

The Theories of Reasoned Action and Planned Behavior Applied to Exercise: A Meta-analytic Update

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Background: Statistical reviews of the theories of reasoned action (TRA) and planned behavior (TPB) applied to exercise are limited by methodological issues including insufficient sample size and data to examine some moderator associations. **Methods:** We conducted a meta-analytic review of 111 TRA/TPB and exercise studies and examined the influences of five moderator variables. **Results:** We found that: a) exercise was most strongly associated with intention and perceived behavioral control; b) intention was most strongly associated with attitude; and c) intention predicted exercise behavior, and attitude and perceived behavioral control predicted intention. Also, the time interval between intention to behavior; scale correspondence; subject age; operationalization of subjective norm, intention, and perceived behavioral control; and publication status moderated the size of the effect. **Conclusions:** The TRA/TPB effectively explained exercise intention and behavior and moderators of this relationship. Researchers and practitioners are more equipped to design effective interventions by understanding the TRA/TPB constructs.

Key Words: physical activity, intention, attitude, subjective norm, perceived behavioral control

Theoretical approaches to studying physical activity provide researchers with a better understanding of the facilitating and inhibiting factors influencing exercise adoption, motivation, and adherence.¹ Many theories have been applied to exercise to understand and explain multidimensional exercise determinants. The most frequently used theories include: a) belief-attitude theories (i.e., protection motivation theory, health belief model, theory of reasoned action/planned behavior); b) control-based theories (i.e., self-determination theory); c) decision-making theories (i.e., transtheoretical model); and d) competence-based theories (i.e., social cognitive theory). The theory of planned behavior is one of the most comprehensive and validated theories in the exercise domain for understanding and predicting exercise behavior, and thus, it has guided much of the exercise behavior research.²

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The *theory of reasoned action* (TRA)^{3,4} posits that people's *intention*, or motivation, is the main determinant of their behavior. Intention is influenced by people's *attitude* (e.g., positive/negative evaluations developed from behavioral beliefs) and *subjective norm* (e.g., perceived social pressure to comply with important others' wishes formed from normative beliefs). In short, the main TRA assumption is that people will engage in a behavior when they have a high intention, and their intention is increased when they evaluate a behavior positively (attitude) and believe that significant others want them to engage in it (subjective norm).

Although the TRA successfully predicts a variety of behaviors, it was developed to explain volitional behaviors (i.e., personal power to engage in the behavior).⁴ Because the TRA does not account for nonvolitional behaviors (i.e., less able to make a choice to engage in the behavior), Ajzen^{5,6} expanded the theory to include *perceived behavioral control*, thus forming the *theory of planned behavior* (TPB). Perceived behavioral control represents one's evaluation about the ease or difficulty of adopting a behavior, including personal resources and skills for performing a behavior. The summary propositions of the TPB include: a) people will intend to engage in a behavior when they evaluate it positively (attitude), believe that significant others want them to engage in it (subjective norm), and perceive it to be under their control (perceived behavioral control); and b) strong intention and perceived behavioral control will increase the likelihood of a behavior.

The paucity of interventions, however, using the TPB is twofold. First, most studies have measured the TPB constructs using a global-level abstraction (i.e., attitude, subjective norm, and perceived behavioral control), when Ajzen⁶ outlined that the development of interventions must be based on belief-level abstractions (i.e., normative, control, and behavioral beliefs). This disparity of higher (global) and lower (beliefs) levels measures is not seen in social cognitive theory⁷ or the transtheoretical model,⁸ thus potentially explaining why these two models dominate the exercise intervention literature.⁹ Second, the TPB was developed and is consistently studied by social psychology researchers. This has led to a vast literature examining the theoretical tenets of the TPB. In contrast, social cognitive theory and the transtheoretical model were developed by clinical psychology researchers, and not surprisingly the practical and applied merits of these theories have been extensively examined. Given the extensive theoretical testing of the TPB, this might be a superior theory for intervention efforts.

The findings from narrative^{10,11} and statistical^{12,13} reviews of the literature support the TRA and TPB for studying and explaining exercise intention and behavior. Despite the success of these theories, however, other social cognitive variables need to be examined to determine their predictive utility. For example, while Ajzen^{6,14} argued that perceived behavioral control is conceptually different than self-efficacy, some researchers found that self-efficacy predicts exercise behavior better than perceived behavioral control.^{15,16} In addition, past exercise behavior could attenuate the influence of attitude on intention and likewise, intention on exercise behavior.¹⁷ Thus, Hagger et al.¹² meta-analytically reviewed 72 TRA and TPB exercise studies to examine self-efficacy and past exercise behavior. They found that attitude, subjective norm, perceived behavioral control, self-efficacy, and past exercise behavior accounted for 60% of the variance in exercise intention and 47% of the variance in exercise behavior. In addition, self-efficacy uniquely influenced intention and behavior. Hagger and his colleagues suggested that the

contributions of self-efficacy and past behavior to the TPB are important for explaining exercise intention and behavior. In addition, they argued that the influence of potential moderator variables (e.g., subject age) are important to examine because they have not been addressed in quantitative research syntheses of the TRA/TPB and exercise behavior.

The Hagger et al.¹² and Hausenblas et al.¹³ meta-analyses have contributed to the understanding of the TRA/TPB and exercise literature; however, these authors acknowledged some limitations in their studies. More specifically, an insufficient number of available effect sizes prevented Hausenblas and her colleagues from examining the predictive contribution of the TRA and TPB constructs, and Hagger and his colleagues suggested that a limited number of studies might have affected the power of their moderator analyses. Thus, there is a need for quantitative reviews that examine the predictive utility of the TRA/TPB and the influence of moderator variables using a larger number of studies.

In addition, several conceptual and methodological concerns have emerged regarding the effectiveness of the TRA and TPB for explaining exercise intention and behavior.¹⁸ It is important to meta-analytically examine these issues because they could impact the effectiveness of the TRA and TPB as an intervention framework. First, there is a measurement inconsistency in the time interval between intention and exercise behavior. Ajzen and Fishbein³ argued that intention should be measured as close in time as possible to the behavior. Thus, a stronger intention–behavior association should occur over shorter compared to longer time intervals.¹⁹ Two meta-analytic reviews, however, examining the time interval between measuring intention and health (e.g., condom use),²⁰ and exercise behaviors¹³ found that the strength of the intention–behavior association did not decline over time. While these findings contradict Ajzen and Fishbein's³ assumption, it is important to note that Randall and Wolf's²⁰ conclusions were based on over 60 health behaviors not specific to exercise, and Hausenblas et al.¹³ only examined four available exercise studies. Thus, it is important to quantitatively review the intention assessment and the behavioral observation using a larger number of TRA/TPB and exercise studies to determine if the predictive utility of the intention–behavior association is greater over shorter time intervals.

Second, there must be scale correspondence, or equivalence in the measures for the action, target, context, and time for intention to properly predict behavior.³ Scale correspondence is present when the same magnitude, frequencies, or response formats are used to measure the TRA/TPB constructs. For example, scale correspondence is achieved if intention is assessed with the item: "I intend to exercise moderately for at least 30 minutes per day on ____ of the next 7 days" and behavior is measured with the item: "I exercised moderately for at least 30 minutes per day on ____ of the past 7 days." Scale correspondence, however, has not always been established. For instance, Hausenblas et al.¹³ found that only 50% of the studies in their meta-analysis had scale correspondence. These authors, however, did not examine if the effect sizes differed between the studies that did and did not have scale correspondence. Thus, because a lack of scale correspondence might violate the theoretical assumptions of the TRA and TPB, and result in misleading predictions for the theory constructs and behavior,^{19,21} it is important to examine if scale correspondence moderates the size of the intention–behavior association.

Third, the intention–behavior association could be moderated by subject characteristics such as age, sex, ethnicity, and socioeconomic status.²² For example, Hagger et al.¹² found that studies with older participants (i.e., ages 26 and older) had a stronger intention–behavior association compared to studies with younger participants (i.e., ages 25 and younger). The dichotomous nature of this classification, however, precluded the authors from examining age differences among children/adolescents (ages 17 and younger), young adults (ages 18 to 25), adults (ages 26 to 64), and older adults (ages 65 and older). Because children/adolescents might have different exercise intentions than young and older adults, it is important to examine the intention–behavior association across more specific age groups. Also, because there are age, sex, and ethnic differences for exercise behavior,²³ it is important to examine if these subject characteristics moderate the effect sizes of the TRA and TPB constructs.

Fourth, because of methodological concerns in measuring the TPB constructs, researchers have examined the influences of the following constructs for explaining exercise intention and behavior: a) intention and expectation; b) affective and instrumental attitude; c) subjective norm and social support; and d) perceived behavioral control, self-efficacy, and perceived barriers. While Ajzen and Fishbein³ argued that intention is the strongest determinant of behavior, other researchers have found that expectation is more strongly associated with exercise behavior than intention.^{13,24} Because researchers have used different items to assess intention (e.g., intend, plan, goal) and expectation (e.g., probability, likelihood), it is important to examine the magnitude of the associations between these items and exercise behavior. In addition, Ajzen²⁵ recommended that because empirical research has found that attitude contains two components (i.e., affective/experiential and instrumental), researchers should use both types of items when measuring people's overall attitude toward a behavior. Some researchers, however, have used only affective items¹² while others have used only instrumental items.²⁶ Thus, because the magnitude of the effect of instrumental versus affective attitude is unknown, it is important to examine their associations with exercise intention and behavior.

Moreover, attitude is a stronger predictor of intention than subjective norm.¹² A weak subjective norm–intention association could result from the following two reasons: a) significant others might not play a critical role in exercise intentions for physically active people; and b) it is not well understood whether people's exercise intentions are influenced by their motivation to comply with the belief that others want them to exercise, or whether it is the actual presence of social support associated with exercising that influences their intention.¹⁸ As a result, some researchers^{27,28} suggested that social support might predict intention better than subjective norm; however, quantitative analyses of the TRA and TPB have not examined this assumption.

Finally, ambiguity in defining perceived behavioral control prompted researchers to examine the contributions of self-efficacy and perceived barriers for predicting exercise intention and behavior. For example, self-efficacy has been found to more strongly predict exercise behavior than perceived behavioral control,^{15,16} and self-efficacy has been found to attenuate perceived behavioral control's influence on exercise intention.¹² In addition, researchers suggest that perceived barriers are equally important in predicting exercise behavior as self-efficacy and

perceived behavioral control.²⁹ Quantitative analyses of the TPB, however, have not examined the moderating influence of perceived barriers. Thus, further research is needed to examine effect size differences among perceived behavioral control, self-efficacy, and perceived barriers with exercise intention and behavior.

Therefore, based on the aforementioned methodological issues and the need for research examining the predictive utility of the TRA/TPB and the influence of moderator variables using a larger number of studies, an updated statistical review is warranted. The purpose of this study was threefold. The first purpose was to examine the strength of the associations among the TRA and TPB constructs with exercise behavior. We hypothesized that: a) large associations would be found for intention–behavior, perceived behavioral control–behavior, intention–perceived behavioral control, and intention–attitude; b) a moderate association would be found for intention–subjective norm; c) the intention–behavior association will be larger than the perceived behavioral control–behavior association; and d) associations for attitude–intention will be larger than for perceived behavioral control–intention and subjective norm–intention.^{12,13}

The second purpose was to examine the predictive utility of the TRA/TPB. We hypothesized that: a) intention and perceived behavioral control would predict exercise; b) intention would more strongly predict exercise than perceived behavioral control; c) attitude, perceived behavioral control, and subjective norm would predict intention; and d) attitude would be the strongest predictor of exercise intention followed by perceived behavioral control and subjective norm.¹²

The third purpose was to investigate the influence of five moderator variables on the associations among the TRA/TPB constructs. First, we hypothesized that a larger intention–behavior association would be evidenced when the time interval between intention and behavior is short rather than long.^{3,4,30} Second, we hypothesized that the magnitude of the intention–behavior association would be larger in studies with scale correspondence compared to studies without scale correspondence.^{19,21} Third, we hypothesized that age would moderate the intention–behavior association with a larger effect size expected for older than younger participants.¹² In addition, because increased levels of physical activity have been found in men compared to women, Caucasian compared to non-Caucasian populations, and higher compared to lower income populations,²³ we hypothesized that the subject sex, ethnicity, and socioeconomic status would moderate the intention–behavior association. Fourth, because of methodological concerns with the TPB constructs, the types of measures used to assess intention, attitude, perceived behavioral control, and subjective norm were assessed. We hypothesized that: a) the expectation–behavior association would be larger than the intention–behavior association;¹³ b) no differences would be observed in the magnitude of the attitude–intention association for studies using affective attitude versus instrumental attitude versus both;²⁵ c) the association for social support–intention would be larger than subjective norm–intention;^{27,28} d) the self-efficacy–intention association would be larger than the perceived behavioral control–intention and the perceived barriers–intention associations; and e) the association for self-efficacy–behavior would be larger than for perceived behavioral control–behavior and perceived barriers–behavior.^{15,16}

Finally, publication bias was examined by comparing the results from published and unpublished studies. Publication bias is when the literature on a particular

topic might only reflect the published data (i.e., significant findings rather than including nonsignificant findings).³¹ Some researchers have recommended that a meta-analysis should include both published and unpublished studies to avoid inflating the magnitude of the treatment effect.³² It has also been suggested, however, that unpublished studies are of poorer quality than published studies, and therefore, should be excluded from meta-analyses.³³ We hypothesized that no effect size differences would be found between published and unpublished studies.

Method

Selection and Inclusion of Studies

A study was considered for the meta-analysis if it met the following two inclusion criteria: a) it applied the TRA/TPB to leisure-time physical activity (i.e., organized sports participation was excluded); and b) it assessed the association between either intention or behavior and another TRA/TPB construct (e.g., attitude–intention, perceived behavioral control–behavior). Five methods were undertaken to identify potential studies. First, computer searches using key words (e.g., TRA, TPB, exercise, intention, attitude, subjective norm, social support, perceived behavioral control, self-efficacy, and perceived barriers) were conducted in the following databases: PsychLIT (1975 to the present), MEDLINE (1975 to the present), SPORTdiscus (1975 to the present), Dissertation Abstracts Online (DAO; 1975 to the present), and FirstSearch (electronic journal search). The year 1975 was chosen as a starting date to coincide with the introduction of the TRA.⁴

Second, journal searches were conducted in the following journals that most often published research examining the TRA and TPB for exercise: *American Journal of Health Promotion*, *Annals of Behavioral Medicine*, *British Journal of Social Psychology*, *Canadian Journal of Applied Sport Psychology*, *European Journal of Social Psychology*, *Health Psychology*, *International Journal of Sport Psychology*, *Journal of Applied Social Psychology*, *Journal of Applied Sport Psychology*, *Journal of Behavioral Medicine*, *Journal of Health Psychology*, *Journal of Leisure Research*, *Journal of Personality and Social Psychology*, *Journal of Sport & Exercise Psychology*, *Journal of Sport Behavior*, *Medicine and Science in Sports & Exercise*, *Perceptual and Motor Skills*, *Preventive Medicine*, *Research Quarterly for Exercise and Sport*, and *The Sport Psychologist*.

Third, published abstracts from conferences with a focus on exercise were searched in the following journals: *Annals of Behavioral Medicine* (1985–2004), *Journal of Applied Sport Psychology* (1994–1997), *Journal of Sport & Exercise Psychology* (1994–2004), *Medicine and Science in Sports & Exercise* (1986–2004), and *Research Quarterly for Exercise and Sport* (1992–2004). In addition, the 1993–2004 *Association for the Advancement of Applied Sport Psychology* conference proceedings were examined. Fourth, manual searches were conducted using the references in narrative and statistical reviews, and each article identified by the aforementioned journal searches. Finally, researchers that have used the TRA and TPB for exercise were contacted to see if they had unpublished data suitable for this review. The identified studies ($N = 192$) were then screened for inclusion in the meta-analysis. Detailed discussions were conducted between the authors concerning classifying and rejecting studies. All studies were independently coded by each

author, and any discrepancies were noted and discussed until agreement between the authors was reached. As a result, 111 studies based on 35,742 participants that yielded 215 effect sizes were retained (a list of the excluded studies [$n = 81$] and a detailed summary of the retained studies [$n = 111$] are available from the first author).

Coding Procedures

The *study characteristics* coded were: year, publication format, theory tested (i.e., TPB or TRA), grant support, study design, location of data collection, proximity of measurement, scale correspondence, psychometrics reported for the model constructs, response and attrition rate, and interrelationships of theory constructs (e.g., intention and perceived behavioral control, intention and attitude, intention and subjective norm). The *subject characteristics* coded were: the number of participants, type of population, subject selection (e.g., target, random) sex, age, ethnicity, and socioeconomic status. Finally, the *behavior characteristics* coded were definition and measure of exercise behavior (e.g., self-report, frequency, pedometer).

Analyses

First, the skewness of the data was examined and the studies containing outliers were inspected. No studies were excluded for outliers. Second, mean effect sizes for the correlations were calculated using the procedures of Hedges³⁴ and Hedges and Olkin.³⁵ Because effect sizes are positively biased in small samples, each effect size was multiplied by a correction factor to obtain an unbiased estimate of the effect size $[1 - (3/((4*n)-3))]$.³⁴ Next, a mean effect size and variance for each of the relationships was obtained by: a) weighing each effect size by the reciprocal of its variance, and b) using the following formula provided by Hedges and Olkin:³⁵ [weighted mean effect size = (effect size/variance)/(1/variance) where variance = $((1-(r_i*r_i)) * (1-(r_i*r_i)))/(n-1)$ where r_i is the i th correlation]. This technique allows effect sizes with smaller variances (i.e., more precise effect sizes) to receive a larger weight than effect sizes with larger variances in the calculation of the overall mean effect size. Also, the standard deviation for each effect size was determined by calculating the square root of the effect size variance. Finally, an overall average effect was calculated from the individual study effects for each of the theory associations (e.g., intention to behavior, intention to attitude).

All effect sizes computed were included in the analysis to determine the average effect. Consequently, some studies had multiple measures of exercise behavior, which violated the assumption of independent data points.³⁶ To control for this assumption, a three-step procedure was used. First, as previously mentioned, an overall average effect was calculated for each of the theory associations that included all of the individual effects for each study. Second, effect sizes were removed by selecting one type of exercise behavior per study participants. In accordance with the current physical activity guidelines, priority was given to moderate and vigorous exercise over mild intensity exercise when multiple behaviors were coded on the same participants.³⁷ This procedure was repeated until one set of effect sizes per behavior was retained. Finally, it was our intention to compare the results of subjective and objective measures of behavior. Only two studies, however, included

objective measures; thus, effect size comparisons could not be examined.³⁸ Therefore, to avoid a bias in the results, these two effect sizes were removed.³⁹

To examine the first purpose, effect sizes were calculated to determine the strength of the associations between the TRA and the TPB constructs. Effect size values of 0.20, 0.50, and 0.80 represent small, medium, and large effects, respectively.^{40,41} A z statistic was used to determine if the effect size was different from zero ($P < 0.05$).⁴² The H statistic was calculated to determine if there was homogeneity in effect sizes within the total sample.^{35,38,43} In addition, 95% confidence intervals were calculated. Also, the file drawer issue was examined. That is, how many unlocated, unpublished, or incomplete studies with null effects have to be found to reduce the effect size to a trivial value that is considered theoretically and practically important.^{44,45} To calculate the fail-safe n for each of the effect size associations among the TPB constructs, Hedges and Olkin's³⁵ formula was used with a trivial criterion value of 0.15.⁴⁶

To examine the second purpose and consistent with the recommendations of Ajzen,⁶ two hierarchical regressions were conducted by converting the mean effect sizes using the formula $[d/\sqrt{d^2+4}]$ by Wolf.⁴⁷ Based on Green's⁴⁸ guidelines and previous research that has found large to moderate effects for the TRA and the TPB constructs,^{49,50} adequate power was obtained to conduct these analyses. Consistent with previous research, variables were entered in the following order: a) in the first regression, exercise behavior (dependent variable) was regressed on intention followed by perceived behavioral control; and b) in the second regression, intention (dependent variable) was regressed on attitude, followed by perceived behavioral control, and then subjective norm.⁶ Finally, to examine the influence of the moderator variables on the size of the effect (i.e., third purpose), univariate weighted least squares analyses were undertaken using the Q statistic (QB) based on the chi square distribution to determine which factors moderated the magnitude of the effect size⁴⁷ when sufficient data were present.⁵¹

Results

Description of the Data

Study Characteristics. Most of the studies were conducted in the 1990s ($n = 59$, 53.2%), followed by the 2000s ($n = 32$, 28.8%), 1980s ($n = 19$, 17.1%), and 1970s ($n = 1$, 0.9%). Most of the studies examined the TPB ($n = 83$, 74.8%) followed by the TRA ($n = 28$, 25.2%). There were more published ($n = 85$, 76.6%) than unpublished studies ($n = 26$, 23.4%), and 40.0% ($n = 34/85$) of the published studies were grant supported. The most common design was longitudinal/prospective ($n = 63$, 56.8%), followed by cross-sectional ($n = 40$, 36.0%), retrospective ($n = 6$, 5.4%), and experimental ($n = 2$, 1.8%). Most of the data were collected during on-site visits ($n = 59$, 53.2%), followed by mail ($n = 16$, 14.4%), telephone ($n = 6$, 5.4%), or a combination of methods ($n = 25$, 22.5%). Most of the studies ($n = 80$, 72.1%) reported the internal consistency scores of the measures which were adequate, and 12.6% ($n = 14$) reported the test-retest values of the theory scales. The majority of the studies ($n = 93$, 83.8%) did not have scale correspondence for the intention-behavior association. The average response rate was 68.2% and was reported in 60.4% ($n = 67$) of the studies. The average attrition rate was 17.9% and was reported in 18.0% ($n = 20$) of the studies.

Subject Characteristics. Subject selection included target groups ($n = 78$, 70.3%), random assignment ($n = 17$, 15.3%), and volunteers ($n = 16$, 14.4%). The majority of the studies included men and women ($n = 79$, 71.2%), followed by women only ($n = 20$, 18.0%), and men only ($n = 7$, 6.3%). The subjects included college students ($n = 30$, 27.0%), community adults ($n = 29$, 26.1%), worksite populations ($n = 14$, 12.6%), children and adolescents ($n = 14$, 12.6%), hospital patients ($n = 12$, 10.8%), fitness club participants ($n = 11$, 10.0%), and not specified ($n = 1$, 0.9%). The subject age was reported in 85.6% ($n = 95$) of the studies with a range of 8 to 80 y. The subject ethnicity was reported in 25.2% ($n = 28$) of the studies, and their socioeconomic status was reported in 30.6% ($n = 34$) of the studies.

Behavior Characteristics. A definition of exercise behavior was provided in 72.1% ($n = 80$) of the studies, with an author-developed definition provided most frequently ($n = 48$, 60.0%), followed by a self-report questionnaire definition ($n = 21$, 26.2%), and the ACSM guidelines³⁷ ($n = 11$, 13.8%). Exercise behavior was assessed by author-developed self-report measures ($n = 49$, 44.1%), standardized self-report measures ($n = 37$, 33.3%), frequency of exercise class attendance ($n = 13$, 11.7%), and frequency of exercise min ($n = 11$, 10.0%).

*Purpose 1: Strength of Associations
Among the TRA/TPB Constructs*

The effect size distributions for each of the TRA/TPB associations were homogeneous, $P > 0.05$. The fail-safe n values indicated that the results can be interpreted with confidence (see Table 1). Large effects were found for intention-exercise

Table 1 Effect Size and Statistics for the Associations Among the Theories of Reasoned Action and Planned Behavior Constructs

Variable	NES ^a	MES ^b	SD ^c	FSn ^d	95% CI ^e	<i>H</i> Statistic
Behavior and intention	166	1.01	0.06	636	±0.009	97.26
perceived behavioral control	146	0.51	0.06	266	±0.010	44.65
Intention and perceived behavioral control	146	0.90	0.05	555	±0.008	89.60
attitude	169	1.07	0.05	681	±0.008	47.81
subjective norm	161	0.59	0.06	326	±0.010	22.44

Note. ^aEffect size number. ^bMean effect size. ^cStandard deviation. ^dFail-safe number of studies (FSn). ^e95% confidence intervals. All effect sizes are significantly different from zero ($P < 0.01$); all H statistics are homogenous ($P_s > 0.05$); all FSn were calculated

behavior, intention-perceived behavioral control, and intention-attitude. Moderate associations were found for perceived behavioral control-behavior and intention-subjective norm.

Purpose 2: Predicting Exercise Behavior and Intention

In the first regression, intention and perceived behavioral control (predictor variables) accounted for 21.0% of the variance in exercise behavior (dependent variable), $F(2, 143) = 18.74, P < 0.001$. Intention ($\beta = 0.42, P < 0.001$) emerged as a significant predictor of behavior whereas perceived behavioral control did not ($\beta = 0.08, P = 0.37$). In the second regression model, attitude, perceived behavioral control, and subjective norm (predictor variables) accounted for 30.4% of the variance in intention (dependent variable), $F(3, 111) = 16.17, P < 0.001$. Attitude ($\beta = 0.34, P < 0.001$) and perceived behavioral control ($\beta = 0.27, P = 0.002$) provided unique contributions, however, subjective norm ($\beta = 0.13, P = 0.14$) did not.

Purpose 3: Examining Moderator Variables

1. Time Interval. Following the procedures of Randall and Wolff,²⁰ the time interval between assessing intention and behavior was examined by classifying the studies into one of four time intervals: a) short (i.e., less than or equal to 1 wk); b) medium (i.e., greater than 1 wk and less than or equal to 1 month); c) long (i.e., greater than 1 month and less than or equal to 1 y); and d) very long (i.e., greater than 1 y). Effect size comparisons for the very long time interval could not be examined because of insufficient data ($n = 3$). Univariate weighted least squares analyses revealed a significant time difference in the size of the effects. A significantly larger intention-behavior association was found for the short interval ($ES = 1.19$, standard deviation = 0.05, $n = 64$) compared to the long interval ($ES = 0.76$, standard deviation = 0.07, $n = 49$), and the medium interval ($ES = 1.20$, standard deviation = 0.06, $n = 47$) compared to the long interval [$QB(2) = 6167.31, P < 0.01$].

No significant group differences were observed between the short and medium time intervals.

2. Scale Correspondence. A significantly larger intention-behavior association was found for studies with scale correspondence ($ES = 1.50$, standard deviation = 0.05, $n = 28$) compared to studies without scale correspondence ($ES = 0.91$, standard deviation = 0.06, $n = 137$) [$QB(1) = 42,972, P < 0.01$].

3. Subject Age, Sex, Ethnicity, and Socioeconomic Status. The moderating influence of the subject age on the intention-behavior association was examined by classifying the studies into one of four age groups: a) children/adolescents (ages 8 to 17), b) young adults (ages 18 to 25), c) adults (ages 26 to 64), and d) older adults (ages 65 and older).²³ Univariate weighted least squares analyses revealed a significant age difference in the size of the effects. A significantly smaller intention-behavior association was observed for children/adolescents ($ES = 0.42$, standard deviation = 0.06, $n = 23$) compared to young adults ($ES = 1.43$, standard deviation = 0.05, $n = 45$), adults ($ES = 0.85$, standard deviation = 0.06, $n = 57$),

and older adults ($ES = 1.01$, standard deviation = 0.06, $n = 12$) [$QB = 39, 303.33$, $P < 0.01$]. In addition, a significantly larger intention–behavior association was found for young adults compared to adults ($P < 0.01$) and older adults compared to adults ($P < 0.01$). No significant effect size difference was observed between older adults and young adults. Because of a lack of studies segregating their sample by sex and the small number of studies reporting the subject ethnicity and socioeconomic status, we could not examine the moderating influence of sex, ethnicity, and socioeconomic status on the intention–behavior association.

4. Measurement Issues with the Theory Constructs. With respect to intention–expectation association, a significantly larger association was found for expectation–behavior ($ES = 1.05$, standard deviation = 0.05, $n = 31$) compared to intention–behavior ($ES = 0.98$, standard deviation = 0.06, $n = 125$) [$QB(1) = 1,249.99$, $P < 0.01$]. We further examined the type of items used to assess intention and expectation, and found the magnitude of the intention–behavior association was significantly larger when intention was measured using plan/goal items ($ES = 1.12$, standard deviation = 0.06, $n = 24$) compared to intend items ($ES = 0.87$, standard deviation = 0.06, $n = 85$) [$QB = 528.68$, $P < 0.01$]. In addition, the expectation–behavior association was significantly larger for probability items ($ES = 1.54$, standard deviation = 0.06, $n = 11$) compared to likelihood items ($ES = 0.91$, standard deviation = 0.05, $n = 18$) [$QB(1) = 14,425.98$, $P < 0.01$].

Comparisons between affective and instrumental attitude could not be undertaken because of the studies that reported an attitude measure ($n = 82$), the majority ($n = 69$, 84.2%) examined both constructs, but only reported one total attitude score.

Because of a small number of available effect sizes for social support ($n = 6$), comparisons between social support and subjective norm were not examined. Thus, instead, we examined the number of items used to assess subjective norm, and we found the magnitude of the subjective norm–behavior association was significantly greater for multiple-item measures ($ES = 0.30$, standard deviation = 0.06, $n = 82$) compared to single-item measures ($ES = 0.11$, standard deviation = 0.07, $n = 48$) [$QB(1) = 1,935.52$, $P < 0.01$]. In addition, a significantly larger subjective–norm intention association was found for multiple-item measures ($ES = 0.68$, standard deviation = 0.06, $n = 83$) compared to single-item measures ($ES = 0.46$, standard deviation = 0.06, $n = 66$) [$QB(1) = 484.90$, $P < 0.01$].

Lastly, with respect to perceived behavioral control, self-efficacy, and perceived barriers, univariate weighted least squares analyses revealed a significant type of perceived behavioral control measurement effect. The association for perceived behavioral control–behavior ($ES = 0.67$, standard deviation = 0.07, $n = 92$) was significantly larger than perceived barriers–behavior ($ES = -0.21$, standard deviation = 0.05, $n = 20$), but it was not significantly different than self-efficacy–behavior ($ES = 0.49$, standard deviation = 0.04, $n = 33$) [$QB(2) = 10,206.51$, $P < 0.01$]. The magnitude of the effect for self-efficacy–behavior was significantly larger than for perceived barriers–behavior. The association for self-efficacy–intention ($ES = 1.17$, standard deviation = 0.05, $n = 25$) was significantly greater than perceived behavioral control–intention ($ES = 1.04$, standard deviation = 0.05, $n = 103$) and perceived-barriers–intention ($ES = -0.36$, standard deviation = 0.06, $n = 17$) [$QB(2) = 43,410.11$, $P < 0.01$]. In addition, the magnitude of the effect for perceived

behavioral control–intention was greater than the perceived barriers–intention ($P < 0.01$).

5. Published vs. Unpublished Research. A significantly larger intention–behavior association was found for the unpublished studies ($ES = 1.23$, standard deviation = 0.06, $n = 36$) compared to the published studies ($ES = 0.95$, standard deviation = 0.06, $n = 130$) [$QB(1) = 22,930.88$, $P < 0.01$]. Similarly, for the perceived behavioral control–behavior association, the magnitude of the effect for unpublished studies ($ES = 0.56$, standard deviation = 0.07, $n = 30$) was greater than for published studies ($ES = 0.49$, standard deviation = 0.06, $n = 116$) [$QB(1) = 1,407.98$, $P < 0.01$]. A significantly larger perceived-behavioral control–intention association was found for the published studies ($ES = 0.91$, standard deviation = 0.05, $n = 111$) compared to the unpublished studies ($ES = 0.87$, standard deviation = 0.06, $n = 35$) [$QB(1) = 818.29$, $P < 0.01$]. Significant group differences, however, were not observed for the attitude–intention (published $ES = 1.08$, standard deviation = 0.05, $n = 128$; unpublished $ES = 1.06$, standard deviation = 0.06, $n = 41$) and subjective–norm intention (published $ES = 0.58$, standard deviation = 0.06, $n = 121$; unpublished $ES = 0.61$, standard deviation = 0.07, $n = 40$) associations ($Ps > 0.05$).

Discussion

The purpose of this meta-analysis was threefold: a) to meta-analytically examine the strength of the associations among the TRA/TPB constructs with exercise behavior; b) to examine the predictive utility of the TRA/TPB; and c) to examine the influence of moderator variables on the associations among the TRA/TPB constructs with exercise behavior. In general, the predictive utility of the TRA/TPB for explaining exercise intention and behavior was supported. Several findings warrant further discussion.

First, as predicted, the magnitude of the effects between intention–behavior, intention–perceived behavioral control, and intention–attitude were large. In addition, the subjective norm–intention effect was moderate. Contrary to our hypothesis, a moderate effect was found for perceived behavioral control and behavior. Consistent with our hypothesis, the magnitude of the effect was larger for intention–exercise behavior compared to perceived behavioral control–exercise behavior. Similarly, the attitude–intention association was larger than the perceived behavioral control–intention and the subjective norm–intention associations. These findings are consistent with previous TRA and TPB exercise reviews,^{10,12} and they suggest that people’s intention is the strongest determinant of their exercise behavior, and their attitude most strongly influences their intention. This information is important for designing exercise interventions because it illustrates that how people feel about exercise (i.e., their attitude) has the greatest impact on whether they will plan to exercise (i.e., their intention).

Second, intention and perceived behavioral control predicted exercise behavior; however, in contrast to our hypothesis,¹² only intention provided a unique contribution. This finding is consistent with other researchers’ conclusions^{49,50} that intention is a stronger predictor of exercise behavior than perceived behavioral control. In addition, attitude, perceived behavioral control, and subjective norm predicted exercise intention, with attitude and perceived behavioral control providing unique contributions, and attitude emerging as the strongest determinant. While

this finding supported our hypothesis, it is important to note that attitude was only marginally stronger than perceived behavioral control in predicting intention. Some researchers argue that attitude is the dominant determinant of exercise intention;⁵² however, others suggest that attitude and perceived behavioral control contribute equally to predicting exercise intention.⁵³ Thus, researchers and intervention specialists aiming to strengthen people's exercise intention might want to focus on strategies for positively influencing both attitude (e.g., benefits of exercise) and perceived behavioral control (e.g., positive self-talk, increasing self-efficacy).

Furthermore, subjective norm did not predict intention, which is consistent with the conclusions of other researchers, and suggests that the influence of significant others has less of an impact on people's exercise intention compared to their attitude and perceived behavioral control.^{15,54,55} Another explanation is there could be limitations in the measurement of subjective norm.¹³ More specifically, although social support might be a better predictor of intention than subjective norm,^{27,28} we could not compare these constructs because of insufficient data. In addition, although the effect sizes were small to moderate, we found larger subjective norm-behavior and subjective norm-intention associations in studies using multiple versus single item measures.

Third, as predicted, the intention-behavior association was larger in studies that measured intention and behavior within a 1-month period compared to the studies with a time interval greater than 1 month. While these findings are in contrast to previous research¹³ they are consistent with the conclusions of researchers who proposed that the predictive power of intention will decrease as the time between the measurement of intention and behavior increases.^{3,19} Specifically for exercise, a number of factors might occur between the time that intention and behavior are assessed (e.g., injury, bad weather, holidays). Thus, to improve the predictive utility of the intention-behavior association, we recommend that exercise behavior is measured within 1 month of the intention assessment.

Fourth, consistent with our hypothesis, studies with scale correspondence produced larger intention-behavior effects than studies without scale correspondence.^{18,19} While our intention was to examine scale correspondence among all of the theory constructs, a lack of information restricted the analysis to only the intention-behavior association. The findings of this review with respect to the issue of scale correspondence are cause for concern. More specifically, only 18 studies out of 111 had scale correspondence, which is far less than we had anticipated. Because there is no "gold standard" theory for explaining exercise behavior, it is important that the theories we use to explain why people do and do not exercise are being properly applied. Measurement issues such as a lack of scale correspondence have the potential to overshadow the positive elements of the TRA/TPB. Thus, it can be argued that the utility of the TRA/TPB is limited by the fact that most of the TRA/TPB and exercise studies do not have scale correspondence. Thus, researchers are encouraged to obtain scale correspondence among all of the theory constructs with respect to action, target, context, and time^{3,25} to improve the predictive utility of the TRA/TPB.

Fifth, the subject age moderated the intention-behavior association. More specifically, a larger intention-behavior association was found for young adults (ages 18 to 25) and older adults (ages 65 to 80) compared to adults (ages 26 to

64) and children/adolescents (ages 8 to 17). These findings partially support our hypothesis and the conclusions of Hagger et al.¹² While it has been suggested that younger people have a greater difficulty with implementing their intentions because of inexperience or a lack of volitional control,²² it is important to note that the intention–exercise behavior association was largest for the young adults. Thus, before conclusions can be made regarding the moderating influence of age, more research is needed to determine when people are most at risk for weak or unstable exercise intentions. Future researchers are encouraged to report their findings segregated by sex and to report more information about the subject ethnicity and socioeconomic status to meta-analytically examine these moderator variables.

Consistent with our hypothesis,^{13,24} the magnitude of the effect for expectation–behavior was greater than for intention–behavior. In addition, we found differences in the type of items used to assess these constructs. For example, we found that probability (e.g., “What is the probability that you will exercise this week?”) had a larger effect than likelihood (e.g., “What is the likelihood that you will exercise this week?”). In addition, the intention–behavior association was larger when intention was measured using plan/goal items (e.g., “I plan to exercise regularly for 30 minutes today”) compared to intention items (e.g., “I intend to exercise regularly for 30 minutes today”). These findings are important for designing prospective studies and exercise interventions because they demonstrate that people could have different interpretations of these terms; thus, impacting the intention–behavior association. We recommend that probability items are used to assess expectation and plan/goal items are used to assess intention.

Moreover, consistent with our hypothesis,^{15,16} the association for self-efficacy–intention was greater than for perceived behavioral control–intention and perceived barriers–intention. In partial support of our hypothesis, however, the association for self-efficacy–behavior was larger than perceived barriers–behavior but not compared to perceived behavioral control–behavior. These findings are in contrast to research that has found that self-efficacy is a stronger predictor of exercise behavior than perceived behavioral control.^{15,16} One explanation for these findings might be because of the conceptual overlap between self-efficacy and perceived behavioral control. For example, Ajzen¹⁴ suggested that self-efficacy is a lower-level construct of perceived behavioral control; however, more research is needed to examine this assumption. These findings are important for intervention research because they suggest that self-efficacy (e.g., one’s ability to be active) could be more important than perceived behavioral control (e.g., resources and skills to be active) for influencing a person’s exercise intention.

Finally, partial support was found for our prediction that no differences would be observed between the TRA/TPB constructs for published versus unpublished studies. More specifically, we found a larger intention–behavior and perceived behavioral control–behavior association for unpublished compared to published studies. We also found a larger perceived behavioral control–intention association for published versus unpublished studies. Thus, the common perception that unpublished studies have nonsignificant findings was not supported by our review of the TRA/TPB and exercise literature. These findings illustrate the importance of examining both published and unpublished research, especially when conducting meta-analytic reviews. Therefore, consistent with Sharpe,³³ the findings of our meta-analysis suggest that unpublished studies be included in reviews of the TRA/TPB.

While the findings from this meta-analysis support the theoretical tenets of the TRA/TPB, several avenues for future research have emerged. Researchers are encouraged to examine potential constructs (e.g., ethnicity, socioeconomic status) that might moderate the TRA/TPB associations. Future researchers are encouraged to evaluate the measurement issues associated with the theory constructs (e.g., perceived behavioral control–self-efficacy, subjective norm–social support) until a consensus exists regarding which constructs are stronger determinants of exercise intention and behavior. In addition, intervention specialists aiming to use the TRA/TPB as a framework to guide exercise interventions might use our study findings when developing their measures. That is, we suggest that researchers: a) assess exercise behavior within 1 month of intention; b) obtain scale correspondence with respect to action, target, context, and time for measuring intention and behavior; and c) examine the type of items used to measure the theory constructs (e.g., probability items to measure expectation, plan/goal items to measure intention).

In summary, we aimed to clarify some of the conceptual and methodological issues by examining the predictive contributions of the TRA/TPB constructs and the influence of five moderator variables. Our study findings support the utility of the TRA/TPB for understanding and explaining exercise intention and behavior, and they demonstrate the usefulness of using these theories to guide exercise intervention research.

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