M., Shephard, R. J., & Simard, C. (1986). Prediction of leisure time exercise behavior among a group of lower-limb disabled adults. *Journal of Clinical Psychology, 42,* 272-279.
Godin, G., Cox, M. H., & Shephard, R. J. (1983). The impact of physical fitness evaluation on behavioural intentions towards regular exercise. *Canadian Journal of Applied Sport Science, 8,* 240-245.
Godin, G., Desharnais, R., Jobin, J., & Cook, J. (1987). The impact of physical fitness and health-age appraisal upon exercise intentions and behavior. *Journal of Behavioral Medicine, 10,* 241-249.
Godin, G., & Gionet, N. J. (1991). Determinants of an intention to exercise of an electric power commission's employees. *Ergonomics, 34,* 1221-1230.
Godin, G., & Shephard, R. J. (1985). Psycho-social predictors of exercise intentions among spouses. *Canadian Journal of Applied Sport Science, 10,* 36- 43.
Godin, G., & Shephard, R. J. (1986a). Importance of type of attitude to the study of exercise behavior. *Psychological Reports, 58,* 91-100.
Godin, G., & Shephard, R. J. (1986b). Psychosocial factors influencing intentions to exercise of young students from grades 7 to 9. *Research Quarterly for Exercise and Sport,* 57, 41-52.
Godin, G., Valois, P., Jobin, J., & Ross, A. (1991). Prediction of intention to exercise of individuals who have suffered from coronary heart disease. *Journal of Clinical Psychology, 47,* 762-772.
Godin, G., Valois, P., & Lepage, L. (1993). The pat-tern of influence of perceived behavioral control upon exercising behavior: An application of Ajzen's theory of planned behavior. *Journal of Behavioral Medicine, 16,* 81-101.
Godin, G., Valois, P., Shephard, R. J., & Desharnais, R. (1987). Prediction of leisure-time exercise behavior: A path analysis (LISREL V) model. *Journal of Behavioral Medicine, 10,* 145-157.
Godin, G., Vezina, L., & LeClerc, O. (1989). Factors influencing intentions of pregnant women to exercise after giving birth. *Public Health Reports, 104,* 188-195.
Harris, S. S., Caspersen, C. J., DeFriese, G. H., & Estes, E. H. (1989). Physical activity counseling for healthy adults as a primary prevention intervention in the clinical setting. *Journal of the American Medical Association, 261,* 3590-3598.
International Society of Sport Psychology. (1992). Physical activity and psychological benefits: A position statement. *International Journal of Sport Psychology,* 23, 86-91.
Kazkin, A. (1974). Self-monitoring and behavior change. In M. J. Mahoney, & C. F. Thoresen (Eds.), *Self-control: Power to the person* (pp. 218-246). Monterey: Brooks-Cole.
Kimiecik, J. (1992). Predicting vigorous physical activity of corporate employees: Comparing the theories of reasoned action and planned behavior. *Journal of Sport & Exercise Psychology, 14,* 192-206.
King, A. C., Carl, F., Birkel, L., & Haskell, W. L. (1988). Increasing exercise among blue-collar employees: The tailoring of worksite programs to meet specific needs. *Preventive Medicine, 17,* 357-365.
Kristiansen, C. M., & Eiser, J. R. (1986). Predicting health-related intentions from attitudes and normative beliefs: The role of health locus of control. *British Journal of Social Psychology, 25* , 67-70.
Lewis, C. E., Raczynski, J. M., Heath, G. W., Levin-son, R., & Cutter, G. R. (1993). Physical activity of public housing residents in Birmingham, Alabama. *American Journal of Public Health, 83* , 1016-1020.
Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin, 18,* 3-9.
McGuire, W. J. (1985). Attitudes and attitude change. In G. Lindzey, & Aronson (Eds.), *The handbook of social psyc.hology* (3rd ed., Vol. 2, pp. 233-246). Hillsdale, NJ: Lawrence Erlbaum.

Melby, C. L., Melby, P. C., & Hyner, G. C. (1984). Rationale for nonpharmacologic therapy in the treatment of borderline-mild hypertension. *Journal of Applied Nutrition, 36,* 63-80.
Montoye, H. J., & Taylor, J. L. (1984). Measurement of physical activity in population studies: A review. *Human Biology, 56,* 195-216.
Mullen, P. D., Hersey, J. C., & Iverson, D. C. (1987). Health behavior models compared. *Social Science and Medicine, 24,* 973-981.
Nunnally, J. C. (1978). *Psychometric. theory* (2nd ed.). New York: McGraw-Hill.
Oldridge, N. B. (1982). Compliance and exercise in primary and secondary prevention of coronary heart disease: A review. *Preventive Medicine, I I ,* 56-70.
Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). *Measurement of meaning.* Urbana, IL: University of Illinois Press.
Paffenbarger, J., R. S., Blair, S. N., Lee, I., & Hyde, R. T. (1993). Measurement of physical activity to assess health effects in free-living populations. *Medicine and Science in Sports and Exercise, 25,* 60-70.
Pender, N. J., & Pender, A. R. (1986). Attitudes, subjective norms, and intentions to engage in health behaviors. *Nursing Research, 35,* 15-18.
Powell, K. E., Caspersen, C. J., Koplan, J. P., & Ford, E. S. (1989). Physical activity and chronic disease. *American Journal of Clinical Nutrition, 49,* 999-1006.
Powell, K. E., Spain, K. G., Christenson, G. M., & Mollenkamp, M. P. (1986). The status of the 1990 objectives for physical fitness and exercise. *Public Health Reports, 101,* 15-21.
Riddle, P. K. (1980). Attitudes, beliefs, behavioral
intentions, and behaviors of women and men toward regular jogging. *Research Quarterly for Exercise and Sport, 51,* 663-674.
Schmelling, E. C. (1985). Identifying the salient out-comes of exercise: Application of marketing principles to preventive health behavior. *Public Health Nursing, 2,* 93-103.
Siconolfi, S. F., Lasater, T. M., Snow, R. C. K., & Carleton, R. A. (1985). Self-reported physical activity compared with maximal oxygen uptake. *American Journal of Epidemiology, 122,* 101-105.
Stephens, T. (1987). Secular trends in adult physical activity: Exercise boom or *bust? Research Quarterly for Exercise and Sport, 58,* 94-105.
Stonecipher, L. J., & Hyner, G. C. (1993). Health practices before and after a work-site health screening: Differences among subpopulations of employees. *Journal of Occupational Medicine, 35 ,* 297- 306.
Tampson, P. (1988). Franklin International: A facility based wellness program adapted to serve a small white and blue collar population. *American Journal of Health Promotion, 2,* 39-46.
Theodorakis, Y., Doganis, G., Bagiatis, K., & Gouthas, M. (1991). Preliminary study of the ability of reasoned action model in predicting exercise behavior of young children. *Perceptual and Motor Skills,* 72, 51-58.
Triandis, H. C. (1977). *Interpersonal behavior.* Monterey, CA: Brooks-Cole.
Ultenbroek, D. G. (1993). Seasonal variation in leisure time physical activity. *Medicine and Science in Sports and Exercise, 25 ,* 755-760.
U.S. Department of Health and Human Services. (1991). *Healthy people 2000: National health pro-motion and disease prevention objectives* (DHHS Publication No. 91-50212). Washington, DC: U.S. Government Printing Office.
Valois, P., Desharnais, R., & Godin, G. (1988). A comparison of the Fishbein and Ajzen and the Triandis attitudinal models for the prediction of exercise intention and behavior. *Journal of Behavioral Medicine, 11,* 459-472.
Wankel, L. M. (1988). Exercise adherence and leisure activity: Patterns of involvement and interventions to facilitate regular activity. In R. K. Dishman (Ed.), *Exercise adherence: Its impact on public health* (pp. 369-396). Champaign, IL: Human Kinetics Books.
Warshaw, P. R., & Davis, F. D. (1985). Disentangling behavioral intention and behavioral expectation. *Journal of Experimental Social Psychology, 21,* 213-228.
Washburn, R. A., Smith, K. W., Goldfield, S. R. W., & McKinlay, J. B. (1991). Reliability and physiologic correlates of the Harvard Alumni Activity Survey in a general population. *Journal of Clinical Epidemiology, 44,* 1319-1326.