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Vigorous physical activity among college students: using the health belief model to assess involvement and social support

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Objectives: The purpose of this study is to examine college students' perceived benefits, barriers, cues to action, and extent of involvement in vigorous physical activity. ***Methods:*** A convenience sample of 480 participants (92% response rate) was surveyed at a Midwestern university. Valid and reliable subscales were developed for the 21-item questionnaire. Analyses were conducted to examine whether benefits, barriers, cues, and vigorous physical activity involvement differed significantly based on sex, grade level, parental exercise patterns, parental encouragement, peer exercise patterns, and peer encouragement. ***Results:*** Results indicated that participants' involvement in vigorous physical activity averaged 2.36 days per week. Parent and peer involvement in and encouragement of vigorous physical activity significantly affected the number of perceived benefits, barriers, cues and involvement in vigorous physical activity. Results showed significant correlations between the number of perceived benefits, barriers, cues to action, and the extent of involvement in vigorous physical activity. ***Conclusions:*** The number of perceived benefits and cues to exercise was associated with higher vigorous physical activity involvement, while the number of perceived barriers was associated with lower vigorous physical activity involvement. Such results should be considered when developing and implementing strategies aimed at increasing vigorous physical activity among students.

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INTRODUCTION

In the last 30 years, a dramatic increase in obesity in the United States has been seen (1, 2). Since 1980, adult obesity rates have doubled, and childhood obesity rates have tripled (3). While the obesity epidemic is national in its scope, the problem is especially evident among college students. Bowman and colleagues (4) reported that between 1991 and 1999 the greatest rise in obesity occurred in the college population. On an average, weight gain among college students was greater than that of the general population over the same time frame (5). The 2007 American College Health Association-National College Health Assessment results indicated that of the students surveyed, 23% were overweight and 13.7% were obese (6). Regarding sex differences, research has found that males are significantly more likely to be obese than females (7). This trend continues beyond college as those students who are obese or develop obesity during the college years are at increased risk for continued obesity throughout adulthood (8, 9). This is a significant problem, since obese individuals are also at increased risk for the many health problems related to obesity, such as heart disease, diabetes, and some cancers (10, 11).

Obesity has physical, psychological, and social consequences (12). Regarding physical consequences, major health organizations have come to an understanding that obesity is linked to serious medical conditions including high blood pressure, high cholesterol, diabetes mellitus, heart disease, stroke, gallbladder disease, arthritis, sleep disturbances, breathing problems and cancer (13, 14, 15). Although obesity has serious physical consequences, the psychological effects are equally problematic. The U.S. Department of Health and Human Services (16) stated that American society's emphasis on the

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perception that slimness equals attractiveness communicates negative messages to overweight individuals that can result in emotional suffering. Aside from the physical and psychological consequences, obesity creates significant social consequences as obese individuals experience discrimination, prejudice and emotional hardship in social situations (16, 17). Due to the stigma associated with obesity, overweight individuals frequently deal with depression, shame, and feelings of rejection (17).

As government agencies recognize the health risks and potential physical, psychological, and social consequences, attempts are being made to address the problem through preventive strategies (18). Research has found several strategies to effectively reduce and prevent obesity. One behavioral strategy is engaging in regular physical activity (18, 19). Numerous physical and mental benefits are linked to physical activity (20, 21). The physical benefits include weight control; reduced risk of heart disease, type 2 diabetes, and some cancers; improved bone health; stronger muscles; improved ability to perform daily activities, and increased life span. The American Heart Association (22) cites additional physical health benefits such as improved blood cholesterol levels, reduced blood pressure, increased energy levels, and improved sleep patterns. Along with the physical benefits associated with regular physical activity, there are also several mental health benefits. Such mental health benefits include decreased tension and stress, improved body image, improved mood, reduced anxiety and depression, and increased enthusiasm and optimism (20, 21, 22).

Despite the known benefits of physical activity, the American College Health Association-National College Health Assessment (23) reported that there has been little progress made in increasing physical activity among college students. Over half of college students do not meet the recommended guidelines for physical activity (24). One study of vigorous physical activity (VPA) found 56% of the college freshmen who had been vigorously active during their senior year of high school were no longer engaging in vigorous amounts of physical activity (25). Among college students, vigorous physical activity is associated with positive health benefits including lower resting heart rate, higher HDL levels and lower fasting blood glucose (26). Overall, vigorous physical activity tends to decline from adolescence to adulthood (27). As research has shown that exercise behaviors adopted in college are likely to carry over into adulthood, it is important that more research be conducted in order to determine how to increase the physical activity levels of college students (28).

One model used to identify factors associated with health behaviors is the Health Belief Model (HBM) (29). The HBM has been used to predict health behaviors in various populations. The literature includes several examples of the HBM as it relates to exercise behaviors (30,31,32). Von Ah and colleagues (33) reported that perceived barriers have the most significant negative impact on college students' health behaviors, and that self-efficacy and perceived barriers are the two most significant factors that predict health behaviors. The authors concluded that health behaviors adopted in adolescence and young adulthood can have a strong impact on future health and risk of disease, which supports their findings on the importance of perceived barriers and self-efficacy in predicting health behaviors among college students. College students' physical activity behaviors appear to be influenced the most by those factors (33, 34, 35, 36). Therefore, research is needed to determine the specific benefits, barriers and perceived cues to students' involvement in vigorous physical activity (34, 35, 37).

Previous research has shown that both male and female college students indicate that a main reason for exercising is to improve physical appearance (34). Institutional, intrapersonal, and interpersonal factors are associated with a variety of barriers to physical activity among college students. Some of the main barriers are school workload, lack of sleep and motivation, social invitations during workout times, and unfamiliarity with the physical activity environment (35). Few cues to action for physical activity among college students have been identified; however, social support and organized intramural sports are thought to be two possible reasons students might choose to become active (34, 38). Nevertheless, sizeable gaps exist in the research. Additional research is clearly needed to more thoroughly understand the issue of physical activity and college students. Inadequate attention has been focused on physical activity patterns among college students, which limits the knowledge about their perceived benefits, barriers, and cues to action.

Research is needed to determine the current benefits, barriers and perceived cues to students' involvement in vigorous physical activity (34, 37, 39). Therefore, the present study will examine these three components of the HBM as they pertain to physical activity behaviors of college students. The HBM suggests that the number of perceived benefits, barriers, and cues help to predict specific behaviors (40). Thus, this study examines the relationship between these factors and involvement in VPA.

Table 1. Demographic and Background Characteristics of Participants

Characteristic	*n*	%
Sex		
Male	162	33.8
Female	318	66.2
Grade		
Freshman	246	51.4
Sophomore	109	22.8
Junior	64	13.4
Senior	45	9.4
Graduate Student	15	3.1
Race/Ethnicity		
African American	44	9.2
Asian	14	2.9
Hispanic	5	1.0
Multi-racial	18	3.8
White	393	82.2
Other	4	0.8
Member of an athletic team in high school	343	71.5
Member of a university team during 2008-2009 school year	32	6.7
Currently a member of a campus fraternity/sorority	43	9.0
Have at least one parent who engages in vigorous physical activity for at least 20 minutes 3 or more times a week	222	46.2
Have at least one friend who engages in vigorous physical activity for at least 20 minutes 3 or more times a week	416	86.8
Have at least one parent who encourages you to engage in vigorous physical activity	286	59.6
Have at least one friend who encourages you to engage in vigorous physical activity	300	62.5

N = 480; Percents refer to valid percents; missing values excluded.

MATERIAL AND METHODS

Participants

A convenience sample of 480 students from a Midwestern university served as the participants of this study (92% response rate). Participants were currently enrolled in a sample of seven general education courses. Participation was voluntary and no incentives were offered. Responses from the students were kept anonymous and confidential.

Instrumentation

A two-page, 21-item survey was developed to determine participants' involvement in vigorous physical activity and their perceived benefits, barriers, and cues to vigorous physical activity. Definitions for vigorous physical activity, moderate physical activity, and strength training activity were listed at the top of the first page of the survey instrument. The survey was divided into the following four sections: (a) The first section of the survey addressed involvement in physical activity. The first three questions asked participants to list the number of days during an average week that they participate in vigorous physical activity, moderate physical activity, and strength training. The fourth question provided a list of 14 activities and asked participants to check all of the activities they had performed in the last 30 days. (b) Section two included three questions addressing

perceived benefits, barriers and cues for VPA. The participants were asked to check all responses that applied from a list of 14 benefits, 15 barriers, and 15 cues to action to engaging in VPA. An "other" category was also included for all three questions. Each checked benefit (range 0 to 15), barrier (range 0 to 16), and cue (range 0 to 16) to engaging in vigorous physical activity received a score of 1, while each unchecked benefit, barrier, and cue received a score of 0. (c) Section three of the survey measured motivational factors to physical activity. Participants were requested to check all responses that applied among 23 motivational factors. Again, an "other" category was included. Each checked factor received a score of 1, while each unchecked factor received a score of 0, resulting in an overall potential range of 0 to 24. (d) The fourth section of the survey requested students to provide demographic and background information including sex, race/ethnicity, age, height, weight, grade level, athletic team involvement, university team involvement, parental/peer involvement in vigorous physical activity, and parental/peer encouragement of vigorous physical activity.

Validity and reliability of the survey were established using a variety of tests.

A panel of experts (n = 5) was used to establish face and content validity. The panel offered suggested revisions that were subsequently incorporated into the final instrument. Test-retest was used to ensure stability reliability. This test assessed the degree of association between survey items at two different points in time. A convenience sample of 27 students was used for the test-retest sample. Kendall's tau-b correlation coefficients were calculated to determine test-retest reliability for nonparametric sections of the survey and yielded the following: perceived benefits, .861; perceived barriers, .884; and perceived cues, .792.

Procedures

After the Institutional Review Board (IRB) granted approval, general education courses from the university's list of course offerings were randomly selected. Once permission was obtained from instructors, surveys were distributed to students during regular class time. A total of nine classes were surveyed, and a combined total of 521 students were in attendance of whom 480 completed the survey. Prior to the survey administration, the researcher explained the purpose of the study, the voluntary nature of the survey and confidentiality of responses, and the granting of their permission to be used in the study.

Statistical Analysis

All data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics (frequencies, means, standard deviations, ranges) were used to describe the demographic and background information. A series of one-way analyses of variance (ANOVAs) were computed to determine whether involvement in vigorous physical activity differed based on the number of perceived benefits, barriers and cues to this activity. Similarly ANOVAs were computed to examine whether involvement in vigorous physical activity differed based on sex, grade level, parental/peer VPA involvement, and parental/peer encouragement for VPA. An alpha level of .05 was established for determining significance.

RESULTS

Demographics

Of a total population of 480 students, most participants were female (66.2%) and white (82.2%) (Table 1). Grade levels included freshmen (51.4%), sophomores (22.8%), juniors (13.4%), seniors (9.4%), and graduate students (3.1%). Ages ranged from 17 to 29 (M = 19.68, SD = 1.756). Seventy-one percent of participants reported that they were members of an athletic team in high school. Only 6.7% reported that they were members of a university team. Most of the respondents (91.0%) reported that they were not members of a fraternity/sorority.

Participants were also asked about parent and friend involvement in and encouragement of vigorous physical activity. Forty-six percent of participants reported having at least one parent/guardian who engaged in VPA for at least 20 minutes three times a week. The majority of participants (86.8%) reported having at least one friend who engaged in vigorous physical activity for at least 20 minutes three times a week. Approximately 60% of participants reported having at least one parent/guardian who encouraged them to engage in VPA, and 62.5% reported having at least one friend who encouraged them to engage in vigorous physical activity.

Involvement in Physical Activity

Students were asked to report the number of days during an average week that they participated in the following: vigorous physical activity, moderate

Table 2. Perceived Benefits of Engaging in Vigorous Physical Activity

Activity	*n*	%
Improving health	408	85.0
Improving appearance	392	81.7
Maintaining a healthy weight	376	78.3
Losing weight	340	70.8
Improving fitness	332	69.2
Increasing strength	323	67.3
Reducing stress	322	67.1
Increasing energy	322	67.1
Improving self-esteem	289	60.2
Enjoyment/fun	255	53.1
Doing something active with others	198	41.2
Meeting new people (socializing)	130	27.1
Learning a new activity/sport	118	24.6
Increasing dating opportunities	70	14.6
Other	12	2.5

N = 480; Percents refer to valid percents; missing values excluded

physical activity, and strength training. The number of days for each activity ranged from 0 to 7. Students reported a mean of 2.34 days (SD = 1.883) for vigorous physical activity, a mean of 4.15 days (SD = 2.306) for moderate physical activity, and a mean of 1.46 days (SD =1.724) for strength training.

Participants were asked to report which types of physical activity they had performed in the last thirty days. Students were provided a list of 13 activities as well as an "other" option and could check all that applied. The top three activities that were reported were jogging/running (67.9%), brisk walking (66.9%), and free weights (41.7%). The lowest ranking activities included jumping rope (7.3%), kickboxing (4.2%), and spinning class (4.0%).

Perceived Benefits of Engaging in Vigorous Physical Activity

Students were instructed to check all appropriate responses based on what they perceived the benefits to be of engaging in VPA from a list of 14 potential benefits plus an option for "other." The top three benefits that students reported included improving health (85.0%), improving appearance (81.7%), and maintaining a healthy weight (78.3%) (Table 2). The least reported perceived benefits included meeting new people/socializing (27.1%), learning a new activity/sport (24.6%), and increasing dating opportunities (14.6%).

Perceived Barriers to Engaging in Vigorous Physical Activity

Students were instructed to check all responses that applied based on what they perceived were barriers to engaging in vigorous physical activity from a list of 15 potential barriers plus an option for "other." The top three perceived barriers included school workload (84.8%), lack of motivation (59.0%), and job (55.0%) (Table 3). The least reported barriers were lack of a place to exercise (7.5%), current health problems (6.9%), and other (1.9%).

Perceived Cues to Engaging in Vigorous Physical Activity

Students were instructed to check all appropriate responses based on perceived cues to action to engage in vigorous physical activity from a list of 15 potential cues plus an option for "other." The top three reported cues included wanting to look physically fit (82.7%), looking at myself in the mirror (56.9%), and having an exercise partner (54.6%) (Table 4). The least frequently reported cues included learning how to set up an exercise program (9.0%), other (4.2%), and receiving motivational email reminders to exercise (3.3%).

Students were also instructed to check all appropriate responses based on what they thought were

Table 3. Perceived Barriers to Engaging in Vigorous Physical Activity

Activity	*n*	%
School workload	407	84.8
Lack of motivation	283	59.0
Job	264	55.0
Lack of sleep	215	44.8
Want to do other things with my time	137	28.5
No exercise partner	123	25.6
Inactive friends	86	17.9
Do not enjoy exercising	84	17.5
Social invitations/parties	61	12.7
Too hung over to exercise	58	12.1
Lack of knowledge about how to exercise/workout	54	11.2
Embarrassed to exercise with others	40	8.3
Lack of a place to exercise	36	7.5
Current health problems	33	6.9
Other	9	1.9
Do not think exercising is important	5	1.0

N = 480; Percents refer to valid percents; missing values excluded

motivational factors for engaging in vigorous physical activity from a list of 24 items including an option for "other". Wanting to look physically fit (68.8%) was the top response, followed by having an exercise partner (68.5%), wanting to increase personal appearance (62.7%), having a friend who exercises (60.6%), and having better time management skills (50.0%). Watching people exercise on television (10.6%), watching exercise channels on television (10.2%), receiving motivational email reminders to exercise (7.3%), and other (2.1%) received the lowest response. Watching people exercise on television was defined as watching people perform exercise on television on any channel. On the other hand, watching exercise channels on television meant watching any form of physical activity being performed on exclusive exercise channels.

Number of Perceived Benefits of Engaging in Vigorous Physical Activity based on Sex, Grade Level, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

The results did show significant differences in the number of perceived benefits for engaging in vigorous physical activity based on sex ($p = .005$), with males perceiving there to be more benefits than females (Table 5). In addition, those who had at least one friend who encouraged vigorous physical activity ($p = .001$), and those who had at least one parent who encouraged vigorous physical activity ($p = .003$) perceived significantly more benefits to engaging in vigorous physical activity. Results indicated that the number of perceived benefits did not differ based on grade level or parental or peer involvement in vigorous physical activity.

Number of Perceived Barriers to Engaging in Vigorous Physical Activity based on Sex, Grade Level, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

Peer involvement in vigorous physical activity had the only significant effect ($p = .005$) on the number of perceived barriers to engaging in vigorous physical activity (Table 6). Results showed that those who had at least one friend who engaged in vigorous physical activity perceived significantly fewer barriers to engaging in vigorous physical activity. Results indicated that the number of perceived barriers did not differ based on grade level, sex, parent engagement in vigorous physical activity, parent encouragement of vigorous physical activity, or peer encouragement of vigorous physical activity.

Table 4. Perceived Cues to Engaging in Vigorous Physical Activity

Activity	*n*	%
Wanting to look physically fit	397	82.7
Looking at myself in the mirror	273	56.9
Having an exercise partner	262	54.6
Having a friend who exercises	250	52.1
Seeing spring/summer clothes you would like to buy (i.e., shorts, tank tops, bathing suits)	242	50.4
Being reminded of the health benefits of physical activity	201	41.9
Participating in competitive activities or fitness challenges	138	28.8
Seeing pictures of physically fit people in magazines, TV or on the Internet	132	27.5
Reading about exercise in magazines	81	16.9
Meeting people at recreation/fitness centers	71	14.8
Having a parent who exercises	55	11.5
Watching people exercise on television	55	11.5
Watching exercise channels on television	43	9.0
Learning how to set up an exercise program	43	9.0
Other	20	4.2
Receiving motivational email reminders to exercise	16	3.3

N = 480; Percents refer to valid percents; missing values excluded

Number of Cues to Engaging in Vigorous Physical Activity Based on Sex, Grade, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

Peer encouragement of vigorous physical activity (p = < .001), parent encouragement of vigorous physical activity (p = .001), peer involvement in vigorous physical activity (p = < .005), and parent involvement in vigorous physical activity (p = .006) all had significant positive effects on the number of perceived cues to engaging in vigorous physical activity (Table 7). The number of perceived cues did not differ based on grade level or sex.

Extent of Involvement in Vigorous Physical Activity Based on Sex, Grade, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

Results also showed that sex (p = <.001), parent involvement in VPA (p = <.001), parent encouragement of VPA (p = <.001), peer involvement in VPA (p = <.001), and peer encouragement of VPA (p = <.001) all had a significant effect on the extent of involvement in vigorous physical activity (Table 8). Regarding sex differences, males had a higher extent of involvement than did females. Parent and peer engagement in and encouragement of vigorous physical activity resulted in a significantly higher extent of involvement in vigorous physical activity.

Finally, results showed significant correlations between the number of benefits, barriers, and cues to vigorous physical activity and the extent of involvement in it. The more perceived benefits and cues there were to engaging in VPA, the higher the extent of involvement there was in it. Likewise, the more perceived barriers there were to engaging in VPA, the lower the extent of involvement there was in it.

DISCUSSION

Physical inactivity is a significant problem in the United States. The present study found that of the college students surveyed, 56% engaged in VPA two or fewer days a week. These findings concur with those of other studies in showing that college students

tend to be insufficiently active (23, 34). Such findings are particularly important, because exercise behaviors during college are strong predictors of exercise behaviors post-college (28). If students are inactive in college, it is likely that they will be just as inactive post-college, placing them at increased risk for obesity and related health problems.

Table 5. Number of Perceived Benefits to Engaging in Vigorous Physical Activity Based on Sex, Grade, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

Item	n	Number of Perceived Benefits *M (SD)*	*F*	*p*
Sex				
Male	162	8.65 (3.187)	7.920	.005
Female	318	7.82 (2.990)		
Grade				
Freshman/Sophomore	355	8.05 (3.101)	.260	.610
Junior/Senior/Grad	124	8.22 (3.038)		
Parent Involvement in VPA				
Yes	222	8.20 (3.053)	.437	.509
No	258	8.01 (3.106)		
Parent Encouragement of VPA				
Yes	286	8.44 (3.065)	8.905	.003
No	194	7.59 (3.039)		
Peer Involvement in VPA				
Yes	416	8.14 (3.063)	.745	.388
No	63	7.78 (3.180)		
Peer Encouragement of VPA				
Yes	300	8.45 (3.169)	10.876	.001
No	180	7.51 (2.835)		

Note: Number of perceived benefits ranged from 0-15, $M = 8.10$, $SD = 3.079$

The present study found that males were more likely than females to be engaged in vigorous physical activity. This is consistent with the professional literature, which found males are more likely than females to engage in physical activity (41). Future research studies should assess the specific reasons that female college students do not engage in VPA. Regarding prevention and intervention strategies, college health professionals should target females with education on the importance of vigorous physical activity. In addition, assessing current physical activity opportunities on campus and ensuring that females have multiple opportunities to participate in VPA may be an important step in increasing activity among female students. Creating and implementing programs specifically for females may also be warranted.

The present study did not find a significant difference in vigorous physical activity involvement based on grade level. These findings differ from previous studies including research conducted by Bridges and colleagues (34), which found that physical activity patterns of college students declined during their four years at school. One possible explanation for this difference is that the sample of the present study was largely comprised of underclassmen with 51% of participants self-reporting as freshmen. Thus, additional research in this area is warranted.

Parent and peer involvement in vigorous physical activity was associated with higher levels of VPA among college students. Similarly, parent and peer encouragement of VPA was associated with increased involvement in activity. Social support is an important correlate to overall health among university students (42). With this in mind, college health professionals should target social support as a method of increasing vigorous physical activity among students. Possible strategies could include encouraging parents to reach out to their child with healthy messages and encouraging their child to exercise with a friend. In the college setting, targeting peers may be a primary strategy to increasing activity among students. Having an exercise partner and having a friend to exercise with were found as important cues to action in this study. Offering group physical activity programs and opportunities, educating students on the benefits of exercising with a friend, and highlighting the social aspects of physical activity may yield increases in activity. Additional research is needed to evaluate such strategies.

The present study found that the participants' top three perceived benefits to engaging in vigorous physical activity were to improve health, improve appearance, and maintain a healthy weight. These differ slightly from previous findings which showed that improving appearance was the main benefit associated with exercising (34). Targeting perceived benefits may be

Table 6. Number of Perceived Barriers to Engaging in Vigorous Physical Activity Based on Sex, Grade, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

Item	n	Number of Perceived Barriers *M (SD)*	*F*	*p*
Sex				
Male	162	3.75 (2.094)	2.247	.135
Female	318	4.05 (2.000)		
Grade				
Freshman/Sophomore	355	3.96 (2.084)	.038	.846
Junior/Senior/Grad	124	3.92 (1.902)		
Parent Involvement in VPA				
Yes	222	3.94 (1.971)	.004	.949
No	258	3.95 (2.093)		
Parent Encouragement of VPA				
Yes	286	3.87 (2.066)	1.021	.313
No	194	4.06 (1.989)		
Peer Involvement in VPA				
Yes	416	3.84 (2.020)	8.110	.005
No	63	4.62 (2.019)		
Peer Encouragement of VPA				
Yes	300	3.84 (2.081)	2.256	.134
No	180	4.13 (1.949)		

Note: Number of perceived barriers ranged from 0-16, $M = 3.95$, $SD = 2.035$

a critical method of increasing college students' vigorous physical activity. Program planners should make a concerted effort to communicate the positive health benefits of activity and the importance of activity in maintaining a healthy weight. In addition, students reported learning a new activity/sport and increasing dating opportunities as the lowest benefits of vigorous physical activity. Interestingly, only 53% reported enjoyment/fun as a perceived benefit. One possible reason for this difference could be that the present study specifically examined vigorous activity, whereas previous studies just examined physical activity in general. It could be that vigorous activity is perceived to be less enjoyable than moderate forms of activity. Educating students on specific types of vigorous physical activity and offering opportunities to engage in multiple forms of this exercise may increase positive social norms toward vigorous physical activity.

Several variables were found to be positively correlated to perceived benefits of vigorous physical activity. In this study, males perceived a greater number of benefits than females to VPA. As part of any educational program, health professionals should stress the positive benefits of physical activity to female students. Perhaps males are more likely to engage in VPA since they perceive a greater number of benefits. Future research should examine this potential relationship.

The present study found that parent and peer engagement in and encouragement of vigorous physical activity was associated with greater perceived benefits to VPA. Previous studies of general physical activity found students perceived a greater number of benefits if parents and peers encouraged physical activity (38). In the college setting, it may be important to establish a supportive environment, which acknowledges the importance of VPA and encourages students to be regularly active. Building social support through peer activities and other campus events could similarly result in increased positive social norms and greater perceived benefits toward vigorous physical activity.

This study also examined perceived barriers to engaging in vigorous physical activity and found the top three barriers to be school workload, job and lack of motivation. A previous study conducted by Bray and colleagues (35) found similar results and cited lack of sleep, wanting to relax, lack of training partners, inactive friends, and social invitations as barriers to exercise. These issues were all identified as perceived barriers in the present study as well.

Table 7. Number of Perceived Cues to Engaging in Vigorous Physical Activity Based on Sex, Grade, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

Item	n	Number of Perceived Cues *M (SD)*	*F*	*p*
Sex				
Male	162	4.51 (2.769)	2.090	.149
Female	318	4.89 (2.673		
Grade				
Freshman/Sophomore	355	4.84 (2.780)	1.140	.286
Junior/Senior/Grad	124	4.54 (2.503)		
Parent Involvement in VPA				
Yes	222	5.13 (2.881)	7.544	.006
No	258	4.45 (2.515)		
Parent Encouragement of VPA				
Yes	286	5.11 (2.920)	11.797	.001
No	194	4.25 (2.277)		
Peer Involvement in VPA				
Yes	416	4.88 (2.728)	8.061	.005
No	63	3.86 (2.306)		
Peer Encouragement of VPA				
Yes	300	5.21 (2.950)	22.472	<.001
No	180	4.02 (2.055)		

Note: Number of perceived cues ranged from 0-16, $M = 4.76$, $SD = 2.709$

Interestingly, of all the variables assessed, the present study found that the number of perceived barriers to engaging in VPA differed only by peer engagement in vigorous physical activity. This result is worth noting since the HBM suggests that perceived benefits, barriers, and cues are important factors in predicting specific behaviors. Ebert and colleagues (33) reported that perceived barriers have the most significant negative impact on college students' health behaviors. The existence of such barriers lends itself to critical implications for future intervention strategies, especially since three previous programs did not implement strategies to specifically target barriers, and two of them yielded insignificant results regarding increasing college students' physical activity (43, 44, 45). Future programs should consider how to effectively overcome such barriers as a means to increase physical activity involvement.

The present study found the top cues to action included wanting to look physically fit, looking at myself in the mirror, having an exercise partner, and having a friend who exercises. Incorporating such cues into any physical activity program may be important to increasing this behavior among college students. Additionally, while the professional literature is somewhat lacking in information regarding perceived cues to engaging in physical activity, the present study found four variables that were significantly associated with perceiving a greater number of perceived cues to engaging in vigorous physical activity. The number of perceived cues was significantly higher for those who had parental and peer engagement in vigorous physical activity and parental and peer encouragement of vigorous physical activity. Similarly to other study findings, parents and peers appear to play a critical role in college students' engagement in VPA. Encouraging parents to extend positive messages about the importance of vigorous physical activity may increase the likelihood of a student engaging in this activity. Finally, incorporating peers in campus programs may increase program effectiveness and positively impact student behavior.

The lowest perceived cues were watching exercise on television, learning how to set up an exercise program, and receiving motivational email reminders to exercise. Not surprisingly, in one previous study that utilized emails and phone calls as follow-up strategies for 18 months, results indicated that the program did not have significant long-term effects on physical activity behaviors (43). Although this is a popular method of reaching many program participants, it appears this method may not be effective with college students.

In addition to examining college students' perceived

Table 8. Extent of Involvement in Vigorous Physical Activity Based on Sex, Grade, and Parent/Peer Involvement in and Encouragement of Vigorous Physical Activity

Item	n	Number of Perceived Cues *M (SD)*	*F*	*p*
Sex				
Male	161	2.93 (1.922)	24.327	<.001
Female	316	4.89 (2.673		
Grade				
Freshman/Sophomore	353	2.34 (1.878)	.001	.972
Junior/Senior/Grad	123	2.35 (1.912)		
Parent Involvement in VPA				
Yes	219	2.56 (1.867)	5.240	.006
No	258	2.16 (1.881)		
Parent Encouragement of VPA				
Yes	284	2.69 (1.907)	24.940	<.001
No	193	1.83 (1.730)		
Peer Involvement in VPA				
Yes	414	2.52 (1.862)	32.241	<.001
No	62	1.11 (1.527)		
Peer Encouragement of VPA				
Yes	300	2.62 (1.905)	17.568	<.001
No	177	1.88 (1.756)		

Note: Number of perceived cues ranged from 0-16, $M = 4.76$, $SD = 2.709$

benefits, barriers, and cues to engaging in vigorous physical activity, the present study also examined the relationship between the number of perceived benefits, barriers, and cues to action and involvement in vigorous physical activity. The results indicated that a higher number of perceived benefits and cues were associated with higher VPA involvement; whereas a higher number of perceived barriers was associated with lower VPA involvement.

One of the main critiques of previous studies regarding physical activity among college students has involved the use of weak intervention designs and the lack of theory-based programs. Bridges and colleagues (34) stated that the primary theoretical frameworks mentioned in previous studies are the social cognitive theory and the transtheoretical model. Based on such critiques and the present study's findings, it may be beneficial to use the HBM to help design future interventions. Developing interventions aimed at reducing barriers and increasing benefits and perceived cues may be effective in increasing vigorous physical activity among college students.

Limitations

The limitations of this study should be noted. First, this study was limited by the self-reporting accuracy of the participants, which may have resulted in some students offering socially desirable responses. Second, the sample was delimited to university students in a Midwestern university, and, therefore, results may not generalize to students located in other geographical areas. Third, physical activity measures are subjective in nature and may or may not correlate with participants' physical activity. Finally, since the study was cross-sectional, cause-and-effect relationships could not be determined.

CONCLUSIONS

When considering strategies to increase vigorous physical activity involvement, findings of the present study should be considered. Results of this research indicate that parent/peer involvement and social support are important factors to consider when designing intervention strategies for increasing college students' involvement in vigorous physical activity. Since college students likely spend more time among their peers due to living away from home and attending classes on campus, it may be more feasible to initially focus on this factor when designing programs. A multitude of strategies should be employed in order to educate individuals and to

effectively communicate clear health messages to the public.

This study found the HBM to be beneficial in exploring students' perceptions of and involvement in vigorous physical activity. Future research should also consider strategies for ensuring consistency among data collection and reporting measures for physical activity. One challenge associated with physical activity research is the inability to compare results of different studies due to the fact that inconsistent and subjective measures of physical activity have been used (34). The research regarding physical activity and the recommended amounts needed for health benefits have evolved in the last ten years. While experts have continued to provide new information in an effort to promote physical activity and quality health, there is still a great deal of confusion among the general population regarding sufficient physical activity levels. Additional research is needed to more fully explore these issues.

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