Predicting Aerobic Versus Resistance Exercise Using the Theory of Planned Behavior

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***Objective*: To test the theory of planned behavior (TPB) in aerobic versus resistance training in a prospective design. Relationships between TPB variables, extroversion, and perceived health were examined. *Methods*: College students (210) completed an initial measurement and a 3-month follow-up assessment. Reasons for exercising were assessed. *Results*: TPB variables, extroversion, and perceived health collectively accounted for substantial variance in aerobic (19%) and resistance exercise (40%). Reasons for exercise included physical, psychological, and social concerns. *Conclusion*: Differences in the predictive validity of model constructs suggest potential differential intervention foci for aerobic versus resistance exercise.**

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As of 1996, over 60% of Americans did not exercise regularly, and 25% of Americans were completely sedentary.[1,2] The benefits of regular *aerobic activity* are clear, and they include decreased risk for coronary disease,[3] decreased risk for developing diabetes, decreased risk of developing colon cancer, and decreased overall risk of dying prematurely.[2] Evidence further indicates that *resistance training* makes muscles work more efficiently, prevents injury during sports, decreases cholesterol,[4] decreases blood pressure, increases endurance,[5] and strengthens bones.[6] The Healthy People 2010 report cites physical activity as one of the leading health indicators to be targeted by prevention programs in the 21st century,[7] and the American College of Sports Medicine recommends resistance training for all healthy adults.[8-9] Effective interventions to increase both aerobic activity and resistance training are needed, and the development of such interventions requires conducting theory-based research to identify determinants of regular exercise.[10-11]

Despite the fact that *both* aerobic activity and resistance training are deemed important by leading health authorities, the vast majority of theoretical and applied research has concentrated only on aerobic activity (see reviews by Blue,[12] Hausenblas et al,[13] and Maddux[11]). In fact, only one published study was found that specifically focused on the predictors of resistance training.[14] The primary goal of the current investigation is to present tests of the predictive validity of the theory of planned behavior (TPB)[1,15] for aerobic-exercise behavior versus resistance training. A secondary goal of this investigation is to ascertain whether 2 variables shown to have bivariate correlations with exercise behavior (eg, extroverted personality and perceived health) can be integrated into the TPB structure to improve the specificity of

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the model for exercise behaviors.

Basic Research with TPB

The TPB posits that intentions to carry out a behavior are the most proximal predictor of engaging in the behavior.[1,15] Intentions, in turn, may be determined by individuals' attitudes towards the behavior, perceptions of subjective normative support for the behavior (norms), and/or perceptions of behavioral control (PBC) with respect to the act in question. In this context, attitudes are beliefs about the behavior and evaluations of the outcome of the behavior (eg, "exercise will make me healthy"). Norms refer to a person's perceptions about whether important referents (eg, peers, family) believe the person should or should not engage in the behavior in question. PBC reflects an individual's belief about how easy or difficult performance of a behavior is likely to be. The TPB further posits that there may be direct effects of PBC on behavior, where behavior is not under complete volitional control. Support for the validity of the TPB in predicting *aerobic*-exercise behavior has been established across populations including older adults,[16,17] college students,[18,19] pregnant women,[10] patients with cardiovascular disease,[20] breast cancer patients,[21] and the disabled.[22] In general, attitudes appear to be more strongly associated with intentions to exercise than are subjective norms supporting exercise,[10,12] and the meta-analysis of TPB studies with regard to exercise by Hausenblas et al[13] showed that attitude was "over two times more useful as a predictor of intention to exercise...than was subjective norm" (pg. 43). Hausenblas et al[13] further concluded that the TPB was superior to the theory of reasoned action, because perceived behavioral control (the only variable that distinguishes the 2 theories) significantly added to the prediction of both exercise intentions and exercise behavior across studies.

In TPB studies of exercise behavior, the authors note 3 limitations. First, though the TPB is specified as a mediational path model, where attitudes, norms, and PBC predict intentions, and intentions predict behavior, a lack of the use of path analysis is noted (but see Godin et al[23]). Further, few authors address or test the mediational assumptions of the TPB, ie, that the effects of attitudes and norms on behavior are mediated by intentions. A second limitation is the focus either exclusively on aerobic activity or on "exercise" with no specification of the type of exercise. Individuals who engage in aerobic activity versus resistance training often have different goals (ie, to slim down versus to "buff up"), and the difficulty of performing these 2 activities (ie, the level of PBC) may be quite different. One only has to own a pair of running or walking shoes to engage in aerobic activity, whereas resistance training may require access to a training facility or at least access to specific equipment. It may be that the relationships among TPB constructs are quite different for the 2 types of exercise behaviors, and this would have implications for the design of interventions to encourage these behaviors. Finally, the meta-analytic and review papers cited herein each call for the study of the relationships between TPB constructs and behavior in a prospective design, such that a stronger case for prediction, rather than simply association, can be made. The primary goals of the current study were to address these 3 limitations by testing the TPB via a path analytic approach, to test the model for aerobic versus resistance training, and to conduct these tests via data gathered in a prospective design.

Possible Precursors of TPB Constructs

The first author's previous research in the use of theoretical models of health behavior to predict condom-use behavior[24-25] has shown the utility of considering possible distal precursors of more proximal psychosocial constructs. For example, in a sample of high-risk adolescents, it was shown that self-esteem and future orientation were significant predictors of perceived behavioral control over condom use.[26] Understanding the personality traits or perceptions that may be related to more general constructs is important for developing intervention content and for identifying participants for whom traditional interventions might not be successful. In the context of exercise behavior, it was hypothesized that 2 distal constructs shown to be

related to exercise may be integrated into the TPB. Specifically, it was suspected that extroversion might be a precursor of normative support for exercise and that perceived health would enhance PBC for exercise.

Previous research has examined the relationship of personality traits to various types of health behavior, including exercise behavior. Courneya and Hellsten[27] found in a cross-sectional design that each of the 5 personality traits in the "Big Five" conceptualization of personality[28-29] was related to motivations to exercise. In addition, and consistent with previous research,[30] extroversion and conscientiousness have been shown to be positively related to actual exercise behavior, whereas neuroticism is negatively related. In the current work, personality dimensions that might have some theoretical relationship with the TPB variables at focus were of interest, and thus, the authors chose to examine extroversion. Extroverts tend to be gregarious and socially oriented,[29,31] and thus, it was hypothesized that extroverted individuals would seek and obtain subjective normative support for exercise behavior and that extroversion would be a precursor of perceived normative support.

Perceived health has been positively correlated with exercise behavior in cross-sectional designs.[32-33] Although it is certainly the case that exercise contributes to perceptions of health, Salminen[34] conducted a prospective study of the relationship between perceived health and exercise behavior and found that perceived health can also *predict* exercise behavior. This relationship is believed to be an important one, in that individuals may need to feel healthy enough, ie, physically able, to exercise before they acquire PBC over the behavior. Thus, it was predicted that perceived health would be a precursor of PBC for both aerobic and resistance exercise.

METHOD

Participants

Introductory psychology students from the University of Connecticut were recruited to participate in a study of lifestyle and health behavior in exchange for class credit. Of the 294 participants who completed the initial survey, a total of 210 completed the 3-month follow-up phone interview. There were no age or sex differences between those who completed the follow-up versus those who did not (age: t-test with unequal variances (109.9)=1.39, ns; sex: $\chi^2(1, n=294) < 1$, ns). Though all participants were predominantly white, participants who completed the follow-up were slightly more likely to be white than were those who did not, χ^2 (1, n=293)=5.62, $p<.05$. However, race was unrelated to frequency of aerobic exercise or resistance training at baseline, F's (5, 292)=1.21 and 1.56, ns, respectively. Further, there were no differences in level of aerobic exercise (t(1,292) <1, ns) or resistance training (t(1,292)=1.69, ns) among those who completed the follow-up versus those who did not. All data reported henceforth are taken from the 210 individuals who completed the baseline and follow-up measures. The average age of those 210 respondents was 18.59 years, sd=1.54 (range 17-31). The sample was 30% male and 70% female. The majority of the participants (81.6%) were white, 7.3% were Asian or Pacific Islander, 4.4% were African American, 2.9% were Hispanic/Latino(a), 1.5% were "multiracial," and 2.4% reported their race as "other."

...210 completed the 3-month follow-up phone interview.

Design and Procedures

Participants completed the initial questionnaire in a self-administered format in small groups. Informed-consent procedures were followed, confidentiality was assured, and participants were asked to respond truthfully. Trained research assistants administered the follow-up phone interview approximately 3 months after the initial data were collected, and these assistants were unaware of participants' initial responses. All procedures were reviewed and approved by a university-level human subjects committee.

Initial Questionnaire

The questionnaire covered demographic measures as well as measures of exercise history over the past 3 months.

Exercise history. For the purpose of

Coefficient alphas for aerobic-exercise attitudes (α=.61) and weight-training (α=.76) attitudes were acceptable.

consistency, aerobic exercise and weight training were explicitly defined for the participants. The following definitions were used: *Aerobic activity*: Any activity that uses large muscle groups, is done for at least 20 minutes, and is done at a level that causes your breathing to be heavy and your heart to beat faster (examples are running, swimming, bicycling, step aerobics, basketball). *Weight training*: Any activity involving resistance (either from free weights, weight machines, or resistance tubing) that is done for at least 20 minutes in which moderate to heavy weight is lifted.

For aerobic exercise and resistance training separately, a series of 3 questions were asked.

1. In the *past 3 months only*, how often did you engage in [aerobic activity/weight training]? Responses ranged from 1 (*never*) to 7 (*often*).
2. In the *past 3 months only*, what is the average number of days per week that you engaged in [aerobic activity/weight training]? Responses ranged from 0 days to 7 days.
3. In the *past week only*, how many days did you engage in [aerobic activity/weight training]. Responses ranged from 0 days to 7 days.

Responses were summed to yield an aerobic-exercise score (1-21 possible; coefficient alpha (α)=.88), and a weight-training score (1-21 possible; α=.91). On average, participants were not highly likely to engage in either aerobic exercise, M=10.4, sd=5.4, or weight training, M=6.23, sd=5.28. Sex was not correlated with level of aerobic exercise, r=.03, ns, but was related to level of weight training, r=.33, p<.001 such that men were more likely to engage in weight training than were women.

Theory of planned behavior constructs. *Attitudes* towards aerobic exercise and weight training were measured with 5 items targeting specific behavioral beliefs including efficacy beliefs (eg, "engaging in [aerobic exercise/weight training] would keep me healthy") and hedonistic beliefs (eg, "[aerobic exercise/weight training] would make me appear more sexually attractive"). Response options on a Likert-type scale ranged from 1 (*disagree strongly*) to 7 (*agree strongly*). Because these 2 scales were original to this research, each scale was first submitted to a confirmatory factor analysis (CFA) in EQS 5.7b[35] in order to establish unidimensionality. Model fit was assessed with the comparative fit index (CFI[36]), which ranges from 0 to 1. A CFI of .90 indicates acceptable fit, whereas .80 indicates marginal fit. In each of the 2 models, all items loaded significantly (all p's<.05) on their hypothesized construct. Acceptable fit was found for each of the new attitude scales: aerobic-exercise attitudes, χ^2(5, n=210) =4.94, ns, CFI=1.00; weight-lifting attitudes, χ^2(5, n=210) =8.28, ns, CFI=.99. Given acceptable unidimensionality, items on each of these scales were reverse scored as necessary and the items averaged to yield a scale score such that higher numbers indicated more positive attitudes. Coefficient alphas for aerobic-exercise attitudes (α=.61) and weight-training (α=.76) attitudes were acceptable.

Norms were measured with 5 items that asked the extent to which participants thought that their parents, friends, boyfriend/girlfriend, doctor, and "most people who are important to [them]" believed that they should participate in aerobic exercise/weight training. Items on the scales were averaged to yield a scale score such that higher numbers indicated more normative support. Coefficient alphas for aerobic norms (α=.87) and weight-training (α=.92) norms were high.

Perceived behavioral control (PBC) was measured with 7 items each for aerobic exercise and weight training and reflected the extent to which participants felt confident in their ability to engage in aerobic exercise/weight training both in general and in the face of obstacles. Sample items include "I feel confident that I know how to do [aerobic exercise/weight training] correctly" and "I feel confident that I could do [aerobic exercise/weight training] even if I was very busy." Items on the scales were averaged to yield a scale score such that higher numbers indicated higher PBC. Coefficient alphas for aerobic (α=.89) and weight-training (α=.95) PBC were high.

Intentions to engage in aerobic exercise and weight training were assessed with 4

items each. These items began, "How likely is it that you will....", and thus they were technically measures of behavioral expectation rather than intention.[37-38] Measures of behavioral expectation appear to have superior predictive relationships to behavior as compared to items phrased "I intend to..." in situations where there may be barriers to the performance of a behavior, as is the case with exercise,[12,38] and thus were chosen for use in the current study. The items asked how likely participants would be to talk to their friends about [aerobic exercise/weight training], get or buy equipment that can be used for [aerobic exercise/weight training], go to the field house (an exercise facility on campus) or a health club to do [aerobic exercise/weight training], and actually do [aerobic exercise 3 times a week/weight training 2 times a week] in the next 3 months. Responses were on a 1 (*not at all likely*) to 7 (*very likely*) scale. Items on the scales were averaged to yield a scale score such that higher numbers indicated higher intentions. Coefficient alphas for aerobic (α=.80) and weight-training (α=.87) intentions were high.

Additional model constructs. The final 2 constructs measured were perceived health and extroversion. *Perceived health* was conceptualized as a measure of subjective health status, and was assessed with two items: (a) "In comparison to people your age, would you say your *health* is much better, about the same, or worse?" measured on a 1 (*my health is much worse*) to 7 (*my health is much better*) scale, and (b) "In comparison to people your age, would you say you are in better *physical shape*, about the same *physical shape*, or worse *physical shape*?" measured on a 1 (*much worse physical shape*) to 7 (*much better physical shape*) scale. These items were averaged to form a reliable scale with α=.80. *Extroversion* was measured with 4 adjectives culled from the extroversion dimension of the Big Five personality structure.[29,31] These adjectives were embedded in an 11-item adjective set to discourage suspicion. Participants were asked to rate themselves on the following 7-point bipolar adjective scales: passive-assertive, weak-strong, not confident-confident, and submissive-dominant. Scores on these items were averaged to form a scale score such that higher numbers indicated higher extroversion. The scale displayed adequate internal-consistency reliability (α=.68).

Coefficient alphas for aerobic (α=.80) and weight-training (α=.87) intentions were high.

Follow-up Questionnaire

The follow-up questionnaire contained the identical behavioral measures for aerobic activity and weight training contained on the initial questionnaire in order to assess behavior in the 3 months since initial data collection. In addition, reasons for exercising or not exercising were assessed.

RESULTS

Because sex was strongly related to exercise behavior in at least the domain of weight-training behavior, and given the sex imbalance in the sample, the structural equation modeling (SEM) tests on the covariance matrices for aerobic exercise and weight training were performed partialling the effects of sex. Because the partialled covariance matrices required complete data on all variables in the model, the final total sample size for the tests of the models in Figure 1 and 2 was n=205, as 5 participants had one or more missing data points.

Aerobic Exercise

Means, standard deviations, and partial correlations among all the variables included in the model of aerobic-exercise behavior appear in Table 1. The correlations for aerobic exercise were consistent with the hypothesized model, such that the 3 proximal TPB predictors of intentions (ie, attitudes, norms, and PBC) exhibited the strongest correlations with intentions. Contrary to expectation, there was no significant relationship between extroversion and perceived normative support. However, there were significant correlations between extroversion and PBC and, as predicted, between perceived health and PBC. Given these findings, the authors chose to estimate a model in which extroversion and perceived health were both precursors of PBC. Finally, as hypothesized, intentions were strongly correlated with follow-up behavior. The model in Fig-

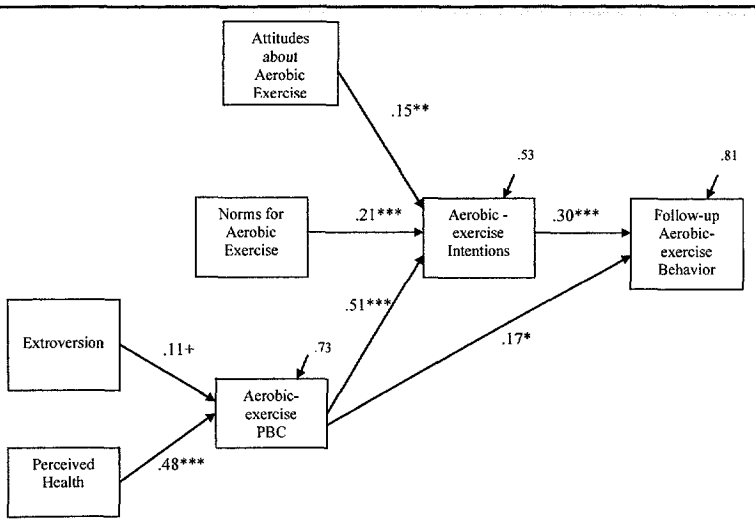
TABLE 1
Means, Standard Deviations, and Correlations[a] Among the Aerobic-exercise Variables (n=205)

Variable	1	2	3	4	5	6	7
1. Extroversion	.—						
2. Perceived health	.28***	.—					
3. Attitudes	.18*	.29***	.—				
4. Social norms	.07	.04	.30***	.—			
5. Perceived behavioral control	.23***	.51***	.52***	.26***	.—		
6. Intentions	.12+	.34***	.47***	.39***	.64***	.—	
7. Follow-up behavior	.12+	.31***	.22**	.23**	.37***	.42***	.—
8. Means	4.79	4.67	6.19	4.71	5.30	5.55	9.08
9. Standard deviations	.92	1.22	.70	1.41	1.30	1.45	4.52

a Correlations represent the partial correlations among the variables partialling sex.
Note: + p<.10, * p<.05, ** p<.01, *** p<.001

ure 1 was estimated using EQS.[35] Model fit was assessed with the CFI and the root mean square error of approximation (RMSEA[39,40]). Both of these measures are more sensitive to model misspecification and less affected by sample size than the likelihood ratio χ^2.[41] The RMSEA ranges from 0 to ∞, with fit values less than .05 indicating close fit and values less than .10 indicating reasonable fit.[42] The fit of the model in Figure 1 was adequate, $\chi^2(6, n=205) = 8.58$, ns, CFI=.99, RMSEA=.05. Standardized path coefficients and significance levels for individual paths appear in Figure 1. As can be seen in the figure, all hypothesized paths were significant, with the

Figure 1
Structural Model Predicting Follow-up Aerobic-exercise Behavior



All exogenous correlations are estimated, as are the correlations between norms and PBC and attitudes and PBC. Coefficients are standardized path coefficients. Overall model fit: χ^2 (6, n= 205) = 8.58, ns, CFI=.99, RMSEA = .05. Note: + p<.10, * p<.05, ** p<.01, *** p<.001.

TABLE 2
Means, Standard Deviations, and Correlations[a] Among the Weight-lifting Variables (n=205)

Variable	1	2	3	4	5	6	7
1. Extroversion	.—						
2. Perceived health	.28***	.—					
3. Attitudes	.16*	.22**	.—				
4. Social norms	.10	.09	.35***	.—			
5. Perceived behavioral control	.27***	.36***	.52***	.39***	.—		
6. Intentions	.21**	.27***	.56***	.44***	.79***	.—	
7. Follow-up behavior	.21*	.29***	.37***	.28***	.61***	.59***	.—
8. Means	4.79	4.67	5.65	3.85	4.31	4.48	5.53
9. Standard deviations	.92	1.22	1.00	1.41	1.83	1.82	4.38

a Correlations represent the partial correlations among the variables partialling sex.
Note: + p<.10, * p<.05, ** p<.01, *** p<.001

exception of the marginally significant path from extroversion to PBC. This model accounted for 47% of the variance in intentions, a large effect size for multivariate prediction models,[43] and 19% of the variance in aerobic exercise behavior, a moderate effect size.[43]

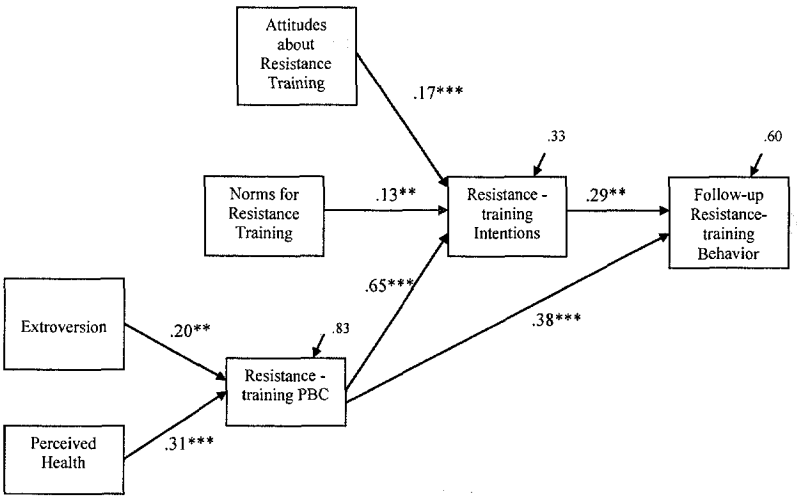
As predicted by the TPB, there was a significant direct effect of PBC on later behavior. In terms of the mediational assumptions of the TPB, an assessment of whether the effects of attitudes and norms on behavior were mediated through intentions was done in 3 ways. The researchers first examined the z-test for the adaptation of the Sobel test[44] of the 2-part indirect path implemented in EQS 5.7b. A significant z-score is evidence of a significant indirect (ie, mediated) effect. Second, the authors assessed whether the direct path from the construct to behavior was significant and whether the addition of this path resulted in a significant change in $\chi^2(\chi^2\Delta)$ for the model. For attitudes, there was a significant indirect effect, z=2.04, p<.05. Adding the direct path from attitudes to behavior did not significantly improve the fit of the model, $\chi^2\Delta$ (1)=.05, ns, nor was the parameter estimate significant, B=-.02, ns. For normative support, there was a significant indirect effect, z=2.68, p<.01. Adding the direct path from norms to behavior did not significantly improve the fit of the model, $\chi^2\Delta$ (1)=1.15, ns, and the parameter estimate was not significant, B=.07, ns. These analyses imply that the influence of attitudes and normative support on behavior is mediated through intentions.

Resistance Training

Means, standard deviations, and correlations among all the variables included in the model of resistance-training behavior appear in Table 2. The correlations were consistent with the hypothesized model. Three proximal TPB predictors of intentions were strongly correlated with intentions. Contrary to hypotheses, however, PBC was actually more strongly correlated with follow-up behavior than were intentions. There were again significant correlations between extroversion and perceived health and PBC. The model in Figure 2 was estimated using EQS.[35] The fit of the model in Figure 2 was actually better than that of Figure 1 according to all indices of fit, χ^2(6, n=205) =3.13, ns, CFI=1.00, RMSEA=.00. Standardized path coefficients and significance levels for individual paths appear in Figure 2. As can be seen in the figure, all hypothesized paths for the resistance-training model were significant. As further indication of the superiority of the model for predicting resistance training, the model accounted for 67% of the variance in resistance-training intentions and fully 40% of the variance in resistance-training behavior, both large effects.[43]

As with aerobic activity, there was a significant direct effect of PBC on behavior. The mediation of the effects of attitudes and normative support on behavior through intentions was assessed. Attitudes about resistance training had a significant indi-

Figure 2
Structural Model Predicting Follow-up Weight-training Behavior



All exogenous correlations are estimated, as are the correlations between norms and PBC and attitudes and PBC. Coefficients are standardized path coefficients. Overall model fit: $\chi^2(6, n= 205) = 3.13$, ns, CFI= 1.00, RMSEA = .00. Note: + p<.10, * p<.05, ** p<.01, *** p<.001.

rect effect, z=2.41, p<.05. Adding the direct path from attitudes to behavior did not significantly improve the fit of the model, $\chi^2\Delta$ (1)=.11, ns, nor was the parameter estimate significant, B=.02, ns. For normative support, there was a significant indirect effect, z=2.18, p<.05. Adding the direct path from norms to behavior did not significantly improve the fit of the model, $\chi^2\Delta$ (1)=.06, ns, and the parameter estimate was not significant, B=.02, ns. As with aerobic exercise, it appears that the influence of attitudes and normative support on behavior is again mediated through intentions.

Reasons for Exercising

As formative research for intervention development, those participants who had engaged in *any* aerobic activity at the time of follow-up were asked about their reasons for doing so. They were asked to answer yes or no to each of 9 possible reasons for exercising and could answer yes to more than one reason. Participants who had not engaged in any aerobic activity *at all* were asked about their reasons for not doing so by answering yes or no to each of 6 possible reasons for not exercising. A series of parallel questions were asked of participants who had engaged in any resistance training (10 possible reasons) and those who had not (8 possible reasons).

Aerobic exercise. Of those 187 participants who engaged in any aerobic activity, the 2 most commonly cited reasons for doing so were "to improve or maintain my health" (95.3%), and "to look better physically" (97.3%). A majority (85.1%) also cited "to relieve stress" as a reason, and a similar number (87.7%) said they engaged in aerobic activity "to feel better about myself." Over half said they engaged in aerobic activity "to lose weight" and to "spend time with friends" (57% and 57.2%, respectively). Finally, almost half (48.1%) said that they engaged in aerobic activity "to attract potential romantic partners." It appears that the reasons for aerobic exercise are evenly split among concerns about physical and psychological health and social concerns involving spending time with friends and looking more attractive.

A total of 23 participants did not engage in any aerobic activity at all during the follow-up period. Only 2 participants reported that this lack of activity was due to injury. Most reported that they did not engage in aerobic activity either because they "don't have time to do" (66.7%) or they

"don't want to do" (41.7%) aerobic exercise.

Weight training. Of those 130 participants who engaged in any resistance training activity, the 2 most commonly cited reasons for doing so were "to improve or maintain my health" (93.1%) and "to look better physically" (95.4%). A majority (79%) again cited "to relieve stress" as a reason, and 89% said they engaged in resistance training "to feel better about myself." Less than half (40%) said they engaged in resistance training "to lose weight," whereas 22% said they did so "to gain weight". Over half (51%) said they did resistance training to "spend time with friends," and the same number said they did so "to attract potential romantic partners." As with aerobic exercise, self-reported reasons for resistance training are split among concerns about physical and psychological health and social concerns.

A total of 79 participants did not engage in any resistance training at all during the follow-up period. The majority (69.6%) reported that this was because they "don't want to." Almost half (45.6%) reported that they "did not know how," and 48% said they did not engage in resistance training because they did not want to "appear bulky." Finally, 49.4% cited a lack of time as a reason for not doing resistance training.

DISCUSSION

The TPB was found to be a valid model for predicting both aerobic-exercise and resistance-training behaviors. All theorized relationships among TPB model constructs and behavior were significant. Consistent with the model, attitudes, norms, and PBC were strongly correlated with intentions. Likewise, intentions and PBC were predictive of actual behaviors using a prospective design. In addition, although there is good evidence that indirect paths exist between attitudes, norms, and PBC and behavior, only PBC was shown to also have a significant direct relationship with behavior, indicating that intentions mediate the influence of attitudes and norms on behavior.

In an attempt to improve the specificity of the model of exercise behaviors, the addition of extroversion and perceived health as precursors of perceived normative support and PBC, respectively, was suggested. Although the evidence did not support extroversion as a precursor of perceived normative support, a marginally significant relationship between extroversion and PBC was detected. PBC reflects

The TPB was found to be a valid model for predicting both aerobic-exercise and resistance-training behaviors.

beliefs about the ease of adopting a behavior and perceptions of opportunities to perform the behavior.[15] Extroverts tend to be more optimistic, adventurous, and active than introverts. These qualities may lead extroverts to perceive fewer barriers to performing behaviors and to perceive themselves as being able to adopt a new behavior in general and to adopt an exercise routine specifically. This finding suggests that further research into the relationship between personality characteristics and proximal beliefs about exercise behavior is warranted. The expected relationship between perceived health and PBC was confirmed. People who are low in perceived health are less likely to believe they can meet the physical or time demands of exercise.

Prior meta-analyses and reviews found stronger associations between attitudes and intentions than between norms and intentions.[10,12,13] The current findings suggested that norms and attitudes are approximately equal in their predictive strength, and it was actually PBC that was the dominant predictor of intentions and behavior, especially in the case of weight training. The finding that PBC is a strong predictor of resistance-training intentions and behavior has implications for designing programs to encourage weight training. Theoretically, under conditions where there is a lack of volitional control, PBC becomes a better predictor of behavior, especially if PBC closely approximates actual control (ie, beliefs that one knows how to engage in weight lifting are likely almost isomorphic with the actual ability to do so). Perhaps weight training is under less volitional control than aerobic exercise due to the increased equipment and training necessary for the former, and thus PBC becomes a more significant direct predictor of behavior. This strong relationship between PBC and behavior may

Reasons for exercising were similar for aerobic and resistance exercise.

account for the superior predictive utility of the TPB for resistance versus aerobic exercise. In terms of intervention, increasing both PBC and actual control for resistance exercise may require extensive training. Indeed, a substantial proportion (45.6%) of participants reported they did not engage in resistance training because they simply did not know how.

Reasons for Exercising/Not Exercising

Participants were asked to identify reasons that they had or had not exercised. Reasons *for* exercising were similar for aerobic and resistance exercise. These included physical health concerns, psychological health concerns, and social concerns. Over half of the participants identified an additional concern, to lose weight, as a reason for engaging in aerobic exercise. This concern was shared by less than half of the participants who had engaged in resistance training; in fact, some participants identified the opposite goal of *gaining* weight as a reason for weight training. When asked to identify reasons they *had not* engaged in exercise, many participants said that they did not want to or did not have time to exercise. Lack of time seemed to be a greater concern in the context of aerobics than resistance training, whereas not wanting to engage in exercise was cited more often in the context of resistance training than aerobics. The dichotomization into categories of any versus no exercise is admittedly somewhat extreme. A more fine-grained analysis could be conducted by separating participants into those who exercise at or above recommended levels, those who exercise at below recommended levels, and those who do not exercise at all. It is probable that barriers to exercise may differ somewhat for individuals in the latter 2 categories.

Implications for Prevention Programs

The consistency of the TPB framework for predicting both aerobic exercise and resistance training in this investigation suggests that increasing positive attitudes and subjective norms could increase exercise behavior. In designing such programs, attention should be paid to the finding that both psychological, appearance-related, social, and health concerns were reported as being important in deciding whether to engage in exercise behaviors. Interventions should address the psychological benefits of exercise such as feeling better about oneself and reducing stress as well as the physical benefits of improving health and looking better physically. Interventions should also capitalize on the fact that individuals, likely young people in particular, appear to exercise for reasons unrelated to their long-term health, ie, to spend time with friends and to attract romantic partners. In the area of smoking behavior, a focus on near-term benefits (eg, having better breath, smelling better) has been suggested as a more successful strategy than a focus on long-term consequences (eg, lung cancer, emphysema) in deterring young people from smoking.[45-46] Perhaps a similar focus on the near-term benefits of exercise would be an effective intervention strategy to encourage young people to initiate or maintain an exercise program.

The finding of a relationship between extroverted personality and PBC should be considered exploratory at this point, but it does suggest that personality may interact with intervention content and should be assessed in addition to intervention-outcome variables to determine whether there are subgroups for whom the intervention was more or less effective. Extroverted individuals, according to these findings, might show large increases in PBC in response to intervention content targeting this construct, as a feeling of being efficacious and in control is consistent with extroversion. Conversely, introverts might show substantially smaller effects on PBC as such efficacy beliefs might be contrary to their self-concept. Certainly, extroversion-introversion is not the only personality characteristic that might interact with program content focused on TPB constructs; future research on other personality factors including conscientiousness, agreeableness, neuroticism, and openness to experience is warranted.

The relationship of perceived health to PBC should be used both from the perspective of developing prevention programs as

well as targeting such programs to particular populations. The finding that perceived health is a precursor of PBC suggests that a feeling of ability to perform exercise may be at least partially dependent upon perceptions of general health and ability. Some groups (eg, adolescents, college students, young adults) are likely to have high levels of perceived health and to benefit from program content building specific efficacy for exercise onto their general notion of vigor and competence. A strong focus on PBC for exercise behavior with populations who are less convinced of their overall health and ability (eg, the elderly or the disabled) might be less beneficial. Individuals conducting interventions with populations who have deficits in their overall perceived competence may need to add additional program content addressing general efficacy and ability prior to focusing on specific skills related to exercise behaviors.

LIMITATIONS AND FUTURE RESEARCH

One of the limitations of the present investigation was the sex imbalance of the participants. Because fully 70% of the sample was female, it was not possible to reliably elucidate possible sex differences regarding the predictors of exercise behaviors. There may also have been self-selection of unusually healthy participants because the study was called "Lifestyle and Health Behavior." Another limitation of this study was that it depended on self-report, a limitation shared by much research in all areas of health behavior. Participants may have inflated reports of exercise behavior in response to social desirability concerns. Although biased selection as well as reliance on self-report has the possibility of inflated mean levels of exercise behavior, it is unlikely that the *relationships* among the variables would be biased by self-report. Future studies might include measures of actual behavior, such as tracking the frequency of use of exercise facilities. Finally, the role of extroversion, as well as other domains of personality, clearly requires further study with more extensive and reliable measures of a larger range of personality domains.

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