

Research article

Relations of self-appraisal and mood changes with voluntary physical activity changes in African American preadolescents in an after-school care intervention

James J. Annesi¹✉, Avery D. Faigenbaum², Wayne L. Westcott³ and Alice E. Smith⁴

¹ Director of Wellness Advancement, YMCA of Metropolitan Atlanta, ² Department of Health and Exercise Science, The College of New Jersey, ³ South Shore YMCA, Quincy, MA, ⁴ Child Health Promotion, Children's Healthcare of Atlanta, USA

Abstract

There is an increasing prevalence of overweight in preadolescents that predicts physical problems over the lifespan. Physical inactivity has been implicated as an associated factor, with African American youth being at an increased risk. Based on social cognitive theory, and proposed correlates of physical activity in youth, changes over 12 weeks in measures of self-appraisal (general self, physical appearance, physical self-concept, exercise barriers self-efficacy) and mood (tension, vigor), and their relations with voluntary physical activity changes, were assessed within an after-school care physical activity intervention. Participants were volunteers recruited from children already registered for a 12-week segment of YMCA after-school care. The treatment group consisted of 146 African American preadolescents with the control group comprised of 123 African American preadolescents who were scheduled to receive the program during the next sequence that it was offered. Results indicated the intervention group reported significantly more positive self-appraisals, reduced tension, and enhanced vigor. Bivariate and multiple regression analyses indicated that when each of the 4 self-appraisal and 2 mood factors were simultaneously entered into a regression equation, 36% of the variance in voluntary physical activity was explained. Findings support the treatment's association with theoretically based correlates of physical activity in the present sample, and suggest directions for physical activity interventions for youth.

Key words: Physical activity, exercise, body mass index, youth, health behavior.

Introduction

Based on race and ethnicity, from 12 to 22% of preadolescents in the U.S. meet the criteria for overweight, which is a body mass index (BMI; kg/m²) $\geq$ 95th percentile. Non-Hispanic African Americans have both the highest prevalence and increase, with 36% of preadolescents from this group classified as either at-risk for overweight (BMI of 85th to 95th percentile) or overweight (Ogden et al., 2002). Recent data indicate an overall 3-fold increase in overweight in Americans of preadolescent age over the previous 25 years (Ogden et al., 2006). Overweight in the late childhood years is particularly important because it predicts weight problems and associated health risks through the entire lifespan (Institute of Medicine, 2007). Along with a diet high in fat and kilocalories, a reduction in physical activity has been implicated as a key component (Institute of Medicine, 2007).

In 2003, only 25% of teenagers engaged in moderate amounts of physical activity for at least 30 minutes, 5 or more days per week. African American boys and girls participated in regular vigorous activity significantly less than their White counterparts (Grunbaum et al., 2004). Reasons suggested have been less access to programs, facilities, and safe areas for play (Salmon and Timperio, 2007), however there has been little direct testing of associated factors.

In the most recent meta-analysis of youth obesity interventions, encompassing published research between 1980 and 2005 that met stringent standards set for inclusion, 48 of 61 (79%) failed to demonstrate a statistically significant reduction in BMI (Stice et al., 2006). The overall effect size was trivial ($r = 0.04$). Interestingly, neither intervention program-based increases in physical activity nor dietary improvement was a significant moderator of effect sizes for BMI change. This suggested that improvements beyond the boundaries of structured programs are important.

Although it has been suggested that schools should play a large part in helping children to reach nationally established goals for physical activity (Centers for Disease Control and Prevention, 1997), physical education (PE) has been given a low priority and, overall, is being reduced (National Association for Sport and Physical Education, 2006). Reductions in PE time are generally not made up outside of school, and more research is required regarding factors associated with increases in children's voluntary (ie, free-time) physical activity (Pate and Sirard, 2000). Despite suggestions to the contrary (Task Force on Community Preventive Services, 2002), most interventions for improving the quantity and quality of children's physical activity have been intended for application during the school day, and therefore must compete with academic and enrichment subjects for time. They have had mixed results, with applications often limited to well-controlled environments, with specialized staff, which may be difficult to replicate large-scale (Stone et al., 1998). Few interventions have been specifically tested with minority populations that are especially in need, although results could be affected by race and ethnicity.

Currently about 7 million children in the U.S. attend after-school care, with a demand far exceeding this number. Although some attempts have been made to adapt schooltime physical activity interventions for after-school care applications (Kelder et al., 2005; Nigg et al., 2004), the Youth Fit For Life protocol was specifically

designed to be administered to large numbers of children by after-school counselors previously untrained in PE methods (National Cancer Institute, 2008). It was hoped that administration of this protocol would help increase total amounts of physical activity routinely completed by many children. In its initial trial of approximately 600 predominantly African American children ages 5 to 12 years, significant improvements in fitness and health-risk factors were found (Annesi et al., 2005).

Youth Fit For Life was developed using tenets of social cognitive theory, and its derivative self-efficacy theory (Bandura, 1986; 1997), which suggest that judgment of one's ability to organize and execute required actions are the foundation of motivation, well-being, and personal accomplishment. Also considered in its development were other proposed correlates of physical activity in youth, which suggest that a positive self-image and positive affect are associated with physical activity (Sallis et al., 2000). In addition to being associated with physiological improvements in body composition, cardiorespiratory endurance, and strength, the Youth Fit For Life protocol sought to increase moderate-to-vigorous physical activity voluntarily completed outside of structured settings such as PE. It was thought that only through a combination of institutionally driven, structured physical activity, and voluntary physical activities completed during free time, would children be most likely to obtain and maintain recommended amounts of at least 60 minutes per day (Strong et al., 2005). It was thought that program administration in a non-threatening, mastery-focused manner - that incorporated training in behavioral skills such as short- and long-term goal setting, self-monitoring of incremental progress, managing self-talk, and recruiting social support - would improve participants' self-management and self-regulatory abilities. This was intended to counter barriers to voluntary physical activity and positively affect identified determinants such as self-efficacy (Pate et al., 1997; Strauss et al., 2001), body image (Strauss et al., 2001), perceived competence (Boyd and Hrycaiko, 1997), self-esteem (Ferguson et al., 1989), and mood (Norris et al., 1992). Provision of behavioral skills to obtain and maintain physical activity behaviors in children has previously been given little research attention.

Presently, theory and research are unclear of possible intercorrelations in the aforementioned constructs, and their association with physical activity in youth (Stone et al., 1998). Whereas in a recent study of obese women, improvements in self-management and self-regulatory strategies to overcome barriers to exercise was the best predictor of weight loss in African American participants (when contrasted with the White participants whose changes in body satisfaction was the strongest predictor) (Annesi, 2007), generalizability of this finding to younger persons is unknown. Researchers have stated a need for extension of research on correlates of physical activity to maximize intervention effects (Baranowski et al., 1998). Although initial testing suggested that significant improvements in self-concept, self-efficacy, and mood were associated with participation in the Youth Fit For Life treatment for 9- to 12-year-olds (Annesi, 2004b; 2005), there was limited inquiry of relations of such changes

with changes in voluntary, moderate-to-vigorous physical activity. Research on specific racial or ethnic groups was not completed. In their comprehensive review of physical activity treatments in youth, Stone et al. (1998) cited a need for research on, "...increasing out-of-school [physical] activity levels." (p. 310), and testing interventions with, "... diverse ethnic/racial groups..." (p. 311). Thus, through use of the extant research on physical activity behavior theory, determinants of physical activity in youth, and physical activity intervention, these gaps were partially addressed within this preliminary investigation. After first replicating assessment of the association of the Youth Fit For Life treatment with participants' changes over 12 weeks, relations of changes in self-description (both general and physical), self-efficacy to physically complete exercise (ie, task self-efficacy), self-efficacy to overcome barriers (ie, self-regulatory efficacy), and mood (tension and vigor); with changes in voluntary moderate-to-vigorous physical activity; were estimated. Preadolescent African Americans were assessed because of a need to understand change processes in physical activity behavior in this group with considerable need.

The following specific hypotheses were given:

1. The Youth Fit For Life program would be associated with significant improvements in the self-appraisal measures of general self, physical appearance, physical self-concept, and exercise barriers self-efficacy, and the mood measures of tension and vigor, over 12 weeks.
2. The Youth Fit For Life program would be associated with a significant increase in voluntary physical activity.
3. Significant bivariate correlations would be found between changes in each of the self-appraisal and mood measures, and changes in voluntary physical activity.
4. Accounting for changes in the 4 self-appraisal factors and, separately, changes in the 2 mood factors, would explain significant portions of the variance in changes in voluntary physical activity.

It was hoped that findings would lead to an increased knowledge of relations of psychosocial variables with physical activity in African American preadolescents, and thus contribute to the development of increasingly comprehensive theoretical models, and following, practical interventions that are more beneficial at reducing health risks.

Methods

Participants

All participants were enrolled in a YMCA-based after-school care program in the southeast U.S. The treatment group consisted of 146 African American preadolescents where the Youth Fit For Life program was administered. The control group consisted of 123 African American preadolescents who were scheduled to receive the program during the next sequence that it was offered. Treatment and control locations were randomly derived. Data from non-African American enrollees (less than 3%, overall) were excluded. No significant difference (p -values >0.30) was found between the treatment and control group on age, male/female ratio, socioeconomic strata, and BMI percentile, so aggregated data are reported. The overall mean age was 10.6 years ($SD = 1.1$),

and 59% were female. Based on household income and participation in the free and reduced-cost lunch program, nearly all were in the lower and lower-middle socioeconomic strata. Mean age-adjusted BMI for the girls corresponded to the 79th percentile, and for the boys the 82nd percentile. Participation was voluntary. After-school care registrants were not aware of the Youth Fit For Life program at time of registration, so a self-select bias associated with recruitment was unlikely to have affected the data for either group. The present data were derived from program evaluation records from January to April 2006, where no names or identifiers of participants were retained. African American children were assessed because of their high prevalence for overweight and inactivity, and high need for effective intervention.

Measures

Self-description: The Self-Description Questionnaire-I (Marsh, 1990) is a self-report survey intended for use with children ages 8 through 12 years. The general self scale and physical appearance scale of the survey were used here. The general self scale relates to, "... perception as an affective, capable individual, proud of and satisfied with the way he is." (Marsh, 1990, p. 7). The physical appearance scale relates to, "... self-concept regarding his physical attractiveness as compared with others, and the perception of how others think he looks." (Marsh, 1990, p. 5). Responses range from 1 (False) to 5 (True). The factor structure was supported across 8 studies, and demonstrated independence between scales. Each scale has 8 items. Items for the general self scale include, "Overall I have a lot to be proud of," and "I can do things as well as most other people." Internal consistency was 0.81. Sample items for the physical appearance scale include, "I like the way I look," and "I have a good looking body." Internal consistency was 0.83. Although usual test-retest methods were considered inappropriate due to expected changes in self-perception over time, findings suggested *systematic* changes over 6 months that supported the scales' stability (Marsh, 1990).

Task self-efficacy: The physical self-concept scale of the Tennessee Self-Concept Scale: 2 Child Form (Fitts and Warren, 1996) is a self-report survey intended for use with children ages 7 through 14 years. The physical self-concept score relates to the construct (within self-efficacy theory) of task self-efficacy (Annesi, 2006), or "... the individual's view of his body, state of health, physical appearance, skills, and sexuality" (Fitts and Warren, 1996, p. 23). A single score is recorded from responses ranging from 1 (Always False) to 5 (Always True) on 12 items. Item clusters, however, include identity (eg, "My body is healthy"), satisfaction (eg, "I don't feel as well as I should"), and behavior (eg, "I'm not good at sports and games"). Factor analysis supported the physical self-concept scale items relative to the other 5 scales of the Tennessee Self-Concept Scale: 2. Internal consistency for the 9- to 12-year-old age group averaged 0.70, and test-retest reliability over 1 week was 0.71 (Fitts and Warren, 1996).

Self-regulatory efficacy: The Exercise Barriers Self-Efficacy Scale for Children (Annesi et al., 2005) is a self-report survey that assesses the construct (within self-

efficacy theory) of self-regulatory efficacy, or the degree one believes he or she possesses the ability to overcome social, personal, and environmental barriers to participating in physical activity (Annesi, 2006). Construction of the 10-item survey, each item beginning with the stem, "I am sure I can exercise three or more days per week even if...", was based on previous research (Marcus et al., 1992), and adapted for the ages of 8 through 12 years. Responses range from 1 (Not at all confident) to 5 (Definitely confident). Items include, "I was nervous being around other people" (social barrier), "My body felt uncomfortable while exercising" (personal barrier), and "The weather was bad (very hot, rainy, very cold)" (environmental barrier). Internal consistency averaged 0.79, and test-retest reliability over 1 week was 0.77 (Annesi et al., 2005).

Mood: The tension and vigor scales of the Profile of Mood States – Short Form (McNair et al., 1992) are self-report surveys of five items each. Responses range from 0 (Not at all) to 4 (Extremely). Items for the tension scale include "nervous," "anxious," and "tense;" and for the vigor scale, "energetic," "active," and "lively." Internal consistency (adult samples) averaged 0.91 and 0.88, respectively. Test-retest reliability over 3 weeks was 0.70 and 0.65, respectively (McNair et al., 1992). Profile of Mood States scales were used with children starting at 9 years of age (Annesi, 2005; Berger et al., 1997). Internal consistency for the present sample was 0.74 (tension) and 0.79 (vigor).

Voluntary physical activity: Voluntary physical activity is defined as physical activity completed of one's own volition, outside of when it is mandated based on requirements and/or expectations from structured settings. For example, when a student completes a bout of physical activity within a PE class, it would not be considered as voluntary physical activity as it would if he chooses to ride his bicycle after school. Consistent with recent research (Annesi, 2006; 2007; Berger et al., 1997), a single-item scale was used to assess the number of days a participant voluntarily completed a moderate-to-vigorous ("made you breathe harder than usual") bout of physical activity or exercise over the previous week, excluding such physical activities completed during school (eg, during PE class) or after-school programs (eg, during a Youth Fit For Life session). The item was based on review of the extant physical activity recall research (Piera et al., 1997), and adapted from recent research with 12-year-olds from Canada (Tremblay et al., 2000). Test-retest reliability over 1 week was .79. Significant correlations between reported days of voluntary moderate-to-vigorous physical activity, and time to complete a 1-mile (1.61 km) run/walk ($r = -0.39$, $p < 0.01$) and distance covered in a 6-minute run/walk ($r = 0.33$, $p < 0.01$), supported the scale's validity. A significant correlation of 0.70, with no significant difference in means, was found when the present scale was administered during the summer, then winter (and counterbalanced), suggesting that responses were not biased by season. Possible responses ranged from 0 to 7 days. Although a single item scale is sometimes discouraged, appropriate reliability, validity (especially, for purposes of this research, predictive validity), and applicability was clearly demonstrated.

Changes on each measure (ie, difference scores) were derived by subtracting scores at baseline from scores at week 12.

Procedure

Participants already registered for a 12-week segment of YMCA after-school care volunteered to enroll in the investigation. Based on location of enrollment either the Youth Fit For Life protocol (treatment group) or an equal amount of time for unstructured physical activity (control group) was incorporated. All other aspects of after-school care were the same (eg, consumption of a snack, completion of homework). Parents and legal guardians were provided information packets, and were required to sign an informed consent form indicating a desire for their child to participate, and sufficient health to avoid undue risks through participation. Information on how collected data were to be handled, including how all identifiers were to be destroyed, was also provided. The contact information of the principal investigator was given so that all concerns and questions could be promptly addressed.

Youth Fit For Life consisted of 3, 45-minute sessions per week, and was delivered in elementary school multi-purpose rooms by after-school counselors whose training in PE methods was generally limited to a 6-hour block of instruction provided just prior to starting with the treatment. Using after-school counselors to administer the protocol directly facilitated testing in a manner that is consistent with the most efficient dissemination of the intervention. Participant-to-counselor ratios averaged approximately 12:1, and were limited to 15:1.

The Youth Fit For Life curriculum was supported by a manual, videotape, and quality control processes from wellness staff members of sponsoring YMCAs (National Cancer Institute, 2008). Its 4 components were cardiovascular exercise (noncompetitive games and tasks designed to maximize moderate-to-vigorous physical activity time for 20 minutes, 3 days per week), resistance exercise (age-appropriate use of resistance bands for 20 minutes, 2 days per week), nutrition/health information (1 new theme each week; 5 to 7 minutes, 3 days per week), and behavioral skills training intended to increase the quality of structured physical activity and increase amounts of voluntary, moderate-to-vigorous physical activity completed outside of structured programs incorporating exercise. Behavioral skills training was adapted from an exercise behavior change protocol for adults, and was administered 1 day per week for 20 minutes. It consisted of an assortment of brief, interactive group lessons. Self-management and self-regulatory areas covered were (1) methods for goal setting (short- and long-term), (2) establishing a system for progress monitoring which related to goals set, (3) the use of facilitative self-talk (eg, thought-stopping, cognitive restructuring), (4) identifying appealing physical activity types, and (5) recruiting social supports (eg, family and peer support; participation in a team or group activities). An interactive workbook supported the behavioral skills training component, and was referred to frequently. In addition, in groups led by the after-school counselors, participants discussed their efforts to utilize the behavioral skills.

All surveys were administered to both treatment and control group participants in a private area at baseline and week 12. Ethics required that participants were not provided opportunities to compare and contrast their personal data, and that all identifiers were promptly removed and destroyed. Without affecting validity, children were given an explanation of how their participation may serve to help develop programs to improve the health of children. In research such as this, it is important that the interests of the child participants and their parents be balanced against the advancement of health promotion research.

Data analysis

Statistical significance was set $\alpha = 0.05$, 2-tailed, throughout. As suggested by Jaccard (1998), a modified Bonferroni correction procedure was incorporated to adjust α -values for multiple tests, where appropriate. Assessment of sex differences were initially made on all variables. Dependent t-tests were next calculated to assess within-group changes in the 4 self-appraisal and 2 mood variables, and days per week of voluntary physical activity, over 12 weeks. Contrasts of changes between groups were then made using independent t-tests.

Regression analyses were next conducted for the treatment group only, to assess relations between changes in the self-appraisal and mood variables, and voluntary physical activity changes. Linear bivariate correlations were calculated between changes in the self-appraisal and mood variables, both controlling for baseline scores and not controlled, and voluntary physical activity changes. Thus, both bivariate and partial correlation coefficients are reported. Based on relationships indirectly suggested within social cognitive and self-efficacy theory, a series of linear multiple regression equations, with simultaneous entry of changes in the measures of self-appraisal, mood, and both self-appraisal and mood, were then conducted to assess their explained variance on voluntary physical activity changes. Although use of change scores has sometimes been questioned, it has been considered advantageous when, as here, it is driven by a priori theory (Fitzmaurice, 2001). In addition, tests for skewness and kurtosis suggested that the score changes over 12 weeks were appropriate for use in parametric tests for these data. Baranowski and colleagues indicated the importance of accounting for the dynamic nature of changes in health behaviors (Baranowski et al., 1998). Thus, consistent with previous research (Annesi, 2006), *actual* changes in scores were incorporated into the multiple regression analyses rather than controlling for baseline values. As previously suggested (Fitzmaurice, 2001; Williams and Zimmerman, 1996), this enabled analyses of changes while retaining the naturally occurring array of actual (rather than statistically adjusted) baseline scores, and their changes. The sample size had sufficient experimental power to detect a medium effect size at a .90 level (Cohen, 1988).

Results

Preliminary analyses: For the treatment group, days of voluntary physical activity per week at baseline were

significantly higher for boys ($M = 2.68$, $SD = 2.21$) than for girls ($M = 1.95$, $SD = 1.93$), $t_{144} = 2.07$, $p = 0.04$. For the control group, voluntary physical activity at baseline was also significantly higher for boys ($M = 2.77$, $SD = 2.19$) than for girls ($M = 1.97$, $SD = 2.03$) at baseline, $t_{121} = 2.07$, $p = 0.04$. Boys also had significantly higher scores at baseline on physical appearance for both the treatment, $t_{144} = 2.07$, $p = 0.04$, and control, $t_{121} = 1.98$, $p = 0.05$, groups. There were, however, no significant differences by sex in score changes from baseline to week 12, on any variable under study, for either the treatment or control groups (all p -values > 0.10). Floor and ceiling effects were not a problem. Therefore, consistent with previous research (Annesi, 2004b; 2005; 2006), data were aggregated by sex for further analyses.

Changes in psychological and physical activity factors: For the treatment group, dependent t -tests indicated significant within-group score changes over 12 weeks on the self-appraisal factors of general self, physical appearance, physical self-concept, and exercise barriers self-efficacy (all d -values = 0.14 to 0.23); and the mood factors of tension and vigor (d -values = 0.42 and 0.26, respectively) (see Table 1). Frequency of voluntary moderate-to-vigorous physical activity significantly increased by a mean of 1.05 days per week ($SD = 1.63$) over 12 weeks, with a moderate effect size ($d = 0.58$). No significant within-group score changes were found for the control group on any variable (see Table 1). Contrasts of score changes indicated that significantly greater improvements were made on each of the self-appraisal, mood, and physical activity measures in the treatment group (see Table 2).

Relation of changes in psychological factors and

physical activity: Significant linear bivariate correlations (all $dfs = 144$) were found between score changes over 12 weeks in the self-appraisal factors of general self, physical appearance, physical self-concept, and exercise barriers self-efficacy, and changes in days per week of voluntary physical activity (r -values = 0.29, 0.37, 0.38, and 0.34, respectively; all p -values < 0.001). Significant bivariate correlations were also found between score changes in the mood factors of tension ($r = -0.20$, $p = 0.02$) and vigor ($r = 0.31$, $p < 0.001$), and changes in days per week of voluntary physical activity. When baseline scores on each self-appraisal and mood factor were controlled, similar strength partial correlation coefficients also suggested significant relationships between score changes in general self ($r_{12.3} = 0.28$, $p = 0.001$), physical appearance ($r_{12.3} = 0.34$, $p < 0.001$), physical self-concept ($r_{12.3} = 0.36$, $p < 0.001$), exercise barriers self-efficacy ($r_{12.3} = 0.34$, $p < 0.001$), tension ($r_{12.3} = -0.19$, $p = 0.02$), and vigor ($r_{12.3} = 0.22$, $p = 0.01$), and changes in days of voluntary physical activity per week.

When the four measures of changes in self-appraisal were simultaneously entered into a multiple regression equation, a significant portion of the variance in changes in days of voluntary, moderate-to-vigorous physical activity per week was accounted for (see Table 3, Model 1). When the 2 measures of changes in mood were entered into a separate regression equation, a significant portion of the variance in changes in days of voluntary physical activity per week was explained (see Table 3, Model 2). When changes on all self-appraisal and mood measures were simultaneously entered into a third regression equation, a greater portion of the adjusted variance in changes in days of voluntary, moderate-to-vigorous

Table 1. Changes in self-appraisal, mood, and days of voluntary moderate-to-vigorous physical activity over 12 weeks. Data are means ($\pm$ SD).

	Baseline	Week 12	t	p	d
Treatment group (n=146)					
Self-appraisal measure					
General self	28.4 (5.3)	29.5 (4.8)	3.00	.003	.19
Physical appearance	31.2 (5.8)	32.5 (5.8)	3.73	<.001	.23
Physical self-concept	35.0 (5.5)	35.7 (5.5)	1.99	.05	.14
Exerc. barriers self-efficacy	26.5 (9.4)	28.7 (9.8)	4.53	<.001	.23
Mood Measure					
Tension	11.9 (4.5)	10.1 (4.5)	-6.87	<.001	.42
Vigor	15.9 (4.6)	17.1 (4.3)	3.94	<.001	.26
Voluntary phys. activity days/week	2.3 (1.8)	3.3 (1.8)	7.09	<.001	.58
Control group (n=123)					
Self-appraisal measure					
General self	29.5 (5.7)	29.6 (6.4)	.84	.40	.01
Physical appearance	31.0 (6.0)	31.1 (6.1)	.63	.63	.03
Physical self-concept	33.0 (4.6)	33.2 (5.9)	.41	.68	.04
Exerc. barriers self-efficacy	27.3 (8.5)	27.4 (8.2)	.29	.77	.01
Mood Measure					
Tension	11.4 (4.6)	11.6 (4.9)	.59	.56	-.04
Vigor	16.3 (5.4)	15.7 (5.6)	-1.10	.27	-.11
Voluntary phys. activity days/week	2.3 (1.6)	2.5 (2.2)	.97	.33	.09

General self and physical appearance are scales of the Self-Description Questionnaire-I. Physical self-concept is a scale of the Tennessee Self-Concept Scale: 2. Tension and vigor are scales of the Profile of Mood States - Short Form. Exerc. barriers self-efficacy = Exercise Barriers Self-Efficacy Scale for Children. Voluntary physical activity days/week refers to recalled number of days in the previous week where moderate-to-vigorous physical activity was completed outside of PE and after-school care programming. SD = standard deviation; d = Cohen's measure of effect size. Treatment group $df=144$; Control group $df=121$.

Table 2. Contrast of treatment and control group changes in self-appraisal, mood, and days of voluntary moderate-to-vigorous physical activity over 12 weeks. Data are means ($\pm$ SD).

	Treatment (n = 146)	Control (n = 123)	t ₂₆₇	p	d
Treatment group (n=146)					
Self-appraisal measure					
General self	1.04 (3.22)	.08 (1.54)	3.03	.003	.38
Physical appearance	1.34 (2.62)	.17 (1.09)	4.63	<.001	.28
Physical self-concept	.75 (2.11)	.16 (1.07)	2.81	.01	.35
Exerc. barriers self-efficacy	2.19 (3.49)	.12 (2.03)	5.80	<.001	.73
Mood Measure					
Tension	-1.88 (3.13)	.20 (2.41)	6.02	<.001	.74
Vigor	1.22 (3.74)	-.61 (2.59)	4.58	<.001	.57
Voluntary phys. activity days/week	1.05 (2.16)	.17 (1.97)	3.46	.001	.43

General self and physical appearance are scales of the Self-Description Questionnaire-I. Physical self-concept is a scale of the Tennessee Self-Concept Scale: 2. Tension and vigor are scales of the Profile of Mood States - Short Form. Exerc. barriers self-efficacy = Exercise Barriers Self-Efficacy Scale for Children. Voluntary physical activity days/week refers to recalled number of days in the previous week where moderate-to-vigorous physical activity was completed outside of PE and after-school care programming.

SD = standard deviation; d = Cohen's measure of effect size.

physical activity per week was accounted for, than for either of the two previous models (see Table 3, Model 3).

Discussion

Findings from this preliminary investigation suggested that the Youth Fit For Life protocol was associated with a significant, moderate increase in days of voluntary, moderate-to-vigorous physical activity completed per week, and significant, small improvements in measures of self-appraisal and mood, in the present sample of African American preadolescents. There were no significant changes associated with the control condition, which reserved time for physical activity but did not administer a structured physical activity curriculum. This suggested that, as presented in hypothesis 1 and hypothesis 2, the Youth Fit For Life protocol induced significantly improved feelings of self-efficacy, self-image, and mood; and increases in freely chosen physical activity in the present sample of African American preadolescents – a group that may be especially at risk for overweight.

A primary focus of the investigation was the relationship of changes in theoretically proposed psychosocial correlates of physical activity, and changes in weekly

moderate-to-vigorous physical activity sessions completed outside of programmed settings. Only the treatment group was included in these analyses because of the restricted ranges in change scores in the control group (that failed to demonstrate a significant improvement on any variable assessed). The significant linear bivariate correlations of changes on the self-appraisal factors and changes in physical activity suggest that increases in both general and physical self-description, and increases in both task and self-regulatory self-efficacy, were associated with increased voluntary physical activity. This confirmed hypothesis 3, principles of social cognitive and self-efficacy theory, and some, but not all, research on correlates of physical activity in youth (Sallis et al., 2000). It is likely that, as intended, the Youth Fit For Life curriculum and administration method served to improve both feelings of one's physical self and competence with physical tasks; and those improvements facilitated more freely chosen physical activity.

The significant linear bivariate correlations of changes in tension and vigor scores, and changes in physical activity sessions completed, suggested relationships similar to those found with adults (Annesi, 2004a; Institute of Medicine, 2007). It is likely that, as in

Table 3. Results of simultaneous multiple regression analyses for change in voluntary physical activity (n=146).

	β	R	R ²	R ² _{adj}	F _{2,73}	p
Model 1		.53	.29	.27	14.08	<.001
Δ General self	.10					.22
Δ Physical appearance	.27					<.001
Δ Physical self-concept	.26					.001
Δ Exerc. barriers self-efficacy	.16					.05
Model 2		.36	.13	.12	10.55	<.001
Δ Tension	-.18					.03
Δ Vigor	.30					<.001
Model 3		.60	.36	.33	12.83	<.001
Δ General self	.08					.29
Δ Physical appearance	.23					.002
Δ Physical self-concept	.25					.001
Δ Exerc. barriers self-efficacy	.17					.03
Δ Tension	-.19					.01
Δ Vigor	.18					.02

The delta symbol (Δ) denotes change in score from baseline to week 12.

adults, physical activity participation is associated with improved mood over time for preadolescents, and improved mood serves to reinforce physical activity behaviors (Annesi, 2004a). Regression analyses suggested that simultaneously accounting for changes in each of the self-appraisal and mood factors increased the accuracy of prediction of changes in days of voluntary physical activity compared to either of the 2 types of predictor variables alone. Simultaneously accounting for changes in each of the self-appraisal *and* mood factors accounted for a substantial 36% of the variance in changes in number of days of moderate-to-vigorous physical activity per week, over 12 weeks. This confirmed hypothesis 4. It is likely that the improved feelings of the self, and improvements in mood, associated with the Youth Fit For Life protocol, served an additive function in regard to inducing freely chosen physical activity in the participants. Inspection of the independent, significant strength of 5 of the 6 factors in multiple regression model 3 (β -values in Table 3) supports this. This will be important knowledge for future developers of treatments that seek to induce increased out-of-treatment physical activity.

Replication is required before generalization of findings is possible, and should include a longer time-frame, account for physiological factors at baseline (eg, BMI), evaluate effects of sex more thoroughly, and directly assess intervention components for their specific effect. For example, a pilot version of Youth Fit For Life was associated with significant improvements in exercise barriers self-efficacy for girls but not for boys, which precipitated modifications in supporting materials for the behavioral skills component. Adjustments based on proposed sex differences in learning styles (Pomerantz et al., 2002) were incorporated into the treatment that were subsequently associated with equalized effects. Effects specific to the African American sample presently tested should also be analyzed. As the present preliminary research is extended into intervention design, curriculum modifications directed at changes on relevant psychological factors should also be accounted for to maximize impact. Effect decomposition, as was completed within this investigation, allows research to be used to purposefully direct curriculum development.

Although experimental confounds consistent with field research were certainly possible here (eg, expectation effects, social support effects), and should be considered limitations, this study served to simultaneously account for extant theoretical, intervention, and application research on psychosocial correlates of physical activity in a group with demonstrated need. Factors consistent with increased activity in African American youth were suggested, and implications for intervention were extended. Future related field research should be careful, however, to maximize integrity of experimental controls, while attempting to maintain high external validity.

Conclusion

After replication with larger and different samples, and based on the identified relationships, future physical activity interventions may be well served to incorporate

curricular components that focus on improvement of perceptions of self-concept and self-efficacy. Comparison of the relative efficacy of multiple treatment components for these ends may also be warranted. The present Youth Fit For Life protocol served as an example of how structured elements of a physical activity intervention, based on social cognitive theory, might positively impact preadolescents' self-image, self-efficacy, mood, and, in turn, their amounts of freely chosen physical activity. Positively affecting voluntary physical activity may be essential if the current suggested standards of 60 minutes per day, 5 or more days per week (Strong et al., 2005), are to eventually be met.

Ultimately, it is hoped that physical activity interventions may deliver effective protocols within multiple venues and in a large-scale manner, which reliably affect propensities for children to be physically active during their free time. It will also be advantageous to have reliable, easily accessed interventions with established theoretical and research bases for referral. It is hoped that through further research, physical activity amounts in youth may be systematically increased, and pathologies related to obesity and a sedentary lifestyle may be reduced.

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Key points

- Social cognitive theory offers a framework for understanding correlates of physical activity in youth.
- This study suggests that it is possible for a convenient physical activity intervention, led by after-school care counselors with minimal training, to improve participants' self-perceptions, mood, and voluntary physical activity.
- Improvements in self-perceptions and mood appeared to be significantly associated with increased free-time physical activity in African American 8- to 12-year-olds.
- This study's findings may lead to a better understanding of physical activity promotion in youth, and foster improvements in physical activity curricula.

AUTHORS BIOGRAPHY

James J. ANNESI**Employment**

Director of Wellness Advancement for the YMCA of Metropolitan Atlanta.

Degree

PhD

Research interests

Exercise adherence treatment, health behavior change, relations of physical activity and depression, anxiety, and self-image, and the behavioral treatment of obesity.

E-mail: jamesa@ymcaatlanta.org

Avery D. FAIGENBAUM**Employment**

Associate Professor with the Department of Health and Exercise Science, The College of New Jersey.

Degree

EdD

Research interests

Optimal physical training in children, and reduction of pediatric health-risk factors.

E-mail: faigenba@tcnj.edu

Wayne L. WESTCOTT**Employment**

Research Director for the South Shore YMCA, Quincy, MA.

Degree

PhD

Research interests

Strength training in athletes, special populations, and reduction of obesity and other health risks.

E-mail: wwestcott@ssymca.org

Alice E. SMITH**Employment**

Manager of the Child Health Promotion Department of Children's Healthcare of Atlanta

Degree

MS, MBA

Research interests

The development of protocols for health-risk reduction in high-risk child populations.

E-mail: alice.e.smith@choa.org

✉ Dr James J. Annesi

YMCA of Metropolitan Atlanta, 100 Edgewood Avenue, NE, Suite 1100, Atlanta, Georgia 30303, USA