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## Brief report: Longitudinal associations between sedentary behaviours and depressive symptoms in adolescent girls



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## ABSTRACT

The purpose of this study was to examine longitudinal associations between sedentary behaviours (SB) and depressive symptoms in adolescent girls. Participants ( $n = 341$ ) completed the self-report ecological momentary assessments diary for the measurement of sedentary behaviours and completed the Center for Epidemiological Studies Depression scale (CES-D) at three time points during a 4-year period. The association between SB and depressive symptoms over time was examined with latent growth models. Both depressive symptoms and SB increased over time. Baseline levels of depressive symptoms were predictive of change in SB, but initial levels of SB did not predict changes in depressive symptoms. These prospective associations remained controlling for age, home electronic equipment and socioeconomic status.

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Depression and depressive disorders are among the leading causes of poor quality of life in Western countries (McLaughlin & King, 2015). Adolescence is a period of heightened vulnerability for the onset of depressive symptoms, and the gender differences in depressive symptoms is first observable during the early adolescent period and becomes pronounced by late adolescence (McLaughlin & King, 2015). Adolescents depression portend a wide range of negative consequences across the life-course, including risk of recurrent episodes in adulthood and poor psychosocial functioning (Costigan, Barnett, Plotnikoff, & Lubans, 2013). Thus, it is important to elucidate factors that increase risk for depression and depressive symptoms in adolescents (Sund, Larsson, & Wichstrom, 2011).

Increases in sedentary behaviours (SB), and in particular entirely sedentary pastimes, such as television viewing and use of computer/electronic games have been reported over the past decades (Costigan et al., 2013). However, a growing body of evidence suggests that high levels of SB has been linked with adiposity, low fitness and some cardiovascular disease risk factors (Tremblay et al., 2011). Additionally, excessive sedentary time has detrimental effects on prosocial behaviours, such as spending time with parents and doing homework (Ramirez et al., 2011), and is also linked with mental health (Hume et al., 2011). There is also evidence suggesting that adolescent girls spend more time in SB, such as watching television, compared with boys (Costigan et al., 2013). Moreover, transition from early to mid-adolescence is a period of high risk for the onset of depression, especially among girls (Ferreiro, Seoane, & Senra, 2012). However, previous longitudinal research examining the relationship between SB and depressive symptoms is still limited. Sund and co-workers (Sund et al., 2011) showed that time spent in sedentary activities predicted depressive symptoms 1 year later in 12-to-15-year-old Norwegian boys but not in girls.

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Additionally, Schmitz et al. (2002) found that adolescents' screen time was predicted by depressive symptoms half a year ago, but a bidirectional effect was not examined. However, in these two studies, only short-time longitudinal relationships between depressive symptoms and SB were investigated. Thus, characterizing depressive symptoms and SB trajectories and their associations with one another over longer time are needed. We address this gap in the literature using data from a three-wave prospective study of adolescent girls. Specifically, we examine longitudinal associations between girls' depressive symptoms and SB across a four-year period. Given there are numerous known risk factors for depression (Costigan et al., 2013) and SB (Biddle, Gorely, Marshall, & Cameron, 2009), we controlled for age, family's socioeconomic status and home electronic equipment.

## Method

### Participants

This is a school-based longitudinal study of adolescent girls carried out in a public schools from city Tartu, Estonia. All public schools ( $N = 18$ ) from a city were invited to participate and 83% ( $n = 15$ ) agreed to take part. Details about basic demographics were self-reported or parent-reported (socioeconomic status = SES). Family's SES was measured with parents' report of family income (2-items, 1 = very low, 5 = very high) and their education level (2-items). Participants were recruited in the beginning of 5th grade and data were collected on three occasions over a 4-year period. These three occasions were Fall of 2010 (beginning of 5th grade, T1,  $N = 368$ ,  $M_{\text{age}} = 11.3 \pm .4$  years), Fall of 2012 (T2,  $N = 352$ ,  $M_{\text{age}} = 13.3 \pm .4$  years), and Fall of 2014 (T3,  $N = 341$ ,  $M_{\text{age}} = 15.3 \pm .3$  years). One-way analysis of variance (ANOVA) revealed no significant differences in age, socioeconomic status, SB and depressive symptoms among those who dropped out of the study and participants remaining in the study.

### Procedure

Prior to data collection, permission was obtained from the parents and from the school principals. At each wave of data collection, researchers visited schools and administered questionnaires to adolescents. Depressive symptoms were measured at the end of the week during which SB data was collected. Family's SES was reporter by parents before baseline data collection. Participants were trained to complete EMA self-report diary by practicing in the presence of a trained research assistant. All procedures were approved by the University of Tartu Medical Ethics Committee.

### Measures

The current study employed a self-report ecological momentary assessment (EMA) procedures outlined by Biddle et al. (2009) for capturing SB. EMA is a method of capturing behavioural episodes and it allows participants to report their current behaviour at a time specified. EMA diary was completed outside of school hours. For the present study, participants were instructed to complete the diary for four days (three weekdays and one weekend day), at 15-min intervals, participants self-reported their main behaviour in response to a single item: "What are you doing now"? For each weekday, 44 time-samples were obtained (one every 15 min from 07.00 h to 08.00 h and from 15.00 h to 23.45 h). For the weekend day, 68 time-samples were obtained (one every 15 min from 07.00 h to 23.45 h). To estimate the time spent in each behaviour category (see Table 1),

**Table 1**  
Descriptive statistics across time ( $N = 341$ ).

Measure	Time 1		Time 2		Time 3	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Watching television schooldays	78.3	16.3	85.7	18.7	88.4	18.8
Watching television WED	105.6	21.9	115.3	23.8	126.7	24.6
Using a computer schooldays <sup>a</sup>	136.3	18.8	144.5	24.8	157.2	27.2
Using a computer WED	155.4	21.6	167.8	25.1	189.3	29.4
Sedentary hobbies schooldays <sup>b</sup>	122.8	15.6	131.2	17.2	145.2	20.5
Sedentary hobbies WED	128.4	17.9	135.3	21.6	152.2	22.6
Doing homework schooldays	55.2	14.3	63.6	16.4	72.1	19.9
Doing homework WED	39.2	11.5	44.2	14.2	49.2	15.6
Sum of sedentary behaviours school-days <sup>c</sup>	392.6	31.6	425.0	33.5	462.6	34.6
Sum of sedentary behaviours WED	428.6	33.5	462.6	34.8	517.4	36.5
Depressive symptoms (0–60)	16.7	5.5	17.5	5.9	18.5	6.4

Note. WED = weekend day; all sedentary behaviours are min.day<sup>-1</sup>.

<sup>a</sup> Sum of all activities related to using of a computer.

<sup>b</sup> Sum of sitting and talking, listening to music, using the telephone, reading and behavioural/cognitive hobbies.

<sup>c</sup> Sum of watching television, using of a computer, sedentary hobbies and doing homework.

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