Physical Activity and Social Cognitive Theory Outcomes of an Internet-Enhanced Physical Activity Intervention for African American Female College Students

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Abstract

Background. African American women report low levels of physical activity (PA) and are disproportionately burdened by related chronic diseases. This pilot study tested a 6-month theory-based (Social Cognitive Theory, SCT) culturally-relevant website intervention to promote PA among African American female college students.

Materials and Methods. A single group pre-post test design (n=34) was used. PA and associated SCT constructs (outcome expectations, enjoyment, self-regulation, social support) were assessed at baseline, 3 months and 6 months.

Results. The sample was comprised of mostly obese (*M* BMI= 35.4, *SD*=6.82) young adults (*M* age= 21.21 years, *SD*=2.31). Fifty percent of the sample completed all assessments. Intent-to-treat analyses showed that participants reported a significant median improvement in moderate-to-vigorous physical activity from 82.5 minutes/week (*M*=81.76, *SD*=76.23) at baseline to 115.0 minutes/week (*M*=122.44,*SD*=97.93) at 3 months (*Wilcoxon z*=2.39, *p*=.02). However these gains appear to have attenuated by 6 months (Median= 82.5 minutes/week, *M*=96.73, *SD*=84.20; *Wilcoxon z*=1.02, *p*=.31). Significant increases from baseline to 6 months were found in self-regulation for PA *(p*=.02*)* and social support for PA from friends (*p*=.02). Changes in the SCT variables were not significantly associated with changes in PA; however, this may have been due to small sample size.

Conclusions. Future studies with larger samples and more aggressive retention strategies (e.g., more frequent incentives, prompts for website use) are needed to further explore the applicability of culturally relevant web-based approaches to promote PA in this at-risk population.

Keywords

Physical Activity; Exercise; Internet; Website; Social Cognitive Theory; African American Women

Cover Page Footnote

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ABSTRACT

Background. African American women report low levels of physical activity (PA) and are disproportionately burdened by related chronic diseases. This pilot study tested a 6-month theory-based (Social Cognitive Theory, SCT) culturally-relevant website intervention to promote PA among African American female college students.

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Conclusions. Future studies with larger samples and more aggressive retention strategies (e.g., more frequent incentives, prompts for website use) are needed to further explore the applicability of web-based approaches to promote PA in this at-risk population.

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INTRODUCTION

Physical activity has established benefits of preventing and treating many adverse health conditions such as heart disease, type II diabetes, osteoarthritis, osteoporosis, depression, and anxiety (American College of Sports Medicine, 2007; U.S. Department of Health and Human Services, 2008). Current guidelines recommend that adults engage in at least 150 minutes of weekly moderate-intensity aerobic physical activity and suggest that health benefits can be achieved in bouts as short as ten minutes (American College of Sports Medicine, 2007; U.S. Department of Health and Human Services, 2008). However, despite the overwhelming positive evidence for performing regular PA, many Americans, especially minority populations, do not engage in physical activity at recommended levels (Centers for Disease Control and Prevention, 2010).

African Americans report particularly low rates of physical activity. In fact, African American women are the least active demographic group, with only 36% meeting the physical activity recommendations (Centers for Disease Control and Prevention, 2010). This group also suffers disproportionally from health conditions associated with being insufficiently active (colon and breast cancers, type II diabetes, and cardiovascular disease) (U.S. Cancer Statistics Working Group, 2010). Thus, such health disparities call for innovative interventions specifically targeting this underserved population.

Internet-based physical activity interventions represent a potential high-reach, low-cost method to promote physical activity (Marcus et al., 2006) and have shown promise in past studies with predominantly White samples (Davies, Spence, Vandelanotte, Caperchione, & Mummery, 2012; van den Berg, Schoones, & Vliet Vlieland, 2007; Vandelanotte, Spathonis, Eakin, & Owen, 2007). However, little is known about the efficacy of these approaches among at-risk groups, such as African American women (Pekmezi & Jennings, 2009). Preliminary secondary data analyses support the use of web-based approaches to promoting physical activity in middle-aged African American adult women (Pekmezi et al., 2010); however, to our knowledge, no prospective studies have examined the efficacy of a web-based intervention specifically designed to promote physical activity among African American women.

The purpose of current study was to evaluate the physical activity and associated Social Cognitive Theory (SCT) outcomes of outcome expectations, enjoyment, social support, and self-regulation following an Internet-based pilot intervention promoting physical activity among young African American women. We hypothesized that participants would report significant increases in both physical activity and the SCT variables from baseline to six months and that enhancements in SCT constructs would be positively associated with increases in physical activity. Findings of the current study provide insight on the acceptability and feasibility of an Internet-enhanced approach designed specifically to promote physical activity among African American women.

METHODS

A single group pre-post test design study was used. Physical activity and associated SCT constructs were assessed via self-report at baseline, midpoint (3 months), and one week following the conclusion of the 6 month intervention.

Intervention Description

The physical activity promotion website used in the current study was a product of two formative research phases. In the first phase of the study's development, cognitive interviews and focus groups were conducted with the target population to identify web-based applications young African American women desire in an Internet-delivered physical activity program. Data

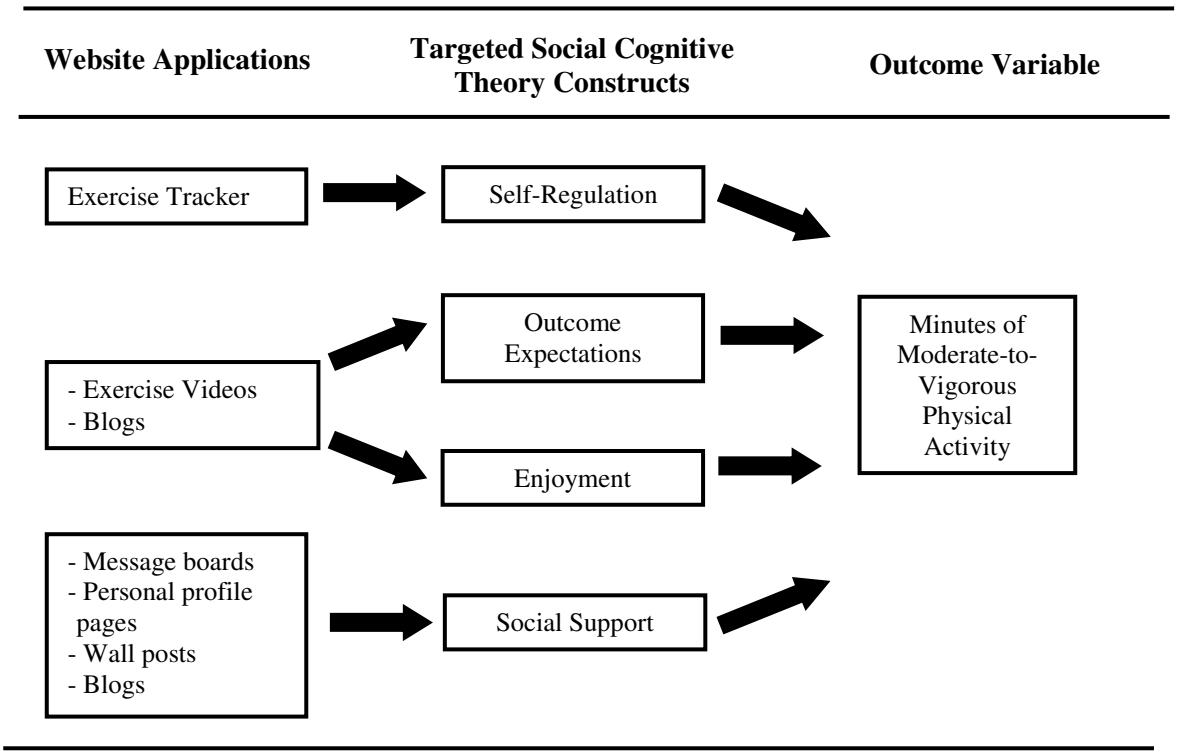
collected during this phase were used to inform development of the initial prototype of the study website. Table 1 illustrates the primary themes that emerged from this formative research phase and the major applications/features that were included on the study website to address these themes.

Table 1. Themes from qualitative assessments used inform website development.

Theme	Sample Participant Quote	Application included on Study Website
Personalization	I think kind of along the lines of the Facebook…Just give the people some kind of blog or some kind of newsfeed. Maybe not someone who *looks like you*; maybe just a picture *of you*. That way, maybe you would have a photo album saying "look at my success." You could put up what you feel like has helped you along the way—an area of inspiration.	Personalized home page with capability of uploading pictures and posting personal status updates
Desire for Diversity of Body Images	I would like someone with a little tire, some thighs. Just someone I could look at and say, "Maybe there *is* a little support system if they look like me." I feel automatically drawn to it. A little bit more of my guard is down. I would feel like I could actually identify with the people who are on there. Pictures of someone who looks like me. I don't want somebody *extra* skinny trying to teach me to do something that I can't get my body to do what they're doing…. I know a lot of time you see on TV or a video (and) they've got the lady and she's got her little sports bra and little shorts. I mean, I can't wear that to the gym! I want somebody that's got a t-shirt and sweat pants on like I'm going to wear! That's going to make me feel more comfortable.	Inclusion of a diversity of African American body type images throughout the website
Health and Beauty Applications	A health and beauty section. Just like makeup or if you drink more water, your skin will get clear… Something like hair salons in the area… more custom to the Black community. This is kind of far-fetch, but what about hair tips? I'm trying to work out now, and I'm finding that I can't keep a hairstyle. So maybe some hair care or hair tips. Yeah, you could put fashion tips on there too for your body shape. Something like, "this is the type of clothes that could flatter you" or something like that.	African American Hair Care Blogs Fashion Tip Blogs
Motivational Applications	I think that having a strong motivational section is very important. Motivation could be anything—photo albums with not just before and after pictures but also the "in-between pictures." I want to see the process. I think that would keep folks motivated.	Blogs to share progress Testimonial Blogs
Physical Activity/Exercise Instruction	…I just stick with what I know how to do and that may not work for the part of my body where I need to get rid of some things…I guess it goes back to insecurity. It's not worrying about the other people around me; it's being shameful about not knowing how to work the machinery. So, if you could have guidance or personal training or something like that. Maybe put some videos on there. Show me how to do what they just did; a little tutorial video so I can get my workout on. You could have a section where they show you how to do stuff at home. Something where you don't *have* to go to the gym.	Exercise demonstration videos Exercise tips for outside of gym (e.g. home)
Physical Activity Goal Setting and Tracking Applications	You could write down how much you need to do or what areas to focus on for a particular day in time. Maybe a BMI calculator. Something to record your progress. Like if you're looking for (aiming for) a particular goal. Having target goals like "where you are today" or "this is your target goal for today." Or if you don't log in for a couple of days, something like, "Well, since you missed your target day, this is your target *now*."	Exercise Tracker Goal setting applications BMI and calories burned calculator

In the second phase of study development, a 6 week feasibility assessment of the intervention was implemented. This phase consisted of participants utilizing the study website as a physical activity promotion tool, engaging in supervised moderate-intensity physical activity sessions, and participating in bi-weekly focus groups to provide feedback for website refinement. Data collected from this phase were used to finalize the website and study protocol implemented in the current study.

Figure 1. Conceptual model illustrating website applications and associated study outcomes.



The final version of the study website was grounded in the constructs of the SCT; a behavioral health theory that explains behavior in a triadic and reciprocal model, where the environment, an individual, and behavior itself continually interact to produce behavior (Bandura, 1986). The website platform allowed participants to access information on physical activity while interacting with other study participants similar to many popular social network sites (e.g., Facebook). Website applications specifically targeting physical activity included: a) personalized profile page, b) message boards and blogs, c) physical activity self-monitoring/tracking tools that allowed participants to record physical activity and view their progress, d) exercise videos, and e) personalized exercise plans tailored to the participants' specific goals. Figure 1 illustrates the major features of the study website and how they coincide with the specific SCT constructs they were designed to target. Additionally, participants were assigned website usage points according to frequency and duration of website usage. Thus, the more frequently they logged on the website and used the applications, the more points they accumulated. Table 2 shows how the website algorithm awarded points for website utilization and Table 3 illustrates how each of the website applications specifically target constructs of the SCT.

In addition to using the study website, participants were encouraged to attend four supervised exercise sessions (monitored by study staff) each week for the duration of the 6 month study. For these sessions, participants were encouraged to either walk the indoor track at the university recreation center or attend a cardiovascular-based group exercises (e.g., Zumba, cycling, etc). The purpose of the exercise sessions was to provide a supportive environment for participants to convene and achieve recommended physical activity levels.

Table 2. Overview of points awarded to participants for website utilization.

Website Activity	Assigned Point Value
Submitting workout on the activity tracker	10
Updating personal weight	10
Updating body measurements (waist, hips, thigh, etc.)	2
Updating personal profile status	5
Uploading a profile picture	50
Requesting to be friends with another user	1
Posting on another user's wall	2
Commenting on another user's wall post	1
Joining a group	2
Posting on a group's wall	2
Posting on a challenge's wall	2
Replying to a message board thread	2
Having other users reply to message board thread you created	2
Setting-up a personal blog	10
Commenting on an exercise, workout plan or diet plan	2

Table 3. Overview of the Application of the Social Cognitive Theory to Intervention Components.

Social Cognitive Theory Construct	Component associated with Web-based Program
Self-Efficacy	Social support from other participants participating in the program Observing other study participants participate in the program (via structure exercise sessions and website profiles)
Observational Learning	Exercise Videos
Outcome Expectations	Blog posts of young African American women providing personal testimonials on the benefits of being physical activity Videos of African American women performing physical activity
Self-Regulation	Exercise Tracker
Social Support	Message boards and blogs discussing and encouraging performance of physical activity Wall posts where participants post messages promoting physical activity
Behavioral Capability	Exercise Plans Exercise Videos Blogs

Participants

Participants recruited for the current study met the following inclusion criteria: a) between the ages of 19 and 30 years, b) a body mass index (BMI) $\geq$ 25 kg/m^2, c) self-identifying as African American, d) currently enrolled as a student at the university, and e) self-reported absence of a medical conditions that would inhibit or limit performance of physical activity. Exclusion criteria for the study included: a) participation in another physical activity, nutrition, or weight loss program, b) uncontrolled high blood pressure (>140/90 mm Hg), c) previous surgery for weight loss, d) currently on weight loss medications, or e) loss of >10 pounds in the three months before enrollment.

Procedure

Participants were recruited from the University of Alabama at Birmingham during the Spring 2011 semester. Sampling strategies included face-to-face recruitment by study staff at the university's student center, flyers placed around campus, and word-of-mouth referrals from potential participants exposed to recruitment efforts. Research staff contacted interested individuals via telephone for eligibility screening and eligible participants were scheduled for a baseline assessment.

The baseline assessment consisted of two study visits scheduled exactly one week apart. At the first visit, informed consent was obtained, demographic and psychosocial data were collected, and participants were given an accelerometer to wear for the next seven days. Seven days after the participant's initial visit, participants returned their accelerometer and completed the Seven Day Physical Activity Recall. Psychosocial and physical activity data were collected again at 3 month and 6 month assessments. Additionally, at the 6 month assessment, participants completed a satisfaction survey to evaluate their overall satisfaction with the study. Participants were eligible to receive a total of $150 for study participation. All study procedures were approved by the University's Institutional Review Board.

Measures

Physical Activity

The Seven Day Physical Activity Recall (7-Day PAR) (Sallis et al., 1985) was the primary measure used to assess physical activity. The 7-Day PAR is a semi-structured interview that assesses duration, intensity, and frequency of physical activity (Pereira et al., 1997). This instrument has been validated with more objective measures of physical activity such as doubly-labeled water (Washburn, Jacobsen, Sonko, Hill, & Donnelly, 2003), physical activity logs (Dishman & Steinhardt, 1988), and accelerometers (Marcus et al., 2007; Richardson, Ainsworth, Jacobs, & Leon, 2001; Sallis et al., 1985).

To corroborate self-report physical activity findings, participants were asked to wear ActiGraph accelerometers for a seven day period at both baseline and six months (overlapping with the days assessed by the 7-Day PAR). The ActiGraph measures both movement and intensity of activity and has been validated to provide an accurate estimate of physical activity when compared to doubly labeled water (Plasqui & Westerterp, 2007) and room calorimeter (Rothney, Schaefer, Neumann, Choi, & Chen, 2008). In the current study, correlations between accelerometer measured and self-reported physical activity (Spearman's rho) were .04 (p=.85) and .67 (p=.04) at baseline and six months, respectively.

Psychosocial Measures

Outcome Expectations. The 9-item, Outcome Expectation Scale for Exercise (Resnick, Zimmerman, Orwig, Furstenberg, & Magaziner, 2000) asks respondents to rate their level of agreement with statements regarding exercise (e.g., "Exercise helps me feel less tired"). This scale has been previously validated in African American populations (Resnick, Luisi, Vogel, &

Junaleepa, 2004) and had reliability estimates (Cronbach's alpha) ranging from .85 to .88 in the current study.

Physical Activity Enjoyment. The Physical Activity Enjoyment Scale (Kendzierski & DeCarlo, 1991) consists of 18 items in which participants indicate their level of agreement with statements such as "I enjoy exercise" using a 7 point Likert-like scale. This scale has established test-retest validity, with correlation coefficients ranging from .60 and .93 (Kendzierski & DeCarlo, 1991), and demonstrated Cronbach's alpha coefficients ranging from .87 to .94 in the current study.

Social Support. The Social Support for Exercise Survey (Sallis, Grossman, Pinski, Patterson, & Nader, 1987) measured social influences associated with performance of physical activity. This 10-item questionnaire asks participants to rate their level of agreement using a 5-point Likert-like scale with 10 statements regarding how often their family and friends provide support for exercise. The Social Support for Exercise Survey has demonstrated adequate test-retest reliability (.79 and .77 for the family and friends scales respectively, $p<.0001$) (Sallis et al., 1987) and had internal consistency estimates (Cronbach's alpha) ranging from .84 to .95 in the present study.

Self-regulation. The Self-Regulation Scale (Anderson, Winett, Wojcik, & Williams, 2010) asks respondents how often in the past month they have performed certain tasks or strategies to increase physical activity levels (e.g., "In the past month how often did you take the stairs instead of the elevator?"). This 10-item scale has been previously validated (Anderson et al., 2010; Anderson, Wojcik, Winett, & Williams, 2006) and demonstrated internal consistency estimates (Cronbach's alpha) of .56, .77, and .77 at the baseline, 3 month, and 6 month assessments.

Website Utilization

Website utilization was assessed using an algorithm employed by the website. This algorithm tracked each time a participant logged onto the study website and awarded points to participants based on the number/ type of applications used (see Table 2). Accordingly, the more frequently participants logged onto the website and used the available applications (i.e., entered physical activity into exercise tracker, posted a blog, watched exercise videos, etc), the higher the number of points they accumulated over the duration of the study.

Website Satisfaction and Self-Reported Website Usage

At the conclusion of the intervention, participants completed a satisfaction survey evaluating their overall experience with the study website. This measure was developed specifically for the current study and covered various topics including frequency of website usage, helpfulness of website, preferred website applications, and overall satisfaction with the study website.

Statistical Analyses

Normality of the data was assessed using box-plots, histograms, and QQplots. Despite the small sample size, all of the SCT variables met assumptions for normality. Paired t-tests were used to assess pre-post changes in the SCT constructs from baseline to 6 months. Preliminary tests showed that physical activity data were positively skewed and did not meet assumptions of normality. Accordingly, Wilcoxon signed rank tests were used to assess pre-post changes in self-reported physical activity outcomes. Bivariate regression analyses were used to assess whether changes in the SCT constructs were associated with changes in physical activity among study completers. Self-reported physical activity was corroborated with accelerometer measured physical activity via correlation analyses.

Both intent-to-treat and complete case analyses were performed. Complete case analyses used only data from participants who provided complete physical activity and psychosocial data at all three assessment periods (baseline, 3 months, and 6 months). For Intent-to-treat analyses, baseline observations were carried forward in the case of missing data at follow-up assessments. Results from the intent-to-treat and complete case analyses showed similar findings; therefore, only results from the more conservative intent-to-treat analyses are discussed in the Results; however, outcomes from the complete case analyses are available in Tables 5, 6 and 7. Statistical significance was set at $p \leq .05$.

RESULTS

Recruitment and Baseline Characteristics

Seventy-two African American females expressed interest in the study and were accordingly screened for study eligibility. Of these, 54 were considered eligible and 38 provided informed consent for study participation (recruitment rate of 47%). However, 4 consented participants withdrew from the study prior to providing full-baseline data; leaving a baseline sample size of 34.

The African American women enrolled in the study (N=34) were mostly obese (mean BMI of 35.37, *SD*=6.82) and had a mean age of 21.21 years (*SD*=2.31). Additionally, the majority were undergraduate students who had never married. Complete baseline demographic characteristics of the study participants are shown in Table 4.

Table 4. Demographic characteristics of participants at baseline (N=34).

Variable	Mean	SD
Age (years)	21.21	2.30
BMI	35.37	6.82
	N	**Percent**
Marital Status		
Married	1	2.9
Divorced	1	2.9
Never Married	31	91.2
No Answer	1	2.9
Degree Currently Obtaining		
Undergraduate	31	91.2
Masters	1	2.9
PhD	1	2.9
RN	1	2.9
Current Year in School		
First Year	2	5.9
Second Year	9	26.5
Third Year	8	23.5
Fourth Year	9	26.5
Fifth Year	6	17.6

At the conclusion of the 6 month study, 17 of the 34 participants provided follow-up data (50% retention). Two of the 17 participants providing 6 month data did not provide 3 month data; therefore, only 15 participants were considered study completers (providing data at all assessment periods). Reasons for study withdrawal included: lack of time to participate in the study (n=11), lack of study enjoyment (n=1), loss of participant contact (n=4), and relocation of state (n=1). Accordingly, the analytic sample sizes for the intent-to-treat and complete case analyses were 34 and 15, respectively.

Changes in Social Cognitive Theory Variables

Intent-to-treat analyses showed significant increases in both self-regulation (p=.02) and social support from friends (p=.02) from baseline to 6 months. Similar improvements in these variables were found from baseline to 3 months (p=.001 and p=.16, respectively). No changes in outcome expectations, social support from family, or enjoyment were observed over the duration of the study. Complete case analyses showed comparable outcomes to the intent-to-treat analyses. Table 5 shows changes in the SCT variables over the duration of the study.

Table 5. Changes in Social Cognitive Theory variables.

Variable	Baseline to Midpoint Mean Change (SD)	*t*	*p*	Baseline to 6 Months Mean Change (SD)	*t*	*p*
Outcome Expectations						
Complete case	-.08 (.25)	-1.24	.23	-.07 (.26)	-1.09	.30
Intent-to-treat	-.01 (.22)	-.33	.75	-.03 (.23)	-.88	.38
Self-Regulation						
Complete case	.60 (.70)	3.30	.005	.28 (.61)	1.79	.10
Intent-to-treat	.36 (.64)	3.31	.002	.24 (.56)	2.48	.02
Enjoyment						
Complete case	-.21 (.72)	-1.12	.28	.01 (.62)	.04	.97
Intent-to-treat	-.06 (.51)	-.65	.52	.10 (.57)	.99	.33
Social Support Family						
Complete case	-.10 (.84)	-.37	.66	-.03 (.68)	-.18	.86
Intent-to-treat	.00 (.58)	.003	.99	.04 (.50)	.43	.67
Social Support Friends						
Complete case	.30 (.91)	.84	.26	.40 (.60)	2.60	.02
Intent-to-treat	.17 (.70)	1.44	.16	.22 (.51)	2.55	.02

Changes in Self-Report Physical Activity

Intent-to-treat analyses showed that participants reported a significant median improvement in moderate-to-vigorous physical activity from 82.5 minutes/week (M=81.76, SD=76.23) at baseline to 115.0 minutes/week (M=122.44,SD=97.93) at 3 months (*Wilcoxon* z=2.39, p=.02). However these gains appear to have attenuated by 6 months (Median= 82.5 minutes/week, M=96.73, SD=84.20; *Wilcoxon* z=1.02, p=.31). Complete case analyses showed similar physical activity trends. Tables 6 and 7 illustrate changes in self-reported physical activity.

Table 6. Mean changes in self-reported physical activity levels.

	Mean (SD)			Mean (SD) Difference	
	Baseline	3 Months	6 Months	Base to 3 months	Base to 6 months
Intent-to-treat (N=34)	81.76 (76.23)	122.44 (97.93)	95.73 (84.20)	40.68 (93.89)	13.97 (10.84)
Complete Case (N=15)	111.00 (88.87)	184.93 (96.56)	136.00 (97.70)	73.93 (125.28)	25.00 (93.21)

Table 7. Median changes in self-reported physical activity.

	Median (range)			Median Change			
				Base to 3 months		Base to 6 months	
	Baseline	3 Months	6 Months	*Z*	*p**	*Z*	*p**
Intent-to-treat (N=34)	82.5 (0 -240.0)	115.0 (0 – 360.0)	82.5 (0 – 230.0)	2.39	.02	1.02	.31
Complete Case (N=15)	100.0 (0 – 240.0)	185.0 (20.0 – 360.0)	95.0 (25.0 – 320.0)	2.05	.04	.68	.50

Note: **P-values based on Wilcoxon signed rank tests.*

Accelerometer data were analyzed and indicated that participants over-reported physical activity (Table 8). However, both assessment measures showed positive increases in physical activity; providing promising findings for the interventions' impact on physical activity.

Associations between changes in the Physical Activity and Social Cognitive Theory Variables

No associations were found between the baseline to 6 month changes in self-reported physical activity and changes in SCT constructs among study completers; including self-regulation of physical activity (ß=.24, *p*=.19) or social support from friends (ß =.18, *p*= .31).

Website Utilization

Analytic tracking software indicated participants logged onto the study website a total of 1,570 times over the 6 month study and spent an average of five minutes and twenty-seven seconds on the website each visit. The median number of website usage points for all participants was 56.00 (range = 0 - 1726). Among the 15 participants that completed the study, the median number was website usage points was 130.00 (range = 10.00 – 1726.00).

Table 8. Correlations (Spearman) between self-reported and accelerometer measured physical activity.

	N	Self-Reported Physical Activity[a] Mean (SD)	Accelerometer Measured Physical Activity[b] Mean (SD)	Correlation	p-value
Baseline					
Total Sample	29	81.76 (76.28)	51.52 (46.14)	.04	.85
Completers	14	118.93 (86.56)	36.00 (40.00)	.59	.03
Six month					
Completers	10	165.00 (94.64)	66.80 (47.33)	.67	.04

Note: Only participants with valid accelerometry data are presented. Mean values are minutes of physical activity per week. [a]Seven Day Physical Activity Recall. [b]Accelerometer measured physical activity performed in ten minute bouts.

Website Satisfaction and Self-reported Website Usage

Among study completers (n=15), 48% reported being "satisfied" or "very satisfied" with the study website and 53% said they were "somewhat satisfied." Sixty-percent of participants identified the study website as "helpful" or "very helpful" for promoting physical activity and 60% identified the features/applications on the website as "enjoyable" or "very enjoyable" to use. Most importantly, 87% of participants reported they would recommend the website to a friend.

The majority of participants (67%) self-reported logging on the study website at least one time per week for the duration of the study. Specifically, 33% reported logging onto the website 1 time per week, 20% said they logged on the website 2-3 times per week, and 13.3% reported logging on 4-6 times per week. The remaining 33% of participants reported logging on the study website less than 1 time per week. Participants self-reported the exercise tracker application as the most frequently used feature on the study website, followed by the exercise videos, and message board forums.

DISCUSSION

African American women report low levels of physical activity and are disproportionately burdened by health conditions associated with being insufficiently active. Internet-based approaches represent a potential method to intervene and help resolve these physical activity-related health disparities. This approach may be especially useful among young adults, since 95% of Americans between 18-29 use the Internet on a daily basis (Pew Internet & American Life Project, 2013). The purpose of the current study was to evaluate the physical activity and associated SCT outcomes of an Internet-based approach designed specifically to promote physical activity among young African American females.

Participants reported a significant increase in physical activity from baseline to 3 months; however, physical activity subsequently regressed back to baseline levels at the 6 month assessment. This initial increase and subsequent decline in physical activity parallels activity trends reported in other longer-term physical activity interventions (Carr et al., 2012; Glasgow et al., 2012; Marcus et al., 2007). Future studies should investigate potential strategies to preserve initial physical activity improvements. Examples of such strategies may include booster contacts after the initial first few months, providing individually-tailored website-delivered messages, sending frequent email/text messages to encourage performance of physical activity, and providing additional monetary or tangible incentives for achieving certain participation benchmarks.

Social support from friends and self-regulation for physical activity significantly increased over the course of the study. The promising social support finding suggests that the web-based social networking components (i.e. message boards, blogs) may have been beneficial in fostering social support for physical activity. Improvements in self-regulation potentially indicate that the self-monitoring tools available on the website, such as the exercise tracker, were effective in promoting physical activity related self-regulatory processes. The lack of association between the increases in SCT constructs and changes in physical activity over the duration of the study may be due to these constructs being less salient factors influencing participation of physical activity among this population of young African American women or due to lack of power due to the study's small sample size.

The non-significant change in social support from family was not surprising given the study did not include any family-level or family-focused components. However, study completers (compared to non-completers) demonstrated higher levels of social support from family at baseline (p=.04), which provides an interesting point to consider. Perhaps, if the current web-based study included family-focused components, the attrition would have been lower. Furthermore, given the breadth of research suggesting that African American women have a prominent caregiver role in the family that influences their available time to participate in physical activity (Bopp et al., 2007; Richter, Wilcox, Greaney, Henderson, & Ainsworth, 2002; Wilcox, Richter, Henderson, Greaney, & Ainsworth, 2002), incorporation of family-based components in web-based efforts may be effective in promoting physical activity in this

population. Potential strategies for future research may include allowing family members to access the study website and adding blogs to the website on how to balance family commitments with performing physical activity.

The SCT constructs of outcome expectations and enjoyment of physical activity did not change over the duration of the study. These findings were somewhat surprising given that several other studies have shown positive outcomes for enhancing these variables through their physical activity interventions efforts (Bopp et al., 2009; Papandonatos et al., 2012; Williams, Anderson, & Winett, 2005). However, participants in the current study reported relatively high initial levels of these constructs, potentially indicating a ceiling effect that allowed little room for improvement over time. The possibility also exists that these measures, while frequently used among African American populations, were not sensitive enough to pick-up on cultural intricacies associated with performance of physical activity among young African American women. For example, researchers have shown that some African American women avoid physical activity due to the fear that it will lead to an unattractive body shape (Mabry et al., 2003; Sanderson, Littleton, & Pulley, 2002; Young, He, Harris, & Mabry, 2002) and/or negatively impact their hair styles (Boyington et al., 2008; Im et al., 2012; Siddiqi et al., 2011). However, these items (or similar) were not addressed by the outcome expectations scale for exercise; providing a possible explanation of why no changes in these variable were observed. Future studies may consider exploring the cultural adaptation of these measures. An additional explanation for lack of change in these variables could be that the web-based intervention did not sufficiently impact these constructs. Given the fact that past studies have shown these variables to be important in increasing physical activity (Bopp et al., 2009; Papandonatos et al., 2012), future researchers in this area should consider how to better address these important theoretical constructs in their Internet-based approaches promoting physical activity among young African American women.

Correlation analyses comparing self-reported and accelerometer measured physical activity indicated that participants over-reported physical activity at both baseline and 6 months. These findings are not unique to the current study, as over-reporting of physical activity is frequently observed in the literature (LeBlanc & Janssen, 2010; Marcus et al., 2006; Sallis & Saelens, 2000). However, despite the issue in the current study, both assessment measures (7-Day PAR and accelerometers) showed positive increases in moderate-to-vigorous intensity physical activity. Future studies should explore strategies to help remedy the over-reporting of physical activity. One potential strategy may include having participants exercise at a moderate-intensity level prior to completing a subjective physical activity assessment, which would provide a point of reference for participants to appropriately gauge the intensity and duration of their physical activity.

Among study completers, overall satisfaction with the Internet-based component of the study was favorable. Eighty-seven percent of participants indicated they would recommend the website to a friend and the majority reported the website as “helpful” to “very helpful” for promoting physical activity and “enjoyable” to “very enjoyable” to use. However, these positive findings should be interpreted with caution as these were the views of only participants who completed the study.

The current study has several strengths. First, this study was one of few examining the effects of an Internet-based approach to promote of physical activity among African American women. This sample of college-aged women is of particular interest because they report high levels of Internet use (Pew Internet and American Life Project, 2013; Smith, 2010) and sharp declines in physical activity (Caspersen, Pereira, & Curran, 2000; Centers for Disease Control

and Prevention, 2010). Other strengths of the study include the grounding of the intervention in behavioral theory, the 6 month duration of the study (as many web-based physical activity interventions are shorter in duration), and the inclusion of both subjective and objective methods for assessing physical activity.

This study is not without limitations. Lack of a control or comparison group hinders causal inferences and does not control for various threats to internal validity such as maturation or secular trends. Therefore, the observed improvements in physical activity, social support, and self-regulation may have been influenced by external forces and not by the intervention itself. Additionally, the web-based component of the study was paired with supervised moderate-intensity exercise sessions, which makes it difficult attribute study outcomes solely to the web-based activities. Therefore, we suggest that the study be viewed as a total physical activity promotion program. However, despite these study design limitations, the overarching purpose of the study was to assess the acceptability and feasibility of an Internet-based approach to promoting physical activity among young African American women; for which the study design was appropriate.

A second limitation was the use of a convenience sample of university students. Therefore, we cannot generalize our findings to other African American female populations (i.e., those not enrolled in college or older African American women). Furthermore, since we provided participants $150 for study participation, we may have inadvertently recruited women from predominately socioeconomically disadvantaged backgrounds, which may also limit generalizability of our sample. However, the compensation provided in the current study is comparable to monetary incentives provided in other 6 month physical activity interventions (Carroll et al., 2010; Franko et al., 2008).

Other limitations include the study's small sample size and high attrition rate. The 50% attrition rate observed in the current study is higher than other web-based physical activity studies focusing on college students (others have ranged from 11% to 28%) (Gow, Trace, & Mazzeo, 2010; Grim, Hortz, & Petosa, 2011; Magoc, Tomaka, & Bridges-Arzaga, 2011; Wadsworth & Hallam, 2010) and higher than the mean attrition rate (22%) found in a recent review on Internet-based physical activity interventions (Joseph, Durant, Benitez, & Pekmezi, In press). However, to our knowledge, no other web-based studies have incorporated supervised exercise sessions into their intervention efforts or exclusively focused on an African American sample; both of these factors likely contributed the high attrition in the current study. For example, previous research has shown that high attrition is a common problem among physical activity interventions targeting African American women (Banks-Wallace & Conn, 2002; Bopp et al., 2009; 2009; 2009; Wilbur et al., 2006). Further, study staff with frequent participant contact indicated that many participants expressed that the supervised exercise sessions were too demanding and/or not convenient with their school and personal schedules. This anecdotal evidence provided by study staff corroborates with the primary reason of study withdrawal, which was "lack of time" to participate in the study. Thus, future studies utilizing a similar study design with this study population may consider incorporating less stringent supervised exercise protocols (i.e., allowing participants to attend 2 supervised walking sessions and exercise 2 days on their own).

Future studies should also focus efforts on innovative strategies to recruit and retain participants. Previous research suggests that increasing monetary incentives and providing other tangible items (prizes/merchandise) to reward achievement and acknowledge progress throughout an intervention may improve retention (Marteau, Ashcroft, & Oliver, 2009; Sutherland, Christianson, & Leatherman, 2008; Volpp et al., 2008). In the current study,

participants received a total of $150 that was distributed incrementally at 3 different time periods (which equates to $25 per month for study participation). However, participants reported they felt the $150 incentive was not adequate due to the time commitment required by the study's supervised exercise sessions. Perhaps providing participant incentives on a more frequent basis (i.e., monthly) and/or slightly increasing compensation would have improved retention, as many college students report financial strains while attending college (Nelson, Lust, Story, & Ehlinger, 2008; Vázquez, Otero, & Díaz, 2012).

CONCLUSION

Participants reported promising increases in physical activity, social support, and self-regulation for physical activity over the duration of the study. These findings, in conjunction with self-reported website usage, indicate that perhaps the most beneficial applications available on the website for promoting physical activity were the exercise tracker/self-monitoring applications and the blog/message board applications; as these website features were designed to specifically target the SCT constructs of self-regulation and social support and were the most frequently used (self-reported) applications on the website.

The short-lived increases in physical activity, high attrition, and the lack of association between positive changes in the SCT constructs and physical activity were somewhat surprising, and deserve further attention in future research. To the authors' knowledge, no other web-based approaches have been developed and/or culturally-adapted to specifically meet the needs of young African American women. Findings from the current study provide some preliminary support for the use of a web-based approach to promoting physical activity among young African American women. Future studies with randomized controlled designs and larger samples are needed to further evaluate the efficacy of culturally-relevant Internet-based approaches to promoting physical activity among African American women.

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