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Effects of the Youth Fit For Life protocol on physiological, mood, self-appraisal, and voluntary physical activity changes in African American preadolescents: Contrasting after-school care and physical education formats[1]

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ABSTRACT. Effects of a 12-week physical activity and health behavior change protocol (Youth Fit For Life), delivered in 3 day/week after-school care and 2 day/week physical education formats, were assessed and contrasted with African American children, ages 9 to 12 years, in an experimental study. Body Mass Index, percent body fat, and muscular strength were significantly improved in both formats for both boys and girls, with effect sizes larger in the after-school care condition. Significant improvements in mood and self-appraisal factors were also associated with participation in the protocol in both formats, with effect sizes somewhat larger in the physical education format. Increases in days per week of voluntary, moderate-to-vigorous physical activity were significant and similar in both conditions (M_{change} = .71 and .75 days/week, *p*s < .01). Multiple regression analyses indicated that changes in scores of physical appearance,

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physical self-concept, exercise self-efficacy, and perceptions of the overall self explained a significant portion of the variance in changes in voluntary physical activity sessions over 12 weeks, R^2 = .24 to .73, *p*s < .001. Implications for development of an adequate explanatory model of physical activity in children, evidence-based physical activity intervention design, and reduction in overweight preadolescents, were suggested.

KEYWORDS. Physical activity. Self-appraisal. Mood. Preadolescents. Experimental study.

RESUMEN. Los efectos de la actividad física durante 12 semanas y el protocolo de cambio de conducta relacionada con la salud (*Youth Fit For Life*) llevados a cabo en los formatos de cuidados extraescolares durante 3 días/semana y educación física de 2 días/semana fueron evaluados y contrastados con niños afroamericanos de 9 a 12 años de edad, en un estudio experimental. El Índice de Masa Corporal, el porcentaje de grasa corporal y la fuerza muscular han mejorado significativamente en ambos formatos en chicos y chicas, con mayores efectos en la condición de cuidado extraescolar. Las mejorías significativas en estado de ánimo y auto-valoración fueron también asociadas a participación en el protocolo en ambos formatos con los tamaños de efectos algo mayores en el formato de educación física. El incremento de días por semana de actividad física voluntaria, moderada a vigorosa, fue significativo y similar en ambas condiciones (M_{cambio} = 0,71 y 0,75 días/semana, *p*s < 0,01). El análisis de regresión múltiple indicó que los cambios en el aspecto físico, autoconcepto físico, autoeficacia en ejercicios y la percepción del ser en general explicó una parte significativa de la varianza en los cambios en las sesiones de actividad física voluntaria a lo largo de 12 semanas, R^2 = 0,24 a 0,73, *p*s < 0,01. Se sugiere implicaciones para el desarrollo de un modelo explicativo adecuado de la actividad física en niños, el diseño de la intervención en actividad física basado en la evidencia y reducción de obesidad en preadolescentes.

PALABRAS CLAVE. Actividad física. Auto-valoración. Estado de ánimo. Preadolescentes. Estudio experimental.

RESUMO. Os efeitos da actividade física durante 12 semanas e o protocolo de mudança comportamental relacionada com a saúde (*Youth Fit For Life*) levados a cabo no formato de cuidados extracurriculares durante 3 dias/semana e educação física de 2 dias/semana foram avaliados e contrastados com crianças Afro-americanas de 9 a 12 anos de idade, num estudo experimental. O Índice de Massa Corporal, a percentagem de gordura corporal e a força muscular, melhoraram significativamente em ambos os formatos em meninos e meninas, com maior efeito na condição de cuidado extra-escolar. As melhorias significativas no estado de humor e a autovalorização foram também associadas à participação no protocolo em ambos os formatos, com os tamanhos de efeitos algo superiores no formato da educação física. O aumento de dias por semana de actividade física voluntária, moderada a elevada, foi significativo e similar em ambas as condições (M_{cambio} = 0,71 e 0,75 dias/semana, *p*s < 0,01). A análise de regressão múltipla indicou que as mudanças no aspecto físico, autoconceito físico, auto-eficácia em exercícios e a percepção de ser em geral explicou uma parte significativa da variância nas mudanças nas sessões de actividade física voluntária ao longo das 12 semanas, R^2 = 0,24 a 0,73,

*p*s < 0,01. Sugerem-se implicações para o desenvolvimento de um modelo explicativo adequado à actividade física em crianças, o desenho da intervenção na actividade física baseado na evidência e redução de obesidade em pré-adolescentes.

PALAVRAS CHAVE. Actividade física. Autovalorização. O estado de humor. Pré-adolescentes. Estudo experimental.

Introduction

From 12 to 22% of American preadolescents are presently overweight (i.e., Body Mass Index; BMI [kg/m^2] ≥ 95th age- and gender-adjusted percentile (U.S. Department of Health and Human Services, 2000). Overall, a three-fold increase in overweight has been observed over the last 25 years (Ogden, Flegal, Carroll, and Johnson, 2002). The most recent data indicate that this trend is continuing (Ogden *et al.,* 2006). Non-Hispanic African Americans have both the highest prevalence and increase in overweight, and risk for overweight (i.e., BMI ≥ 85th percentile). Along with a diet high in fat and energy, a reduction in physical activity has been implicated (U.S. Department of Heath and Human Services, 1996a, 1999). In 2003, only 25% of teenagers engaged in moderate amounts of physical activity for at least 30 min., five or more days per week. African American boys and girls participated in regular vigorous activity significantly less than their White counterparts (U.S. Department of Heath and Human Services, 1996b).

Although schools can help with reaching nationally established goals for children's physical activity, in many U.S. communities physical education (PE) has been given a low priority compared to academic subjects and has been reduced (National Association for Sport and Physical Education, 2006). Studies also suggest that only 10 to 36% of class time in elementary school Physical Education (PE) is spent with students participating in moderate-to-vigorous physical activity (McKenzie *et al.*, 1995; Simons-Morton, Parcel, Baranowski, Forthofer, and O'Hara, 1991; Simons-Morton, Taylor, Snider, and Huang, 1993), with the higher proportions of time associated with classes run by PE specialists (McKenzie, Sallis, Kolody, and Faucette, 1997). 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 physical activity (Pate and Sirard, 2000).

In addition to PE, after-school care may be an appropriate setting for administering physical activity interventions to children. Currently about 7 million children attend after-school care in the U.S., with a demand of approximately 22 million (Afterschool Alliance, 2004). Although some attempts have been made to adapt school-time physical activity interventions for after-school applications (see Kelder *et al.,* 2005; Nigg, Battista, Chang, Tamashita, and Chung, 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. Improvements in measures of body composition and fitness, associated with use of this protocol over 3 months, were found in a sample of 5 to 12 year-olds (Annesi, Westcott, Faigenbaum, and Unruh, 2005).

Although most of the concern regarding adequate amounts of physical activity has been focused on physical health concerns, there are also potential benefits to mood and self-concept. Though these areas have not been well-studied in children, Annesi (2005) and Tomson, Pangrazi, Friedman, and Hutchison (2003) found positive changes in mood associated with physical activity in participants, ages 8 through 12 years. Also, scores of physical and overall self-concept were significantly increased (Annesi, 2005, 2006). Although improvements in these areas are important in their own right, it is possible that positive changes in self-appraisal factors are associated with increases in freely chosen physical activity. This is consistent with various theories of motivated behavior (see Culos-Reed, Gyurcsik, and Brawley, 2001, for a review). Increased voluntary physical activity is important because it is unlikely that compulsory programs will alone supply children with the recommended amounts of 60 min. per day of moderate-to-vigorous physical activity (Strong *et al.*, 2005).

The aforementioned Youth Fit For Life protocol was developed using tenets of social cognitive and self-efficacy theory (Bandura, 1986, 1997), and psychological correlates of physical activity in youth (see Barbeau, 2005; Cavill, Biddle, and Sallis, 2001; Sallis, Prochaska, and Taylor, 2000, for reviews). It was thought that program administration which incorporates training in behavioral skills such as short- and long-term goal setting, self-monitoring of incremental progress, managing self-talk, and recruiting social support in a non-threatening, mastery-focused manner would improve participants' self-management and self-regulatory abilities. This was intended to counter barriers to voluntary exercise and positively affect determinants of physical activity such as self-efficacy (Dishman *et al.*, 2004; Pate *et al.,* 1997; Strauss, Rodzilsky, Burack, and Colin, 2001), body image (Douthitt, 1994), perceived competence (Boyd and Hrycaiko, 1997; Cavill *et al.,* 2001; Jiménez-Castuera, Cervelló-Gimeno, García-Calvo, Santos-Rosa, and Iglesias-Gallego, 2007; Sallis, Alcaraz, McKenzie, and Hovell, 1999), and self-esteem (Ferguson, Yesalis, Promrehn, and Kilpatrick, 1989; Márquez, 2006).

More specifically, through application of the Youth Fit For Life protocol it was thought that improvements in participants' self-efficacy to overcome barriers to complete regular physical activity (i.e., self-regulatory efficacy), perceptions of making progress in exercise-related goals (i.e., task self-efficacy), and physical self-description, would be associated with increased voluntary physical activity. It was not known whether changes in global perceptions of the self (i.e., general self-description) would be a covariant of the previous three self-appraisal constructs or uniquely contribute to accounting for changes in frequency of activity. Researchers have indicated a need for further study on theory-based mediators of desired health behaviors to improve adequacy of interventions (Baranowski, Anderson, and Carmack, 1998; Lewis *et al.,* 2006; Lewis, Marcus, Pate, and Dunn, 2002).

Relative to a control condition, significant improvements were found in both the preceding psychological variables (Annesi, 2005, 2006) and physiological factors (Annesi *et al.*, 2005), it was a goal here to assess generalizability of the Youth Fit For Life protocol with a sample with demonstrated need and with a format different than after-school care. African American preadolescents were selected for evaluation because

research indicates that this group is especially in need of effective interventions for increased physical activity and reductions in health risk factors. The preadolescent age group also enabled adequate assessment of possible behavioral correlates of physical activity through use of standardized, self-report surveys (where with younger ages this may have been difficult). A twice per week PE format was chosen for testing because it commonly occurs in the field, and the protocol has potential for large-scale dissemination there. It was also a goal to test theory-based mediators for their association with changes in voluntarily completed physical activity. In their comprehensive review of physical activity interventions in youth, Stone, McKenzie, Welk, and Booth (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, this exploratory investigation had the following purposes:

- To assess and contrast the physiological changes associated with the Youth Fit For Life protocol in after-school care and PE formats.
- To assess and contrast changes in factors of mood, self-appraisal, and voluntary physical activity associated with the Youth Fit For Life protocol in after-school care and PE formats.
- To evaluate whether changes in theory-based factors of self-appraisal predict a significant portion of the variance in changes in voluntary physical activity.

It was expected that physiological improvements would be significant and associated with both the after-school care and PE conditions. Because of potentially counterbalancing factors of more time for physical activity in the after-school care condition and PE specialists directly administering the protocol in the PE condition, there was no hypothesis regarding expected differences in physiological changes between conditions. It was expected that similar, significant improvements would be made on the mood and self-appraisal factors, and voluntary days of physical activity per week, in both conditions. Finally, as suggested by social cognitive and self-efficacy theory, it was expected that changes on the self-appraisal factors would predict a significant portion of the variance in changes in reported voluntary physical activity. Following recently established editorial norms (Ramos-Álvarez, Valdés-Conory, and Catena, 2006), the design of the investigation was experimental (Montero and León, 2005).

Method

Participants

For Part 1 of this study, African American preadolescents, ranging in age from 9 to 12 years, were recruited from 10 Young Men's Christian Association (YMCA) - based after-school care sites and eight PE classes from a YMCA-affiliated charter school in the southeast U.S. A complete set of study-related physiological data was required for inclusion. Thus, analyses for the after-school care condition were conducted on 62 boys (M_{age} = 10.1 years, *SD* =.8) and 66 girls (M_{age} = 9.6 years, *SD* =.7). Analyses for the PE condition were conducted on 51 boys (M_{age} = 10.1 years, *SD* = 1.2) and 62

girls (M_{age} = 10.4 years, *SD* = 1.1). BMI (Body Mass Index) scores at baseline are reported in Table 1. There was no significant difference (*p*s > .20) among either the boys or girls between formats. For the after-school groups of boys and girls, BMI scores corresponded to the 84th and 86th percentile (U.S. Department of Health and Human Services, 2000), respectively. For the PE groups of boys and girls, BMI scores corresponded to the 92nd and 91st percentile, respectively. Based on locations of their residences and use of the free and reduced price meal program, participants were generally in the lower to lower-middle socioeconomic strata. Informed consent was required from a parent or caregiver.

For Part 2 of this study, 46 boys and 57 girls from the above samples of after-school care participants, and 21 boys and 27 girls from the above samples of PE participants, were included as participants. A complete set of the mood, self-appraisal, and recalled physical activity surveys was required for inclusion.

Measures

- Body Mass Index (BMI) and Body composition. A recently calibrated scale and tape measure were used to measure BMI. Skinfold calipers were used to assess body composition as percentage of body fat. Validity was supported through correlations with dual-energy x-ray absorptimetry (r^2 = .85, p < .0001) and air displacement plethysmography (p < .003) in both African American and White children (Nicholson *et al.,* 2001). Triceps and calf skinfolds were chosen because those areas were minimally invasive and strongly correlated with total body fat (Golding, 2000). Sex- and age-specific equations by Slaughter *et al.* (1988) were used, and adjustments for African American preadolescents (see Cameron *et al.,* 2004) were applied.
- Strength. Number of push-ups completed at a 3-s pace within 1 min was used as the measure of muscular strength. Participants were required to start in an upright position and lower the body using the arms until the elbows were at a 90° angle. The required pace was indicated by a recording heard by both the participant and tester. When either the required form or pace was not kept, the assessment was terminated and the number of properly completed push-ups was recorded. Test-retest reliability of the 90° angle push-up test was reported at .90 to .91 for ages 7 to 11 years (McManis and Wuest, 1994). Validity was demonstrated through correlations ≥ .70 with combined bench press, latissimus pull-down, and arm curl scores, after controlling for body weight (Rutherford and Corbin, 1993).
- Flexibility. Consistent with recent research (Plowman, 2006), the shoulder stretch was used as the measure of flexibility. This was an alternative to the more often used sit-and-reach test which has consistently demonstrated poor validity as a measure of general flexibility in preadolescents (e.g., Jackson and Baker, 1986; Patterson, Wiksten, Ray, Flanders, and Sanphy, 1996). With the right hand, the participant reached over the right shoulder and down the back. The left hand was placed behind the back reaching up. The distance between the fingers was recorded in cm. If the fingers touched, the score was 0. Test-retest reliability for boys and girls ages 5 to 12 years was ≥ .90 (Annesi *et al.*, 2005).

- Endurance. To estimate endurance or cardiovascular fitness, each participant ran/walked as far as possible in a period of 6 min. The distance covered was recorded in m. Test-retest reliability ranged from .60 to .84 for the present sample. Concurrent validity was evaluated by correlating distance covered, with VO_2max treadmill testing. Previous studies of children ages 9 to 11 years found correlations ranging from .71 to .82 (Jackson and Coleman, 1976).
- Tension and Vigor. The Tension and Vigor scales of the Profile of Mood States – Short Form (McNair, Lorr, and Droppleman, 1992) are self-report surveys of five items each. Responses range from 0 (*Not at all*) to 4 (*Extremely*). Sample items for the Tension scale are "Nervous," "Anxious" and "Tense" and for the Vigor scale are "Energetic," "Active" and "Lively." Internal consistency averaged .91 and .88, respectively. Test-retest reliability over 3 weeks was .70 and .65, respectively (McNair *et al.*, 1992). Although designed for adults, Profile of Mood States scales have been used with children starting at 9 years of age (Annesi, 2005; Berger, Grove, Prapavessis, and Butki, 1997).
- Physical appearance and General self. The Self-Description Questionnaire-I (Marsh, 1990) is a self-report survey intended for children, ages 8 through 12 years. The General Self and Physical Appearance scales were used in this research. Responses range from 1 (False) to 5 (True). The factor structure was supported across eight studies (see Marsh, 1990, pp. 29-39, for a review), and independence between scales was demonstrated. Each scale has eight items. Sample items for General Self are, "Overall I have a lot to be proud of," "I can do things as well as most other people," and "I'm as good as most other people." Internal consistency was .81. Sample items for the Physical Appearance scale are, "I like the way I look," "I have a good looking body," and "I am better looking than most of my friends." Internal consistency was .83. Although usual test-retest methods were considered inappropriate due to expected changes in the measured constructs over time, findings suggested *systematic* changes over 6 months (Marsh, 1990). The General Self scale was related to the construct of general self-description, and the Physical Appearance scale was related to physical self-description.
- Physical self-concept. 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. A single score is recorded from possible responses of 1 (*Always False*) to 5 (*Always True*) on 12 items, although item clusters include identity (e.g., "My body is healthy"), satisfaction (e.g.,'"I don't feel as well as I should"), and behavior (e.g., "I'm not good at sports and games"). Factor analysis supported the Physical Self-Concept scale items relative to the other five scales of the Tennessee Self-Concept Scale: 2. Internal consistency for the 9- to 12-year-old age group averaged .70, and test-retest reliability over 1 week was .71 (Fitts and Warren, 1996). Physical self-concept was related to the construct of task self-efficacy.
- Exercise barriers self-efficacy. The Exercise Barriers Self-Efficacy Scale for Children (Annesi *et al.*, 2005) is a self-report survey intended to assess exercise barriers self-efficacy or the degree one believes he or she has the ability to

overcome social, personal, and environmental barriers to participating in physical activities. Based on previous research (Marcus, Selby, Niaura, and Rossi, 1992; McAuley, 1991; McAuley and Mihalko, 1998), each of the 10 items begins with the stem, "I am sure I can exercise three or more days per week even if…." Responses range from 1 (*Not at all confident*) to 5 (*Definitely confident*). Sample items are, "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 for the 9- to 12-year-old age group averaged .79, and test-retest reliability over 1 week was .77 (Annesi *et al.*, 2005). Exercise barriers self-efficacy was related to the construct of self-regulatory efficacy.

– Voluntary physical activity. A single item was used to assess the number of days a participant voluntarily completed a bout of moderate-to-vigorous ("made you breathe harder than usual") physical activity or exercise over the previous week, excluding physical activities completed during school (e.g., during PE class) or after-school care programs (e.g., during a Youth Fit For Life session). The item was based on review of the extant physical activity recall research (see Piera *et al.*, 1997), and adapted from recent research with 12-year-olds from Canada (Tremblay, Inman, and Willms, 2000). Test-retest reliability over 1 week was .79. The correlation between days of voluntary, moderate-to-vigorous physical activity and time to complete a 1-mile (1.61 km) run/walk was significant, $r = -.39$, $p < .01$. Responses range from 0 to 7 days. Changes on each measure were derived by subtracting scores at baseline from scores at Week 12.

Procedure

Study participants were enrolled in a 12-week segment of either after-school care or PE, which administered the Youth Fit For Life protocol. Instructors completed a 4- to 5-hr training on the protocol which was supported by manuals and a video and kept for ongoing reference. The participant-to-instructor ratio was similar for both conditions at approximately 15:1. Youth Fit For Life curriculum components are described more fully elsewhere (see Annesi *et al.*, 2005) and will be provided by the first author upon request. A brief overview will be given here.

For the after-school care condition, in addition to typical processes (e.g., completing homework, receiving tutoring), the Youth Fit For Life protocol was administered by after-school counselors who were formerly untrained in exercise methods. They were supported one session every two weeks by YMCA wellness instructors who performed structured quality-control audits. The treatment was three sessions per week for 45 min per session. It included cardiovascular activities in the form of non-competitive games and tasks each day for 20 min. Two days per week, resistance training was completed utilizing age-appropriate resistance bands for 20 min. Every attempt was made to keep participants active throughout these exercise components. Review of various self-management and self-regulatory skills (e.g., goal setting, self-monitoring, self-talk/cognitive restructuring, recruiting social support) was provided one day per week for 20 min. A workbook tailored for the present age range was used to enhance learning

and application of the self-management and self-regulatory skills. General health and nutrition information topics were also addressed with participants (one theme per week, e.g., "Fruits and Vegetables," "Heart Health," "Fast Foods") for 5 min per day. These were supported by display of corresponding posters. All Youth Fit For Life components were completed in the multi-purpose room of the corresponding after-school care site.

The PE version of the Youth Fit For Life protocol was delivered by PE specialists, two sessions per week at 45 min per session. All components were the same as in the after-school care condition, but delivered in a gymnasium. Cardiovascular training was completed each session. Resistance training was held on three consecutive sessions with the fourth substituting instruction on the self-management and self-regulatory skills named above. Health and nutrition information topics were addressed 5 min. each day.

Before the start and at the end of the 12-week Youth Fit For Life treatments; children from both conditions completed the physiological, mood, self-appraisal, and physical activity assessments. Due to time restrictions associated with academic subjects, only four of the eight PE classes completed the surveys. Based on scores of audits, the overall quality of program administration for both conditions was judged sufficient to retain collected data for analyses.

Results

Alpha levels were set at .05, two-tailed, unless otherwise noted. Due to the exploratory nature of this research, it was important not to overlook changes and relationships in variables which could lead to more thorough investigation. Thus, based on this and suggestions from Perneger (1998), no adjustments were made for multiple tests.

Part 1

Changes in physiological factors

Dependent *t* tests suggested significant improvements over 12 weeks on BMI, body composition, strength, and flexibility for both groups of boys. Improvements in endurance did not reach statistical significance for either group (see Table 1). To control for minor variations in baseline scores, contrasts of mean changes over the 12-week treatment were calculated between groups. Improvements in the after-school group were significantly greater than the PE group on strength and endurance for boys (see Table 2). Improvements over 12 weeks on BMI, body composition, and strength were found for both groups of girls. Improvements in flexibility and endurance were statistically significant for the after-school care group only (see Table 1). Contrasts of changes over 12 weeks suggested that mean improvements in the after-school group were significantly greater than the PE group on body composition and endurance for girls (see Table 2). Effect sizes for within-group changes were moderately higher in the after-school care groups, throughout.

Consistent with previous research (Annesi *et al.*, 2005), where a statistically significant improvement in a physiological factor was found, a *post hoc* test was conducted to

contrast this change with the expected change associated with participants' maturation over the length of the investigation. Based on age- and sex-adjusted normative data (U.S. Department of Health and Human Services, 2000 –BMI-; Martin and Ward, 1996 -body composition-; Plowman, 2006 -strength and endurance-), all such improvements were significantly greater than expected changes (see Table 2). Appropriate normative data were unavailable for contrasts on flexibility.

TABLE 1. Changes in physiological factors from baseline to program end.

Physiological factor	*Baseline*		*Week 12*		*t*	*p*	*d*
	M	*SD*	*M*	*SD*			
After-school care boys (*n* = 62)							
Body Mass Index	19.29	5.07	18.05	4.20	-7.23	<.001	.24
Body Composition	12.53	8.23	11.09	6.17	-3.16	.001	.17
Strength	7.52	4.89	11.04	5.67	3.01	.003	.72
Flexibility	2.97	5.33	.85	3.43	-3.32	.001	.40
Endurance	764.52	192.56	783.87	2.60	.70	.244	.10
PE boys (*n* = 51)							
Body Mass Index	21.24	12.41	20.40	10.59	-2.74	.004	.06
Body Composition	13.54	5.21	12.64	4.85	-4.49	<.001	.17
Strength	10.29	4.34	11.47	3.06	3.26	.001	.27
Flexibility	3.28	8.43	2.39	6.20	-2.11	.020	.11
Endurance	746.60	330.57	778.12	250.97	1.62	.056	.10
After-school care girls (*n* = 66)							
Body Mass Index	20.44	4.07	19.35	3.30	-6.62	<.001	.27
Body Composition	17.11	8.57	14.44	4.07	-5.91	<.001	.31
Strength	7.87	5.12	10.60	3.40	3.52	<.001	.53
Flexibility	2.05	5.34	.08	.45	-2.92	.003	.37
Endurance	603.03	209.50	754.55	415.71	1.99	.026	.72
PE girls (*n* = 62)							
Body Mass Index	21.53	7.38	20.47	6.57	-4.88	<.001	.14
Body Composition	15.16	4.99	14.09	4.66	-4.76	<.001	.21
Strength	9.55	6.78	11.18	5.22	3.98	<.001	.24
Flexibility	1.02	4.88	.74	3.30	-.64	.264	.06
Endurance	681.82	325.74	716.60	214.00	.56	.288	.11

Note. Body composition (% fat) was derived by skinfold conversion equation (Slaughter *et al.*, 1988) and adjusted for ethnicity (Cameron *et al.*, 2004). Body Mass Index is expressed as wt(kg)/ht(m^2). Strength is expressed as number of push-ups completed in 1 min on a 3-s cadence. Flexibility is expressed as distance (cm) from fingers touching behind the back. Endurance is expressed as distance (m) covered during a 6-min run/walk.

*df*s = 61, 50, 65, and 61 for the After-school care boys, PE boys, After-school care girls, and PE girls, respectively.

t tests were one-tailed. *d* = Cohen's measure of effect size.

TABLE 2. Group contrasts in changes in physiological factors from baseline to program end.

Physiological factor	*M*	*SD*	*(Norm)*	*M*	*SD*	*(Norm)*	*t*	*p*	*d*
	After-school boys (n = 62)			PE boys (n = 51)					
Body Mass Index	-1.24	1.35	(.12)[c]	-.85	2.21	(.12)[b]	1.16	.249	.21
Body Composition	-1.44	3.54	(.12)[c]	-.90	1.44	(.12)[c]	1.02	.311	.20
Strength	3.52	6.07	(.57)[c]	1.18	2.57	(.57)[a]	2.57	.011	.50
Flexibility	-1.49	3.56	(…)	-.89	3.05	(…)	0.95	.343	.18
Endurance	193.55	218.67	…	41.52	183.00	…	3.95	<.001	.75
	After-school girls (n = 66)			PE girls (n = 62)					
Body Mass Index	-1.09	1.34	(.13)[c]	-1.06	1.71	(.13)[c]	.11	.912	.02
Body Composition	-2.52	3.46	(.46)[c]	-1.07	1.75	(.31)[c]	2.96	.004	.53
Strength	2.73	5.60	(.20)[c]	1.63	3.23	(.10)[c]	1.35	.180	.24
Flexibility	-1.77	5.31	(…)	-.28	3.56	…	1.85	.066	.33
Endurance	251.52	429.11	(9.10)[c]	34.77	486.23	…	2.68	.008	.47

Note. Body composition (% fat) was derived by skinfold conversion equation (Slaughter *et al.*, 1988) and adjusted for ethnicity (Cameron *et al.*, 2004). Body Mass Index is expressed as wt(kg)/ht(m^2). Strength is expressed as number of push-ups completed in 1 min on a 3-s cadence. Flexibility is expressed as distance (cm) from fingers touching behind the back. Endurance is expressed as distance (m) covered during a 6-min run/walk.

(Norm) = Expected changes (based on normative data) associated with maturation (adjusted for each group's mean age and sex). (…) = Normative data were unavailable.

Between-group t tests were two-tailed. dfs = 111 and 126 for contrasts of After-school and PE boys and girls, respectively. d = Cohen's measure of effect size.

[a]$p < .05$, [b]$p < .01$, [c]$p < .001$ (one-tailed), for contrasts between mean group changes (where significant) and expected changes associated with maturation.

Part 2

Consistent with previous research (Annesi, 2005, 2006), and because significant differences were not found on any factor based on sex at baseline or change from baseline to Week 12, data were pooled for further analyses.

Changes in mood and self-appraisal factors

With the exception of Tension scores for the PE group, all mood and self-appraisal factors demonstrated statistically significant improvements over the length of the investigation, for both groups (see Table 3). Improvements in scores of Physical appearance, Physical self-concept, and General self were significantly greater for the PE group (see Table 4).

Changes in voluntary physical activity

Increases in days of voluntary, moderate-to-vigorous physical activity per week were significant for both groups; with moderate effect sizes (see Table 3). No differences in changes in voluntary physical activity were found between groups (see Table 4).

TABLE 3. Changes in mood and self-appraisal factors, and voluntary physical activity, from baseline to program end.

	Baseline		*Week 12*		*t*	*p*	*d*
	M	*SD*	*M*	*SD*			
After-school care group (*n* = 103)							
Mood factor							
Tension	11.92	4.36	10.06	4.48	-5.86	<.001	.43
Vigor	15.92	4.79	17.27	4.15	3.72	<.001	.28
Self-appraisal factor							
Physical appearance	30.90	6.01	32.10	5.59	2.78	.007	.20
Physical self-concept	35.11	5.66	35.92	5.47	2.18	.031	.14
Exercise self-efficacy	27.26	9.23	29.06	9.75	2.99	.003	.20
General self	28.07	5.59	29.12	5.11	2.84	.006	.19
Voluntary physical activity days/week	2.20	2.05	2.91	2.13	4.35	<.001	.35
PE group (*n* = 48)							
Mood factor							
Tension	12.50	3.54	11.69	3.29	-1.88	.066	.23
Vigor	14.44	3.61	15.56	4.29	2.46	.018	.31
Self-appraisal factor							
Physical appearance	26.31	4.40	30.94	5.76	9.79	<.001	1.05
Physical self-concept	36.00	3.30	40.81	4.88	8.93	<.001	1.46
Exercise self-efficacy	26.19	6.93	29.38	5.90	3.14	.003	.46
General self	22.94	5.37	26.94	7.62	6.63	<.001	.74
Voluntary physical activity days/week	2.38	1.18	3.13	1.38	2.94	.005	.64

Note. Tension and Vigor were measured using the Profile of Mood States Short Form (McNair *et al.*, 1992). Physical appearance and General self were measured using the Physical Appearance and General Self scales of the Self-Description Questionnaire–I (Marsh, 1990). Physical self-concept was measured using the corresponding scale of the Tennessee Self-Concept Scale: 2 Child Form (Fitts and Warren, 1996). Exercise self-efficacy was measured using the Exercise Barriers Self-Efficacy Scale for Children (Annesi *et al.*, 2005). *t* tests were two-tailed. *df*s = 102 and 47 for the After-school care and PE groups, respectively. *d* = Cohen's measure of effect size.

TABLE 4. Group contrasts in changes in mood and self-appraisal factors, and voluntary physical activity, from baseline to program end.

	M	*SD*	*M*	*SD*	*t*	*p*	*d*
	After-school group (n = 103)		*PE group (n = 48)*				
Mood factor							
Tension	-1.86	3.23	-.83	2.99	-1.87	.064	.33
Vigor	1.35	3.68	1.13	3.17	0.36	.722	.06
Self-appraisal factor							
Physical appearance	1.19	4.37	4.63	3.27	4.47	<.001	.89
Physical self-concept	.82	3.79	4.81	3.73	6.05	<.001	1.06
Exercise self-efficacy	1.80	6.09	3.19	7.03	1.24	.216	.21
General self	1.05	3.75	4.00	4.18	4.34	<.001	.74
Voluntary physical activity days/week	.71	1.67	.75	1.77	.13	.893	.02

Note. Tension and Vigor were measured using the Profile of Mood States Short Form (McNair *et al.*, 1992). Physical appearance and General self were measured using the Physical Appearance and General Self scales of the Self-Description Questionnaire–I (Marsh, 1990). Physical self-concept was measured using the corresponding scale of the Tennessee Self-Concept Scale: 2 Child Form (Fitts and Warren, 1996). Exercise self-efficacy was measured using the Exercise Barriers Self-Efficacy Scale for Children (Annesi *et al.*, 2005). Between-group *t* tests were two-tailed. *df* = 149. *d* = Cohen's measure of effect size.

Relations of mood and self-appraisal factors with voluntary physical activity

Consistent with previous research (Annesi, 2006; Lewis *et al.,* 2006) utilizing a mediating variable framework (see Baranowski *et al.,* 1998; Lewis *et al.,* 2002), two separate linear multiple regression analyses were conducted for each group, simultaneously entering changes in scores on Physical appearance, Physical self-concept, and Exercise self-efficacy (first equation); and Physical appearance, Physical self-concept, Exercise self-efficacy, and General self (second equation) as predictor variables for changes in days per week of voluntary physical activity. For the after-school group, results of both the first, $R^2 = .237$, $R^2_{adj} = .214$, $F_{(3, 99)} = 10.27$, $p < .001$, and second, $R^2 = .241$, $R^2_{adj} = .210$, $F_{(4, 98)} = 7.78$, $p < .001$, equation were significant. For the PE group, results of both the first, $R^2 = .580$, $R^2_{adj} = .552$, $F_{(3, 44)} = 20.74$, $p < .001$, and second, $R^2 = .728$, $R^2_{adj} = .703$, $F_{(4, 43)} = 28.81$, $p < .001$, equation were also significant. Corresponding beta weights are reported in Table 5.

TABLE 5. Summary of predictor variables for changes in voluntary days of physical activity per week.

	β	*t*	*p*	95% Confidence Interval
After-school care group (n = 103)				
Model 1				
Δ Physical appearance	.305	2.66	.009	.049 to .183
Δ Physical self-concept	.264	2.64	.010	.29 to .203
Δ Exercise self-efficacy	.134	1.32	.189	-.018 to .091
Model 2				
Δ Physical appearance	.327	3.45	.001	.053 to .197
Δ Physical self-concept	.260	2.58	.011	.026 to .202
Δ Exercise self-efficacy	.154	1.46	.148	-.015 to .099
Δ General self	-.067	-.675	.501	-.117 to .058
PE group (*n* = 48)				
Model 1				
Δ Physical appearance	.480	4.27	<.001	.137 to .382
Δ Physical self-concept	.458	4.29	<.001	.115 to .319
Δ Exercise self-efficacy	-.032	-.29	.776	-.064 to .048
Model 2				
Δ Physical appearance	.201	1.86	.070	-.009 to .226
Δ Physical self-concept	.444	5.10	<.001	.127 to .293
Δ Exercise self-efficacy	-.345	-3.12	.003	-.143 to -.031
Δ General self	.636	4.84	<.001	.157 to .381

Note. The delta symbol (Δ) denotes change in scores from baseline to Week 12. β denotes standardized beta. 95% Confidence Interval is based on unstandardized beta.

Discussion

This exploratory field investigation assessed changes over 12 weeks in measures of physiological, mood, and self-appraisal factors, and recalled physical activity associated with the Youth Fit For Life protocol administered to African American preadolescents in both after-school care and PE formats. Important markers of health risks, BMI and body fat, improved significantly across conditions, along with muscular strength. Contrasts of changes associated with maturation further suggested the positive effects of the treatment. Changes in flexibility were variable and may reflect minimal emphasis in the corresponding area. Endurance changes were consistently positive, but generally did not reach statistical significance. It was not clear whether the brief length of the treatment, or the curriculum itself, were related to the minimal (but consistent) improvements. It did not appear that administration of the protocol by PE specialists overcame the greater physiological improvements that an additional day per week enabled for the after-school care condition. Differences in favor of the after-school care condition were notable on strength for boys and on body composition for girls. The present findings

were favorable compared to interventions with similar age participants which typically found significant changes in physical activity, but not in body composition or BMI (Caballero *et al.*, 2003; Donnelly *et al.*, 1996; Luepker *et al.*, 1996; Trevino *et al.,* 2004).

As hypothesized, significant changes in mood and self-appraisal factors were found across conditions, with the PE group demonstrating significantly greater improvement in scores on Physical appearance, Physical self-concept, and General self. It appeared that physical activities delivered in a mastery-focused manner, and inclusion of an array of self-management and self-regulatory skills, were contributors. Possibly the expertise that the PE specialists possessed was an additional advantage in these areas. Additionally, changes in Physical appearance, Physical self-concept, and Exercise self-efficacy explained a substantial portion of the variance in increases in participants' days of voluntary physical activity per week. Based on the inconsistency of unique contributions to the variance in activity found by changes in general perceptions of the self, it was unclear whether this construct should be considered in extensions of this research.

Theoretical models which predict behavior through changes in perceptions of the self such as social cognitive and self-efficacy theory (Bandura, 1986, 1997), and related theories concerned with physical activity and management of body weight (e.g., Baker and Brownell, 2000), were supported. Based on suggestions emanating from the mediating variable framework (Baranowski *et al.*, 1998), results suggest that future physical activity interventions should also incorporate a mastery-focused environment with minimal social threat to the participant. Also, specific attention to the development of behavioral skills is suggested because the present intervention was associated with their improvement, increased voluntary exercise, and their interrelationship. Future research should test extensions of the present protocol for comparative effects on related psychological variables which may also have an association with increased, freely chosen physical activity time. Different ethnic groups, socioeconomic strata, and age groups should be considered to assess generalizability of findings.

Although limitations of this research were some self-selection for participation, possible expectation effects, and lack of a no-treatment control group, this field investigation had high external validity due to its use of applied settings which are common to preadolescents. Considerable consistency of results was found across applications within after-school care, and a PE environment of two sessions per week. To further extend this line of inquiry, the effects of additional formats for the Youth Fit For Life protocol are currently being evaluated in settings such as YMCA camps and with home-schooled children. Additional testing will also incorporate a component for involvement of the participants' caregivers. It is hoped that adequate administration of conveniently delivered, effective physical activity protocols will be possible in enough settings, using enough different types of instructors, that reductions in PE may be effectively countered and community health and childhood obesity may be positively impacted.

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