

The Association of Physical Activity and Depressive  
Symptoms, and the Role of Emotion Regulation

Mohammad Abdulwahid and Mattias Olsson  
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Örebro University

Supervisor: Lauree Tilton-Weaver

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## Abstract

Given increases in depressive symptoms among Swedish adolescents, we investigated the association between physical activity and depressive symptoms, and the role of emotional regulation plays in these associations. In a longitudinal study, the sample was gathered from three mid-sized cities in Sweden. The participants were adolescents aged 13 to 19 years with a total sample size of 2973 participants. Our research questions were: Is physical activity related to depressive symptoms? What is the direction of this association? Does emotion dysregulation mediate the association between physical activity and depressive symptoms? We analyzed the data using hierarchical regressions, testing indirect effects. The results showed that there was an association between emotion dysregulation and depressive symptoms. However, there was no association between physical activity and depressive symptoms nor a mediating effect in either direction.

*Keywords:* depressive symptoms, emotional regulation, physical activity, adolescents, mediation

### Sammanfattning

Då depressiva symptom ökar bland ungdomar i Sverige väljer vi i denna studie att undersöka associationen mellan fysisk aktivitet och depressiva symptom, samt rollen emotionsregleringen spelar. Urvalet till denna studien var ifrån en tidigare longitudinell studie med ungdomar från tre städer i Mellansverige. Deltagarna i denna studie är ungdomar i åldrarna 13 till 19. Det totala urvalet till studien var 2973. Vår forskningsfråga var: Är fysisk aktivitet relaterad till depressiva symptom? I vilken riktning var de relaterade till varandra? Kan känsloreglering mediera ett samband mellan fysisk aktivitet och depressiva symptom? För att besvara vår forskningsfråga gjorde vi en hierarkisk regressionsanalys för att testa indirekta effekter. Resultatet visade att det fanns en association mellan depressiva symptom och dysfunktionell emotionsreglering. Däremot fanns det ingen association mellan fysisk aktivitet och depressiva symptom eller en medierande effekt oavsett riktning.

*Nyckelord:* depressiva symptom, emotionsreglering, fysisk aktivitet, ungdomar, mediation

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### The Association of Physical Activity and Depressive Symptoms, and the Role of Emotion Regulation

A moderate amount of physical activity is recommended to reduce depressive symptoms, according to Folkhälsomyndigheten (2013). Another way of reducing depressive symptoms is through emotion regulation (Yildiz & Duy, 2017). The benefits of physical activity and emotion regulation are of particular interest during adolescence because it is when depressive symptoms rise (Garber, Weiss, & Shanley, 1993). The aim of this study is to investigate how physical activity, emotion dysregulation, and depressive symptoms are related to each other during adolescence.

#### **Links between depressive symptoms and physical activity**

There is an increasing body of studies that suggest that physical activity can halt the development of depressive symptoms, especially in adults (Deslandes et al., 2009; Dunn, Trivedi, & O'Neal, 2001; Penedo & Dahn, 2005). The question is, to what extent does this apply to adolescents? In cross-sectional research on depressive symptoms and physical activity during adolescence (Checcini, Fernández-Rio, Méndez-Giménez, Carriedo, & Arruza, 2017; McDowell, MacDonncha, & Herring, 2017) the results have all suggested that higher levels of physical activity are associated with a decrease in depressive symptoms. Researchers have interpreted this as meaning that engaging in moderate to high levels of physical activity decreases the risk of depressive symptoms in adolescence.

Results of studies using longitudinal data are more equivocal. Some have found that among adolescents, physical activity declines as depressive symptoms increase between the ages of 12 to 17 years (Duncan, Seeley, Garu, Stycker, & Farmer, 2012). Among these studies, low amounts of physical activity were linked to increases in depressive symptoms (Baldursdottir, Gylfason, Krettek, Sigfusdottir, & Valdimarsdottir, 2016; Duncan et al., 2012).

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De Jonge, Oldehinkel, Ormel, Roest, Stavrakakis, and Verhulst (2013), however, found no significant association between physical activity and depressive symptoms.

Looking at the differences across studies, it may be that De Jonge et al. (2013) found a different result than the others because they looked at specific aspects of physical activity whereas in the other studies physical activity was assessed at a more general level. No study, however, has looked at a physical activity that does not include exercise or organized sports. We view this as important because people can be physically active in other ways, such as cleaning the house, gardening, or moving at work. We speculate that the problem with looking at a specific physical activity is that it underestimates adolescents' physical activity by focusing only on activity in sports, failing to include other physical activity that is also important. Another explanation for the lack of concordance in results might be that the longitudinal lags differed. To overcome this bias, more general measures of physical activity should be used.

Another possible reason for the divergence in results is that DeJong et al. (2013) used an interval of 2.5 years, whereas others used annual assessments. If 2.5 years is too long for the beneficial results of physical activity to emerge, shorter intervals should be used.

We also identified a third problem, the assumption that the causal direction is from physical activity to depressive symptoms. It is also possible that adolescents who feel depressed lack the motivation to continue engaging in physical activity, becoming more sedentary. De Jonge et al. (2013) recognized the importance of this issue and tested both directions. However, they found no significant associations in either direction. Nonetheless, this is an important issue that needs to be addressed by analyses that test both potential causal directions.

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In summary, what is needed is to test the direction of associations between physical activity and depressive symptoms are longitudinal data, with lags less than two years, and with physical activity measured more generally.

### **Links between physical activity and emotion regulation/dysregulation**

The previous research on emotion regulation and physical activity is an impressive body of work and it contains experimental studies on adults. In an experimental study with a rather small sample ( $n = 27$ ), Edwards, Loprinzi, and Rhodes (2017) stressed participants by having them watch a film. Following the stressor, two randomly-assigned groups either walked or jogged for 15 minutes. The control group stretched for 15 minutes. The results showed that the control group reported significantly higher levels of anger and anxiety than both experimental groups, and the group that jogged reported the lowest level of anxiety. In a similar experimental study with a larger sample ( $n = 80$ ), Mikolajczak et al. (2015) found that physical activity regulated sadness, but only for the participants that were having difficulties with emotion regulation, to begin with. Another experimental study on this subject (Bernstein, Curtiss, Wu, Barreira, & McNally, 2018) found that physical activity only makes participants recover faster to their baseline levels when it comes to anxiety. The study also suggested that the intensity of emotions had no association with physical activity. Although these studies generally show physical activity helps regulate anger and anxiety, and to a lesser extent, sadness. However, all these studies focused on the short-term effects of physical activity and most focused exclusively on some form of walking or jogging. Moreover, the studies focus solely on reduced negative emotions and not the mechanisms of emotion regulation. There is also a lack of studies on how physical activity is linked to emotion regulation during adolescence. If physical activity helps negative emotions during adolescence, decreases in physical activity may compromise adolescents' ability to regulate their emotions. Thus, the

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issue of how physical activity relates to emotion regulation and negative moods are important issues to address.

### **Links between emotion regulation/dysregulation and depressive symptoms**

Previous research conducted by Fussner, Luebbe, and Bell (2015) has shown a link between emotion regulation problems and depressive symptoms during adolescence, where adolescents who are depressed are unable to maintain positive affect and dampen negative affect. In essence, they develop forms of emotion *dysregulation* or cognitions and behaviors that detract from regulating stressful events and negative mood. Two types of dysregulation are most commonly tied to depressive symptoms: rumination and worry. Rumination is according to Pedersen (2018) defined as obsessive overthinking and mental replay of a past negative event repeatedly without making any progress towards a resolution. Worry is defined by Borkovec, Robinson, Pruzinsky, and DePree, (1983) as:

A chain of thoughts and images, negatively affect-laden and relatively uncontrollable. The worry process represents an attempt to engage in mental problem-solving on an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes. Consequently, worry relates closely to fear process. (p.10)

Researchers have found associations between these two types of dysregulation and depressive symptoms (Flett, Coulter, Hewitt, & Nepon; 2011; Fowler, Miernicki, Rudolph, & Telzer, 2017; Verstraeten, Bijttebier, Vasey, & Raes, 2011; Young & Dietrich, 2015). Research by Anniko, Boersema, and Tillfors (2018) have shown that some forms of dysregulation mediate the link between stress and depressive symptoms (e.g., worry). The conclusion of most researchers is that emotion dysregulation ties stressful events to increases in depressive symptoms. However, no research has specifically examined whether a) physical

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activity reduces emotion dysregulation, and b) whether emotion dysregulation mediates the associations of physical activity and depressive symptoms.

Like other research examining only one direction of causality, it is possible that the onset of depressive symptoms gives rise to dysregulation. Certainly, depression leads to many different types of cognitive biases, such as hostile attribution bias (Nasby, Hayden, & DePaulo, 1980). It stands to reason that when adolescents experience depressive symptoms, dysregulations increase. Thus, both directions of associations are of interest.

To summarize, previous research has indicated that physical activity reduces negative affect in adults. It has been assumed that physical activity helps regulate emotions and in turn, reduces depressive symptoms. The research on adults has not been consistent because of differences in measuring physical activity and differences in longitudinal time lags. More importantly, the idea that physical activity reduces depressive symptoms has not been tested with an adolescent sample. The first issues to address, are the design problems. In this study, we used a general measure of physical activity, to avoid underestimating what adolescents do. We also used longitudinal data that were collected annually, to assess when changes in physical activity and depressive symptoms are likely to occur.

To extend the literature, we focus on emotion dysregulation, specifically rumination and worry, as mechanisms linking physical activity and depressive symptoms. Although the evidence is relatively clear that emotion dysregulation is related to increases in depressive symptoms, it is not clear if physical activity is related to decreased dysregulation. To address this, we assessed rumination and worry, to find out if these are related to physical activity.

Because physical activity is linked to both depressive symptoms and to emotion regulation, and theory suggests that emotion dysregulation leads to depressive symptoms, a reasonable conclusion is that physical activity leads to fewer depressive symptoms because it improves emotion regulation. In other words, we expect lower levels of physical activity to be

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related to higher levels of worry and rumination. In turn, we expect higher levels of worry and rumination to be related to increases in depressive symptoms.

However, we also speculate that there is an alternative model, in which the causal direction is reversed. With limited research examining this possibility, but logic suggesting that it is possible, we tested a theoretical model in which depressive symptoms give rise emotion dysregulation and result in decreased physical activity. Specifically, we expected higher levels of depressive symptoms to be related to lower levels of physical activity, mediated by higher levels of worry and rumination.

In summary, we tested two models linking physical activity and depressive symptoms via emotion dysregulation (i.e., worry and rumination), with each model testing a different causal direction.

### **Method**

#### **Sample**

The participants for this study were from Trestadstudien (Boersma, 2018). This longitudinal study involved five waves of data collected from students in grades 7 and 8 at the start of the study. The students attended public schools in three small to mid-sized communities in the middle of Sweden. Our study used data collected at waves 2 and 3 (referred to as T1 and T2, respectively) when questions on emotion dysregulation were available. The full sample consisted of 3864 students of whom 2973 participants had completed data in T1 and T2. The sample consisted of 1407 (47.3%) girls and 1566 (52.7%) boys. The participants ranged in age from 13 to 19 ( $M_{age} = 14.85$  years,  $SD = 0.73$ ).

To test if the participants responded to the questionnaire both times ( $n = 2973$ ) were significantly different from the participants that dropped out at T2, we compared the two groups on all T1 study variables with t-tests. The results showed that more boys than girls dropped out at T2,  $t = -1.46$ ,  $p = .14$ . We found no other significant differences.

## Measures

**Worrying.** We used The Penn State Worry Questionnaire (PSWQ; Chorpita, Tracey, Brown, Collica, & Barlow, 1997), consisting of 14 items asking participants about what the adolescents do when they become scared or start to worry about something (sample items are: “My worries really bother me,” “I don’t really worry about things,” “When I’m under pressure, I worry a lot.”). Students responded using a 4-point Likert scale ranging from *never true* (1) to *always true* (4). The inter-item reliability of the measure was  $\alpha = .91$ .

**Rumination.** To assess rumination, we used the Children’s Response Styles Scale (CRSS-rumination subscale; Rood, Roelofs, Bögels, & Alloy, 2010; Ziegert & Kistner, 2002), consisting of a 10-item scale asking the adolescents what they do when they feel sad. Sample items are: “I think about the other times that I felt this way,” “When I’m feeling sad, I think about that I should have done things differently,” “When I’m feeling sad, I withdraw and think about why I feel that way,” and “When I’m feeling sad, I isolate myself to think about my feelings.” The participants responded using a 5-point Likert scale ranging from *never* (1) to *always* (5). The inter-item reliability of the measure was  $\alpha = .92$ .

**Depressive symptoms.** We used the Epidemiological Studies Depression Scale for Children (CES-DC; Olsson & von Knorring 1997; Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977), to assess depressive symptoms. The measure consisted of 20 items tapping their symptoms in the week prior to data collection. Sample items are: “I didn’t sleep as well as I usually sleep,” “I did not feel like eating; I wasn’t very hungry,” “I felt like I couldn’t pay attention to what I was doing,” “I felt like I was too tired to do things,” and “I felt scared.” Students responded using a 4-point Likert scale ranging from *not at all* (1) to *often* (4). The inter-item reliability of the measure was  $\alpha = .92$ .

**Physical Activity.** This was a single item, created for the study, asking how much physical activity the students engaged in during a week. The response scale ranged from “I

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*rarely or never do physical activities in my spare time such as sport, run, swim, ride a bike, dance, go to the gym, etc.” (1) to “I very often (7 or more times a week) do physical activities in my spare time” (5).*

### **Procedure**

Trained research assistants collected the data yearly, using questionnaires administered to the students during their classes. The participants were given 90 minutes to complete the questionnaires, during which they were provided with a break and snacks.

Prior to collecting the data, the assistants provided information about the content of the study, guarantees of confidentiality, and the students' rights to end their participation without penalty. The parents of the participants were informed beforehand and gave consent, due to the ethical rules of underaged participants.

### **Plan of Analysis**

We used hierarchical regression to test two models, each involving the association of physical activity with depressive symptoms. The first analysis used depressive symptoms at T2 as the outcome. In the first block of variables, we entered depressive symptoms at T1 to control for baseline levels. Next, we entered physical activity at T1 as the independent variable. In a final step, we entered the emotion dysregulation variables (i.e., rumination and worry). We then used the PROCESS module (Hayes, 2013) which is a tool used in a statistical analysis program (SPSS) to test whether emotion dysregulation mediated the association between physical activity and change in depressive symptoms. For the second analysis, we used physical activity at T2 as the outcome. As before, we entered physical activity at T1 as a control. Next, we entered depressive symptoms at T1 to predict change in physical activity. The emotion dysregulation variables were then entered and tested as mediators using the PROCESS module.

## Results

We calculated the descriptive statistics and zero-order correlations (see Table 1) prior to modeling. All the study variables were significantly inter-correlated. We did, however, find some unusual correlations, depressive symptoms T1 and physical activity T1 had a weak negative correlation (-.24), and the same for depressive symptoms T2 and physical activity T2 (-.22) as reported in Table 1.

Table 1

*Descriptive statistics and correlations between study variables*

Construct	<i>M</i>	<i>SD</i>	$\alpha$	Correlations					
				1	2	3	4	5	6
1. Depression T1	35.4	11.6	.92	-	.61**	-.24**	-.19**	.59**	.49**
2. Depression T2	36.1	11.7	.92	.61**	-	-.16**	-.22**	.48**	.38**
3. Physical Activity T1	2.90	1.23	-	-.24**	-.16**	-	.63**	-.14**	-.09**
4. Physical Activity T2	2.90	1.22	-	-.19**	-.22**	.63**	-	-.15**	-.10**
5. Worry	30.8	9.24	.91	.59**	.48**	-.14**	-.15**	-	.62**
6. Rumination	28.5	9.58	.92	.49**	.38**	-.09**	-.10**	.62**	-

*Note.*  $n = 2793$ .

### Does physical activity predict change in depressive symptoms, and is it mediated by emotion dysregulation?

In our first set of analyses, we tested if physical activity predicted change in depressive symptoms through rumination and worry (see Table 2). The result of the control block showed that baseline depressive symptoms at T1 predicted depressive symptoms at T2 ( $b = .63$ ,  $SE = 0.02$ ,  $\beta = .61$ ,  $t = 35.33$ ,  $p < .001$ ), with approximately 37% of the variance in depressive symptoms shared over time ( $R^2 = .37$ ,  $F = 1247.86$ ,  $p < .001$ ). This means depressive symptoms showed some rank-order change (~63%). The results of block 2 revealed that physical activity did not predict depressive symptoms,  $b = -.14$ ,  $SE = 0.17$ ,  $\beta = -.01$ ,  $t = -0.81$ ,  $p = .42$ . In block 3, depressive symptoms were significantly predicted by rumination,  $b = 0.06$ ,  $SE = 0.03$ ,  $\beta = .05$ ,  $t = 2.25$ ,  $p < .05$ , and worry,  $b = .21$ ,  $SE = 0.03$ ,  $\beta = .16$ ,  $t = 6.90$ ,  $p < .001$ . That is, higher levels of rumination and worry at T1 were related to increases in depressive symptoms. However, only about 2% of the variance in this second

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block was explained by these three variables ( $R^2 = .02$ ,  $F = 28.35$ ,  $p < .001$ ). This tells us that the combined contribution of physical activity, rumination, and worry to predicting change in depressive symptoms is rather small. We found no support for mediation, as neither the combined indirect effect ( $b = -.0001$ ,  $p = .99$ ) nor the individual indirect effects were significant: rumination ( $b = .0057$ ,  $SE = 0.01$ ,  $\beta = .0006$ ,  $t = 0.57$ ,  $p = .67$ ) and worry ( $b = -.0058$ ,  $SE = 0.03$ ,  $\beta = -.0006$ ,  $t = 0.38$ ,  $p = .79$ ). Approximately 39% of the variance in depressive symptoms at T1 was accounted for by the full set of predictors ( $R^2 = .39$ ). In sum, the analysis revealed that depressive symptoms were not significantly predicted by physical activity or mediated by rumination or worry.

Table 2  
*Regression Model Estimates*

Outcome and model	<i>b</i>	<i>SE</i>	<i>B</i>	<i>T</i>	<i>P</i>	$R^2 / \Delta R^2$	$F / \Delta F$	<i>p</i>
Depression T2								
Block 1						.37	1247.86	<.001
Depression T1	0.63	0.02	.61	35.33	<.001			
Block 2						.02	28.35	<.001
Physical activity T1	-0.14	0.17	-.01	-0.81	.42			
Rumination	0.06	0.03	.05	2.25	.02			
Worry	0.21	0.03	.16	6.90	<.001			
Block 3: Mediation								
Total indirect	-0.0001	0.04	<.0001	-0.003	.99			
Rumination	0.0057	0.01	.0006	0.57	.67			
Worry	-0.0058	0.03	-.0006	0.38	.79			
Full model						.39	345.22	<.001
Physical activity T2								
Block 1						.40	1403.40	<.001
Physical activity T1	0.64	0.02	.63	37.46	<.001			
Block 2						.004	4.45	<.001
Depression T1	-0.002	0.002	-.02	-0.94	.35			
Rumination	-0.001	0.003	-.004	-0.20	.85			
Worry	-0.006	0.003	-.05	-1.93	.05			
Block 3: Mediation								
Total indirect	-0.0031	0.0015	-.03	-2.07	.28			
Rumination	-0.0002	0.0012	-.002	-0.17	.89			
Worry	-0.0029	0.0016	-.03	-1.81	.32			
Full model						.40	355.89	<.001

### **Does depressive symptom predict change in physical activity, and is it mediated by emotion dysregulation?**

In our second set of analyses, we tested if change in physical activity was predicted by depressive symptoms and if this prediction was mediated by rumination and worry (see Table 2). The results of the control block showed that baseline physical activity at T1 predicted physical activity T2 ( $b = .64$ ,  $SE = 0.02$ ,  $\beta = .63$ ,  $t = 37.46$ ,  $p < .001$ ), explaining approximately 40% of the variance ( $R^2 = .40$ ,  $F = 1403.40$ ,  $p < .001$ ). This result indicated that physical activity had some stability, but also a good degree of variability in change (~60%). The results of the second block, adding depressive symptoms, rumination, and worry explained a very small but significant amount of variance in the change in physical activity (0.4%,  $R^2 = .004$ ,  $F = 4.45$ ,  $p < .001$ ). Examining the individual estimates revealed that depressive symptoms did not significantly predict change in physical activity,  $b = -.002$ ,  $SE = 0.002$ ,  $\beta = -.02$ ,  $t = -0.94$ ,  $p = .35$ . Neither was change in physical activity significantly predicted by rumination,  $b = -.001$ ,  $SE = 0.003$ ,  $\beta = -.004$ ,  $t = -0.20$ ,  $p = .85$ , or worry  $b = -.006$ ,  $SE = 0.003$ ,  $\beta = -.05$ ,  $t = -1.93$ ,  $p = .05$ . The total variance explained by this model is 0.4% ( $R^2 = .004$ ,  $F = 4.45$ ,  $p < .001$ ). This indicates that these three variables play a combined role in predicting physical activity. We found no support for mediation, as neither the combined indirect effect ( $b = -.0031$ ,  $p = .28$ ) nor the individual indirect effects were significant: rumination ( $b = .0002$ ,  $SE = 0.0012$ ,  $\beta = -.002$ ,  $t = -0.17$ ,  $p = .89$ ) and worry ( $b = -.0029$ ,  $SE = 0.0016$ ,  $\beta = -.03$ ,  $t = -1.81$ ,  $p = .32$ ). Approximately 40% of the variance in physical activity at T1 was accounted for by the full set of predictors ( $R^2 = .40$ ). In sum, the analyses revealed that change in physical activity was not significantly predicted by depressive symptoms, nor mediated by rumination or worry.

Thus, our results found no support for the idea that depressive symptoms and physical activity are predicted by each other in either direction. Nor did we find evidence supporting

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the idea that rumination and worry mediated associations between physical activity and depressive symptoms. Like others, we found that worry and rumination predicted increases in depressive symptoms, even after controlling for physical activity.

### **Discussion**

The purpose of this study was to investigate 1) how physical activity, emotion dysregulation, and depressive symptoms are related to each other during middle adolescence, 2) why adolescents tend to become more sedentary and mood problems rise. In this study, we tested whether emotion dysregulation mediated the association between physical activity and depressive symptoms. We tested both potential directions from physical activity to depressive symptoms and vice versa. We found no evidence that physical activity is related to change in depressive symptoms nor evidence that depressive symptoms are related to change in physical activity. We found, however, that adolescents who worry and ruminate feel increasingly depressed, a result well-founded in previous literature (Young & Dietrich, 2015). We did not, however, find any signs that these dysfunctional regulation strategies act as mechanisms linking physical activity and depressive symptoms.

Instead, we found marginally significant result indicating that physical activity is predicted by worrying. In other words, the more the adolescents worried the less physically active they were. This suggests that the association between physical activity and worrying found in previous cross-sectional research (Mikolajczak et al., 2015) should not have been interpreted as physical activity predicting worry. Rather the opposite direction is supported by our study.

This study is a minority in this field as we did not find an association between general physical activity and depressive symptoms which is coherent with the results from the study conducted by De Jong et al. (2013) in which specific physical activity were examined. This can however perhaps be explained by the fact that previous research (Checcini et al., 2017;

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McDowell, 2017) have taken the intensity of the physical activity into consideration. Another possible explanation for our results might be that we use a single item measure of physical activity. Due to limitations in our data, we had no way to assess reliability or validity. Hence, error in our measurement may have contributed to Type 2 error. We recommend future research attend to these measurement issues, taking a more multidimensional approach, tapping the type of physical activity, as well as the intensity, frequency, duration, and regularity of activity. Another possibility is not to rely on self-reports. Rather, researchers could use more objective measures, such as pedometers, accelerometers, and similar devices (e.g., Fitbit®).

Another issue that may explain our lack of findings is that this study investigates the long-term effects whereas the effects found in experimental studies such as Edwards et al. (2017) are of very short duration, without few lasting effects.

Another avenue for future research would be for researchers to examine emotion regulation strategies that might be more amenable to change through physical activity. This might include positive emotion regulation strategies such as mindfulness.

Despite the limitations we have just recognized, our study has some considerable strengths, including a very large longitudinal sample of individuals which indicates a good generalizability, and measured at the appropriate time for seeing a change in physical activity and depressive symptoms. This prospective measurement depressive symptoms likely reduced recall bias. Another strength of our study is the use of well-known and validated instruments to depressive symptoms, worrying, and rumination. A third strength with this study is that the measures used in this study are all very strong since they all have a reliability score over .90.

In our study, we found empirical support for that physical activity does not decrease depressive symptoms. This is particularly interesting given that both the World Health Organization (2013) and Folkhälsomyndigheten (2013) are recommending physical activity to

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decrease depressive symptoms. These findings may also be part of the explanation as to why depressive symptoms continue to increase among adolescents in Sweden (Socialstyrelsen, 2017). However, further research is needed before concluding that physical activity is unrelated to mood problems during adolescence. Until a clearer picture is provided, practitioners likely need to focus on emotion dysregulation problems in their attempts to reduce depressive symptoms. If our results are correct, it would also prove beneficial for adolescents' physical activity and health.

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