Published in final edited form as:
J Sch Health. 2010 March ; 80(3): . doi:10.1111/j.1746-1561.2009.00477.x.

Relationship between Frequency and Intensity of Physical Activity and Health Behaviors of Adolescents

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Abstract

Background—While studies have determined the importance of physical activity in advancing health outcomes, relatively few have explored the relationship between exercise and various health behaviors of adolescents. The purpose of this study was to examine the relationship between frequency and intensity of physical activity and both health risk and health promoting behaviors of adolescents.

Methods—Data were collected from 822 students attending a large, diverse suburban high school in northeast Florida using a self-administered survey. Multivariate analysis of variance (MANOVA) and analysis of variance (ANOVA) tests examined differences on mean health behavior measures on three exercise frequency levels (low, medium, and high) and two intensity levels (vigorous physical activity: VPA, and moderate physical activity: MPA).

Results—Results showed adolescents engaged in high levels of VPA used marijuana less frequently ($p=0.05$) and reported heavy use of marijuana less frequently ($p=0.03$); consumed greater amounts of healthy carbohydrates ($p<0.001$) and healthy fats in their diets ($p<0.001$); used stress management techniques more frequently ($p<0.001$); and reported a higher quality of sleep ($p=0.01$) than those engaged in low levels of VPA. Fewer differences were found on frequency of MPA and health behaviors of adolescents.

Conclusion—These findings suggest that adolescents who frequently participate in VPA may be less likely to engage in drug use, and more likely to participate in a number of health promoting behaviors. Longitudinal and experimental studies are needed to determine what role frequent VPA may play in the onset and maintenance of health enhancing and protecting behaviors among adolescent populations.

Keywords

Adolescent health; physical fitness; health behaviors

INTRODUCTION

Physical activity is well documented as a protective factor against many chronic diseases, such as coronary heart disease, hypertension, Type II diabetes mellitus, colon cancer, obesity, osteoporosis, and depression.[1,2] It is widely believed that the combined influence of physical activity with other health promoting behaviors further reduces the likelihood of developing these chronic diseases.[3] Lack of regular physical activity, smoking, and poor diet are the leading preventable causes of death and chronic disease in the United States.[4]

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However, the relationship between physical activity and other health behaviors is not yet fully understood.[5,6,7] These health behaviors are often established during adolescence, share common determinants, are related to similar health behavioral patterns in adulthood and are most beneficial to health outcomes when practiced throughout the lifespan of individuals.[8,9,10,11,12,13] Therefore, understanding the relationships among multiple health behaviors is critical, especially in adolescent populations.[14]

Investigators have recently expressed the need for further research regarding the feasibility and effectiveness of interventions promoting multiple behavioral health changes during adolescence.[7,15] An extensive understanding about the relationship of physical activity and other health behaviors among adolescents might provide invaluable information for the development of such interventions.[16] According to previous research, physical activity may be associated with the promotion of other health enhancing behaviors.[17,18] However, there is also seemingly contradictory evidence suggesting that being physically active or involved with sports is associated with health risk behaviors in adolescent populations.[5,19,20] Most studies examining the relationship between physical activity and other health behaviors have been limited to comparing physical activity to either one or a relatively small set of behaviors.[6,8,13,17] Such limitations in previous research reflect the need for studies that examine the relationship of physical activity across a broad range of both health risk and health promoting behaviors.

It has been demonstrated that the physiological benefits of physical activity are directly linked to the frequency, intensity, and duration of the physical activity performed.[2,14,21] Few studies, however, have examined the relationship between the intensity of physical activity (e.g., moderate or vigorous), as well as the frequency (number of times a week engaging in physical activity), on health.[5] Varying levels of physical exertion may help to explain the contradictory findings about the relationship between physical activity and other health habits.

This study examined the relationship between the frequency and intensity of physical activity and health behaviors of adolescents. Specifically, this study investigated associations among low, medium, and high frequency levels of both vigorous and moderate intensity physical activity and health risk behaviors including alcohol, cigarette, and marijuana use, and health promoting behaviors including nutrition, sleep, and stress management of high school aged adolescents. We hypothesized that adolescents participating in increasing frequency of both vigorous and moderate physical activity would be less likely to engage in health risk behaviors, and more likely to engage in health promoting behaviors.

METHODS

Subjects

Data were collected from a sample of 822 11th and 12th grade students attending an ethnically and socio-economically diverse suburban school in northeast Florida during fall 2005 and 2006. Participants were recruited in the classroom settings using formal presentations describing the study's aims, procedures, benefits, and risks. The mean age of participants was 17 years old (SD = 0.81). Females were slightly more represented (56%). Most students were White (45%), followed by African American (26%) and Hispanic youth (10%). The participant sample was similar to the overall student population in terms of racial and ethnic proportions; however the participants slightly over represented the general female population (56% vs. 48%). Less than a third (29%) of participants engaged in 0–1 times of moderate physical activity (MPA) during the past 7 days, compared to 37% of those who engaged in MPA 2–4 times a week, and 33% for 5 or more time a week. Approximately

one-third (33%) of participants reported 0–1 times of vigorous physical activity (VPA) during the past 7 days, with 40% reporting 2–4 times a week, and 27% reporting 5 or more days a week. With regard to health risk behaviors, 34% of the participants reported using alcohol, 15% reported using marijuana, and 13% reporting using cigarettes during the past 30 days. Meanwhile, for health promoting behaviors, less than one third of participants (30%) consumed four or more servings of fruits and vegetables on average each day during the same 30 day period (See Table 1).

Procedures

This study analyzed baseline data collected from two prevention intervention trials. Data were collected using identical procedures during each of the two trials. The protocols for conducting the intervention trials, including parent consent and youth assent procedures, were approved by a university's institutional research review board. Trained research staff followed standardized research protocols and implemented the self-administered survey to small groups of students within the participating school.

Instrumentation

The Personal Development and Health Survey is an aggregate of previously validated health behavior surveys. We used this survey to collect data on multiple health behaviors including: physical activity level (two items), alcohol, cigarette, and marijuana consumption (four items each), dietary habits (three items), stress management (one item), and sleeping patterns (one item). These measures were adapted from previous research and were pilot tested on a sample of high school students to ensure psychometrically sound and highly readable items for the target population.

Physical Activity—We used an adaptation of the Godin Leisure Time Exercise Questionnaire (LTEQ) to assess moderate physical activity (MPA) and vigorous physical activity (VPA).[22] Previous research has validated the LTEQ in adolescent populations, and has demonstrated sound reliability and concurrent validity across multiple populations.[23] The LTEQ measure asked: "Considering a typical 7 day period (one week), how many times on the average do you do the following kinds of exercise for more than fifteen minutes?" Two items defining MPA and VPA followed this question. MPA was defined as non-exhausting exercises such as fast walking, baseball, tennis, slow bicycling, volleyball, badminton, and easy swimming. VPA was defined as activities that cause the participant's heart to beat rapidly, such as running, jogging, football, soccer, basketball, rollerblading, skateboarding, vigorous swimming, and fast bicycling. Participants were then grouped into low, medium, and high MPA or VPA classifications based on the frequency of times they reported corresponding physical activities in a typical 7 day period. Participants reporting 0–1 times of MPA/VPA in the past 7 days were grouped into low categories; those reporting 2–4 times of MPA/VPA were grouped into medium categories; and those reporting 5 or more times of MPA/VPA were grouped into high categories.

Health Risk and Promoting Behaviors—Health risk behavior measures included length of use, and past 30 day frequency, quantity, and heavy use of alcohol, cigarette and marijuana consumption. Measurement scales were identical for assessing length of use (1 = do not use, 2 = 30 days or less, 3 = more than 30 days but less than 6 months, 4 = more than 6 months but less than 1 year, 5 = more than one year) and past 30-day frequency of use (1 = 0 days, 2 = 1–2 days, 3 = 3–5 days, 4 = 6–9 days, 5 = 10–19 days, 6 = 20–29 days, 7 = all 30 days) for alcohol, cigarettes, and marijuana. Quantity of use and heavy use were specifically tailored for the alcohol, cigarette, and marijuana measures. Quantity of past 30 day use included average number of alcoholic drinks typically consumed (1 = 0 drinks, 2 = 1 drink, 3 = 2 drinks, 4 = 3 drinks, 5 = 4 drinks, 6 = 5 drinks, 7 = 6 drinks, 8 = 7 drinks, 9 = 8 drinks,

10 = 9 drinks, 11 = 10 drinks, 12 = 11 drinks), average number of cigarettes smoked (1 = 0 cigarettes, 2 = less than one cigarette, 3 = 1–5 cigarettes, 4 = 6–10 cigarettes, 5 = 11–15 cigarettes, 6 = 16–24 cigarettes, 7 = more than 24 cigarettes), and average number of times using marijuana in the past month (1 = 0 times, 2 = 1–2 times, 3 = 3–5 times, 4 = 6–9 times, 5 = 10–19 times, 6 = 20–29 times, 7 = 30–39 times, 8 = 40 or more times). Past 30 day heavy use (1 = 0 days, 2 =1–2 days, 3 = 3–5 days, 4 = 6–9 days, 5 = 10–19 days, 6 = 20–29 days, 7 = all 30 days) of alcohol consumption (defined as 5 or more drinks for males, and 4 or more drinks for females in a row), of cigarettes (defined as number of days smoking a pack of cigarettes in one day), and marijuana (defined as number of days participants were "very high / really stoned") of participants were collected. Items assessing length of substance use, and past 30-day frequency, quantity, and heavy substance use were adopted from previous prevention research.[24,25,26, 27] Cronbach's alpha for the alcohol consumption scale was .79; for cigarette smoking behavior measures, .91; and for marijuana use measures, .94.

Health promoting behaviors measures included nutrition, use of stress management techniques, and sleep. Three nutrition items (α = .78) examined past 30-day servings of fruits and vegetables, number of times of eating foods with healthy carbohydrates, and number of times of eating foods with healthy fats (1 = 0 servings, 2 = 1 serving, 3 = 2 servings, 4 = 3 servings, 5 = 4 servings, 6 =5 servings, 7 = 6 servings, 8 = 7 servings, 9 = 8 servings, 10 = 9 or more servings). Stress management behaviors were assessed with five sub-items that measured the frequency of using a variety of stress management techniques (e.g. prayer, deep breathing, meditation). The sleep measure included one item that measured the average quantity of sleeping for participants (1 = 9 or more hours, 2 = 8 hours, 3 = 7 hours, 4 = 6 hours, 5 = 5 hours or less).

Data analysis

All analyses were performed using SPSS version 15.0. Chi-square analyses tested demographic differences in physical activities. Multivariate analysis of variance (MANOVA) tests and analysis of variance (ANOVA) tests were conducted to assess differences on mean health behavior scores across three categories (low, medium, and high) of frequency of MPA and VPA. Tukey post hoc analyses were performed when statistical significance ($p \leq .05$) was obtained to identify significant pairwise differences.

RESULTS

Table 2 shows that an overall MANOVA indicated significant differences on VPA level for marijuana ($F = 2.13$; $p = .03$). Univariate and post hoc pairwise analysis showed that a high level of VPA was significantly associated with less frequent marijuana use ($F = 2.99$; $p = .05$) and less heavy marijuana use ($F = 3.60$; $p = .03$), compared to a low level of VPA. An overall MANOVA was also significant for nutrition ($F = 3.63$; $p < .001$), with univariate tests demonstrating that a high level of VPA was significantly associated with greater consumption of healthy carbohydrates ($F = 5.63$; $p < .001$), and healthy fats ($F = 10.68$; $p < .001$), compared to a low level of VPA. In addition, ANOVA and pairwise tests showed that a high level of VPA was significantly associated with more use of stress management techniques ($F = 12.01$; $p < .001$), and a greater quality of sleeping ($F = 4.83$; $p = .01$), compared to low VPA. A similar pattern was found for frequency and quantity of cigarette smoking, with less cigarette use for those youth engaged at high levels of VPA compared to those at low levels of VPA, although the overall MANOVA was not significant.

Table 3 shows a significant overall MANOVA for nutrition behaviors across MPA levels ($F = 2.12$; $p = .05$), with univariate and post hoc pairwise analysis revealing that a high level of MPA was significantly associated with increased consumption of healthy fats ($F = 6.42$; p

< .001), compared to a low level of MPA, and a similar pattern approaching significance for eating good carbohydrates (p=.06). In addition, stress management techniques differed across MPA (F = 13.45; p < .001), with those engaged in high levels of MPA using more stress management compared to those engaged in low levels of MPA. No differences were found across MPA on alcohol, cigarette or marijuana use, and quality of sleep.

DISCUSSION

This study examined the relationships of physical activity levels with health risk and health promoting behaviors among adolescents. Our findings supported the hypothesis that adolescents participating in increased levels of physical activity would be less likely to engage in health risk behaviors and more likely to engage in health promoting behaviors. The main findings demonstrate that adolescents engaged in high levels of VPA were using less marijuana, had a healthier dietary intake, greater stress management skills, and better quantity of sleep than those engaged in low or no VPA. While overall MANOVA analysis for the cigarette use scale was non-significant for VPA, significant differences were found with the high VPA group demonstrating lower frequency of cigarette smoking and quantity of cigarette smoking than the low VPA grouping.

Less supportive of our hypothesis was the finding that participation in high levels of MPA was not as consistently associated with other health behaviors when compared to participation in high levels of VPA. Increased healthy fat food consumption and improved stress management were the only health behaviors found to be statistically significant among adolescents engaged in high levels of MPA. This suggests VPA is a better predictor of other health habits in adolescence than MPA. Further research should examine why these differences may exist, as this finding has potential implications for increasing our understanding and possibly affecting multiple behavior patterns of youth.[27]

Our results indicate VPA may be an important factor to consider for interventions that simultaneously address multiple health behaviors, especially in similarly diverse adolescent populations in the southeastern United States. Additional studies of adolescents involving more geographically diverse populations will improve the generalizability of the relationship between VPA and other health behaviors in adolescents.

The associations between high levels of VPA and smoking, dietary behaviors and stress management are particularly important considering these are leading factors for longevity, chronic disease prevalence, and quality of life.[1,3] Additionally, the finding that adolescents participating in high levels of VPA smoked marijuana less frequently and heavily is significant considering marijuana is the most commonly used illicit drug, and is equal to rates of cigarette smoking among adolescents.[28,29] Longitudinal studies are needed to examine the temporal relationships and causal associations among levels and types of physical activity and other critical health behaviors of adolescents.

It is possible that the relationship between increased physical activity and healthy psychological well-being may serve as a protective factor against health risk behaviors and contribute to health promoting behaviors.[30,31,32] Moreover, those who engage in high levels of physical activity may be exposed to positive social influences that promote healthy behaviors.[33,34] Social images that characterize individuals who are engaged in large amounts of physical activity may also help to explain this relationship. For example, social images attributed to individuals participating in high levels of VPA reflect an individual engaged in other positive health behaviors, such as good nutrition and the avoidance of smoking behaviors.[15, 35] In addition, motivational factors associated with participating in

high levels of physical activity, may inherently attract individuals who are already predisposed towards avoiding unhealthy behaviors and engaging in healthy behaviors.[36]

Our findings suggest the importance of promoting VPA among adolescents, especially considering rates of VPA among this population are very low.[9,37] National prevalence studies estimate that between 34% to 7% of adolescent populations meet the Centers for Disease Control and Prevention's (CDC) guidelines for regular vigorous physical activity.[14,16,29] Our study supports these findings with less than 27% of our sample meeting the CDC standards for engaging in VPA. Considering the impact VPA has on physical health and its potential influence on other health risk and promoting behaviors, along with the low rates of VPA within this population, the promotion of regular VPA in adolescents should continue as a major public health priority.

Limitations

Results of this study should be interpreted in lieu of several limitations. First, our findings are based on a sample of 11th and 12th grade students from a single suburban high school. Additional studies of adolescents involving probability samples drawn from urban, rural, suburban, and more geographically diverse populations would improve generalizability. A second limitation of this study was the exclusive use of self-reported data, without corroboration from other sources. The use of costly biochemical or mechanical verification of self-reports remains a challenge for those engaged in multiple behavior research. A third limitation was use of cross-sectional data, which precludes establishing a temporal and causal relationship among varying levels of physical activity and health behaviors. A final limitation was the lack of more precise measures of identifying participation in specific physical activities (i.e. – swimming, cycling, tennis, skateboarding), and the lack of inclusion of measures of sport participation. Recent research has indicated that certain types of physical activities and sports are associated with both positive and negative health behaviors of young people.[40]

Conclusion

In conclusion, the results from this study suggest high frequency levels of VPA are associated with a number of health risk and health promoting behaviors in adolescents. Future research is needed to examine whether the statistically significant associations found in the high VPA groupings are practically significant for improving other health behaviors in adolescence. Our findings underscore the critical need for incorporating more robust experimental methodologies, such as physiological health measures and longitudinal research designs, into examining the practical importance between VPA and various adolescent health risk and promoting behaviors. Such studies will help to inform the potential public health impact of school based interventions targeting multiple health behaviors in adolescents.

Implications for Schools

A theme of physical activity is congruent with recent studies advocating for the promotion of healthy youth development to enhance a wide range of health behaviors in adolescent populations.[38, 39] Innovative school health promotion and health education efforts incorporating VPA with multiple health behavioral change strategies may help to improve the magnitude of mean difference seen in our significant findings. Additionally, this type of approach towards school based health promotion may be more cost effective, and ready for widespread dissemination and adoption than more traditional approaches to school health[7,15] Furthermore, exploring the efficacy of these interventions will help to fill a void in the scientific knowledge of school based health promotion and multiple health behavior intervention research.

References

1. Fletcher GF, Balady G, Blair SN, et al. Statement on exercise: benefits and recommendations for physical activity programs for all Americans. Circulation. 1996; 94:857–862. [PubMed: 8772712]
2. Pate RR, Pratt M, Blair SN, et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sport Medicine. JAMA. 1995; 273(5):402–407. [PubMed: 7823386]
3. Wilson DB, Smith BN, Speizer IS, et al. Differences in food intake and exercise by smoking status in adolescents. Prev Med. 2005; 40(6):872–879. [PubMed: 15850890]
4. McGinnis JM, Foege WH. Actual causes of death in the United States. JAMA. 1993; 270(18):2207–2212. [PubMed: 8411605]
5. Kulig K, Brener ND, McManus T. Sexual activity and substance use among adolescents by category of physical activity plus team sports participation. Arch Pediatr Adolesc Med. 2003; 157(9):905–912. [PubMed: 12963597]
6. Patrick K, Norman GJ, Calfas KJ, et al. Diet, physical activity, and sedentary behaviors as risk factors for overweight in adolescence. Arch Pediatr Adolesc Med. 2004; 158(4):385–390. [PubMed: 15066880]
7. Pate RR, Trost SG, Levin S, Dowda M. Sports participation and health-related behaviors among US youth. Arch Pediatr Adolesc Med. 2000; 154(9):904–911. [PubMed: 10980794]
8. Kelder SH, Perry CL, Klepp KI, Lytle LL. Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. Am J Public Health. 1994; 84(7):1121–1126. [PubMed: 8017536]
9. Pate RR, Long BJ, Heath G. Descriptive epidemiology of physical activity in adolescents. Pediatr Exerc Sci. 1994; 6(4):434–447.
10. Arthur M, Hawkins J, Pollard J, Catalano R, Baglioni A. Measuring risk and protective factors for substance use, delinquency, and other adolescent problem behaviors. Eval Rev. 2002; 26(6):575–560. [PubMed: 12465571]
11. Durlak JA. Common risk and protective factors in successful prevention programs. Am J Orthopsychiatry. 1998; 68(4):512–520. [PubMed: 9809111]
12. Nahas MV, Goldfine B, Collins MA. Determinants of physical activity in adolescents and young adults: the basis for high school and college physical education to promote active lifestyles. Physical Educator. 2003; 60(1):42–56.
13. Paavola M, Vartiainen E, Haukkala A. Smoking, alcohol use, and physical activity: a 13-year longitudinal study ranging from adolescence into adulthood. J Adolesc Health. 2004; 35(3):238–244. [PubMed: 15313507]
14. Pate RR, Freedson PS, Sallis JF, et al. Compliance with physical activity guidelines: prevalence in a population of children and youth. Ann Epidemiol. 2002; 12(5):303–308. [PubMed: 12062916]
15. Werch CC, Moore MJ, DiClemente CC, Bledsoe R, Jobli E. A multihealth behavior intervention integrating physical activity and substance use prevention for adolescents. Prev Sci. 2005; 6(3): 213–226. [PubMed: 16133900]
16. Sanchez A, Norman GJ, Sallis JF, Calfas KJ, Cella J, Patrick K. Patterns and correlates of physical activity and nutrition behaviors in adolescents. Am J Prev Med. 2007; 32(2):124–130. [PubMed: 17197153]
17. Audrain-McGovern J, Rodriguez D, Moss HB. Smoking progression and physical activity. Cancer Epidemiol Biomarkers Prev. 2003; 12(11):1121–1129. [PubMed: 14652270]
18. Pate RR, Heath GW, Dowda M, Trost SG. Associations between physical activity and other health behaviors in a representative sample of US adolescents. Am J Public Health. 1996; 86(11):1577–1581. [PubMed: 8916523]
19. Peretti-Watel P, Beck F, Legley S. Beyond the U-curve: the relationship between sport and alcohol, cigarette and cannabis use in adolescents. Addiction. 2002; 97(6):707–716. [PubMed: 12084140]
20. Skolnick AA. Studies raise doubts about benefit of athletics in reducing unhealthy behavior among adolescents. JAMA. 1993; 270(7):798, 800. [PubMed: 8340965]

21. Winnail SD, Valois RF, McKeown RE, Saunder RP, Pate RR. Relationship between physical activity level and cigarette, smokeless tobacco, and marijuana use among public high school adolescents. J Sch Health. 1995; 65(10):438–442. [PubMed: 8789710]
22. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. Can J Appl Sport Sci. 1985; 10(3):141–146. [PubMed: 4053261]
23. Sallis JF, Buono MJ, Roby JJ, Micale FG, Nelson JA. Seven-day recall and other physical activity self-reports in children and adolescents. Med Sci Sports Exerc. 1993; 25(1):99–108. [PubMed: 8423762]
24. Botvin G, Baker E, Botvin E. Prevention of alcohol misuse through the development of personal and social competence: a pilot study. J Stud Alcohol. 1984; 45(6):550–552. [PubMed: 6521482]
25. Johnson CA, Pentz MA, Weber MD, et al. Relative effectiveness of comprehensive community programs for drug abuse prevention with high-risk and low-risk adolescents. J Consult Clin Psychol. 1990; 58(4):447–456. [PubMed: 2212182]
26. Erikson PL, Hays RD. Beliefs about resistance self-efficacy and drug prevalence: do they really affect drug use? Int J Addict. 1991; 25(11A):1153–1178.
27. Werch C, Moore M, DiClemente CC, Owen DM, Jobli E, Bledsoe R. A sport-based intervention for preventing alcohol use and promoting physical activity among adolescents. J Sch Health. 2003; 73(10):380–388. [PubMed: 14727390]
28. Johnson RA, Gerstein DR. Initiation of use of alcohol, cigarettes, marijuana, cocaine, and other substances in US birth cohorts since 1919. Am J Public Health. 1998; 88(1):27–33. [PubMed: 9584029]
29. Eaton DK, Kann L, Kinchen S, et al. Youth Risk Behavior Surveillance – United States, 2007. MMWR CDC Surveill Summ. 2008; 57(SS04):1–131.
30. Calfas KC, Taylor WC. Effects of physical activity on psychological variables in adolescents. Pediatr Exerc Sci. 1994; 6(4):406–423.
31. Brosnahan J, Steffen LM, Lytle L, Pattesron J, Boostrom A. The relation between physical activity and mental health among Hispanic and non-Hispanic White adolescents. Arch Pediatr Adolesc Med. 2004; 158(8):818–823. [PubMed: 15289257]
32. Piko BF, Keresztes N. Physical activity, psychosocial health, and life goals among youth. J Community Health. 2006; 31(2):136–145. [PubMed: 16737174]
33. Nelson MC, Gordon-Larson P. Physical activity and sedentary behaviors are associated with selected adolescent health risk behaviors. Pediatrics. 2006; 117(4):1281–1290. [PubMed: 16585325]
34. Petosa RL, Hortz BV, Cardina CE, Suminski RR. Social cognitive theory variables associated with physical activity among high school students. Int J Sports Med. 2005; 26(2):158–163. [PubMed: 15726493]
35. Kirkcaldy BD. Shephard RJ, Siefen RG. The relationship between physical activity and self-image and problem behaviour among adolescents. Soc Psychiatry Psychiatr Epidemiol. 2002; 37(11): 544–550. [PubMed: 12395145]
36. Sallis JF, Procheska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. Med Sci Sports Exerc. 2000; 32(5):963–975. [PubMed: 10795788]
37. Bungum T, Dowda M, Weston A, Trost SG, Pate RR. Correlates of physical activity in male and female youth. Pediatr Exerc Sci. 2000; 12(1):71–79.
38. Catalano RF, Berglund ML, Ryan JAM, Lonczak HS, Hawkins JD. Positive youth development in the United States: research findings on evaluations of positive youth development programs. Ann Am Acad Pol Soc Sci. 2004; 591(1):98–124.
39. Flay BR, Allred CG. Long-term effects of the Positive Youth Action Program. Am J Health Behav. 2003; 27(S1):S6–S21. [PubMed: 12751643]
40. Moore MJ, Werch CE. Sport and physical activity participation and substance use among adolescents. J Adolesc Health. 2005; 36(6):486–493. [PubMed: 15901513]

Table 1

Demographic Characteristics of Participating Students (N = 822)

Characteristics	n (%)
Gender	
Male	366 (44.5%)
Female	456 (55.5%)
Ethnicity	
White	375 (45.4%)
Black/African American	216 (26.3%)
Hispanic	85 (10.3%)
Age	
15 years old	5 (.6%)
16 years old	206 (25.1%)
17 years old	361 (43.9%)
18 years old	229 (27.9%)
19 years old	21 (2.6%)
Moderate Physical Activity	
Low (0–1 times/week)	239 (29.1%)
Medium (2–4 times/week)	303 (36.9%)
High (5 or more times/week)	273 (33.0%)
Vigorous Physical Activity	
Low (0–1 times/week)	271 (33.0%)
Medium (2–4 times/week)	326 (39.6%)
High (5 or more times/week)	220 (26.7%)
Past 30 day substance use	
Alcohol	(34.0%)
Marijuana	(15.0%)
Cigarettes	(13.0%)
Consumption of four or more servings of fruits and vegetables in past 30 days	(30.0%)

Table 2

Means and standard deviations of health behaviors by level of vigorous physical activity

	Low (0–1 times/week) n = 271		Medium (2–4 times/week) n = 326		High (≥5 times/week) n = 220				
Measures	**M**	**SD**	**M**	**SD**	**M**	**SD**	***F***	***df***	***P***
Alcohol[a]				*F* = .95; *df* = 8, 1614; *p* = .47					
Length	2.61	1.85	2.36	1.78	2.32	1.74	2.12	2,814	.12
Frequency	1.73	1.11	1.63	1.16	1.58	1.08	1.07	2,813	.34
Quantity	2.65	2.96	2.44	2.86	2.51	2.87	.43	2,812	.65
Heavy use	1.34	.86	1.33	.87	1.33	.90	.06	2,813	.94
Cigarettes[a]				*F* = 1.35; *df* = 8, 1598; *p* = .21					
Length	1.49	1.20	1.45	1.16	1.26	.93	2.72	2,814	.07
Frequency	1.65	1.70	1.56	1.56	1.30	1.14	3.59	2,812	.03
Quantity	1.34	.85	1.31	.86	1.16	.56	3.49	2,813	.03
Heavy use	1.10	.50	1.15	.70	1.06	.46	1.72	2,805	.18
Marijuana[a]				*F* = 2.13; *df* = 8, 1604; *p* = .03					
Length	1.68	1.42	1.63	1.38	1.53	1.29	.77	2,814	.46
Frequency	1.51	1.35	1.42	1.15	1.25	.89	2.99	2,810	.05
Quantity	1.52	1.45	1.40	1.16	1.30	1.03	2.10	2,813	.12
Heavy use	1.47	1.33	1.32	.98	1.22	.77	3.60	2,810	.03
Nutrition[b]				*F* = 3.63; *df* = 6, 1622; *p* = .001					
Fruits/vegetables	4.54	2.40	4.73	2.53	5.01	2.48	2.23	2,814	.11
Good carbohydrate	5.09	2.68	5.46	2.68	5.91	2.70	5.63	2,813	.00
Good fats	4.11	2.56	4.58	2.59	5.21	2.75	10.68	2,814	.00
Sleep[a]	3.72	1.06	3.55	1.05	3.44	.99	4.83	2,812	.01
Stress management[b]	1.92	.58	2.14	.66	2.25	.70	12.01	2,562	.00

Table 3

Means and standard deviations of health behaviors by level of moderate physical activity

	Low (0–1 times /week) n = 239		Medium (2–4 times /week) n = 303		High (≥5 times /week) n = 273				
Measures	**M**	**SD**	**M**	**SD**	**M**	**SD**	***F***	***df***	***P***
Alcohol[a]				$F = .53$; $df = 8, 1610$; $p = .83$					
Length	2.58	1.81	2.35	1.79	2.39	1.80	1.19	2,812	.30
Frequency	1.75	1.16	1.60	1.09	1.62	1.13	1.22	2,811	.30
Quantity	2.69	2.94	2.48	2.90	2.45	2.85	.52	2,810	.60
Heavy use	1.36	.88	1.31	.84	1.33	.90	.24	2,811	.79
Cigarettes[a]				$F = 1.12$; $df = 8, 1594$; $p = .34$					
Length	1.48	1.22	1.40	1.09	1.36	1.07	.82	2,812	.44
Frequency	1.63	1.70	1.46	1.43	1.47	1.42	1.13	2,810	.32
Quantity	1.36	.96	1.25	.73	1.23	.68	1.99	2,811	.14
Heavy use	1.18	.78	1.08	.50	1.07	.44	2.71	2,803	.07
Marijuana[a]				$F = 1.09$; $df = 8,1600$; $p = .36$					
Length	1.67	1.42	1.58	1.35	1.62	1.36	.33	2,812	.72
Frequency	1.51	1.40	1.34	1.03	1.38	1.07	1.61	2,808	.20
Quantity	1.54	1.52	1.36	1.09	1.37	1.10	1.84	2,808	.16
Heavy use	1.48	1.36	1.28	.91	1.30	.92	2.77	2,810	.06
Nutrition[b]				$F = 2.12$; $df = 6,1618$; $p = .05$					
Fruits/vegetables	4.47	2.50	4.78	2.42	4.91	2.51	2.07	2,812	.13
Good carbohydrate	5.15	2.67	5.45	2.74	5.71	2.66	2.82	2,811	.06
Good fats	4.13	2.59	4.61	2.60	4.96	2.69	6.42	2,812	.00
Sleep[a]	3.63	1.10	3.55	.98	3.56	1.06	.41	2,810	.67
Stress management[b]	1.90	.62	2.14	.63	2.24	.68	13.45	2,561	.00