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## Gender Similarities and Differences in Factors Associated with Adolescent Moderate-Vigorous Physical Activity

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### Abstract

This study investigated the relationship between predisposing, reinforcing, and enabling factors conceptualized within the Youth Physical Activity Promotion Model (YPAP) and moderate to vigorous physical activity (MVPA) of adolescent males and females. Specifically, self-efficacy to overcome barriers, enjoyment of physical activity; family support, peer support, perceived school climate, neighborhood safety and access to physical activity were examined. The Physical Activity Questionnaire for Adolescents (PAQ-A) and the Actigraph 7164 were used to obtain three different measures of MVPA in 205 adolescents (102 males, 103 females). Family support emerged as the most significant and consistent factor associated with the MVPA of both adolescent males and females. This relationship was noted even when different methods of measuring MVPA were employed. These findings should increase the confidence of public health officials that family support has the potential to positively alter the physical activity behavior of adolescents.

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In response to growing evidence of the health benefits of physical activity for adolescents and the health risks posed by inactivity experts have recommended that adolescents should accumulate at least 60 minutes of moderate to vigorous physical activity (MVPA) each day (4) and should limit bouts of sedentary activity to less than 2 hours/day (1). Unfortunately, as recently as 2006 the CDC reported only 35.8% of adolescents 14 through 18 years of age met these physical activity guidelines and 37.2% reported watching television  $\geq 3$  hours per day. Additionally, research has determined that adolescent males are more active than females (17,24) and that the level of physical activity decreases during adolescence (4). This is particularly concerning as patterns of inactivity in adolescence have been found to track into adulthood (2,19).

To address this issue, Welk (1999) developed an ecological physical activity model for use by practitioners and researchers. This Youth Physical Activity Promotion (YPAP) model conceptualized unique predisposing, reinforcing, and enabling influences on the behavior of children and adolescents (32). According to the YPAP model, predisposing factors are intrapersonal factors that collectively increase the likelihood of being physically active on a

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regular basis; reinforcing factors are the interpersonal factors found in the social environment that might promote physical activity behavior; and enabling factors were defined as aspects of the physical environment that allow a youth to be physically active (Figure 1). Others have recognized the utility of this model (25,30) and have reported an association between select predisposing and reinforcing factors and physical activity measured by a pedometer (25). This current study adds to these findings by examining additional predisposing and reinforcing factors, including the examination of enabling factors, and using an accelerometer and self-report instrument to measure physical activity.

## Purpose of the Study

The primary purpose of this study was to investigate whether predisposing, reinforcing, and enabling factors suggested by the YPAP model (32) were associated with adolescent activity behavior and whether the relationships between these factors and adolescent physical activity varied by gender. Self-efficacy to overcome barriers and enjoyment were investigated as predisposing factors. Support for physical activity from family and friends and one aspect of the perceived school climate were investigated as reinforcing factors, and the enabling factors examined were safety and access to physical activity in environment. Given MVPA is addressed in the current recommendations for adolescents, this study used the Physical Activity Questionnaire for Adolescents (PAQ-A) and the Actigraph model 7164, to capture multiple dimensions of MVPA. Specifically, the percent of time participants engaged in MVPA on a daily basis (% MVPA), 5-minute bouts of MVPA, and the Total MVPA performed were examined.

## Method

### Participants

The participants were a subset of individuals involved in the Iowa Bone Development Study (IBD), an on-going longitudinal study examining the impact of lifestyle and genetic factors on bone health (15). Of the 250 adolescents invited to participate, 216 agreed but only 205 (102 male and 103 female) adolescents wore the activity monitor for at least 8 hours/day for at least 3 days and returned the questionnaire based on the YPAP model. Additionally, 179 participants completed the PAQ-A.

### Procedures

All procedures were approved by the University of Iowa Committee for the Protection of Human Subjects. Participants wore the activity monitor at the hip via a clip or elastic belt up to five consecutive days (Wednesday through Sunday). Participants also completed a daily log of their monitor wear and the questionnaire about the YPAP factors; the PAQ-A was completed at their regularly scheduled clinic visit as part of the IBD study.

### Instruments

**MVPA Measures**—A measure of total MVPA was obtained using the PAQ-A. This instrument has shown good reliability and validity in previous studies (6,18). A recent study reported the PAQ-A was a desirable instrument for epidemiologic studies due to its good internal consistency and validity (16). The modified questions and scoring described by this study were used to construct the Total MVPA outcome variable (16).

This study also used the Actigraph LLC (Model 7164) to measure MVPA. There is general agreement that the Actigraph provides a valid and reliable measure of adolescent physical activity (11). Minute by minute movement counts were recorded. The age-specific regression equation developed by Freedson was used to determine the MVPA threshold (1377 cpm) and

to construct two additional outcome variables (29). The % MVPA variable was derived by dividing the number of counts above the MVPA threshold by the time worn activity counts. The numbers of 5-minute bouts above the MVPA threshold were also used to construct another outcome variable.

**Choices Questionnaire Guided by the YPAP Model**—A unique 26-item Choices Questionnaire was developed for use in this study to measure the predisposing, reinforcing and enabling factors suggested by the YPAP (32). All questions included in this instrument have been used to measure these factors in previous studies (3,7,8,20,22,24,28), although not in this format or within a single study. Prior to data collection, a pilot study conducted with 52 adolescents examined the internal consistency of these questions and provided further support for this questionnaire.

The questions used to assess self-efficacy to overcome barriers to physical activity were an abridged adaptation of a previously developed measure (28). These four questions yielded acceptable internal consistency reliability in our pilot study measure (Cronbach's alpha = 0.76). An example of items included in the self-efficacy scale is: "I am confident I will be able to be physically active even when I have homework." Participants rated all of their responses to the items included in the Choices Questionnaire on a 5-point scale ranging from 1 (*disagree a lot*) to 5 (*agree a lot*).

Enjoyment of physical activity was measured using seven negatively-worded questions from the Physical Activity Enjoyment Scale (PACES), which was adapted for adolescents and reported elsewhere (8,22). In our pilot study, the internal consistency (Cronbach's alpha) was 0.89 for these questions. The enjoyment scale included questions such as: "When I am active I feel as though I would rather be doing something else." Responses were rated on the described 5-point scale.

The family and friend support questions were initially developed and used as part of the Amherst Study; reliability and validity of these scales has been reported previously (24). The family support scale assessed the following types of family support: parental encouragement, praise, transportation, physical activity participation with the adolescent, and watching the adolescent participate in sports or physical activity. The friend support scale assessed peer praise, encouragement, participation, and the adolescent's encouragement of others to be physically active. Our pilot study found the Cronbach's alpha for these scales to be 0.80 and 0.85 respectively. Examples of the support questions are: "In the past 7 days, how often has a member of your family or household provided transportation so you could be physically active?" or "In the past 7 days, how often has one of your friends praised you for being physically active?" These questions were rated on a scale from 1 (*none*) to 5 (*almost every day*).

Questions about the perceived school climate scale were adapted from a scale used in the Trial of Activity for Adolescent Girls (TAAG) study reported elsewhere (3). In our pilot study, the internal consistency (Cronbach's alpha) for this scale was 0.85. The following is an example of the questions in this section: "In my school, PE teachers think it is more important for boys to be physically active than girls." Participants selected a response using the same 5-point scale as enjoyment and self-efficacy.

Questions about the perceived access and safety of the participants' home and neighborhood environment were adopted from well known scales and have previously been used with adolescents (21). Our study found the Cronbach's alpha of these scales to be 0.47 and 0.61 respectively. The relatively lower correlation coefficients were similar to those found in previous studies (21) and are likely due to the fact that only two items comprised the scales

and the lack of variability in the participants' responses; there was very little within group variance in this sample. Examples of the questions included in these scales are: "In my neighborhood there are parks, gyms, recreation facilities or open yard spaces where I can be physically active," and "It is safe to walk or jog in my neighborhood during the day." Respondents selected answers using the previously described 5-point scale.

Safety and access were also measured by objective means. Recent physical activity research suggests facilities must be located within a half-mile radius to be considered accessible to adolescents (5,12,13). Specifically, this study utilized Google Earth™ to determine the distance from the individual's residence to parks, recreation centers, and schools. A 2-point scale in which 1 = *no facilities accessible within 0.5 mile* and 2 = *facilities accessible within a 0.5 mile* was used to score the participant's access to physical activity based on the distance prescribed in previous studies (5,12,13).

A scale using the Uniform Crime Report (UCR) data available from the FBI ([www.fbi.gov/ucr/ucr.htm](http://www.fbi.gov/ucr/ucr.htm)) was adapted for this study (10,13). This resource tracks criminal activity within cities, counties, and states. Low and high crime rates for the participant's county of residence were rated on a 2-point scale, in which 1 (*Low crime rate*) = 0–3,433 crimes/100,000 people and 2 (*High crime rate*) = 3,434 crimes/100,000 and above. If no crime data were available for the current year, data were imputed from surrounding counties as suggested by the literature (10).

## Data analysis

Prior to analysis, the data were split by gender and two variables, the 5-minute bouts of MVPA and enjoyment of physical activity were log transformed due to their non-normal distribution. Gender differences were examined using t-tests. Spearman rank correlations coefficients were examined among the study variables. This method of correlation analysis was selected as it did not make any assumptions about the distribution from which the sample was drawn, could be used when all of data were not interval or ratio, and was less likely to inflate the relationships. Only the factors associated with MVPA at a 0.20 level or higher were entered into the regression models.

Stepwise linear regression analysis was conducted to determine which combinations of factors in the YPAP model explained the variance in the different measures of physical activity. The significance level was set at  $p < 0.05$  to enter and at  $p < 0.10$  for removal from the model.  $R^2$  changes were examined along with beta weights to determine the individual and total variance in adolescent physical activity explained by the YPAP factors using SPSS (v.13).

## Results

The age of the participants included in the final analysis ranged from 12.47 to 14.36 years with a mean age of 13.0 years ( $SD = .30$ ). The weight of the participants ranged between 30.39 kg and 145.15 kg, with a mean weight of 54.07 kg ( $SD = 15.48$ ). Over 90% of the participants resided in the State of Iowa. Crime statistics for the participants' counties ranged from 271 to 7,349 crimes/100,000 inhabitants with a mean of 3,215 crimes/100,000 inhabitants ( $SD = 1615$ ). We found 43.5 % of the participants had no access to physical activity facilities in their neighborhood and 56.5% had access to physical activity within 0.5 miles of their residence.

The male adolescents included in this study spent a greater percentage of their day engaged in MVPA, performed a higher number of 5-minute bouts of MVPA, and reported more MVPA (Table 1) than did their female counterparts supporting earlier findings. Statistically significant gender differences were noted in the perception of family support and greater physical access to activity opportunities. The effect sizes for between group differences were calculated using

Cohen's formula. The effect size for physical access was 0.43 suggesting it was a small to moderate effect size. The effect size for family support, friend support, school climate, perceived access and crime were small ranging from 0.20 – 0.29. The effect size for self-efficacy, enjoyment and perceived safety were all under 0.20

Regardless of how MVPA was measured, the Spearman rank correlations demonstrated family support, friend support and self-efficacy were all associated with the adolescent male MVPA (Table 3). The strength of this association, however, varied with the method of measurement. Family support had the strongest association with the MVPA of male participants when this activity was measured objectively ( $r = 0.37$ ) but when the MVPA outcome variable from the PAQ-A was used, friend support had the strongest, statistically significant, association with male MVPA ( $r = 0.44$ ) followed closely by family support. When using the PAQ-A to measure MVPA, enjoyment and perceived safety demonstrated modest, statistically significant associations.

For the female participants, family support was the only factor associated with all measures of MVPA (Table 4). This association was small but statistically significant ( $r = 0.23 - 0.31$ ). The only other statistically significant association was noted between self-efficacy and MVPA; again this association was small. Positive associations were noted between female MVPA and enjoyment, friend support, perceived safety and perceived access but none of these were significant.

While some of the relationships between YPAP factors and physical activity were statistically significant the correlations were small, ranging from 0.20 – 0.44 which might explain the lack of variance noted in the regression analysis (Table 5). Family support entered the male regression models first and explained 13% of the variance of % MVPA, with self-efficacy accounting for an additional 4%. In 5-minute bouts of MVPA, family support was the only significant factor and accounted for 14% of the variance. Regressing the YPAP factors on the PAQ-A score of the adolescent males resulted in four factors entering the regression model. Collectively, family support, physical access, friend support, and enjoyment accounted for 30% of the variance of MVPA when measured by self-report.

In the step-wise linear regression analysis of the female data, family support was the only factor that entered the regression models. Regardless of how MVPA was measured, family support accounted for 9% to 10% of the variance in adolescent female MVPA.

## Discussion

Many studies have examined and reported significant gender differences in adolescent physical activity behavior but few have examined the gender differences in the predictors of this behavior (9). The intent of this study was to examine gender differences in the association between YPAP factors and adolescent physical activity. Understanding the possible predictors or influencers of adolescent MVPA is critical if public health authorities hope to alter the current trends of physical activity behavior in this population.

Self-efficacy has been reported as an important predictor of adolescent physical activity in a number of previous research studies (3,7,21). In this study, self-efficacy demonstrated a positive, statistically significant, relationship with the MVPA of both males and females. Additionally, self-efficacy has been found to mediate the physical activity behavior of adolescent females (7,10,21,31). This relationship was not examined in this study but would be important to pursue in the future.

Enjoyment has also been cited as an important predictor of physical activity. While enjoyment explained 4% of the variance in the MVPA of males when measured by the PAQ-A, it was not



associated with any aspect of female MVPA. These findings are contrary to previous findings (8,23). The lack of strong empirical support for the relationship between enjoyment and the MVPA of adolescents in this study may have occurred due to methodological effects from the negatively worded questions (8,21), the lack of within group variance in this scale, or enjoyment may have acted as a mediator, as reported in previous studies (8,23).

Of all the factors, family support demonstrated the strongest and most consistent relationship with both male and female MVPA. The fact that this relationship was present when different methods of measuring MVPA were employed should give practitioners and researchers additional confidence that family support is a salient factor in adolescent physical activity engagement. Again, the magnitude of this association was greater with the male MVPA than the female MVPA. In fact, it was the only factor significantly associated with female MVPA regardless of how measured, yet the female adolescents perceived less support from family than the male participants. This is important to note as we know the performance of physical activity often requires support from others and the perception of this support might be associated with physical activity by increasing barriers self-efficacy or enjoyment of physical activity which, in turn, might increase actual physical activity. If female adolescents do not perceive the amount or type of support needed from the family, they may be less likely to persist in or enjoy this activity. The relationship between the reinforcing factors and other factors within the YPAP model should be examined in future studies to determine if this is the case.

Additional insight could also be gained by determining the specific type (verbal praise, transportation, watching performance, encouragement, actual participation) of family support that contributed to the association noted. While this study did examine the quantity of five different types of family support, it did not examine the quality of this support nor did it differentiate which family member, if any, is most responsible for this association. Recent studies have suggested that family support should not be treated as one composite variable; instead different dimensions should be examined (20). Deriving questions from the Self-Determination Theory (SDT) which differentiates between the quality and type of social support has the potential to add to our knowledge in this area and should be considered in future studies (26).

Friend support demonstrated a significant correlation with the MVPA of the male participants but did not emerge as an important factor in any aspect of the female MVPA examined. This is contrary to previous findings where peer support was a significant predictor for boys and girls in grades 7–9 (2,24,27). Whether these results are a reflection of actual gender differences in the social support associated with physical activity or are a reflection of differences in biological maturity could not be established with the measures used in this study. Recent research has attributed some of the gender differences in adolescent physical activity to differences in maturation (29) and should be considered in future work.

The perception that the school climate is more supportive of males being active than females has the potential to negatively impact the physical activity behavior of female adolescents and should be examined further. Contrary to previous findings (3) we found a negative relationship between the school climate and the MVPA of both the male and female participants and none of the relationships were significant. When adolescents are in school, their ability to choose to be active is limited and likely contributed to the lack of a relationship. Other measures of the school climate and the interaction of these factors should be examined before a determination is made about the usefulness of including this construct in adolescent physical activity research (3).

Perceived safety was significantly correlated with the MVPA of the adolescent males when measured by the PAQ-A. The same was not true in the female MVPA assessed by this measure. In fact, no other significant relationships between MVPA and safety emerged in either gender. Previous research findings have noted adolescent females may need to reside within a safe neighborhood to engage in physical activity but it may not be enough to directly promote female MVPA even though unsafe neighborhoods seem to limit physical activity (21). This may explain the lack of relationships found in the current study between both perceived safety or the actual crime rate and MVPA. Most of the participants in this study lived in relatively safe neighborhoods. The crime rate for the participants' counties ranged from 271 – 7,349/100,000 people with a mean of 3,215/100,000 (SD = 1615) indicating the majority live in a low crime rate neighborhood (10). Additionally, county crime statistics might not accurately reflect the adolescent's immediate neighborhood. Further use of safety measures with a more diverse population are needed to establish whether this is a salient factor for adolescent engagement in physical activity.

Perceived access demonstrated modest, positive associations with the MVPA of the male and female adolescents but none of the associations were statistically significant. The associations between MVPA and physical access measured via Google were varied. Physical access was positively associated with male MVPA and explained 4% the variance when measured by the PAQ-A. No such associations were found with female MVPA. Additionally, negative associations were noted between physical access and adolescent MVPA, particularly in the females. This was an unexpected finding. It indicated more access to recreational facilities was correlated with less activity. Possibly individuals with access to recreation facilities also had access to competing sedentary activities. Further research with objective measures is needed to explain these results.

## Summary

One of the most important findings in this study was the relationship noted between family support and adolescent MVPA. While the magnitude of the associations varied, family support was associated with % MVPA, Bouts of MVPA, and self-reported MVPA in both the male and female participants in this study. In fact, it was the only factor consistently associated with adolescent female MVPA. These findings support previous research where family support has been found to be associated with adolescent physical activity and should serve to reassure practitioners and researchers that family support is a salient factor in adolescent MVPA.

Additionally, it is important to note the YPAP factors associated with MVPA and the strength of these associations differed by gender and the method used to measure MVPA. This highlights the importance of utilizing multiple measures of physical activity and considering gender when conducting further research and/or developing intervention programs.

Beyond family support, limited associations were noted between the YPAP factors and adolescent MVPA. The homogeneity of this sample (age, ethnicity, geographic location) and the cross-sectional nature of this research may have contributed to these results. Examining additional predisposing, reinforcing, and enabling factors with a more diverse population and the interaction of these factors should be considered in future studies. Also rather than examining family support as one composite factor and/or the quantity of this support, future studies should consider examining different dimensions of family support provided by different members of the family. Because SDT addresses types of support, questions derived from this theory and those aimed at specific members of the family have the potential to further our understanding of important influences or predictors of adolescent physical activity behavior.

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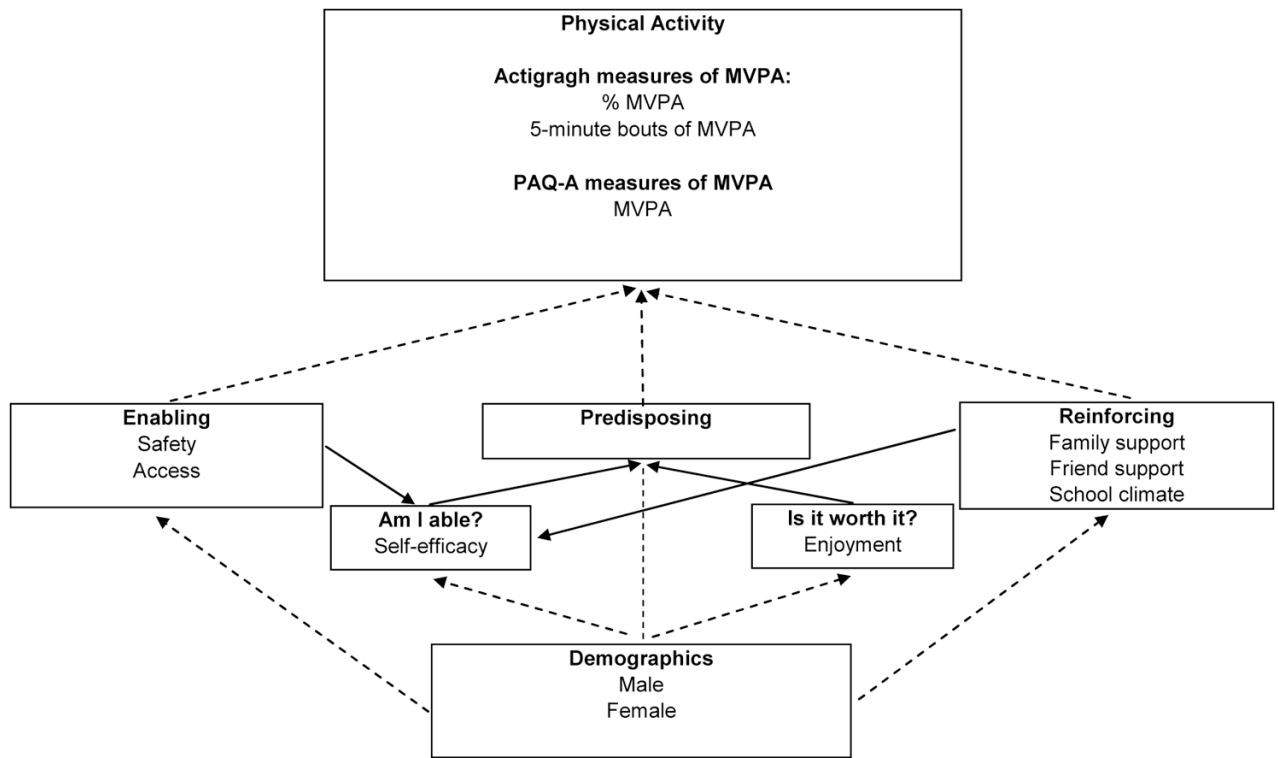
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**Figure 1. Operationalization of the YPAP Model for this Study**

*Note.* MVPA = Moderate to vigorous physical activity; VPA = vigorous physical activity, PA = physical activity; PAQ-A = Physical Activity Questionnaire for Adolescents.

**Table 1**  
Results of Independent t Test Comparing Male and Female Outcome Variables

	Male			Female			T	df	p
	N	Mean	SD	N	Mean	SD			
<b>MVPA</b>									
% MVPA	102	14.01	4.43	103	9.97	3.65	7.14	203	0.00
5 min bouts of MVPA	102	7.43	4.15	103	4.46	3.20	5.73	203	0.00
PAQ-A total score	87	2.90	0.76	86	2.60	0.66	2.74	171	0.01

*Note.* MVPA = Moderate to vigorous activity; % MVPA = Movement counts greater than MVPA threshold divided by the time worn; 5-min bouts of MVPA = Total number of bouts of 5-min bouts above the threshold; PAQ-A = Physical Activity Questionnaire for Adolescents.

**Table 2**  
Results of Independent t Tests Comparing Male and Female Responses on Independent Variables

	Male			Female			T	df	p
	N	Mean	SD	N	Mean	SD			
Self-efficacy	102	3.95	0.75	103	3.83	0.82	1.08	203	0.28
Enjoyment	102	4.62	0.60	103	4.50	0.68	1.32	203	0.19
Family	102	3.21	0.81	103	2.96	0.87	2.08	203	0.04
Friends	102	3.24	0.91	103	3.02	0.98	1.67	203	0.10
School climate	102	3.91	1.08	103	4.17	1.04	-1.78	203	0.08
Perceived access	102	4.50	0.71	103	4.32	0.88	1.66	203	0.10
Perceived safety	102	4.54	0.78	103	4.54	0.79	3.10	203	0.82
Physical access	102	1.67	0.47	103	1.46	0.50	0.22	203	0.00
Crime	102	1.49	0.50	103	1.39	0.49	1.47	203	0.14

**Table 3**  
Spearman Correlations Among Study Variables and Adolescent Male MVPA

	Self-efficacy	Enjoyment	Family support	Friend support	School climate	Perceived access	Perceived safety	Physical access	Crime
Enjoyment	.45**								
Family support	.29**	.34**							
Friend support	.33**	.20*	.66*						
School climate	.01	.22*	.16	.15					
Perceived access	.26**	.32**	.08	.10	.14				
Perceived safety	.22*	.26**	.19	.15	.08	.27**			
Physical access	-.15	-.12	-.01	-.11	-.17	.13	-.01		
Crime	.15	.18	.03	.06	-.04	-.01	.07	.11	
% MVPA	.33**	.06	.37**	.30**	-.02	.06	.15	-.05	.10
5-min bouts	.26**	.04	.36**	.31**	-.00	.12	.15	-.04	.04
PAQ-A <sup>a</sup>	.23*	.22*	.43**	.44**	-.06	.14	.28**	.20	.16

Note: MVPA = Moderate to vigorous physical activity; PAQ-A = Physical Activity Questionnaire for Adolescents

<sup>a</sup>N = 87

\* p < .05,

\*\* p < .01



**Table 4**  
Spearman Correlations Among Study Variables and Adolescent Female MVPA

	Self-efficacy	Enjoyment	Family support	Friend support	School climate	Perceived access	Perceived safety	Physical access	Crime
Enjoyment	.43**								
Family support	.38**	.30**							
Friend support	.36**	.26**	.65**						
School climate	.19	.30**	.14	.09					
Perceived access	.24*	.10	.10	.04	.06				
Perceived safety	.18	.16	.01	.03	.18	.29**			
Physical access	-.13	-.02	-.28**	-.25*	-.12	.22*	-.9		
Crime	.16	.05	-.06	-.08	-.14	-.14	.05	-.09	
% MVPA	.20*	.12	.31**	.16	-.01	.18	.11	-.03	.08
5 min bouts	.18	.10	.23**	.12	.02	.15	.12	-.05	-.02
PAQ-A <sup>a</sup>	.21*	.17	.25*	.16	-.01	.11	.05	-.18	.08

Note. MVPA = Moderate to vigorous physical activity; PAQ-A = Physical Activity Questionnaire for Adolescents

<sup>a</sup>N = 86

\* p < .05,

\*\* p < .01

**Table 5**  
 Linear Stepwise Regression Results: Variance of MVPA explained by YPAP Factors

Gender PA	Variable	B	SD	$\beta$	R <sup>2</sup> cumulative
% MVPA					
Male	Family support	1.64	.53	.30**	.13
	Self-efficacy	1.20	.57	.20*	.17
Female	Family support	1.34	.39	.32***	.10
5-min bouts					
Male	Family support	.30	.07	.37**	.14
Female	Family support	.30	.10	.30***	.09
PAQ-A					
Male	Family support	.24	.12	.22**	.16
	Physical access	.48	.15	.30*	.20
	Friend support	.23	.11	.27*	.26
	Enjoyment	.94	.46	.20*	.30
Female	Family support	.23	.08	.30***	.09

Note. MVAP = Moderate to vigorous physical activity; PAQ-A = Physical Activity Questionnaire for Adolescents

\* p < .05,

\*\* p < .01