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ORIGINAL ARTICLE

Factors associated with good self-rated health in European adolescents: a population-based cross-sectional study

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Abstract
Objectives The aim of the present study was to investigate self-reported health status and associated factors.
Methods In this cross-sectional study, the participants were 6501 adolescents (52% females) aged 14–19 years from three European countries: Croatia, Lithuania and Serbia. Self-rated health was assessed by using one item question: "How would you perceive your health?" The answers were arranged along a 5-point Likert-type scale: (1) very poor, (2) poor, (3) fair, (4) good and (5) excellent. The outcome was binarized as "good" (fair, good and excellent) and "poor" health (very poor and poor). Potential factors associated with self-rated health included demographic (age, gender, socioeconomic status and body-mass index), social (social capital) and lifestyle (physical activity and psychological distress) variables.
Results In both univariate and multivariate models, being older, being a boy, having higher level of family, neighbourhood and school social capital, participating in moderate-to-vigorous physical activity more frequently and having low psychological distress were associated with good self-rated health.
Conclusions Our findings suggest strong associations between social and lifestyle factors and self-rated health. Other explanatory variables will require future research.

Keywords Social capital · Physical activity · Mental problems · Youth · Health

Introduction

Adolescence represents a period marked with great physical, social, economic and mental changes (National Research Council and Institute of Medicine 2007).

One of the most investigated social factors is social capital. It represents "the resources that are derived from an individual's social network" (Portes 1998). According to Coleman (1990), social capital inheres in the structure of relations between persons and among persons. Associations between social capital and health have been primary investigated in adults (Murayama et al. 2012). In children and youth, most of the studies have examined the associations between social capital and academic achievement (Coleman 1990). A few studies have reported that different social factors, such as monthly income, family support and school environment have been important factors in adolescent health (Novak et al. 2015; Sharma et al. 2016).

Physical activity is, along with social capital, a potential factor influencing adolescent health (Novak et al. 2016). Today, physical inactivity is a major public health problem, causing chronic diseases at any age (World Health Organization 2009). Several studies have investigated the associations between physical activity and self-rated health in adolescents (Galan et al. 2013; Tittlbach et al. 2011). Galan et al. (2013) reported, that higher levels of moderate-to-vigorous physical activity were strongly associated with

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health benefits. In general, short-term benefits of physical activity are associated with improvements in blood pressure, body-mass index, emotional and behavioural functioning (Biddle and Asare 2011; Janssen and Leblanc 2010).

Physical activity has been shown to have positive effects on psychological distress (Hamer et al. 2009) and better mental self-reported health scores among adults (Kim et al. 2012). In children and youth, recently there has been a few studies investigating the associations between psychological distress and self-rated health (Novak et al. 2015; Novak and Kawachi 2016). Psychological distress was treated as a cofounding variable in the study by Novak et al. (2015) and served as a dependent variable in the study by Novak and Kawachi (2016). In both studies, the associations between self-rated health and psychological distress were inverse, that is, high self-rated health was associated with low psychological distress.

In addition one study showed that higher levels of depressive symptoms and poor self-rated health were both associated with lower sociodemographic factors, like subjective household income (Meireles et al. 2015). Body-mass index is also self-rated health. A few studies have obtained the inverse associations between self-rated health and body-mass index in adolescents, that is, higher values of body-mass index indicated poorer self-rated health (Krause and Lampert 2015; Novak et al. 2015; Meireles et al. 2015). According to the literature sources, higher values of body-mass index may have negative effects on the subjective overall health (Vingilis et al. 1998).

There have been only a few studies investigating the associations between social, lifestyle and socioeconomic factors with self-rated health in adolescents (Meireles et al. 2015; Vingilis et al. 1998). Also, the same associations are still unclear in transitional European countries and there has been no study investigating this topic. Thus, the aim of the present study was to investigate self-reported health status and associated factors in a large sample of European adolescents. We hypothesised, that good self-rated health may be associated with higher social capital in family, neighbourhood and school domains, higher levels of moderate-to-vigorous physical activity and total physical activity and self-perceived socioeconomic status, while poor self-rated health may be associated with higher body-mass index and psychological distress.

Methods

Participants

This study was conducted on a 6501 adolescents from three European countries: Croatia, Lithuania and Serbia. A random sampling approach was used to select secondary schools. At the first stage, we randomly selected schools from different districts of each country. For example, there are 18 districts and approximately 540 secondary schools in Serbia. We approached to 18 schools, where randomization for each school in each district was done by replacement, by drawing school codes on slips of paper from a box, with each school having equal probability of selection. At the second stage, classes from schools who wanted to participate in the study were randomly selected in the same way. At the end, 20 schools from Croatia, 15 school from Lithuania and 15 schools from Serbia took part in the study. Response rate for final sample was 97.0% and by country 95% for Croatia, 98% for Serbia and 98% for Lithuania. Before the study was conducted, students, along with their parents/guardians needed to sign informed consent for the participation in the study. The basic descriptive statistics are presented in Table 1. This study was approved by the Ethics Committee of the Faculty of Kinesiology, University of Zagreb, Croatia. All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Self-rated health

The outcome variable of self-rated health was assessed using one-item question: "How would you rate your health status?" with five possible answers arranged on a Likert scale: (1) very poor, (2) poor, (3) fair, (4) good and (5) excellent (Eriksson et al. 2001). Then, the answers were categorized as "very poor" and "poor" represented "poor", while "fair", "good" and "excellent" represented "good" self-rated health. The measure of self-rated health was previously used as a predictor of mortality among adolescents (Johnson and Richter 2002).

Social capital domains

Social capital was organized in three major domains: family, neighbourhood and school social capital (Furuta et al. 2012). Family social capital was assessed by using one question: "Do you feel your parents trust you?" Neighbourhood social capital was assessed by using two questions: "Do you feel your neighbours trust you?" and "Do you feel your neighbours criticise someone's deviant behaviour during school period?" First question was part of the neighbourhood trust and the second one was part of the informal social control. School social capital was assessed by using three questions: "Do you feel teacher and students trust each other in your school"? "Do you feel students

Table 1 Study characteristics of the participants from Croatia, Lithuania and Serbia, 2015/2016 ($N = 6501$)

	Total ($N = 6501$)	Males ($N = 3078$)	Females ($N = 3422$)	p*
Age (years)				
14–15	630 (9.7)	298 (9.7)	332 (9.7)	0.940
16–17	1219 (18.8)	572 (18.6)	647 (18.9)	
18–19	4652 (71.6)	2209 (71.7)	2443 (71.4)	
Family trust (parent–child trust)				
Low	358 (5.5)	156 (5.1)	202 (5.9)	0.142
High	6143 (94.5)	2923 (94.9)	3220 (94.1)	
Neighbourhood trust (neighbour–child trust)				
Low	1850 (28.5)	736 (23.9)	1114 (32.6)	**<0.001**
High	4651 (71.5)	2343 (76.1)	2308 (67.4)	
Informal social control (neighbour criticises child)				
Low	1564 (24.1)	764 (24.8)	800 (23.4)	0.181
High	4937 (75.9)	2315 (75.2)	2622 (76.6)	
Vertical school trust (teacher–student interpersonal trust)				
Low	1963 (30.2)	838 (27.2)	1125 (32.9)	**<0.001**
High	4538 (69.8)	2241 (72.8)	2297 (67.1)	
Horizontal school trust (student interpersonal trust)				
Low	1650 (25.4)	611 (19.8)	1039 (30.4)	**<0.001**
High	4851 (74.6)	2468 (80.2)	2383 (69.6)	
Reciprocity at school (collaboration between students in school)				
Low	843 (13.0)	328 (10.7)	515 (15.0)	**<0.001**
High	5658 (87.0)	2751 (89.3)	2907 (85.0)	
Total physical activity (in a week)				
<300 min/week	5402 (83.1)	2474 (80.4)	2928 (85.6)	**<0.001**
≥300 min/week	1099 (16.9)	605 (19.6)	494 (14.4)	
Frequency of undertaking moderate-to-vigorous physical activity (days)				
0	1265 (19.5)	450 (14.6)	815 (23.8)	**<0.001**
1–2	2427 (37.3)	1033 (33.5)	1394 (40.7)	
3–4	1840 (28.3)	989 (32.1)	851 (24.9)	
5–6	670 (10.3)	414 (13.4)	256 (7.5)	
7	299 (4.6)	193 (6.3)	106 (3.1)	
Body-mass index				
Underweight	837 (12.9)	170 (5.5)	667 (19.5)	**<0.001**
Normal	4936 (75.9)	2385 (77.5)	2551 (74.5)	
Overweight	608 (9.4)	435 (14.1)	173 (5.1)	
Obesity	120 (1.8)	89 (2.9)	31 (0.9)	
Self-rated health				
Poor	343 (5.3)	114 (3.7)	229 (6.7)	**<0.001**
Good	6158 (94.7)	2965 (96.3)	3193 (93.3)	
Psychological distress				
Low	5720 (88.0)	2822 (91.7)	2898 (84.7)	**<0.001**
High	781 (12.0)	257 (8.3)	524 (15.3)	

Table 1 continued

	Total ($N = 6501$)	Males ($N = 3078$)	Females ($N = 3422$)	p*
Self-perceived socioeconomic status				
Low	1370 (21.1)	620 (20.1)	750 (21.9)	0.090
Middle	2056 (31.6)	978 (31.8)	1078 (31.5)	
High	3075 (47.3)	1481 (48.1)	1594 (46.6)	

The values are N (%)

* Chi square test

trust each other in your school?" and "Do you feel students collaborate with each other in your school?" First question was part of the vertical school trust, the second one of the horizontal school trust and the third one of the reciprocity at school. Answers in social capital domains were arranged along Likert scale with five possible answers: (1) strongly disagree, (2) disagree, (3) neither agree or disagree, (4) agree and (5) strongly agree. The answers in each question were categorized, so answers "strongly disagree" and "disagree" represented "low" and "neither agree or disagree", "agree" and "strongly agree" represented "high" social capital.

Physical activity

As a measure for assessing different levels of physical activity, we used International Physical Activity Questionnaire-short version for the last 7 days (Craig et al. 2003). Number of days and hours doing light and moderate-to-vigorous physical activity were drawn from the data. We categorized the frequency of undertaking moderate-to-vigorous physical activity into five categories: (1) 0 days, (2) 1–2 days, (3) 3–4 days, (4) 5–6 days and (5) 7 days (Galan et al. 2013). As a measure of total moderate-vigorous physical activity, we summed minutes spending in moderate-to-vigorous physical activity. The criteria used for the recommendation of physical activity in young individuals was doing at least 60 min of moderate-to-vigorous physical activity at least 5 days a week (total of 300 min/week). We categorized the outcome, in a way that participants who had not participated in at least 300 min/week in moderate-to-vigorous physical activity, were categorized as insufficiently active, opposed to those who have participated in $\geq$300 min/week as sufficiently active (World Health Organization 2010).

Psychological distress

Psychological distress was assessed using Kessler's questionnaire, used for screening for mental illness (Kessler et al. 2003). The questionnaire has 6 questions as follows: "During the last 30 days, how often did you feel nervous?", "During the last 30 days, how often did you feel hopeless?", "During the last 30 days, how often did you feel restless or fidgety?", "During the last 30 days, how often did you feel depressed that nothing could cheer you up?", "During the last 30 days, how often did you feel that everything was an effort?" and "During the last 30 days, how often did you feel worthless?" The answers were arranged along a 5-item scale: (4) always, (3) most of the time, (2) sometimes, (1) rarely and (0) never. The answers were summed up (0–24 points), where lower scores represented low level of psychological distress. Previous study from Kessler et al. (2003) showed strong discriminative power between responses in the range between 0–12 and $\geq$13.

Demographic factors

Demographic factors included gender, age, body-mass index and self-perceived socioeconomic status. In this study, there were 3045 males (48%) and 3276 females (52%) aged 14–19 years. Body-mass index was obtained by self-reported height and weight of the participants. We categorised the results into four categories: (1) underweight, (2) normal weight, (3) overweight and (4) obesity, proposed by Cole et al. (2000). Self-perceived socioeconomic status was based on both parents' occupation during the time the study was performed. The categorization of self-perceived socioeconomic status was done into three levels: (1) high (both parents were managers or professionals), (2) middle (white collar) and (3) low (blue collar) (Wang et al. 2005).

Procedure

In consultation with the teachers, the examiner came at the beginning of the class, when all the children were in the classroom. Parents or legal guardians gave their written informed consent for examinations and data collection for their children, whereas children expressed oral consent. Ethics approval was obtained from the research ethics authority. Next, the examiner introduced the students with the study design and aims. It is worthwhile to mention, that

each examiner was instructed how to go through the testing procedure prior the study. It took approximately 30 min for fulfilling the questionnaires. Those students who did not want to be in the study were asked to hand over empty questionnaires. The examiner has been at the disposition for any asks. At the end, students put the questionnaires inside the box. All the procedure was anonymous.

Data analysis

All the data were analyzed in SPSS 20.0 software (SPSS Inc. Chicago, IL USA). Gender differences were determined by using Chi square test. The associations between social capital domains, physical activity, psychological distress and sociodemographic factors with self-rated health were analyzed using multiple logistic regression analysis with odd ratios (ORs) and 95% confident intervals (CIs). In the univariate model, we performed 13 logistic regression analysis (for each independent variable associated with self-rated health) to examine separate associations with the outcome. In the multivariate model, we used multiple logistic regression analysis to examine the simultaneous associations between the factors and self-rated health. Significance was set up at $\alpha \leq 0.05$.

Results

Basic descriptive statistics of the study participants are presented in Table 1. The majority of the population reported having good self-rated health (94.7%). However, higher percentage of boys reported having good self-rated health compared to girls (96.3 vs. 93.3%, $p < 0.001$). Interestingly, boys had higher neighbourhood trust (76.1%), vertical (72.8%) and horizontal (80.2%) school trust and reciprocity at school (89.3%) compared to girls. Also, higher percentage of boys reported doing total physical activity ≥300 min/week than girls (19.6 vs. 14.4%, $p < 0.001$). Boys also spent more time doing moderate-to-vigorous physical activity ($p < 0.001$). However, higher percentage of girls reported experiencing high psychological distress in the past 30 days (15.3 vs. 8% in boys, $p < 0.001$). No significant differences occured between boys and girls in reporting socioeconomic status ($p = 0.090$).

The associations between the factors and self-rated health are presented in Table 2. In univariate model, self-rated health was associated with age ($p_{trend} < 0.001$), family trust (OR 3.97; 95% CI 2.93–5.39), neighbourhood trust (OR 2.23; 95% CI 1.79–2.77), informal social control (OR 1.68; 95% CI 1.34–2.12), vertical (OR 2.39; 95% CI 1.92–2.98) and horizontal (OR 2.70; 95% CI 2.17–3.37) school trust and reciprocity at school (OR 3.34; 95% CI 2.62–4.25). Also, self-rated health was associated with more days spending in moderate-to-vigorous physical activity ($p_{trend} < 0.001$), body-mass index (underweight category: OR 0.42; 95% CI 0.32–0.55, overweight category: OR 0.56; 95% CI 0.40–0.79 and obesity: OR 0.36; 95% CI 0.20–0.65) and psychological distress (OR 0.35; 95% CI 0.28–0.59). In multivariate model, when all the factors were entered simultaneously into the model, self-rated health was associated with family trust (OR 2.04; 95% CI 1.43–2.91), neighbourhood trust (OR 1.48; 95% CI 1.16–1.89), informal social control (OR 1.44; 95% CI 1.12–1.84), vertical (OR 1.44; 95% CI 1.11–1.86) and horizontal (OR 1.42; 95% CI 1.07–1.87) school trust and reciprocity at school (OR 1.71; 95% CI 1.28–2.29). Also, self-rated health remained associated with more days spending in moderate-to-vigorous physical activity ($p_{trend} < 0.001$), body-mass index (underweight category: OR 0.57; 95% CI 0.43–0.77, overweight category: OR 0.46; 95% CI 0.33–0.66 and obesity category: OR 0.33; 95% CI 0.17–0.63) and psychological distress (OR 0.60; 95% CI 0.43–0.83).

Discussion

The aim of the present study was to determine the associations between social capital, physical activity, psychological distress and sociodemographic factors with self-rated health. Results from our study showed strong associations between family trust, neighbourhood trust and school trust with self-rated health, which is consistent with some other studies (Novak et al. 2015). Novak et al. (2015) found statistically significant associations between higher levels of family social capital and self-rated health as families represent key and most important factor foradolescent's development. In addition, a sense of belonging (Morgan and Haglund 2009) and family social support (Morrow 2001) were both related to adolescent's behaviour health. Other results from the present study showed significant associations between neighbourhood trust and self-rated health. Similar results were obtained in previous studies (Novak et al. 2015; Khawaja et al. 2006; Boyce et al. 2008). Novak et al. (2015) reported that children, who live in high-trust communities reported better health than children who come from low-trust communities. Also, Khawaja et al. (2006) investigated the associations between neighbourhood social capital and self-rated health among adolescents living in Beirut. The authors reported that certain distrust and fragmentation in the community were higher among adolescents living in a poor suburban communities. Another study from Boyce et al. (2008) showed that mutual trust between neighbours and children led to higher attendance to the formal (hospitals) or informal

Table 2 Odds ratios for good self-rated health among participants from Croatia, Lithuania and Serbia, 2015/2016 ($N = 6501$)

	Univariate results[a]		Multivariate results[b]	
	OR (95% CI)	p*	OR (95% CI)	p*
Age (years)				
14–15	Ref.		Ref.	
16–17	1.50 (1.02–2.23)	0.041	1.25 (0.82–1.91)	0.298
18–19	1.52 (1.10–2.11)	0.011	1.27 (0.86–1.87)	0.224
Gender				
Boys	Ref.		Ref.	
Girls	0.54 (0.43–0.67)	<0.001	0.64 (0.49–0.82)	<0.001
Family trust (parent–child trust)				
Low	Ref.		Ref.	
High	3.97 (2.93–5.39)	<0.001	2.04 (1.43–2.91)	<0.001
Neighbourhood trust (neighbour–child trust)				
Low	Ref.		Ref.	
High	2.23 (1.79–2.77)	<0.001	1.48 (1.16–1.89)	0.002
Informal social control (neighbour criticises child)				
Low	Ref.		Ref.	
High	1.68 (1.34–2.12)	<0.001	1.44 (1.12–1.84)	0.004
Vertical school trust (teacher–student interpersonal trust)				
Low	Ref.		Ref.	
High	2.39 (1.92–2.98)	<0.001	1.44 (1.11–1.86)	0.006
Horizontal school trust (student interpersonal trust)				
Low	Ref.		Ref.	
High	2.70 (2.17–3.37)	<0.001	1.42 (1.07–1.87)	0.014
Reciprocity at school (collaboration between students in school)				
Low	Ref.		Ref.	
High	3.34 (2.62–4.25)	<0.001	1.71 (1.28–2.29)	<0.001
Total physical activity (in a week)				
<300 min/week	Ref.		Ref.	
≥300 min/week	1.20 (0.88–1.64)	0.238	0.96 (0.69–1.34)	0.822
Frequency of undertaking moderate-to-vigorous physical activity (days)				
0	Ref.		Ref.	
1–2	2.13 (1.62–2.79)	<0.001	1.78 (1.34–2.38)	<0.001
3–4	2.18 (1.62–2.93)	<0.001	1.79 (1.30–2.45)	<0.001
5–6	2.19 (1.44–3.33)	<0.001	1.86 (1.12–2.75)	0.014
7	2.37 (1.30–4.35)	0.005	2.04 (1.07–3.89)	0.030
Body-mass index				
Underweight	0.42 (0.32–0.55)	<0.001	0.57 (0.43–0.77)	<0.001
Normal	Ref.		Ref.	
Overweight	0.56 (0.40–0.79)	<0.001	0.46 (0.33–0.66)	<0.001
Obesity	0.36 (0.20–0.65)	<0.001	0.33 (0.17–0.63)	<0.001
Psychological distress				
Low	Ref.		Ref.	
High	0.35 (0.28–0.59)	<0.001	0.60 (0.43–0.83)	0.002

Table 2 continued

	Univariate results[a]		Multivariate results[b]	
	OR (95% CI)	p*	OR (95% CI)	p*
Self-perceived socioeconomic status				
Low	Ref.		Ref.	
Middle	0.80 (0.61–1.06)	0.126	1.02 (0.75–1.40)	0.890
High	0.86 (0.67–1.11)	0.244	1.15 (0.85–1.56)	0.371

* $p \leq 0.05$

[a] Examined the associations between each independent variable separately entered into the model (13 models) and self-rated health

[b] Examined the associations between each independent variable simultaneously entered into the model (1 model) and self-rated health

(friends or family) healthcare systems. Self-rated health was also associated with school social capital, that is, higher levels of trust between teachers and students and between students and collaboration between students led to good self-rated health. Concerning family, sense of belonging between students create positive surroundings and may promote better overall (Morrow 2001) and psychological health (Due et al. 2003). In general, children spend most of their time in school, establishing new connections, which may lead to improved health. The school environment serves as an avenue for children's and youth self-esteem and future life satisfaction (Bradshaw and Keung 2011). Poikolainen et al. (1995) reported that symptoms experienced by adolescents in school affect their school attendance, social development and overall health. Moreover, school peers represent one of the key factors for establishing social network, where higher social support is associated with lower rates of depression (Samdal et al. 2000) and substance use (Borges et al. 2010). Similar results to this study were obtained on adolescents' population in Croatia (Novak et al. 2015) and Brazil (Borges et al. 2010). Previous findings, which were part of the Health Behaviour School-Aged Children project showed, that adolescents who reported negative home and school environment were more likely to report psychological problems and higher levels of substance use, which may potentially lead to poorer self-rated health (Freeman et al. 2010). Children reporting low family social capital had 80% more chance to be physically inactive, while those reported having poor school environment had 50% to be physically inactive, pointing out that parents and family connection, along with school play significant role for child's health (Šimetin et al. 2011).

In the present study, self-rated health was associated with higher levels of moderate-to-vigorous physical activity, measured in days. Our results showed linear trend, which is similar to some other studies (Galan et al. 2013). Galan et al. (2013) stated, that dose–response relationship between physical activity and health led to health status improvements. Moreover, these finding were found in other studies related to the topic, where physical activity had positive effects on metabolic, cardiovascular and mental functioning (Janssen and Leblanc 2010). Short-term benefits of physical activity lead to better diet, physical and mental health (Biddle and Asare 2011). In general, even though 60 min of moderate-to-vigorous physical activity is recommended, our findings suggest that even a small amount (1–2 days/week) of moderate-to-vigorous physical activity is associated with good self-rated health. Also, previous findings have shown, that physical activity improves concentration, memory and classroom behavior (Strong et al. 2005) and children who are more physically active do not have lower test scores than their lower active peers (Sallis et al. 1999).

Next, inverse associations were observed between self-rated health and psychological distress. Similar findings were observed in other studies (Novak et al. 2015; Novak and Kawachi 2016; Meireles et al. 2015). Meireles et al. (2015) reported that adolescents who had lower satisfaction with their life reported worse self-rated health. Many factors may be direct mediators between the psychological distress and self-rated health, including socioeconomic status, body weight, health behaviours, school, family and neighbourhood social capital and school achievement (Vingilis et al. 1998). Also, previous findings have shown, that adolescents when reporting self-rated health give much more emphasis to psychological than physical functioning (Zullig et al. 2005).

Our results showed, that body-mass index was inversely associated with self-rated health, which is consistent with some other studies (Krause and Lampert 2015; Heshmat et al. 2015; Herman et al. 2014). Krause and Lampert (2015) reported that overweight and obese male and female adolescents reported fair to very poor self-rated health more often than their normal weight peers. Also, the authors concluded that overweight/obesity was associated with poor self-rated health, regardless of self-perceived socioeconomic status or type of school. Heshmat et al. (2015) showed that both overweight and underweight children were associated with lower odds of having higher

levels of self-rated health. Moreover, in one other study, the odds of reporting poorer self-rated health were higher among obese adolescents. Higher sedentary behaviour was associated with poorer self-rated health (Herman et al. 2014). This study clearly showed that showed there was no association between self-perceived socioeconomic status and self-rated health, that is, adolescents who reported high socioeconomic status were not more likely to report good self-rated health. Results from Meireles et al. (2015) showed that lower socioeconomic status have been described as risk factor for poor self-rated health among Brazilian adolescents. Similar results were obtained in one other study (Vingilis et al. 1998), where higher socioeconomic status was associated with good self-rated health among adolescents. Breidablik et al. (2008), among multifactorial composite model associated with self-rated health, found that parents' income significantly influence on adolescents self-rated health.

This study has several limitations. First, due to the cross-sectional design, we cannot exclude the possibility for reverse causality, that is, good self-rated health led to higher values of family trust, neighbourhood trust, reciprocity at school, total physical activity, frequency of undertaking moderate-to-vigorous physical activity, self-perceived socioeconomic status, age and lower values of psychological distress, body-mass index and gender. Second, we used questionnaires to assess potential factors which might influence on self-rated health, which may have resulted in method bias away from the null. Third, family, neighbourhood and school social capital domains were analyzed at the individual level, that is, adolescents have had different perceptions of social capital, which we referred on. Fourth, future studies should be conducted in different-aged sample and tracking which factors may influence the most on self-rated health for a longer period of time. Fifth, since we collected the data from different countries and by different examiners, there was a potential of bias.

In general, our study showed that higher values of family, neighbourhood and school social capital trust, more days spending in moderate-to-vigorous physical activity, and age were associated with good self-rated health and both underweight, overweight and obesity categories, along with psychological distress were associated with poor self-rated health among Croatian, Lithuanian and Serbian adolescents. Our main results showed low prevalence of undertaking moderate-to-vigorous activity and total physical activity and high percentage of sedentary behaviour which are today one of the biggest public health problems in the world (World Health Organization 2009). According to that, special policies and strategies need to be implemented within the school system (i.e. more hours of physical education/week, more extra-curricular activities, organized leisure-time physical activity) to encourage and improve physical and mental health status of adolescents. Also, schools can promote physical activity by providing the information to children's parents about the benefits of physical activity and to encourage school stuff to be physically more active, since they serve as a role models for students. Moreover, it has been recommended that schools should provide at least 225 min of physical education per week (National Association for Sport and Physical Education 2004), at least 20 min of recess per day in addition to physical activity classes (National Association for Sport and Physical Education 2006) and participate in different programs, like going to school by bike (Cooper 2005).

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Author contribution DN, AE, BM, IM, SRJ and IK conceived and designed the experiments. DN, AE, BM, IM and SRJ performed the experiments. LŠ analyzed and interpreted the data. DN, AE, BM, IM, SRJ and IK contributed reagents/materials/analysis tools. DN and LŠ wrote the paper.

Compliance with ethical standards

Ethical statement All the procedures in the study were performed in accordance to Declaration of Helsinki and were approved by the Institution of the leading author.

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