

# Associations between physical activity and mental health problems among adolescents at a child and adolescent psychiatric clinic

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## Abstract

### *Objectives*

The aims of this study are to investigate longitudinal associations between physical activity level and mental health problems in a child and adolescent psychiatric sample, and further whether team sports participation is associated with less mental health problems than individual sports.

### *Methods*

The study population was adolescents referred to a child and adolescent psychiatric clinic. PA was measured two times, three years apart, by the World Health Organization Health Behaviour in School aged Children physical activity questionnaire. Internalizing/externalizing problems were measured by Youth Self Report. Linear regressions were carried out separately with physical activity level or self-reported team sports participation as independent variables and internalizing or externalizing problems as dependent variables. Results were adjusted for sex, age and socioeconomic status.

### *Results/conclusions*

High physical activity was significantly associated with less internalizing and externalizing problems than low physical activity. Team sports participation was not significantly associated with less or more internalizing or externalizing problems than individual sports.

*Keywords:* physical activity, adolescence, team sports, longitudinal, internalizing problems, externalizing problems.

## **Samandrag**

### *Bakgrunn*

Målsetjingane med denne studien er å undersøkje longitudinelle assosiasjonar mellom fysisk aktivitetsnivå og mentale helseproblem i eit barne- og ungdomspsykiatrisk utval, og undersøkje om deltaking i lagidrett er assosiert med mindre mentale helseproblem enn individuell idrett.

### *Materiale og metode*

Studiepopulasjonen var ungdomar som var henvist til ein barne- og ungdomspsykiatrisk klinikk. Fysisk aktivitetsnivå vart målt to gonger med tre års mellomrom ved å nytte Verdas Helseorganisasjon si spørjeundersøking om fysisk aktivitet «Health Behaviour in School aged Children». Internaliserande/eksternaliserande problem vart målte ved å nytte «Youth Self Report». Lineære regresjonar vart utførte separat med fysisk aktivitetsnivå eller sjølvrapportert deltaking i lagidrett som uavhengige variablar og internaliserande eller eksternaliserande problem som avhengige variablar. Resultata vart justerte for kjønn, alder og sosioøkonomisk status.

### *Resultatar og konklusjon*

Høgt fysisk aktivitetsnivå var signifikant assosiert med mindre internaliserande og eksternaliserande problem enn lågt fysisk aktivitetsnivå. Deltaking i lagidrett var ikkje signifikant assosiert med mindre eller meir internaliserande eller eksternaliserande problem enn individuell idrett.

*Nøkkelord:* fysisk aktivitet, ungdom, lagidrett, longitudinell, internaliserande problem, eksternaliserande problem.

## 1. Introduction

Mental disorders are very common and have profound impacts on peoples' lives. Depressive disorders and anxiety disorders were in 2015 listed as the 3<sup>rd</sup> and 9<sup>th</sup> global leading causes of years lived with disability respectively (Vos et al., 2016). Among children and young people aged 10 – 24 years, neuropsychiatric disorders are the main cause of years lived with disability (Gore et al., 2011). In the research efforts for finding effective ways to promote mental health and prevent and treat mental disorders, physical activity (PA) is one of the interventions frequently studied (Das et al., 2016; Min, Lee, & Lee, 2013). Also, there is a growing evidence for positive effects on mental health for children and adolescents (Biddle & Asare, 2011; Johnson & Taliaferro, 2011). A review of prospective studies suggests that PA may prevent depression in healthy adults (Mammen & Faulkner, 2013) and one meta-analysis of randomized controlled trials suggests that PA is effective in the treatment of depression in adults (Cooney et al., 2013).

The research on effects of PA on mental health is more extensive for the adult population than for children and adolescents. Research focused on children and adolescents is mainly cross-sectional studies and most focus on anxiety, depression and self-esteem (Biddle & Asare, 2011). Systematic reviews of randomized trials indicate a small reduction in depressive and anxiety symptoms and an increase in global self-esteem from physical activity for children and youth, but due to methodological limitations of the conducted trials, firm conclusions cannot be drawn (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2004; Larun, Nordheim, Ekeland, Hagen, & Heian, 2006).

There is little knowledge about the mechanisms that mediate the positive effects of physical activity upon cognition and mental health. Both neurobiological, psychosocial and behavioral mechanisms have been suggested (Lubans et al., 2016). A qualitative study on a physical activity intervention for depressed youth suggests that important factors that mediate the improvement related to exercise are meeting others with similar problems, feeling a sense of achievement, distraction from problems and having routine (Carter, Morres, Repper, & Callaghan, 2016). Similar factors are found in adults who attend physical activity interventions for mental illness (Mason & Holt, 2012). Recommendations for school-age youth have been suggested to be 60 minutes or more of moderate to vigorous physical activity every day (Strong et al., 2005). However, children and adolescents with psychiatric disorders have lower levels of physical activity and participate less in sports than those in the normal population (Mangerud, Bjerkeset, Lydersen, & Indredavik, 2014). This may contribute to maintain or worsen mental health problems. The 2005 NICE guidelines on identification and management of depression in children and young people suggest regular exercise as part of the intervention (National Collaborating Centre for Mental Health, 2005).

Several cross-sectional studies suggest negative associations between physical activity and depressive symptoms in adolescents (Johnson & Taliaferro, 2011). Regarding patients with hyperkinetic disorders, studies suggest positive effects from physical activity. Classical symptoms of ADHD are attenuated and social behavior, executive functioning, strength and motor skills are improved after physical activity (Hoza, Martin, Pirog, & Shoulberg, 2016; Kamp, Sperlich, & Holmberg, 2014).

An important perspective on the effects of physical activity on children and adolescents' mental health is the social interaction and relationships in team sports and organized sports, as discussed by Skrove, Romundstad, and Indredavik (2013). Parents, coaches and peers play a role in this interaction which influences how a child experiences social development, motor competence, positive self-perceptions and positive affect when taking part in organized sports (Smith, 2003). However, organized youth sports can also have negative influences on adolescents like eating disorders, athletic burnout, excessive pressure to win, low self-esteem and violent behavior. To what extent adolescents experience positive development through sports depends largely on program design and influence from parents and coaches (Fraser-Thomas, Côté, & Deakin, 2005). There is evidence, mainly from cross-sectional studies, suggesting that team sports are associated with better health than individual activities (Eime, Young, Harvey, Charity, & Payne, 2013).

The level of physical activity among youth is associated with sex, age and social status (Henriksen, Rayce, Melkevik, Due, & Holstein, 2016; Sterdt, Liersch, & Walter, 2014). This indicates that these factors should be taken into account when studying associations between physical activity and mental health.

The aims of this study are to investigate the associations between physical activity level and internalizing and externalizing problems in a child and adolescent psychiatric clinic sample in a three years' perspective. Furthermore, to assess possible additional effects from social interaction, stability and belonging in a team, associations between team sports participation and internalizing and externalizing problems will be investigated among adolescents with high physical activity level in the same sample.

We hypothesized that higher levels of physical activity are associated with less internalizing and externalizing problems, and that team sports participation is associated with less internalizing and externalizing problems than individual sports among youth with high physical activity.

## **2. Methods**

### *2.1 Study design*

The study is part of The Health Survey in the Department of Child and Adolescent Psychiatry (CAP), St. Olav's University Hospital, Trondheim, Norway. This is a longitudinal study with data collected in the periods 2009 – 2011 and 2012 – 2014. Mean follow up time was 3.0 years (SD 0.2). Inclusion criteria were: referred adolescents, aged 13–18 years, who had at least one personal attendance at the clinic between February 15<sup>th</sup> 2009 and February 15<sup>th</sup> 2011. Exclusion criteria were: major difficulties in answering the questionnaire due to their psychiatric state, cognitive function, visual impairments or lack of sufficient language skills. Emergency patients were invited to take part once they entered a stable phase.

### *2.2 Study procedure*

Newly referred patients and patients already enrolled at the CAP clinic received oral and written invitations at their first attendance after the project started. Written informed consent was obtained from adolescents and parents prior to inclusion, according to the CAP survey procedures. At baseline, the participating adolescents responded to a questionnaire one by one at the clinics, with access to a research assistant for clarification of questions. At follow up, the participating adolescents responded to an electronic questionnaire at home. Parents also responded to a questionnaire.

### *2.3 Study population*

In the study period, 2032 adolescent patients had at least one attendance at the CAP clinic. Of these, 289 were excluded on the basis of the exclusion criteria. Also, 95 were lost to registration (missing). Hence, 1648 (81.1 %) were eligible and were invited to participate. Of these, a total of 717 (43.5 %) participated in the CAP baseline survey; 393 (54.8 %) girls and 324 (45.2 %) boys.

To explore the representativeness of the study population, anonymous information about the reference population was collected from annual reports from St. Olav's University Hospital, 2009–2011. All adolescents in the study period (n=2032) minus those excluded (n=289) were defined as reference population (n=1743). In accordance with the permission given by the Norwegian Social Science Data Services; The Data Protection Official for Research, we compared age, sex and main reason for referral between participants (n=717) and non-participants (n=1026) of the reference population. Participants were 0.27 (95 % CI: 0.10-0.45) years older than non-participants (Mean (SD): 15.66 (1.65) vs 15.39 (1.95), p=0.0015). There were more girls in the study group than in the non-participating group (393

(54.8 %) vs. 509 (49.6 %),  $p=0.032$ ). Main reason for referral did not differ between participants and non-participants (data not shown, Pearson Exact Chi-Square test;  $p=0.11$ ).

A total of 685 agreed to be contacted for follow up studies. Of these, a total of 570 (34,6 % of eligible) participated in the follow up study. Although 14 (2.5 %) of the participants were aged 19 – 20 years at baseline, they are included in the study. Only adolescents who participated in the follow up study were included in this study ( $n=570$ ).

## *2.4 Measures*

### *2.4.1 Physical activity (PA)*

Physical activity was measured at baseline and follow up by the World Health Organization (WHO) Health Behaviour in School aged Children (HBSC) physical activity questionnaire (King, Wold, Tudor-Smith, & Harel, 1996). The questionnaire contained questions about frequency and total duration of weekly physical activity. The frequency question has been shown to have higher reliability and validity than the duration question (Rangul, Holmen, Kurtze, Cuypers, & Midthjell, 2008). Therefore, the frequency question was chosen for this study. The question was: “Outside school hours: How many days a week do you play sports or exercise so much that you get out of breath and/or sweat?”. The response options were an 8 points scale ranging from «never» to «every day». In this study the adolescents were categorized into three mutually exclusive groups of physical activity level: Adolescents exercising less than 2 times a week at baseline OR follow up were designated «low PA». Adolescents exercising at least 4 times a week at baseline AND follow up were designated «high PA». Adolescents who did not fulfill the requirements for high activity, but exercised at least 2 times a week at baseline and follow up were designated «moderate PA». By including data from baseline and follow up, this variable is an approximate measure of PA habits over a three years period.

### *2.4.2 Internalizing and externalizing problems*

Internalizing and externalizing problems were measured at follow up by Achenbach System of Empirically Based Assessment (ASEBA) Youth Self Report (YSR) (Achenbach & Rescorla, 2001). It is an internationally widely used multi-aspect standardized scoring tool for mapping psychiatric symptoms and emotions. It contains 105 questions (problem items), from which 32 are included in internalizing and 35 are included in externalizing problems. Each question is answered on a 3 points scale from 0 «not true» to 2 «very true or often true» for the last 6 months. Internalizing problems scores can range from 0 to 64 and externalizing problems scores can range from 0 to 70. Higher scores reflect more symptoms.

Internalizing and externalizing problems scores from baseline could not be used because of high numbers of cases with missing data.

#### *2.4.3 Team sports participation*

Team sports participation was measured at baseline by the following question made for the study: «How often have you been doing the following exercise activities the last 12 months?: Team sports/ball sports (for example football, volleyball, handball, ice hockey, squash)»: «Never», «Less than once a week», «once a week» and «more than once a week». We chose participation in team sports once a week at baseline as cutoff point because we consider weekly attendance a minimum in order to gain belonging, security and predictability in the team. Team sports participation was not measured at follow up.

#### *2.4.4 Socioeconomic status (SES)*

SES was represented by the highest level of parental education, reported by the parents themselves. This was coded to a 4-points scale ranging from 0 “Less than compulsory school or one to two years in high school” to 3 “Academy/university for five years or more, or a PhD”.

Data were collected systematically and quality assured.

#### *2.5 Statistics*

Descriptive statistics are reported as mean (SD) and frequencies (percentages) where relevant. Linear regressions were carried out for the whole sample (n=570) with internalizing and externalizing problems as dependent variables and physical activity as covariate. Separate analyses were carried out for the adolescents with high physical activity (n = 54) with internalizing and externalizing problems as dependent variables and team sports participation as covariate.

Afterwards, linear regressions were carried out including (adjusting for) each of the potential confounding variables sex, age and SES, one at a time, and simultaneously. For each analysis, cases that were missing necessary data were excluded (available case analysis). Because many adolescents missed information about SES, separate regressions were carried out including only those providing information about SES (n=398) (appendix 1).

Associations with a p-value below 0.05 were considered statistical significant.

Normality of residuals was evaluated by visual inspection of Q-Q plots. Analyses were carried out in SPSS 24.

## *2.6 Ethics*

Written informed consent was obtained from adolescents and parents prior to inclusion, according to the study procedures in the CAP survey. Study approval was given by the Regional Committees for Medical and Health Research Ethics (reference numbers CAP survey: 4.2008.1393, present study: 2016/1588/REK Midt), and by the Norwegian Social Science Data Services (reference number CAP survey: 19976).



### 3. Results

Internalizing and externalizing problems scores were provided by 97 % of participants. Cases with missing data are less than 4.0 % for all variables except socioeconomic status, where 27.4 % were missing.

#### 3.1 Sample descriptives

Descriptive statistics for the sample are shown in table 1.

**Table 1**  
Descriptives

	<b>Low PA n = 377 (66.1 %)</b>	<b>Moderate PA n = 139 (24.4 %)</b>	<b>High PA n = 54 (9.5 %)</b>	<b>Missing n = 0 (0 %)</b>	<b>Total n = 570 (100 %)</b>
Boys: n (%)	160 (42.4 %)	56 (40.3 %)	30 (55.6 %)	0 (0 %)	246 (43.2 %)
Girls: n (%)	217 (57.6 %)	83 (59.7 %)	24 (44.4 %)	0 (0 %)	324 (56.8 %)
Team sports participation: n (%)	86 (22.8 %)	67 (48.2 %)	35 (64.8 %)	16 (2.8 %)	188
Age at baseline: mean (SD)	15.7 (1.7)	15.7 (1.7)	15.7 (1.4)	0 (0 %)	15.7 (1.7)
SES: mean (SD)	1.5 (0.9)	1.6 (0.9)	2.0 (0.8)	156 (27.4 %)	1.6 (0.9)
YSR Internalizing problems: mean (SD)	17.7 (11.5)	15.6 (11.0)	13.1 (11.1)	18 (3.2 %)	16.8 (11.4)
YSR Externalizing problems: mean (SD)	12.3 (7.2)	10.6 (6.7)	9.6 (6.0)	18 (3.2 %)	11.6 (7.1)

Percentages are calculated from PA groups. Missing and total percentages are calculated from total sample n=570. SD = standard deviation, PA = physical activity, YSR = Youth Self Report.

#### 3.2 Associations between physical activity and internalizing/externalizing problems

Expected differences in internalizing and externalizing problems are expressed by regression coefficients when comparing moderate and high PA to low PA, see Table 2.

**Table 2**

Linear regression with YSR internalizing or externalizing problems as dependent variable.  
Regression coefficients for moderate and high PA compared to low PA.

	n	Internalizing problems		Externalizing problems	
		B (95 % CI)	p	B (95 % CI)	p
<b>High PA compared to low PA</b>					
<b>Unadjusted</b>	552	<b>-4.66 (-7.90 to -1.41)</b>	<b>0.005</b>	<b>-2.73 (-4.73 to -0.72)</b>	<b>0.008</b>
<b>Adjusted separately for</b>					
Sex	552	<b>-3.16 (-6.05 to -0.274)</b>	<b>0.032</b>	<b>-2.58 (-4.58 to -0.57)</b>	<b>0.012</b>
Age	552	<b>-4.70 (-7.90 to -1.51)</b>	<b>0.004</b>	<b>-2.74 (-4.74 to -0.73)</b>	<b>0.008</b>
SES	398	<b>-5.50 (-9.27 to -1.72)</b>	<b>0.004</b>	-1.75 (-4.08 to 0.59)	0.14
<b>Adjusted for all</b>	398	<b>-3.81 (-7.24 to -0.39)</b>	<b>0.029</b>	-1.55 (-3.90 to 0.79)	0.19
<b>Moderate PA compared to low PA</b>					
<b>Unadjusted</b>	552	-2.14 (-4.37 to 0.10)	0.061	<b>-1.71 (-3.08 to -0.33)</b>	<b>0.015</b>
<b>Adjusted separately for</b>					
Sex	552	<b>-2.21 (-4.19 to -0.23)</b>	<b>0.029</b>	<b>-1.71 (-3.09 to -0.34)</b>	<b>0.015</b>
Age	552	-2.08 (-4.28 to 0.12)	0.063	<b>-1.69 (-3.07 to -0.32)</b>	<b>0.016</b>
SES	398	<b>-2.64 (-5.14 to -0.14)</b>	<b>0.038</b>	-1.25 (-2.80 to 0.29)	0.11
<b>Adjusted for all</b>	398	<b>-2.57 (-4.82 to -0.31)</b>	<b>0.026</b>	-1.25 (-2.79 to 0.29)	0.11

Total sample: n = 570. Missing values vary between analyses. Associations with a p-value below 0.05 are written in bold letters. PA = physical activity, SES = socioeconomic status, YSR = Youth Self Report.

### 3.3. Associations between team sports participation and internalizing/externalizing problems

No statistically significant associations between team sports participation and internalizing problems or externalizing problems were found in the high activity group. The unadjusted unstandardized regression coefficients for team sports participation compared to non-participation (n=53) was -2.07 (95 % CI: -8.63 to 4.48, p = 0.53) for internalizing problems and 0.32 (95 % CI: -3.25 to 3.90, p = 0.86) for externalizing problems.

Also, no statistical significant associations were found when including potential confounding factors in the model.

#### 4. Discussion

The aims of this study are to investigate longitudinal associations between physical activity level and mental health problems in a child and adolescent psychiatric sample, and further whether team sports participation is associated with less mental health problems than individual sports. This study shows statistically significant associations between physical activity level and internalizing and externalizing problems among adolescents in a child and adolescent psychiatric sample. However, the results for internalizing problems changed to weaker associations and lower statistical significance when adjusting for sex. Furthermore, no associations were found between team sports participation and internalizing/externalizing problems among adolescents with high physical activity level in the same sample.

Although this study contains longitudinal data about PA, it lacks information about internalizing and externalizing problems from baseline and does not measure within-adolescent variation. Therefore, directions of causality cannot be determined, even though the longitudinal design favors the explanation that PA causes a reduction of mental health problems. Measuring change in internalizing and externalizing problems during the follow up period would be more informative.

High PA level compared to low PA level predicts more pronounced differences in internalizing and externalizing problems than moderate PA level compared to low PA level. This may suggest a negative dose-effect relationship between physical activity and mental health problems. A useful background knowledge for evaluating the results could be looking at the differences in internalizing and externalizing problems between clinical adolescent populations and general adolescent populations. The following numbers are differences in normative mean values between clinical and general adolescent populations, calculated from Achenbach and Rescorla (2001): For boys, the difference is 5.8 for internalizing problems and 8 for externalizing problems. For girls, the difference is 7.1 for internalizing problems and 6.6 for externalizing problems. This might give us a background for evaluating the clinical relevance of the differences between high and low PA measured in the present study. The current results are to be considered clinically meaningful because they may suggest that increased physical activity levels could be an important step towards a normal level of mental health problems for mentally ill adolescents.

A possible background mechanism for the associations measured could be that those who benefit more from PA tend to be more physically active than those who experience less effect. People respond differently to exercise interventions for depression. Many of the moderators suggested in the literature, like social support, self-esteem and marital status may also be protective factors for mental health (Schuch, Dunn, Kanitz, Delevatti, & Fleck,

2016). The placebo effect has also been suggested as a possible mechanism that differs between people (Szabo, 2013).

The differences are more pronounced for internalizing than externalizing problems when comparing adolescents with high to low PA. The same pattern is also the case when comparing adolescents with moderate to low PA. This is consistent with previous cross-sectional findings for a healthy youth population (Kantomaa, Tammelin, Ebeling, & Taanila, 2008). Previous prospective studies show conflicting results about whether depressive symptoms predict low PA levels (Jerstad, Boutelle, Ness, & Stice, 2010; Olive, Telford, Byrne, Abhayaratna, & Telford, 2016). Because internalizing symptoms include anhedonia, lack of energy, low self-efficacy and somatic complaints, it is plausible to think that the symptoms themselves can lead to low physical activity levels. Longitudinal associations with externalizing symptoms as exposure and PA level as outcome are to our knowledge not previously explicitly studied. Youth with mainly externalizing symptoms may have less obvious reasons to disengage in PA than youth with mainly internalizing symptoms. However, behavioral problems could lead to negative feedback from peers and coaches/parents which in turn reduces motivation for participation as discussed by Kantomaa et al. (2008). Studies on children and youth with ADHD report less effect from exercise on behavior than on emotional and social problems (Hoza et al., 2016), which supports the differences found in the present study.

When adjusting for sex, the associations are weaker, but still significant for internalizing problems when comparing high to low PA. This could be caused by girls in this sample being less physically active than boys as reported by Mangerud et al. (2014), and that girls are more highly represented in the low- and moderate PA groups than in the high PA group. In clinical samples, girls often have more internalizing problems and slightly less externalizing problems than boys (Achenbach & Rescorla, 2001). This can also contribute to the stronger unadjusted associations with internalizing than externalizing problems. The other associations measured did not change considerably when adjusting for sex.

When adjusting for SES, the sample size was substantially reduced. Therefore, results that were adjusted for SES could not be compared to results with larger sample sizes. The separate analyses including only participants providing information about SES showed a more valid picture of how SES influences the results as the samples were identical (Appendix 1). In these results, the associations with externalizing problems when comparing high to low PA were slightly weaker when adjusting for SES. The other results did not change considerably. Adjusting for age did not change any of the results considerably. We acknowledge that there are probably several relevant confounding factors that we have not

taken into account in this study. We consider for example parental support, support from friends (Sterdt et al., 2014), being bullied (Henriksen et al., 2016) and taking part in other organized youth activities (Badura, Geckova, Sigmundova, van Dijk, & Reijneveld, 2015) possible factors that are both associated with PA level and influencing mental health. We suggest that future epidemiological research explore a wider range of confounding factors in more detail.

No associations between team sports participation and internalizing/externalizing problems were found in the high PA level group. This may indicate that there is little additional effect from the psychological benefits from social interaction and belonging in the team compared to exercise only. However, many adolescents doing individual sports are attending organized trainings and competitions where they may achieve similar or even stronger psychological benefits. Also, because team sports participation was not measured at follow up, we do not know whether the adolescents participated throughout the follow up period.

#### *4.1 Strengths and limitations*

The follow up time of three years enables us to detect associations from engaging in physical activity in the long term. In an Australian cohort study, dropping out from sports was associated with higher psychological difficulties (Vella, Cliff, Magee, & Okely, 2015). The longitudinal design makes us able to take this into account by only including those who show persistent high activity levels in the high PA level group. Our PA measure does not include physical activities at school. This may introduce bias at high-school age where the amount of physical activity at school differs significantly among adolescents. In Norway, not all high school study programs include physical education classes. Also, some adolescents go to specialized sports high schools focusing on for example football, skiing etc. where a substantial amount of exercise is included in the teaching. These adolescents may not need to exercise outside school hours.

All data are based on self-report, which can be a source of bias. The possibility of social desirability bias, recall bias, response bias, misunderstanding of questions and unserious answers should be kept in mind when interpreting the results (Fan et al., 2006; Schechter & Herrmann, 1997). Another weakness of the study is the use of YSR at follow-up. The tool is designed and validated for use in adolescents up to the age of 18. In our sample, the mean age at follow up was 18 to 19 years.

## *4.2 Conclusion*

In this sample, a high PA level predicts significantly lower internalizing and externalizing problems than a low PA level. The difference is more pronounced for internalizing than for externalizing problems. Participation in team sports among adolescents with high PA level does not predict any difference in internalizing or externalizing problems. Similar associations for team sports participation were not measured for adolescents with low or moderate PA level.

### **Conflicts of interest**

None

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# Appendix

## Appendix 1

Linear regression with YSR internalizing or externalizing problems as dependent variable. Regression coefficients for moderate and high PA compared to low PA. Including only adolescents with information about SES (n=398)

	n	Internalizing problems		Externalizing problems	
		B (95 % CI)	p	B (95 % CI)	p
<b>High PA compared to low PA</b>					
<b>Unadjusted</b>	398	<b>-5.41 (-9.13 to -1.68)</b>	<b>0.005</b>	-2.25 (-4.58 to 0.08)	0.059
<b>Adjusted separately for</b>					
Sex	398	<b>-3.92 (-7.30 to -0.54)</b>	<b>0.023</b>	-2.10 (-4.44 to 0.24)	0.078
Age	398	<b>-5.37 (-9.06 to -1.68)</b>	<b>0.004</b>	-2.24 (-4.57 to 0.09)	0.059
SES	398	<b>-5.50 (-9.27 to -1.72)</b>	<b>0.004</b>	-1.75 (-4.08 to 0.59)	0.14
<b>Adjusted for all</b>	398	<b>-3.81 (-7.24 to -0.39)</b>	<b>0.029</b>	-1.55 (-3.90 to 0.79)	0.19
<b>Moderate PA compared to low PA</b>					
<b>Unadjusted</b>	398	<b>-2.63 (-5.13 to -0.14)</b>	<b>0.039</b>	-1.29 (-2.85 to 0.26)	0.10
<b>Adjusted separately for</b>	398				
Sex	398	<b>-2.54 (-4.79 to -0.28)</b>	<b>0.027</b>	-1.28 (-2.84 to 0.27)	0.11
Age	398	<b>-2.71 (-5.18 to -0.25)</b>	<b>0.031</b>	-1.31 (-2.86 to 0.25)	0.10
SES	398	<b>-2.64 (-5.14 to -0.14)</b>	<b>0.038</b>	-1.25 (-2.80 to 0.29)	0.11
<b>Adjusted for all</b>	398	<b>-2.57 (-4.82 to -0.31)</b>	<b>0.026</b>	-1.25 (-2.79 to 0.29)	0.11

Associations with a p-value below 0.05 are written in bold letters. PA = physical activity, SES = socioeconomic status, YSR = Youth Self Report.