

Ninth-Grade Students' Physical Activity Levels and Self-Efficacy

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Purpose: This study examined ninth-grade students' physical activity levels within a week of a regular school semester and their self-efficacy to overcome barriers to physical activity. **Methods:** One hundred thirty-one students from a 6A midwestern state high school in the United States completed the study where the authors collected students' data on their Physical Activity levels via the Physical Activity Questionnaire for Adolescents (PAQ-A), Self-efficacy in Physical Activity assessed via Adolescents' self-efficacy to overcome barriers to physical activity scale (Dwyer et al., 2012), and the general demographic data. The authors intended to examine differences in physical activity levels among ethnic groups and between male and female students, and to identify significant factors that predict physical activity levels. **Results:** There were no statistically significant differences in physical activity levels among ethnic groups (e.g., $M_{Caucasian} = 2.87$; $SD = 0.67$; $M_{AfricanAmerican} = 2.73$; $SD = 0.63$; $F(3,122) = .824$, $p > .05$). Moreover, male and female students reported similar physical activity levels ($M_{Male} = 2.93$; $SD = 0.74$, $M_{Female} = 2.83$; $SD = 0.67$; $t(129) = .791$, $p > .05$). The physical activity readiness levels and the self-efficacy scores on overcoming the internal, social, and responsibility barriers were the only significant factors in predicting students' physical activity levels.

Keywords: adolescents, youths, physical activity, self-efficacy

Stierman et al. (2021) found that the prevalence of obesity increases with age. They found the obesity rate was 12.7% among U.S. children 2–5 years old, 20.7% among those 6–11, and 22.2% among adolescents 12–19 years old. The number of U.S. youths aged 2–19 years who have obesity is an astounding 14.7 million. The World Health Organization (2022) estimated that over 80% of adolescents worldwide were insufficiently active, with statistical indicators indicating that 1.4 billion people do not get enough physical activity. Bull et al. (2020) even stated that physical inactivity is a global problem. Furthermore, there are significant obesity rate disparities among ethnic groups, where African American and

Hispanic youth tend to have higher rates of obesity than Caucasian and Asian counterparts (e.g., Skinner et al., 2018).

Besides the obesity rate disparities, African American youth are less active than other ethnic groups. Based on the Youth Risk Behavior Surveillance System (U.S. Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance System, 2024b) from the U.S. Centers for Disease Control and Prevention, the percentage of African American students in grades 9–12 who were physically active at least 60 minutes per day on all seven days were lower than the total population (21.5% vs 24.6%), and the percentage of them who were not physically active for at least 60 minutes on at least one day were higher than the total population [23.5% vs 15.9%; U.S. Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance System (2024a)]. Nevertheless, the findings were based on nationally aggregated data, in which all units were combined. That data presents some basic ideas but provides little value to a specific school's Physical Education program regarding how well it offers opportunities for all students to engage in physical activity (PA). Will they hold true

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in an environment where students from different ethnic groups take physical education classes and participate in extracurricular sports together? This is a question the authors will answer by comparing physical activity (PA) levels across different ethnic groups in this study.

With the staggering youth obesity numbers, it is vital to understand factors influencing the PA levels of adolescents. Su et al. (2022) conducted a multilevel meta-analysis of 112 studies on parental influence on child and adolescent physical activity levels. They found that the provision of positive parental support was significantly associated with higher PA levels among children and adolescents. In contrast, negative parental influence was not significantly associated with children's and adolescents' PA levels. More importantly, many studies found the association between parents' PA and educational levels and children's and adolescents' PA levels, where kids with parents with high PA levels and education status had higher PA levels than their counterparts without such parents (e.g., Lim & Biddle, 2012; Petersen et al., 2020; Yao & Rhodes, 2015). Guided by the literature, this study included questions about parents' education levels and PA levels and created two predictor variables for students' PA levels.

Besides parental influence, peers' influence also plays a significant role in adolescents' PA levels during organized sports and spontaneous physical activity. Evidence suggests that participating in a sports team with friends is associated with increased PA levels (Salvy et al., 2009), and youth with a greater presence of peers reported greater engagement in PA levels (Beets et al., 2006; Salvy et al., 2008). This study included a question about the number of active peers and treated it as a predictor of students' PA levels.

Research has demonstrated that self-efficacy in overcoming barriers to physical activity is a significant predictor of adolescents' participation in physical activity, and that increased self-efficacy is associated with higher physical activity levels (e.g., Dwyer et al., 2012; Bektas et al., 2021). Self-efficacy refers to an individual's subjective evaluation of his or her ability to complete a specific behavior in a specific situation. An individual with a resilient sense of self-efficacy can productively use skills despite various personal, social, and situational impediments (Bandura, 1997). This study examined students' self-efficacy in overcoming internal barriers, harassment, physical environment barriers, social environment barriers, and responsibility barriers, and assessed how well these factors predicted participants' PA levels (Dwyer et al., 2012).

The Transtheoretical Model (TTM) is a framework

mainly designed to guide behavior change programs in health behavior (Prochaska & Velicer, 1997) and has been further utilized to study participants' physical activity readiness and physical activity interventions in many studies (e.g., Han et al., 2017; Liu et al., 2018; Pennington, 2021). For example, Liu et al. (2018) found that the stages of change can indirectly increase PA levels by enhancing self-efficacy and decision-making. Based on the TTM framework, this study included a single self-reported item to construct a variable for predicting participants' PA levels.

This study aims to explore differences in physical activity (PA) levels across ethnic groups, hypothesizing that African American and Hispanic/Latino students will have significantly lower PA levels than their Caucasian and Asian peers. Additionally, the research seeks to examine gender disparities in PA and predicts that male students will exhibit higher PA levels than female students. The study also investigates how factors such as parents' PA and education levels, the number of active peers, stages within the transtheoretical model (TTM), and self-efficacy subscales predict PA levels.

With knowledge of the internal factors that may affect students' PA levels, including self-efficacy in overcoming PA barriers, their TTM stage, and external factors such as parents' PA and education levels and the number of active peers, practitioners can use these factors effectively to promote active lifestyles among adolescents. Moreover, this study was conducted during the 2023 COVID period, and none of the cited literature was from a similar background; thus, the findings will contribute to the literature.

Method

Participants and Setting

All five hundred and two 9th graders from a 6A high school (1871 students — one of the largest schools in the state) in a midwestern state were invited to participate in the study, and one hundred and thirty-one ($M = 14.4$, $SD = .57$; 60 males and 71 females; out of one hundred and seventy-one; response rate: 34.1%, completion rate: 26.1%) successfully completed the study, but data for 40 students had to be discarded because their physical activity levels were affected by COVID-19, injuries, or other health-related issues, thus data from excluded students were not examined.

Before recruiting participants, the University Institutional Review Board (IRB #23-37) protocol was submitted and approved, and this study was conducted in accordance with guidelines 45 C.F.R. 46.103 (b) (4) and 45 C.F.R. 46.116 (b) (5). All participants signed assent

forms, and their parents signed consent forms. Participants also received a data collection schedule in advance. Students did not receive extra credit or penalties for participating in the study. We solicited the help of the physical education teachers with the administrative aspect of data collection.

Instrumentation

Physical Activity Data. The Physical Activity Questionnaire for Adolescents (PAQ-A) was utilized to collect participants' PA data. Studies about PAQ-A validity and reliability are well documented. For example, Bervoets et al. (2014) reported 0.67–1 item-level content validity indexes (I-CVI) for PAQ-A and 0.90 scale-level content validity indexes (S-CVI), Cronbach's α 0.758, and the 0.516 ($p = 0.001$) correlation between PAQ-A score and VO_2 peak — corrected for age, gender, height, and weight. Moreover, this reliability and validity study included obese and normal-weight adolescents to capture a broader representation of youth weight status. Kowalski et al. (1997) reported convergent validity, with a moderate relationship with teachers' ratings of physical activity ($r = .45$). They also reported construct validity, with a moderate correlation with perceptions of athletic competence ($r = .48$).

Moreover, Aggio et al. (2016) suggested that the variety of sports and PA options in question 1 (Have you done any of the following activities in the past 7 days?) should be made age-appropriate and culturally relevant. For example, using tennis, rugby, and cricket to replace cross-country skiing, ringette, and street hockey is a better fit for British youth. To better align with the adolescent's characteristics and regional sports availability, the authors deleted Skipping, Tag, Cross-country skiing, and Ice Hockey from question 1.

Benítez-Porres et al. (2016) found that a PAQ-A score of 2.75 is the cut-off point to discriminate whether an adolescent achieves 60 minutes of moderate to vigorous physical activity (MVPA) after they compared 234 adolescents' PAQ-A scores and the PA data collected by Accelerometers (Actigraph GT3X). Similarly, Voss et al. (2013) utilized Receiver Operating Characteristic (ROC) analyses of PAQ scores against cardiorespiratory fitness, finding the cut-off point at 2.92 for 14–14.9 boys (656 samples) and 2.42 for 14–14.9 girls (533 samples) to determine whether an adolescent was categorized into “at risk” or “no-risk” for metabolic syndrome. Since PA data collected with accelerometers have higher accuracy than other methods (Heyward & Gibson, 2014), and Benítez-Porres et al. (2016) used a single cut-off for both genders, the researchers chose to use the 2.75 cut-off point to interpret the PAQ-A PA data.

PAQ-A has nine questions about participants' self-perceived physical activity levels in spare (leisure) time, during physical education, lunch recess, right after school, evenings, and weekends. The 9th question asks whether the participant was sick, absent, or ‘other,’ any of which would prevent them from engaging in regular physical activity. Anyone responding “yes” to this question was excluded from the data collection. Forty students responded “yes” to the question and had to be dropped from the study; thus, their data were excluded from analysis.

The PAQ-A data were collected on a 5-point Likert Scale ranging from 1 = “the least PA level” to 5 = “the most PA level.” For example, one question asks, “In the last 7 days, what did you do most of the time at recess?” The choices: 1 = Sat down; 2 = Stood around or walked around; 3 = Ran or played a little bit; 4 = Ran around and played quite a bit; 5 = Ran and played hard most of the time. The average of questions 1–9 is the PAQ-A score.

Self-efficacy Data. The 23-item measures from the Adolescents' Self-efficacy to overcome barriers to physical activity scale (Dwyer et al., 2012) were utilized to measure students' self-efficacy to overcome internal (6 items), harassment (3 items), physical environment (5 items), social environment (4 items), and responsibility barriers (5 items). A series of Cronbach's alpha tests were conducted to measure the internal consistency/reliability within each of the self-efficacy subscales, and each of the subscales reached either acceptable/adequate reliability (0.7–0.79), which included a 0.763 score for the social barriers subscale and a 0.759 score for the responsibility barriers subscale, and good/strong reliability (0.8–0.89) scores, which included a 0.833 score for the internal barriers subscale, a 0.821 score for the harassment barrier score, and a 0.865 the physical barrier score.

The self-efficacy scales were collected on a 5-point Likert Scale ranging from 1 = “Strongly Disagree” to 5 = “Strongly Agree.” For example, one question in the responsibilities barriers asks, “When you have too much schoolwork, you will continue to participate in physical activity.” Students must choose a number from 1 to 5 to indicate how strongly they agree with the statement. The researchers added the score from this question to the scores of the other four responsibility barrier questions, calculated the total, and divided by the total number of questions (five in this example) to obtain the responsibility subscale score. The same method was used to calculate the scores for the other four subscales.

Demographic and Transtheoretical Model (TTM) Data. The researchers asked participants about their age, gen-

der, ethnicity, parents' education, parents' physical activity levels, and the number of peers who are physically active at least 30 minutes a week. Parents' education levels were assessed using a single item on a 4-point scale (1 = less than high school, 2 = high school graduate, 3 = some college/university, 4 = college/university graduate). Parents' PA levels were also assessed using a single item on a 3-point scale (1 = inactive — not active at all, 2 = irregularly active — active from time to time, 3 = regularly active — set time for physical activity regularly). Students needed to choose two options or one option twice to represent both the father's and mother's education and PA levels; thus, the data inputs in SPSS for Parents' education levels also included 5 (1+4; 2+3), 6 (2+4; 3+3), 7 (3+4), and 8 (4+4), as did parents' PA levels include 4 (1+3, 2+2), 5 (2+3), and 6 (3+3).

The number of active peers was assessed using a single item on a 4-point scale (1 = none, 2 = one, 3 = two, 4 = more than two). This question was asked only about the number of friends who were physically active at least 30 minutes a week, since physical activity in this context was defined as any activity outside the school environment, excluding activity during physical education classes and any school-related sports clubs. In other words, an active peer in this context was one who spent at least 30 minutes playing sports each week outside of the school environment.

Participants were also asked to choose one of the six stages they considered to be in the TTM, which are pre-contemplation (do not exercise and do not intend to start exercising in the next 6 months), contemplation (realize the problems of not exercising and begin to think about making a change), preparation (set specific exercise goals and ready to take actions in the near future), action (exercise regularly within the last 6 months), maintenance (exercise regularly for more than 6 months), and relapse (used to exercise). The authors slightly adapted the definitions of the TTM stages from Pennington (2021). The authors acknowledged that the TTM model is only a framework, not a theory to understand human beings' behavior change process, and using a single self-reported item to create a variable to infer students' PA levels alone may not be perfect, but when it was paired with self-efficacy data, practitioners would have a better understanding of both.

Data Analysis

Based on G-Power 3.1.9.7 (Erdfelder et al., 1996), the F tests — Linear multiple regression: Fixed model, R^2 deviation from zero — the required total sample size for effect size 0.15, error probability 0.05, power 0.8, and number of predictors 9 is 114, which is smaller than the

acquired sample size 131.

Data were analyzed by SPSS 31. A one-way ANOVA was used to examine physical activity levels across ethnic groups. The dependent variable was PA levels, and the independent variable was ethnicity. An independent t test was conducted to examine the physical activity levels between male and female students, where the dependent variable was PA levels, and the independent variable was gender. The authors used the Kolmogorov-Smirnov test ($p > .05$) and the Shapiro-Wilk Test ($p > .05$) to assess normality assumptions for the ANOVA and t test. We further checked the visual Normal Q-Q plots, which also indicated that the data were approximately normally distributed. We also checked the homogeneity of variance for the two tests by Levene's test ($p > .05$).

Multiple regressions (where the grand mean centering technique was employed for all the independent variables) were used to investigate the extent to which parents' education and PA levels, the number of active peers, the physical activity readiness (TTM stage), and the self-efficacy to overcome physical activity barriers (five in total) predict participants' PA levels. The dependent variable is PA levels; all other variables are independent. The regression tests were conducted in two steps. The first step (Model 1) was completed by entering only parents' education and PA levels, and the number of active peers, which were grouped together since they are factors participants cannot control. The second step (Model 2) added factors that participants can control — the TTM stage and the five self-efficacy subscales. With the addition of the extra factors, the change in the predicted variance of the dependent variables they introduced could be explained.

Results

The first research question examined whether there are significant differences in physical activity (PA) levels among ethnic groups. Data for American Indian or Alaska Native and Asian groups were not reported for PA differences due to small sample sizes (only two samples each), which are insufficient to represent these populations. However, these groups were included in gender PA comparisons and regression analyses, where they could still contribute.

There were no statistically significant PA level differences among ethnic groups as determined by one-way ANOVA ($F(3, 122) = .824, p > .05$). In other words, students had statistically similar PA levels (Figure 1). The mean and standard deviation for the groups are: $M_{Caucasian} = 2.87, SD = 0.67$; $M_{African.American} = 2.73, SD = 0.63$; $M_{Hispanic} = 2.85, SD = 0.85$; $M_{Others} = 3.13, SD =$

0.78. Based on Eta-squared, the effect size was .02, a small effect.

It is important to note that African Americans were the only group with an average PA level (2.73) that was slightly below the 2.75 cut-off point (Benítez-Porres et al., 2016), suggesting that this group may be at greater risk of not meeting the 60 minutes of MVPA per day guidelines, although individual variability could not be assessed in this study. However, the mean PAQ-A score for all students exceeded the 2.75 threshold ($M_{all} = 2.89$, $SD = .70$), suggesting that on average, participants' activity levels were consistent with meeting the MVPA guidelines; however, this does not mean all individuals met the recommendation.

Research has shown that adolescents have lower PA levels in winter than in summer (e.g., Bélanger et al., 2009; Silva et al., 2011), so it was especially meaningful for the participants to achieve the recommended 60 minutes of daily MVPA in the week after Thanksgiving, a winter month.

The second research question looked at the difference in PA levels between male and female students. Based on the independent-sample t tests, there was no significant difference in PA levels between the groups; $t(129) = .791$, $p > .05$; ($M_{Male} = 2.93$, $SD = .74$) vs. ($M_{Female} = 2.83$, $SD = .67$). Based on Cohen's d and Hedge's correction, the effect sizes were .139 and .138, indicating a small effect.

The last research question identified the factors that predict physical activity levels. Two multiple regression analyses were conducted to address this research question. The first multiple regression analysis included only parents' education, PA levels, and the number of active peers. Those factors were grouped as factors that the participants had no control over (external factors). The second multiple regression analysis included factors participants could control (internal factors), including physical activity readiness (TTM stage) and self-efficacy to overcome physical activity barriers (five in total). All independent variables were grand-mean-centered (Table 1).

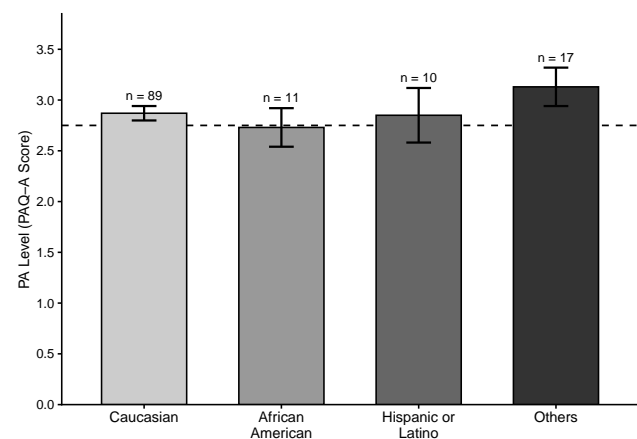
With the addition of the variables the participants could control in the second multiple regression, we could detect the change in R-squared attributable to them. All of the independent variables had collinearity statistics — Variance Inflation Factors (VIF) ranging from 1.18 to 2.79, which were below the multicollinearity criterion (10); thus, all the variables were maintained for subsequent analysis. The low collinearity among the variables was further demonstrated in the variable correlation matrix (Table 2). Besides a moderate 0.73 relationship between

physical barriers and harassment barriers, the relationships among the other variables ranged from $-.001$ to 0.50.

In the first multiple regression, only the number of active peers was a statistically significant predictor of students' PA levels. Based on this model, while holding all the other variables constant, every additional active peer was associated with an estimated 0.214 increase in the PA score. However, even though the model was significant at the $p = .05$ level, it accounted for only 5.2% of the variance in the dependent variable — PA levels.

When the physical activity readiness (TTM stage) and the five subscales of self-efficacy to overcome physical activity barriers were added to the model, the model accounted for 41.3% of the variance in the dependent variable, and the additions were statistically significant at $p = .01$. Compared to Model 1, the addition of those variables in the full model increased PA variance by 36.1%. Physical activity readiness and self-efficacy scores to overcome responsibility, social environment, and internal barriers were statistically significant variables at $p = .01$ for predicting PA levels. It was worth noting that the number of active peers was no longer a statistically significant variable in the full model. Based on this model, while holding all other variables constant, every unit increase in physical activity readiness was associated with an estimated 0.213-unit increase in PA scores. By the same token, while holding all other variables constant, every unit increase in the ability to overcome responsibility barriers, social environment barriers, and internal barriers was associated with increases of 0.201, 0.234, and 0.245 units in PA scores, respectively.

Figure 1: Students' PA Levels by Ethnicity



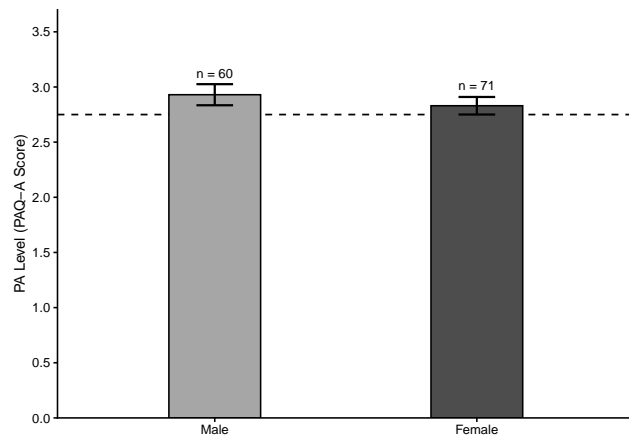
Note. The dashed line represents the MVPA cut-off score (2.75). Error bars represent the Standard Error of the Mean: SE = .07, .19, .26, and .18 for Caucasian, African American, Hispanic or Latino, and Others, respectively.

Table 1: Factors Predicting PA Levels ($N = 131$)

| Variable | Model 1 | | | Model 2 | | |
|------------------------------------|---------|-------|---------|---------|-------|---------|
| | B | SE B | β | B | SE B | β |
| Constant | 2.88 | 0.06 | | 2.652 | 0.236 | |
| Parents' Education Levels | 0.069 | 0.036 | 0.17 | -0.001 | 0.03 | -0.003 |
| Parents' PA Levels | 0.006 | 0.054 | 0.011 | 0.003 | 0.043 | 0.004 |
| Number of Active Peers | 0.214 | 0.099 | 0.188* | 0.09 | 0.081 | 0.079 |
| Transtheoretical Stages | | | | 0.213 | 0.053 | 0.31** |
| Self-efficacy — Responsibility | | | | 0.201 | 0.059 | 0.271** |
| Self-efficacy — Social Environment | | | | 0.234 | 0.067 | 0.292** |
| Self-efficacy — Internal | | | | 0.245 | 0.066 | 0.303** |
| Self-efficacy — Physical Environ. | | | | -0.08 | 0.082 | -0.111 |
| Self-efficacy — Harassment | | | | -0.066 | 0.073 | -0.098 |
| R^2 | 0.074 | | | 0.453 | | |
| Adjusted R^2 | 0.052 | | | 0.413 | | |
| F for change in R^2 | 3.392* | | | 11.14** | | |

Note. All independent variables were centered at their means. * $p < .05$. ** $p < .01$. B: Unstandardized B; SE B: Coefficients Std. Error; β : Standardized Coefficients Beta.

Hispanic or Latino, and Others, respectively.

Figure 2: Students' PA Levels by Gender

Note. The dashed line represents the MVPA cut-off score (2.75). Error bars represent the Standard Error of the Mean: SE = .10 and .08 for males and females, respectively.

Discussion

The study aimed to find the PA level differences among the different ethnic groups (e.g., Caucasian, African American, and Hispanic or Latino), the PA level differences between male and female students, and using parents' education and PA levels, the number of active peers, students' PA readiness (TTM stage), and the self-efficacy subscales to overcome PA barriers to predict PA levels.

Based on the one-way ANOVA ($F(3, 122) = .824, p >$

.05), all ethnic groups had similar PA levels, and the overall student population met the daily 60-minute MVPA guidelines. In other words, African American students had statistically similar PA levels as other groups, which was different from the findings of the CDC Youth Risk Behavior Surveillance System (U.S. Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance System, 2024b), where African American youth are less active than other ethnic groups. The school's daily PE and wide range of after-school sports may have contributed to students' overall MVPA achievement, although we did not directly measure program qualities or students' participation. The school provides Physical Education daily throughout the academic year and offers after-school sports, including football, basketball, volleyball, soccer, tennis, cross country, and wrestling. Apparently, when quality PE programs and after-school sports opportunities were provided, all students, including African American students, benefited equally.

Meanwhile, girls reported similar PA levels as boys ($M_{Male} = 2.93, SD = .74$ vs $M_{Female} = 2.83, SD = .67$), which is contrary to findings from other studies (e.g., Telford et al., 2016; Trost et al., 2002) where girls gained significantly lower PA levels than boys. However, it was unclear whether participants in those studies had co-educational or single-sex physical education. The ninth-grade participants in the study had single-sex physical education, with girls and boys separated for physical education. Moreover, girls were taught only by female physical education teachers, and boys were taught only by male physical education teachers, even though

Table 2: Variable Correlation Matrix

| Variable | PA | Pa-Ed | Pa-PA | Peers | Resp | Social | Inter | Hara | Trans | Physic |
|--------------------|-------|-------|-------|-------|------|--------|-------|------|-------|--------|
| PA levels | 1.00 | | | | | | | | | |
| Parents' Education | 0.20 | 1.00 | | | | | | | | |
| Parents' PA | 0.09 | 0.25 | 1.00 | | | | | | | |
| Active Peers | 0.21 | 0.13 | 0.17 | 1.00 | | | | | | |
| Responsibility | 0.28 | 0.08 | 0.07 | 0.06 | 1.00 | | | | | |
| Social | 0.32 | 0.15 | -0.03 | 0.01 | 0.24 | 1.00 | | | | |
| Internal | 0.37 | 0.08 | -0.05 | 0.12 | 0.19 | 0.43 | 1.00 | | | |
| Harassment | -0.01 | -0.05 | -0.11 | 0.08 | 0.48 | 0.38 | 0.47 | 1.00 | | |
| Transtheoretical | 0.47 | 0.28 | 0.15 | 0.27 | 0.11 | 0.17 | 0.25 | 0.14 | 1.00 | |
| Physical Environ. | -0.06 | -0.06 | -0.15 | -0.01 | 0.50 | 0.50 | 0.38 | 0.73 | -0.03 | 1.00 |

both shared the same curriculum. When the study was conducted, students were in a basketball unit. Wallace et al. (2020) found that girls had higher PA levels in single-sex physical education classes than in co-educational physical education classes, since many girls reported they were likely to put in less physical effort around boys due to male dominance, embarrassment, lack of confidence, and perceived competence. It was highly likely that the single-sex physical education contributed to girls' high PA levels, which were similar to boys' PA levels.

Research has demonstrated that children and adolescents with parents with high PA and education levels have higher PA levels (e.g., Lim & Biddle, 2012; Petersen et al., 2020; Yao & Rhodes, 2015) than their counterparts who do not have such parents, and youth with active peers reported higher PA levels than those without such peers. As a result, it was surprising to find, from regression model 2, that students' PA levels were not affected by parents' education or PA levels, nor by the number of active peers. Participants reported a mean score of 6.45 for their parents' education, with a standard deviation of 1.73, indicating that either parent was a college/university graduate or both parents attended some college/university. Another piece of evidence supporting the parents' homogeneous group was based on Niche school ratings. The school the participants attended had the lowest Free or Reduced-Price Lunch (FRPL) rate at 31%, compared to the highest at another public school at 71%. The National Center for Education Statistics (National Center for Education Statistics, 2023) could rank the school the participants attended as a low-poverty school, with less than 25% of the student population eligible for FRPL. Given the school's relatively low FRPL rate and the reported parents' education levels at some college/university or above, it is possible that the sample comprised predominantly middle-income families; this

might partly explain why parents' education and PA levels were not significant predictors for participants' PA levels. After all, the parents' situations were homogeneous. However, it was not clear why the number of active peers did not affect the outcome. Further research is needed to examine the reasons.

Based on regression model 2, physical activity readiness (TTM) and self-efficacy scores to overcome responsibility, social environment, and internal barriers were statistically significant predictors of PA levels. Based on the descriptive data, most students reported being in the action stage, where they currently exercise regularly, but they had only begun doing so within the last 6 months ($M = 4.27$; $SD = 1.02$). In other words, if students progress to the next stage — maintenance, where they exercise regularly for more than 6 months — they would gain 0.213 higher PA scores. Thus, the key is to find ways to keep students motivated and interested in maintaining active lifestyles over the long term.

To further promote active lifestyles among students, it is also vital to improve students' ability to overcome responsibility barriers (e.g., school work, family responsibilities, and jobs), to overcome social environment barriers (e.g., busy social life, friends are not supportive, or not have someone to do physical activity with), and to overcome internal barriers (e.g., embarrassed about others watching, concerned about weight, not motivated, and not enough skills), which corresponded to 0.201, 0.234, and 0.245 unit increase of PA scores respectively.

Helping students overcome those barriers requires extensive effort to understand their situations and may prove extremely difficult for educators. For example, it may be difficult for a student to balance family responsibilities and job duties when they live in a low-income household and must care for family members while working part-time to support them. Under such conditions,

the student would struggle greatly to overcome barriers to responsibility, and little could the practitioners and educators do for the student. However, practitioners and educators can do more to develop students' motor and sport skills to overcome internal barriers and to cultivate an environment that emphasizes teamwork and cooperative play to overcome social environment barriers. When those efforts are made and outcomes are achieved, students are more likely to overcome those two barriers to achieve higher PA levels.

This study did not find that self-efficacy to overcome physical barriers was a significant predictor. One possible speculation may be related to the abundance of community and school programs; students may not feel they have difficulty finding a sports- or exercise-related program. Another speculation was that, given their high self-efficacy in overcoming responsibility, social environment, and internal barriers, participants may be more willing to overcome physical barriers (e.g., lack of community and school programs, lack of transportation to facilities). For example, even if no community programs are available, students with high scores on the three subscales of self-efficacy may seek programs in nearby communities. Those are two speculations, and future research is needed to examine them.

Implications

Students from all ethnic groups had similar PA levels, and the same was true for male and female students' PA levels. Moreover, the overall student population achieved the recommended 60 minutes of daily MVPA. One key to promoting active lifestyles among adolescents is providing high-quality Physical Education and after-school programs; the other is improving students' PA readiness and self-efficacy to overcome responsibility, social environment, and internal barriers. Practitioners and physical education teachers can contribute immensely to developing students' abilities to overcome social environment and internal barriers to promote PA levels. With enhanced abilities to overcome those barriers, students may be less affected by parents' PA levels and the number of active peers, and they may even seek sports and PA opportunities in other communities when few are available in the immediate vicinity.

In terms of promoting higher PA levels for female students, single-sex physical education may be a solution worth considering, even with the potential costs of reduced social interactions with male students. After all, the reduced social interactions in single-sex physical education may not be a problem at all if other subjects are taught in co-educational settings.

Limitations

There are several limitations in this study. First, all participants in this study were 9th graders; future studies should include other high school students. Second, the authors utilized the convenient self-report PAQ-A to collect PA data; future researchers may choose to assess PA data using accelerometers. The removal of some sport options from PAQ-A question 1 that are not compatible with regional sports availability may slightly affect comparisons with other studies that use the original PAQ-A questionnaire. Third, participants from a single midwestern 6A high school and convenience sampling are other limitations that may affect the study's generalizability. It was a cross-sectional study and was limited in its ability to establish causal inference. Fourth, instead of using specific socioeconomic data for the sample, only the 31% score for economically disadvantaged students (the percentage of students receiving free or reduced-price lunches) was available, suggesting that most participants were from middle-income families. Fourth, the use of single items for some key constructs, including parents' PA levels, parents' education levels, the number of active peers, and TTM stages, added value to the self-efficacy data even though they may not be the most robust.

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