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Keywords

Reasoned Action Approach; resistance training; physical activity

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Abstract

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Introduction

The U.S. Department of Health and Human Services estimates 10% of premature mortalities can be attributed to not meeting physical activity (PA) recommendations, with an associated burden of $117 billion in health care costs annually (Physical Activity Guidelines Advisory Committee, 2018). The second edition of the *Physical Activity Guidelines for Americans* underscores the importance of both aerobic and muscle-strengthening PA as part of a healthy lifestyle (Physical Activity Guidelines Advisory Committee, 2018). Aerobic and muscle-strengthening PA are ideal behaviors for multiple behavior change interventions, since they are interrelated, yet distinct, and provide complementary health benefits. Benefits of aerobic PA include reductions in all-cause cardiovascular mortality, reductions in chronic diseases (e.g., hypertension, diabetes, stroke, and some cancers), and improvements in quality of life, cognition, and sleep (Alves et al., 2016; McKinney et al., 2016; Physical Activity Guidelines Advisory Committee, 2018). Benefits of regular muscle-strengthening PA include improving and maintaining physical function and reducing the likelihood of mental illness, osteoporosis, obesity, osteoarthritis, sarcopenia, insulin resistance, heart disease, diabetes, and some forms of cancer (Ashton et al., 2020; Figueiredo et al., 2018; Garber et al., 2011; Gordon et al., 2018; Mazzilli et al., 2019; Physical Activity Guidelines Advisory Committee, 2018). Muscle-strengthening PA has also been linked to a lower risk of all-cause mortality, alone and in tandem with aerobic PA (Saeidifard et al., 2019).

Promoting aerobic and muscle-strengthening PA in a multiple behavior change intervention may be difficult however, given the differences there are in participation rates and how the behaviors are promoted. For example, while approximately half of adults meet aerobic activity recommendations (50.9%), less than a third (30.4%) meet recommendations for muscle-strengthening PA (Physical Activity Guidelines Advisory Committee, 2018). In addition, only 20% of U.S. adults meet both recommendations (Physical Activity Guidelines Advisory Committee, 2018). A great deal of research has focused on intervening upon and understanding psychosocial correlates and determinants of aerobic PA, while less has focused on muscle-strengthening PA (Rhodes et al., 2017). Of the little work that has been done with muscle-strengthening PA, research shows participation varies by a number of sociodemographic characteristics. For example, men are more likely to participate compared to women; younger adults are more likely to participate than older adults; white/non-Hispanics are more likely to participate compared to other racial groups; those with a college degree are more likely to participate than those with lower educational attainment; and lower income groups are less likely to participate than higher income groups (Bennie et al., 2018). This suggests that individuals may require training and education for muscle-strengthening PA skill development that would otherwise not be needed for participating in aerobic PA (Lemos et al., 2012). Thus, a better understanding of behavioral, social, and environmental factors that play a role in muscle-strengthening PA behaviors is warranted. In addition, research that examines the psychosocial correlates of muscle-strengthening PA, under the context of aerobic PA, can explore the interrelatedness and co-dependence of these PA behaviors.

The reasoned action approach (RAA) is a third-generation theory, stemming from the theory of reasoned action (TRA), and the theory of planned behavior (TPB). The first model, the TRA, posited that one's intentions primarily determine their behaviors, and one's intentions are formed by their attitudes and subjective norms towards the behavior. The second-generation model, the TPB, made a significant improvement by adding the 'perceived behavioral control' construct, which allowed the model to account for both volitional and non-volitional behaviors. The RAA continued to develop the TPB by adding an additional normative construct (descriptive norms), and also delineating attitudes into cognitive (or instrumental) and affective (or experiential) types (Fishbein & Ajzen, 2010). The theory of reasoned action (TRA) and the theory of planned behavior (TPB) have been used many times in behavior change research, and are commonly used in PA research (Hagger et al., 2002; Michie et al., 2014). In addition, the RAA has started to be used in PA research, however most has focused upon the aerobic forms (McEachan et al., 2016). The purpose of this study was to apply the reasoned action approach (RAA) towards understanding theory-based correlates of muscle-strengthening PA, and explore differences that may exist between participants currently meeting and not meeting aerobic PA recommendations.

Methods

A convenience sample of students (n = 392) enrolled in a Southwestern university were recruited via mass e-mail. Eligibility included being 18 to 24 years old, a currently enrolled student, and physically capable of meeting weekly aerobic and muscle-strengthening PA recommendations. Informed consent was obtained on the first page of the survey, and students who completed the survey were eligible to participate in a raffle for one of ten gift cards ($10 each). This protocol was approved by the sponsoring university's Institutional Review Board.

Survey Development

Aerobic PA levels were evaluated using a modified version of the CDC's Behavioral Risk Factor Surveillance System (BRFSS) (CDC, 2011). Participants were first asked if they had participated in cardio PA in the past week and if they answered "Yes", they were asked to report the type of activity, minutes spent doing the activity, and how many times per week they participated in the activity. Researchers used the 2011 Compendium of Physical Activities, from the CDC's user guide for evaluating physical activity type, which included light (< 3 METs), moderate (3 to 6 METs), or vigorous (≥ 6 METs) activity. Each participant was then coded as meeting or not meeting current aerobic recommendations (weekly participation in at least 150 minutes of moderate-intensity activity, or 75 minutes of vigorous-intensity activity, or a combination of both types of activity). Next, participants were asked to respond to the item from the BRFSS used to evaluate overall muscle-strengthening PA ("During the past month, how many times per week or per month did you do physical activities to strengthen your muscles?"). Participants were also reminded for this item to not count aerobic activities, and only count activities using their own body weight like yoga, sit-ups, or push-ups, and those using weight machines, free weights, or elastic bands. Those that responded two times per week or more were considered meeting the muscle-strengthening guidelines.

The theoretical framework used to develop the survey was the RAA. Therefore, the first step was to define the muscle-strengthening PA behavior using the TACT principle (that is, clearly defining the target of the behavior, the action that is to be performed, the context the behavior is performed under, and the time frame within which the behavior should be implemented). Muscle-strengthening PA was defined as 'participating in muscle-strengthening exercises for all major muscle groups at least two days per week'. Muscle groups included: chest, back, shoulders, arms, abdomen, hips, and legs. Muscle-strengthening PA was clarified in the survey by informing participants to only count activities using their own body weight or activities using free weights or weight machines.

The RAA measures were developed for this study, and evaluated for multiple forms a validity, including construct validity using the maximum likelihood extraction method of factor analysis, face and content validity using a panel of six experts, and internal consistency reliability (intentions: α = 0.97; attitudes: α = 0.87; perceived norms: α = 0.81; PBC: α = 0.75). The intentions construct was evaluated using three items (e.g., "I intend to get the recommended amount of muscle-strengthening exercise every week). The attitudes construct was evaluated by four items, with two items measuring instrumental attitudes and two items measuring experiential attitudes (e.g., "Getting the recommended amount of muscle-strengthening exercise every week is" <Non-beneficial/Beneficial-Instrumental>; <Frustrating/Enjoyable-Experiential>).

The perceived norms construct was evaluated by four items including two injunctive norms (e.g., "Most people who are important to me think I should get the recommended amount of muscle-strengthening exercise every week") and two descriptive norms (e.g., "Most people similar to me get the recommended amount of muscle-strengthening exercise every week"). Perceived behavioral control (PBC) was evaluated using four items including two measuring capacity (e.g., "I am certain that I can get the recommended amount of muscle-strengthening exercise every week") and two measuring autonomy (e.g., "It is mostly up to me whether or not I get the recommended amount of muscle-strengthening exercise every week"). All items were evaluated using a 7-point semantic differential scale. After data collection, all of the scales were normalized between -3 and +3 to aid in the interpretation of the data [i.e., indicating a strong negative attitude (−3) to a strong positive attitude (+3)].

Data Analysis

Participants were first categorized as meeting or not meeting aerobic recommendations. Pairwise correlations (*r*) among all of the RAA constructs were then estimated for each group. Independent t-tests were used to evaluate differences between groups for overall days of muscle-strengthening PA, intentions, attitudes (including both instrumental and experiential), perceived norms (including both injunctive and descriptive norms), and PBC (including both capacity and autonomy). In the case of statistical significance, Cohen's *d* was used to determine practical significance (interpreted as small [$d = 0.2$], medium [$d = 0.5$], and large [$d = 0.8$] effects) (Cohen, 1992).

Linear regression models were used to evaluate correlates of muscle-strengthening PA for both groups. In the first set of regression models intentions, PBC, and the interaction between the two variables (intention x PBC) were used to predict participation in muscle-strengthening PA. The moderation analysis was conducted using the PROCESS macro (v3.0) developed by Hayes (2018). This was utilized given its ease of use, and the advantages it affords over the standard SPSS regression tool, in that it automatically centers the independent variables, it automatically creates interaction terms, and it produces simple slopes for continuous moderator variables. In the Results section, simple slopes for the moderator are only presented when the interaction term is statistically significant.

In the second set of regression models, intentions were predicted using both a three-component model (independent variables included overall attitudes, perceived norms, and PBC) and a six-component model (independent variables included instrumental attitudes, experiential attitudes, injunctive norms, descriptive norms, capacity, and autonomy). Assumption testing was conducted for each model and results indicated that assumptions were met for multicollinearity, homoscedasticity of variance, and normality of the data. All analyses were conducted using SPSS version 25. To predict a small to medium effect size, an a priori sample size of 159 was determined (G*Power, Version 3.1.3; McEachan et al., 2016).

Results

Overall, we collected data from 392 participants, with 56% ($n = 220$) meeting the aerobic PA recommendations, and 44% ($n = 172$) not meeting the recommendations. In addition, 25% ($n = 99$) reported meeting the muscle-strengthening PA recommendation, while 75% ($n = 293$) did not meet the recommendations. The mean age of participants was 19.9 years (± 1.76), and there was no difference in age between groups (meeting aerobic PA = 20.0 years old ± 1.73; not meeting aerobic PA=19.8 years old ± 1.79). There were also no differences between race or class standing: a majority were white/Caucasian [meeting aerobic PA (84.5%; $n = 186$); not meeting aerobic PA (81.9%; $n = 141$)], and female [meeting aerobic PA (67.7%; $n = 149$); not meeting aerobic PA (71.5%; $n = 123$)].

Table 1 reports the results for the muscle-strengthening PA participation and the RAA constructs for both groups. Participants who were already meeting the aerobic PA recommendations reported sig-

Table 1

Differences in RAA Constructs Between Participants Meeting (n=220) and Not Meeting (n=172) Aerobic PA Recommendations

	Meeting Aerobic PA Guidelines Mean (SD)	Not Meeting Aerobic PA Guidelines Mean (SD)	*p*-value	Effect Size (Cohen's *d*)
Overall Days Per Week Muscle Strengthening PA	2.89 (2.0)	2.06 (1.9)	< 0.001	0.42
Behavioral Intentions	0.90 (1.9)	0.13 (2.0)	< 0.001	0.40
Attitudes towards the behavior	1.49 (1.4)	1.02 (1.5)	0.002	0.33
Instrumental Attitudes	1.91 (1.5)	1.74 (1.6)	0.277	--
Experiential Attitudes	1.07 (1.7)	0.31 (1.9)	< 0.001	0.43
Perceived Norms about the behavior	.50 (1.2)	0.14 (1.3)	0.005	0.29
Injunctive Norms	1.21 (1.3)	0.92 (1.4)	0.042	0.22
Descriptive Norms	-0.21 (1.4)	-0.66 (1.5)	0.003	0.31
Perceived Behavioral Control over the behavior	1.81 (1.1)	1.51 (1.2)	0.008	0.26
Capacity	1.71 (1.4)	1.28 (1.6)	0.005	0.29
Autonomy	1.92 (1.2)	1.74 (1.2)	0.127	--

Note. Aerobic Physical Activity (PA) Guidelines consist of weekly participation in at least 150 minutes of moderate-intensity activity, or 75 minutes of vigorous-intensity activity, or a combination of both types of activity.

nificantly higher participation in muscle-strengthening PA (p = 0.001; d = 0.42). Among the RAA constructs, participants meeting the aerobic PA recommendations consistently had significantly higher scores, notably for intentions (p = 0.001; d = 0.40) and experiential attitudes (p = 0.001; d = 0.43). No statistically significant difference was found, however, for the constructs of instrumental attitudes (p = 0.277) or autonomy (p = 0.127).

Correlations between the RAA constructs for both groups can be found in Table 2. Effect sizes mostly ranged from medium to large. The associations between the intentions and attitudes, perceived norms, and PBC were also slightly stronger for the participants who did not meet the aerobic PA recommendations [intentions w/attitudes (r = 0.613); w/perceived norms (r = 0.579); and w/PBC (r = 0.606)] compared to those that did [intentions w/attitudes (r = 0.540); w/perceived norms (r = 0.501); and w/PBC (r = 0.521)].

Correlates of Intentions Towards Meeting Muscle-strengthening PA Guidelines

Behavior-specific regression models were used to explore correlates of intentions towards muscle-strengthening PA. Using the three-component model for the participants meeting aerobic PA recommendations, attitudes, perceived norms, and PBC explained 45.5% of the variance in intentions. When using the using the six-component model, capacity, experiential attitudes, and descriptive norms explained 52.2% of the variance (instrumental attitudes, injunctive norms, and autonomy were not statistically significant). Similar results were found for participants not meeting aerobic PA recommendations. Using the three-component model, attitudes, perceived norms, and PBC explained 59.7% of the variance of intentions, and when using the using the six-component model, capacity, experiential attitudes, and descriptive norms explained 64.0% of the variance.

Correlates of Meeting Muscle-strengthening PA Guidelines

For predicting participation in muscle-strengthening PA, for participants meeting the aerobic PA recommendations intentions was the only significant predictor, explaining 40.7% of the variance. For participants not meeting the aerobic PA recommendations however, intentions ($p < 0.001$), PBC ($p < 0.021$), and the interaction between intentions and PBC were significant ($p < 0.011$). In total, the constructs accounted for 52.2 % of the variance. To interpret the moderation effect, the simple slopes were examined in two ways. First, high (+1 SD to the mean of PBC), medium (mean of PBC), and low (-1 SD to the mean of PBC) values of PBC were used, and second the Johnson-Neyman method was used (Hayes, 2018). Using the first method, the intentions variable was found to be a significant predictor of muscle-strengthening PA at all 3 levels of PBC, however the trend of the slopes revealed that as PBC increased, the slopes (and thus the relationship between intentions and muscle-strengthening PA) increased [Low PBC (β = 0.423); Medium PBC (β = 0.558); High PBC (β = 0.693)]. Next, using the Johnson-Neyman method it was revealed that the relationship between intentions and muscle-strengthening PA was not significant at very low levels of PBC (PBC scores between -3 and -1.80), and the magnitude of the relationship between intentions and muscle-strengthening PA became stronger as levels of PBC increased. This shows that for participants not meeting the aerobic PA recommendations, at very low levels of control, intentions did not translate to participating in muscle-strengthening PA, and it was upon participants feeling control over the behavior, that their intentions translated to participation in muscle-strengthening PA (Table 4).

Table 2

Pairwise Correlations (r) Among RAA Constructs of Participating in Muscle-strengthening PA Guidelines

		Meeting Aerobic PA Guidelines (n = 270)									
		1. Int	2. Att	3. IA	4. EA	5. PN	6. IN	7. DN	8. PBC	9. Cap	10. Aut
Not Meeting Aerobic PA Guidelines (n = 172)	1. Intentions	-	0.540***	0.410***	0.544***	0.501***	0.397***	0.494***	0.521***	0.631***	0.197**
	2. Attitudes	0.613***	-	0.876***	0.901***	0.482***	0.440***	0.422***	0.368***	0.427***	0.163*
	3. Instrumental Attitudes	0.425***	0.853***	-	0.580***	0.422***	0.419***	0.340***	0.302***	0.348***	0.137*
	4. Experiential Attitudes	0.636***	0.907***	0.553***	-	0.433***	0.365***	0.407***	0.350***	0.409***	0.152*
	5. Perceived Norms	0.579***	0.465***	0.381***	0.434***	-	0.882***	0.904***	0.302***	0.415***	0.053
	6. Injunctive Norms	0.502***	0.451***	0.406***	0.391***	0.869***	-	0.596***	0.296***	0.371***	0.096
	7. Descriptive Norms	0.513***	0.368***	0.266***	0.372***	0.885***	0.539***	-	0.246***	0.370***	0.004
	8. Perceived Behavioral Control	0.606***	0.391***	0.259***	0.415***	0.330**	0.341**	0.240***	-	0.874***	0.798***
	9. Capacity	0.693***	0.444***	0.274***	0.487***	0.422***	0.403***	0.340***	0.912***	-	0.404***
	10. Autonomy	0.309***	0.203**	0.161*	0.194*	0.107	0.157*	0.034	0.827***	0.523***	-

$p < 0.001$***; $p < 0.01$**; $p < 0.05$*

Table 3

Parameter Estimates and Model Prediction for Correlates of Intentions for Meeting Muscle-strengthening PA Guidelines

	Adjusted R^2	Standardized coefficients β	t	*P*
Meeting Aerobic PA Guidelines				
3-construct model	0.455			
Perceived Behavioral Control		0.335	6.166	< 0.001
Attitudes		0.292	4.949	< 0.001
Perceived Norms		0.259	4.493	< 0.001
6-construct model	0.522			
Capacity		0.446	7.621	< 0.001
Experiential Attitudes		0.258	4.231	< 0.001
Descriptive Norms		0.213	3.456	< 0.001
Instrumental attitudes		0.039	0.648	0.518
Injunctive Norms		-0.003	-0.056	0.955
Autonomy		-0.028	-0.537	0.592
Not Meeting Aerobic PA Guidelines				
3-construct model	0.597			
Perceived Behavioral Control		0.379	7.074	< 0.001
Attitudes		0.325	5.676	< 0.001
Perceived Norms		0.303	5.425	< 0.001
6-construct model	0.640			
Capacity		0.442	6.931	< 0.001
Experiential Attitudes		0.282	4.559	< 0.001
Descriptive Norms		0.197	3.481	< 0.001
Instrumental Attitudes		0.062	1.090	0.277
Injunctive Norms		0.083	1.403	0.162
Autonomy		-0.007	-0.123	0.902

Discussion

The purpose of this study was to apply the reasoned action approach (RAA) towards understanding theory-based correlates of muscle-strengthening PA, and examine differences that may exist between participants currently meeting and not meeting aerobic PA recommendations. Research has demonstrated that participation in moderate to vigorous PA is a strong correlate of meeting muscle-strengthening recommendations (Patterson et al., 2015). Researchers have also shown that meeting aerobic PA guidelines is positively associated with other 'chronic disease prevention' behaviors, such as higher consumption of fruit and vegetables and lower rates of cigarette smoking (Hart et al., 2017). This is echoed in the present study in which participants who were already meeting the aerobic PA recommendations also reported significantly higher participation in muscle-strengthening PA, and participants meeting the aerobic PA recommendations consistently had significantly higher levels of the RAA constructs (i.e., intentions and experiential attitudes). In this study the difference in muscle-strengthening PA between participants meeting and not meeting aerobic PA guidelines was about a 1-day per week. It should be noted however that while significant, this effect was considered 'small to medium' so caution

Table 4

Parameter Estimates and Model Prediction for Muscle-strengthening PA

	Adjusted R^2	β	SE	t	*P*
Meeting Aerobic PA Guidelines	0.407				
Intentions		0.574	0.118	5.179	< 0.001
Perceived Behavioral Control		-0.094	0.110	-1.538	0.125
Int x PBC (moderator)		0.127	0.051	1.204	0.203
Not Meeting Aerobic PA Guidelines	0.522				
Intentions		0.389	0.103	3.769	< 0.001
PBC		0.263	0.113	2.331	0.021
Int x PBC		0.112	0.043	2.589	0.011
PBC (at levels of low/medium/high) as a moderator between Intentions/Muscle Strengthening PA					
-1 SD = 0.31 (Low PBC)		0.423	0.093	4.564	< 0.001
M = 1.51 (Medium PBC)		0.558	0.064	8.753	< 0.001
+1 SD = 2.71 (High PBC)		0.693	0.071	9.839	< 0.001
PBC as a moderator between Intentions/Muscle Strengthening PA (Johnson-Neyman method)					
-3.00		.0514	.2219	.2316	.8171
-2.70		.0851	.2094	.4065	.6849
-2.40		.1189	.1970	.6035	.5470
-2.10		.1526	.1846	.8265	.4097
-1.80		.1863	.1724	1.0809	.2813
-1.50		.2201	.1603	1.3730	.1716
-1.20		.2538	.1483	1.7111	.0889
-.99		.2769	.1402	1.9742	.0500
-.90		.2875	.1366	2.1054	.0367
-.60		.3213	.1251	2.5688	.0111
-.30		.3550	.1139	3.1171	.0021
.00		.3887	.1031	3.7687	.0002
.30		.4225	.0930	4.5429	< .0001
.60		.4562	.0836	5.4540	< .0001
.90		.4899	.0754	6.4983	< .0001
1.20		.5237	.0686	7.6291	< .0001
1.50		.5574	.0639	8.7280	< .0001
1.80		.5911	.0615	9.6084	< .0001
2.10		.6249	.0619	10.0956	< .0001
2.40		.6586	.0649	0.1424	< .0001
2.70		.6923	.0703	9.8486	< .0001
3.00		.7261	.0775	9.3685	< .0001

should be taken in regard to overstating the difference between groups.

In addition, this study explored the moderation effects of PBC on the intention-behavior relationship, and PBC was found to moderate the relationship between intentions and muscle-strengthening PA participation only for participants not meeting aerobic PA recommendations. One explanation for this finding is that individuals who participate in aerobic PA may participate in more muscle-strengthening PA because they perceive fewer barriers than those who are inactive (Marcus et al., 1992).

A growing number of studies have evaluated the RAA as a six-component model instead of the more traditional three-component model for a variety of health behaviors (McEachan et al., 2016). That is, instead of evaluating determinants of intentions as one's overall attitudes, normative pressure, and perceived behavioral control, researchers and practitioners have distinguished sub-components of the constructs. Namely, attitudes consist of both cognitive (instrumental) and affective (experiential) components, perceived norms consist of injunctive (pressure one feels from others to act) and descriptive (pressure one puts on themselves to conform to how others act) normative pressures, and PBC consists of one's capacity (or self-efficacy to behave in a certain way) and autonomy (or one's opportunity to behave in a certain way). Studies have shown that these sub-components exhibit discriminant validity within the pairs indicating they account for distinct variance. Using the RAA as a six-component model allows researchers to test the independent effects of all six sub-components' on intentions and behavior. In the context of the present study, all three constructs in the traditional model were found to be significant in predicting intentions for both groups, however when separating them not all of the six constructs were significant. This indicates the six-component model may be more sensitive than the three-component model, and may allow for better specification when identifying the most salient constructs for interventions. As Fishbein and Ajzen (2010; p. 367) note, "Selection of appropriate primary beliefs is perhaps our theory's most important contribution to behavior change interventions." Public health practitioners designing interventions should be aware of these differences in the subcomponents in the theory constructs, as it will likely allow them to design the most effective interventions through targeting the most critical constructs.

In order to increase PBC and intentions for college students, key barriers must be addressed including time constraints and other obligations, along with body image issues, lack of social motivation, lack of facilities, and limited knowledge about proper weight-lifting techniques or strength equipment use (Ebben & Brudzynski, 2008; O'Dougherty et al., 2008; Sharpe et al., 2004; Salvatore & Marecek, 2010). In particular, women report concerns about being evaluated for appearance and competence when doing muscle-strengthening activities in a gym (Salvatore & Marecek, 2010). Thus, simply promoting the health benefits of muscle-strengthening activities is not enough for behavior change; addressing evaluation concerns through skill building, social support, and changing social norms must occur (Salvatore & Marecek, 2010; King et al., 2014).

Other strategies to increase PBC include contextualizing each person's goals and proficiencies to aid in tailored exercise prescription. In order to meet recommend-dations, it is important to involve all major muscle groups and include exercises to develop muscular strength, endurance, and power (Physical Activity Guidelines Advisory Committee, 2018; Riebe et al., 2018). Of note, this can be accomplished by using a variety of resistance training equipment (e.g., free weights, weight machines, resistance bands) and body weight exercises (Reibe et al., 2018).

Individuals who have positive intentions to be physically active may decrease the intention/behavior gap by scheduling time for PA in a group setting with participants similar in skill level (Lippke et al., 2016; Sheeran & Webb, 2016). In addition, the use of a diary, or training log, may be beneficial during times of physical inactivity as a means to view what accomplishments have previously been made and observe the development of skill and experience (Dzewaltowski et al., 1990). Identifying a facility that meets one's needs to bridge the intention/behavior gap may also be beneficial (Dean et al., 2006). Also, those with limited time for PA might consider concurrent activity programs where they complete aerobic and muscle-strengthening PA in the same workout, such as in high-intensity functional training (Feito et al., 2018).

It is important to note that an individual's negative affective evaluation (or experiential attitudes) of an exercise-related stimulus will act as a restraining force against positive cognitions (or instrumental attitudes), and this may hinder attempts towards action (Brand & Ekkekakis, 2018). This is in alignment with findings from this study that show experiential attitudes were a significant correlate of intentions for both groups, while instrumental attitudes were not, despite both types of attitudes being relatively favorable. The affective-reflective theory (ART) of physical inactivity and exercise posits that automatic affective evaluations (type-1 process) form from automatic associations triggered after a PA stimulus, and are connected to an action impulse such as approach or avoidance (Brand & Ekkekakis, 2018). Controlled responses (type-2 process), however, are used to form action plans if resources are available (Brand & Ekkekakis, 2018). One interpretation of the theory is that anticipation of positive affective consequences of action are stronger than anticipated positive cognitive consequences of actions. This is supported by a meta-analysis (Rhodes et al., 2009) that examined 38 studies measuring both instrumental and experiential attitudes, and found that affective attitudes were a significant independent predictor of intentions in 32 of the 38 samples, while instrumental attitudes were a significant predictor in only 15 of the 38 samples.

This study had a few notable limitations that should be addressed. First, this study used a convenience sample of university students aged 18-24, therefore these results may not be generalizable to other populations. Second, information about individuals' aerobic and muscle-strengthening behaviors were collected via a self-report questionnaire, which may not be as accurate as objective measures (e.g., exercise log, observation, etc.) However, some studies have shown that self-report methods, while not perfect, have adequate content validity and reliability, and both cost and feasibility are considerations when selecting measurement methods (Sallis & Saelens, 2000; Dowd et. al, 2018). Finally, our sample was slightly more physically active than what is reported for the average adult in the United States; according to the CDC, 50.9% of adults meet aerobic PA recommendations, while in our sample, 56% met the recommendations (Physical Activity Guidelines Advisory Committee, 2018). Future studies may want to use a stratified sample, to better represent the typical physical activity rates for adults.

Implications for Health Behavior Theory

In conclusion, this study found that there are differences in theoretical correlates of meeting muscle-strengthening recommendations based on whether participants meet or do not meet recommendations for aerobic PA. In addition, PBC was found to moderate the relationship between intentions and the behavior of meeting muscle-strengthening recommendations for the group that did not meet recommendations for aerobic PA. This effect was not found for the group that met recommendations for aerobic PA. Practitioners designing interventions should be aware of these differences, as it will allow them to design the most effective interventions through targeting the most important behavior constructs. For example, some researchers have differentiated theory-based methods for TPB-based interventions as motivational in nature (those that promote favorable intentions), or implementational in nature (those that promote PBC, so that individuals can act upon their intentions) (Steinmetz et al., 2016). The most commonly used strategies for promoting *motivation* were provision of information (i.e., advantages/disadvantages of participating in muscle-strengthening PA), persuasion, and social encouragement, while the most common strategies for promoting *implementation* were skill development, planning, goal-setting, and self-monitoring (Steinmetz et al., 2016). Findings from this study suggest that to promote muscle-strengthening PA among college students who already meet aerobic recommendations, more motivational intervention methods are warranted, while for college students not meeting aerobic recommendations, more implementational intervention methods are warranted.

Discussion Question

Our findings indicate that participation in one behavior (aerobic PA) can have a significant impact on individuals' participation in another behavior (muscle-strengthening PA). What other behaviors should be clustered with these types of physical activity when planning public health promotion interventions?

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