3   Twisk D, Commandeur JJF, Bos N, et al. Quantifying the influence of safe road systems and legal licensing age on road mortality among young adolescents: Steps towards system thinking. *Accid Anal Prev* 2015;74:306–13.

4   Twisk D, Bos N, Shope JT, Kok G. Changing mobility patterns and road mortality among pre-license teens in a late licensing country: an epidemiological study. *BMC Public Health* 2013;13:333.

5   Twisk DAM, Stacey C. Trends in young driver risk and countermeasures in European countries. *J Safety Res* 2007;38:245–57.

6   Crone EA, Dahl RE. Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nat Rev Neuroscience* 2012;13:636–50.

7   Dahl RE. Adolescent brain development: a period of vulnerabilities and opportunities. Keynote address. *Ann N Y Acad Sci* 2004;1021:1–22.

8   United Nations E, Social Council ITC. Convention on road traffic, done at Vienna on 8 November 1968 = Convention sur le circulation routière, fait à Vienne le 8 Novembre 1968–1994.

9   United Nations. Statistics of road traffic accidents in Europe and North America. New York: United Nations, 1995.

10   Gennarelli TA, Wodzin E, editors. *Abbreviated Injury Scale (AIS) 2005*. Barrington, IL: Association for the Advancement of Automotive Medicine AAAM, 2005.

11   Reurings MCB, Stipdonk HL. Estimating the number of serious road injuries in The Netherlands. *Ann Epid* 2011;21:648–53.

12   Haagsma JA, Polinder S, Lyons RA, et al. Improved and standardized method for assessing years lived with disability after injury. *Bull World Health Organ* 2012;90:513–21.

13   Polinder S, Toet H, Mulder S, Van Beeck EF. APOLLO: the economic consequences of injury. Final Report. Amsterdam, 2008.

14   Dhondt S, Macharis C, Terryn N, et al. Health burden of road traffic accidents, an analysis of clinical data on disability and mortality exposure rates in Flanders and Brussels. *Accid Anal Prev* 2013;50:659–66.

15   Polinder S, Haagsma JA, Bos NM, et al. Burden of road traffic injuries: Disability-Adjusted Life Years in relation to hospitalization and the Maximum Abbreviated Injury Scale (MAIS). *Accid Anal Prev* 2015;80:193–200.

16   Weijermars W, Bos N, Stipdonk H. Health burden of serious road injuries in the Netherlands. *Traffic Inj Prev* 2016;17:863–9.

17   Polinder S, Van Beeck EF, Essink-Bot ML, et al. Functional outcome at 2.5, 5, 9, and 24 months after injury in the Netherlands. *J Trauma* 2007;62:133–41.

18   Twisk D, Vlakveld W, Dijkstra A, Reurings M, Wijnen W. *From Bicycle Crashes to Measures: Brief Overview of What We Know and Do Not Know (Yet)*. Leidschendam: SWOV Institute for Road Safety Research, 2013.

19   OECD/International Transport Forum. *Cycling, Health and Safety*. Paris: OECD publishing/TRF, 2013.

20   Schepers P, Fishman E, Beelen R, et al. The mortality impact of bicycle paths and lanes related to physical activity, air pollution exposure and road safety. *J Transport Health* 2015;2:460–73.

21   De Hartog JJ, Boogaard H, Nijland H, Hoek G. Do the health benefits of cycling outweigh the risks? *Environ Health Perspect* 2010;118:1109–16.

22   Jea W. Health Effects of the London bicycle sharing system: health impact modelling study. Available at: http://googl/QZJbzY 2014.

23   Twisk DAM, Davidse RJ, Schepers P. Challenges in reducing bicycle casualties with high volume cycle use: lessons from The Netherlands In: Gerike R, Parkin J, editors. *Cycling Futures: From Research into Practice*. Ashgate Publishing Limited, Farnham, England, 2015.

....

....

Associations between self-rated health, mental health problems and physical inactivity among urban adolescents

Marketa Lachytova[1], Zuzana Katreniakova[1,2], Pavol Mikula[1], Marian Jendrichovsky[1], Iveta Nagyova[1,2]

1 Department of Social and Behavioural Medicine, Faculty of Medicine, PJ Safarik University, Kosice, Slovak Republic
2 Slovak Public Health Association – SAVEZ, Kosice, Slovak Republic

Correspondence: Iveta Nagyova, Department of Social and Behavioural Medicine, Faculty of Medicine, PJ Safarik University, Tr SNP 1, 040 11 Kosice, Slovak Republic. Tel: +421 55 234 3394, Fax: +421 55 642 8151; e-mail: iveta.nagyova@upjs.sk

Background: Self-rated health is a valid and reliable subjective indicator of general health. We aimed to assess the associations between self-rated health, mental health problems, physical activity, sedentary behaviour and BMI among Slovak urban adolescents. **Methods:** Data were collected within the EU-FP7: EURO-URHIS 2 (The European Health Indicator System Part 2) project in two largest Slovak cities: Bratislava and Kosice. Sample included 1111 adolescents (response rate 73.7%, mean age 14.32 ± 0.48 years, 52.8% boys). Self-rated health was measured with the first item from the Short Form Health Survey 36 questionnaire, mental health problems were assessed by the Strengths and Difficulties Questionnaire and for physical activity and sedentary behaviour questions from the WHO HBSC questionnaire were used. Logistic regression was performed to determine the associations between self-rated health and the independent variables. **Results:** Self-rated health was found to be significantly associated with mental health problems, sedentary behaviour and BMI. However, the strongest association was found with engagement in physical activity every day (OR 8.0; 95% CI 1.6–39.9). **Conclusions:** Previous research revealed that self-rated health was associated with various mental health problems. Our findings add to these results by showing that physical activity and sedentary behaviour are also very important additional factors related to self-rated health. Better understanding of these associations can help in developing more effective public health intervention programmes for adolescents.

....

Introduction

Adolescence is a period of human life characterized by rapid physical and psychological changes in the individual as well as by the increasing influence of peers, school, mass media and the wider society as a whole.[1] Indeed, adolescence is generally a healthy period of life compared with early childhood and old age; however, adolescent morbidity shows worrying trends in key areas such as mental health (suicide, depression, eating disorders, anxiety, attention deficit/hyperactivity disorder, psychosis), cardiovascular risk (obesity and type 2 diabetes) and sexual health.[2]

Self-rated health (SRH) is a construct that express an individual's perception and assessment of his or her own health.[3] It is a commonly used measure in adolescent research and has been found to be a reliable and valid indicator of physical and mental functioning[4,5]; moreover, can be considered a sensitive tool for public health in terms of monitoring the effect of large-scale socioeconomic events.[6] SRH among adolescents is associated with a broad spectrum of medical, psychological, social and lifestyle factors, where both the positive and negative ends of the SRH scale are affected in a similar but inverse manner.[5] There are two theoretical views on SRH status: the first says that SRH is considered to be based on feedback about one's present state of wellness or illness (i.e. a more spontaneous assessment); the second says that it is considered to reflect an individual's prior beliefs about being a healthy or unhealthy person (i.e. a more stable self-concept of health). Longitudinal studies among adolescents have concluded that SRH is best understood as an enduring self-concept.[7] Although adolescence is a time of great changes in a young person's life, research shows that SRH is on the whole a stable construct for rating subjective health.[1]

Mental health is a strong predictor of the self-rated health, independent of the objective measures of health, and self-rated mental health is two times more important than self-rated physical health in predicting self-rated health.[8] Most mental health problems (MHP) diagnosed in adulthood begin in adolescence, and half of lifelong diagnosable mental health disorders start by age 14; this number increases to 75% by the age of 24 years. MHP are more common and include MHP temporarily experienced as a reaction to life stressors. They are less severe and of a shorter duration than mental disorders but may later develop into a mental disorder.[9] Physical activity (PA) and sedentary behaviour (SB) are lifestyle factors that may also play an important role in forming SRH status. PA provides fundamental health benefits for children and youth. Similarly to adults positive associations between higher engagement in PA and SRH have been reported in also youth.[10] SB is associated with negative health outcomes distinct from those of inactivity and independent of the benefits associated with PA.[11] During the last decades, media have become one of the crucial factors in the developing of SB. Media affect youth not only by increasing the time they spend sitting but also by influencing their beliefs and behaviours. Many negative associations of social (electronic) media use have been reported relating to reduced PA and overweight,[12] but media can also be powerful pro-social and educational factors.[13] The value of PA to normal growth and development, including the health and well-being of children and adolescents, is undisputed. Chakravarthy and Booth[14] have hypothesised that there is a threshold of PA for optimal expression of inherited genes and genotypes—and falling below this threshold has been defined as a 'physical activity deficiency'. The manifestation of this concept is called 'sedentary death syndrome'.[15] One of the negative consequences of inadequate PA and/or excessive SB is a higher BMI. Several international studies analyzing the relationship between overweight/obesity and SRH have revealed that overweight or obese adolescents report poor SRH more often than those of normal weight.[10]

Previous research has shown that SRH is an independent predictor of morbidity and mortality, health-risk behaviour and long-term sickness absence.[16–18] in a wide range of populations, including adolescents. It has also been shown that SRH is established early in life and becomes a rather stable construct early in adolescence.[1] Engaging in PA is a key factor in promoting adolescent health, not only in maintaining a normal BMI but also in maintaining good mental health, which is one of the main determinants of SRH in adolescence. The role of SB in relation to SRH is less clear, but it is a subject of intense research.[8] Given the fact that SRH has been found to be established mainly before adolescence,[1] public health activities aimed at children, adolescents and their families are highly important. Yet, the number of studies identifying factors influencing perceptions of SRH during this period is limited. Thus, the aim of this study was to investigate the role of BMI, SB (watching TV and using a PC), PA and MHP in relation to SRH in urban adolescents.

Methods

Sample and procedure

The data were collected within the FP7 European Urban Health Indicators project (EURO-URHIS 2, Grant agreement No. 223711) in the two largest cities in Slovakia—Bratislava (the capital city) and Kosice in the autumn of 2010. Selections of cities were in accordance with the definition of Urban Audit (DG Regio). The design of the study was cross-sectional; the EURO-URHIS 2 sampling and data collection procedures have recently been published by Pope et al.[19] The EURO-URHIS 2 methodology proposed stratification to obtain representative samples of school sectors (e.g. private, public, religious and academies) within the defined area boundary. Cluster sampling was used, with the primary sampling unit being the school class (or school in the absence of a sampling frame of classes). The recommended minimum sample size according to the EURO-URHIS 2 methodology was 400 adolescents for each urban area. For EURO-URHIS 2 data collection in Slovakia 50 schools were identified (28 from Bratislava and 22 from Kosice) with a total of 1701 adolescents. We obtained data from 1253 adolescents (649 from Bratislava and 604 from Kosice), which represents a response rate of 73.7%. Non-response was primarily due to illness and parental disapproval of the participation of their children. After applying step-by-step the exclusion criteria (<75% completion, extreme cases, no age or gender, not aged 14–16 years, not living in urban area) 1111 valid questionnaire (570 from Bratislava and 541 from Kosice) were used for further analyses (Pope et al. 2015).[19]

Measures

The original questionnaire of the EURO-URHIS 2 project was translated from English to Slovak and then back-translated according to the standard procedure.[20]

Self-rated health

SRH was measured by a single question from the Short Form Health Survey (SF-36)[21]: *Would you say your health is...?* Answering options were: excellent (1), very good (2), good (3), not bad (4) and bad (5). The answers were dichotomised as (very) good/excellent (options 1, 2 and 3) and less than good (options 4 and 5).

Mental health problems

The SDQ (The Strengths and Difficulties Questionnaire)[22] is used all around the world as a routine screening measure to detect children and adolescents at high risk of MHP. This is a self-completion instrument for adolescents comprising 25 items; it is made up of five sub-scales indicating conduct problems, inattention-hyperactivity, emotional symptoms, peer problems and pro-social behaviour. The questions relate to the period of the previous 6 months.

Responses to each of the 25 items consist of three options: not true (1); somewhat true (2); certainly true (3). Each of the five sub-scales was scored (range 0–10) if all five items were completed. A scale score could be calculated if at least three items were filled in. An overall estimate of psychological adjustment is derived from the summed scores (0–40) of the first four of these five sub-scales (except for the pro-social scale) and creates a total difficulty score. In our analyses, the total difficulty score was classified in three categories as: normal (1; range 0–15), borderline (2) and abnormal (3; range 20–40). The self-report version of the SDQ has demonstrated good reliability and validity.[22] In our study, the Cronbach's alpha for the SDQ total difficulty score was 0.61.

PA and SB

Questions were taken from the WHO survey Health Behaviour in School-aged Children (HBSC).[23,24] Participating in PA was rated by the following question: *How often do you do sports (such that you breathe hard and sweat) in your free time?* Answering options were: every day (1), four to six times a week (2), two three times a week (3), once a week (4), once a month (5), less than once a month (6) and never (7).

Respondents were asked two questions in relation to SB. The first was: *How much time do you spend watching television during an average school day?* And the second one was: *How much time do you spend on a computer during an average school day?* The answers were dichotomized into two or more hours watching TV and using a PC (1) and less than 2 hours watching TV and using a PC (2) depending on the amount of a time they spent watching TV and using PC for 2 or more hours during an average school day.

BMI status

The measurement of body weight and height was made without shoes, and height was measured using stadiometers (precision ±0.5 cm) by trained assistants. Adolescents were divided into four groups according to BMI: underweight, normal weight, overweight and obese. We used cut offs set by the National Reference Standards BMI of Slovakia for children and adolescents.[25] Under the 25th centile BMI was defined as being underweight. Normal weight was defined as being in the BMI range at or above the 25th and under the 75th centile; overweight was defined as being at or above the 75th centile and under 90th; BMI at or above the 90th centile indicated obesity.

Statistical analyses

As a first step, we computed baseline statistics (prevalence rates/ frequencies) for the variables under the study (BMI, SB, PA, MHP, SRH), and consequently the chi-square test of independence was used to determine whether there are significant difference in these categorical variables between boys and girls or between Bratislava and Kosice. Next, logistic regression was used to examine the associations between SRH and MHP; PA, SB and BMI and gender. The reference categories were as follows: BMI: category of obesity; gender: girls; PA: an engagement in PA never; SB: 2 or more hours watching TV, 2 or more hours using a PC; MHP: abnormal total difficulty score category. A crude effect of all the variables was calculated in relation to SRH, respectively. Subsequently, variables were added into logistic regression models, and the final model was controlling the effects of all variables in relation to SRH. ORs were calculated for all analyzed variables to predict the likelihood of self-rated health being (very) good/ excellent. All statistical analyses were performed using the statistical software IBM SPSS 22.0 for Windows.

Results

The present study sample included 1111 adolescents: 587 boys (52.8%; mean age of 14.4 years; 95% CI 14.35–14.43; SD .502) and 524 girls (mean age of 14.2 years; 95% CI 14.21–14.28; SD .443). According to the methodology, half of adolescents (50.1%) were classified as having normal weight, 24.9% as underweight and approximately 10% as obese. Adolescents spent more time in front of a PC screen (75%) than watching TV (68%). The surveyed adolescents most often reported being physically active two to three times a week (35%), and those without any PA represented 3.3% of adolescents. Approximately 73% of adolescents were without MHP (i.e. with a normal total difficulty score). An overwhelming majority of adolescents reported their health as (very) good/excellent (95.1% boys and 95.2 girls). Significant differences were found between boys and girls in SB and PA. No significant differences were found in the studied variables between Bratislava and Kosice. Background descriptive characteristics of the sample are presented in table 1.

Logistic regression was performed in order to examine the associations between SRH and independent variables. The crude effect of each variable on SRH was calculated separately. The other variables were then included in the models successively. First, the MHP variable was included in the analyses (model 1), followed by PA and SB (model 2) and finally BMI and gender (model 3) were included. For assessing the goodness of the fit of the models, we calculated Nagelkerke R Square and − 2 Log Likelihood. In the final model, the Nagelkerke R Square was .17 and the − 2 Log Likelihood was 319.7.

The crude significant effect of the variables on SRH are as follows: adolescents with normal weight are 3.1 times more likely (95% CI 1.3–7.6) to evaluate their health as (very) good/excellent compared with obese adolescents. Adolescents who do not watch TV are 2.4 more likely (95% CI 1.4–4.1) to rate their health as (very) good/ excellent as adolescents watching TV. Teenagers without MHP (normal class of total difficulty score, it means score of 0–15) were assess five times more likely (OR 4.9, 95% CI 2.4–9.9) to assess their health as (very) good/excellent in comparison to teenagers with MHP. However, the closest association was found between SRH and PA. Adolescents who were engaged in PA every day are over 11 times (OR 11.5, 95% CI 2.0–65.8) more likely to evaluate their health as (very) good/excellent. A less close association is visible between adolescents engaged in PA four to six times a week (OR 4.2, 95% CI 1.2–14.9) in comparison to those who have no PA at all.

After determining the crude effect of the variables, we performed logistic regression to control for the effects of all variables that were subsequently added to the models. Even after controlling for the impact of the others variables, there was no fundamental change in OR except for that of PA. The crude OR was 11.5 without controlling for the impact of the other variables, and when controlled for BMI, SB and MHP, the OR of PA performed every day decreased to OR 8.0 (95% CI 1.6–39.9) in the final model.

The results of the final logistic regression analysis revealed that PA performed every day was the factor most strongly associated with (very) good/excellent SRH in adolescents. The other significant factors were PA—performed four to six times a week, with OR 3.7 (95% CI 1.14–11.8); BMI—category of normal weight, with OR 3.0 (95% CI 1.6–7.8); SB—watching TV, with OR 2.6 (95% CI 1.4–4.8); and MHP—normal category of total difficulty score, with OR 4.9 (95% CI 2.2–10.6). The crude effect and OR when controlling for the effects of all variables on SRH are presented in table 2.

Discussion

The aim of this study was to investigate the associations of BMI, SB (watching TV and using PC), PA and MHP with SRH in Slovak urban adolescents. This study showed that BMI, SB specifically watching TV and MHP are factors associated significantly with (very) good/excellent SRH; however, the strongest association with

Table 1 Background characteristics of the sample

	N (%)	Boys N (%)	Girls N (%)	P value
BMI				0.19
Underweight	258 (24.9)	143 (25.5)	115 (24.4)	
Normal weight	518 (50.1)	267 (47.6)	251 (53.2)	
Overweight	153 (14.8)	85 (15.2)	68 (14.4)	
Obesity	104 (10.1)	66 (11.8)	38 (8.1)	
Sedentary behaviour: watching TV				**0.00**
2 or more hours	747 (68.4)	371 (63.9)	376 (73.6)	
Less than 2 hours	345 (31.6)	210 (36.1)	135 (26.4)	
Sedentary behaviour: Using a PC				**0.01**
2 or more hours	814 (75)	447 (77.9)	367 (71.7)	
Less than two hours	272 (25)	127 (22.1)	145 (28.3)	
PA				**0.00**
Every day	175 (15.8)	130 (22.3)	45 (8.6)	
4–6 times a week	262 (23.7)	168 (28.8)	94 (18.0)	
2–3 times a week	387 (35.0)	176 (30.2)	211 (40.4)	
Once a week	149 (13.5)	62 (10.6)	87 (16.7)	
Less than once a week	132 (12)	47 (8.1)	85 (16.3)	
Mental health problems				0.39
Normal	807 (72.8)	432 (73.7)	375 (71.8)	
Borderline	197 (17.7)	96 (16.4)	101 (19.3)	
Abnormal	104 (9.5)	58 (9.9)	46 (8.9)	
Self-rated health				0.52
Very good excellent	1051 (95.1)	558 (95.1)	493 (95.2)	
Less than good	54 (4.9)	29 (4.9)	25 (4.8)	

Statistical significance at *P* < 0.05 is in bold. The missing cases for the variables are as follows (%): BMI (7.6); sedentary behaviour: watching TV (3.2); sedentary behaviour: using a PC (2.8); PA (1.1); mental health problems (0.8); SRH (0.6).

Table 2 Logistic regression model of factors associated with (very) good/excellent self-rated health among adolescents (OR with 95% CI)

	Crude effect	Adjusted effect		
		Model 1	Model 2	Model 3
Mental health problems				
Normal	**4.85 (2.37–9.90)**	**4.65 (2.22–9.73)**	**4.95 (2.30–10.65)**	**4.86 (2.23–10.58)**
Borderline	1.40 (0.66–2.99)	1.87 (0.80–4.34)	2.25 (0.93–5.14)	2.19 (0.89–5.37)
PA				
Every day	**11.53 (2.02–65.78)**		**9.71 (1.49–63.06)**	**8.04 (1.62–39.85)**
4–6 times a week	**4.23 (1.20–14.90)**		4.49 (0.98–20.57)	**3.67 (1.14–11.78)**
2–3 times a week	2.42 (0.77–7.54)		1.66 (0.45–6.19)	1.35 (0.57–3.18)
Once a week	1.40 (0.43–4.58)		1.10 (0.27–4.47)	0.94 (0.35–2.55)
Sedentary behaviour				
Less than 2 hours watching TV	**2.36 (1.35–4.10)**		**2.65 (1.43–4.91)**	**2.56 (1.37–4.79)**
Less than 2 hours using a PC	1.11 (0.59–2.08)		0.86 (0.40–1.81)	0.85 (0.39–1.81)
BMI				
Underweight	1.09 (0.46–2.56)			1.01 (0.40–2.50)
Normal weight	**3.12 (1.27–7.64)**			**3.01 (1.17–7.79)**
Overweight	2.16 (0.73–6.42)			2.05 (0.66–6.40)
Gender				
Boys	0.78 (0.41–1.49)			0.80 (0.42-1.50)

Adjusted effect: model 1 adjusted for mental health problems; model 2 adjusted for mental health problems, PA and sedentary behaviour; model 3 adjusted for mental health problems, PA, sedentary behaviour, BMI and gender. The reference categories are as follows: mental health problems: abnormal total difficulty score; PA: less than once a week; sedentary behaviour: 2 or more hours watching TV; sedentary behaviour: 2 or more hours using a PC; BMI: obesity; gender: girls. Statistical significance at *P* < 0.05 is in bold. The missing cases for the variables are as follows (%): BMI (7.6); sedentary behaviour: watching TV (3.2); sedentary behaviour: using a PC (2.8); PA (1.1); mental health problems (0.8); SRH (0.6). The differences in OR for MHP between models 1 and 2 are due to missing cases in the final multivariate model.

respect to rating one's SRH as (very) good/excellent was found unequivocally with daily engagement in performing PA.

In our sample, the majority of adolescents reported their health as (very) good/excellent (95.1% boys and 95.2 girls). This is in line with the results from the 41 countries that participated in the HBSC studies,[23,24] where the majority of adolescents reported excellent or good health (at age 15 years: 85% of girls and 89% of boys). In other countries, the prevalence of (very) good/excellent SRH ranges from 70% to 90%.[4,26,27]

Health perceptions are associated with many other health outcomes,[28] but differences due to BMI and gender differences in variables associated with SRH usually occur only for self-rated psychological health, with boys rating their health higher.[29] In our sample, half of adolescents were classified as having normal weight, and these adolescents had approximately a more than three times higher chance of evaluating their health as very good/excellent in comparison with obese adolescents. This is in line with our hypothesis and the findings of previous studies.[30]

Another factor associated with SRH was watching TV. The influence of the media, especially watching TV, on health is disputable. The positive media effect holds only when adolescents predominantly talk with their real friends.[31] However, recent evidence raises concerns about media's effects on aggression, sexual behaviour, substance use, eating disorders and academic difficulties, and although the media are not the leading cause of any of these problems, the reviewed research suggests that they are a significant factor.[32] We identified that adolescents who watched TV less than two hours were more likely to evaluate their health as (very) good/excellent (OR 2. 6; 95% CI 1.4–4.8) in comparison with those who watched TV 2 or more hours. More information is needed in order to more clearly explain the relationship between watching TV and SRH, because we only know that 68% of adolescents watched TV for 2 or more hours a day during the last week. Therefore, in the future, it would be of interest to gain information on what type of programs are preferred by adolescents and also to define the interaction between the type of program and MHP or SRH in youth.

Mental health is an important determinant of SRH. The stronger weight of mental health implies that the mental component of SRH is stronger than the physical one.[8] The prevalence of MHP (the abnormal category of the total difficulty score, i.e. a score between 20 and 40) in our sample was 9.5%. In other countries, the prevalence varied from 6.6% to 10% in Germany and in Great Britain[33,34] and a higher prevalence (15%), e.g. was found in two countries: Turkey and Nigeria.[35] Overall, there is less research examining the associations between PA and/or SB and mental health in youth in relation to SRH.[36] Even when controlling for the impact of SB, PA, BMI and gender simultaneously, adolescents without MHP had in our study an almost five-times higher chance of rating their health as (very) good/excellent.

The most important factor associated with SRH is however PA. PA has established benefits on many aspects of health and quality of life across the lifespan.[37] Generally, boys participate in more PA than girls,[38] as confirmed also by our findings. We concluded that the strongest crude effect was engagement of PA every day (OR 11.5, 95% CI 2.0–65.8) as well as between PA performed four to six times a week (OR 4.2, 95% CI 1.2–14.9). Even after controlling for all of the analyzed variables in the final logistic regression model, PA every day remains the most important factor associated with adolescent's SRH (OR 8.0, 95% CI 1.6–39.9). This outcome highlights the great importance of engagement in PA daily in children and youth in order to maintain good health. The scientific evidence available for the age group 5–17 years supports the overall conclusion that PA provides fundamental health benefits, including both cardio-respiratory fitness and muscular strength, reduced body fatness, favourable cardiovascular and metabolic disease risk profiles, enhanced bone health and reduced symptoms of depression.[39] Another clearly visible trend is a dose–response relationship, in that greater doses of PA are associated with improved indicators of health. These outcomes are in line with the WHO Global recommendations on PA for health, suggesting that important health benefits can be expected to accrue in most children and youth who accumulate 60 or more minutes of moderate to vigorous PA daily and that amounts of PA greater than 60 minutes provide additional health benefits.[39]

Strengths and limitations

The strength of the study lies in the methodology of the EURO-URHIS 2 FP 7 project for urban population health, including all the relevant determinants of health. Results of this study should be interpreted in the context of several study limitations, however. First, this was a cross-sectional study, and it is not possible to determine causal relations. Second, we measured study variables by self-reported questionnaires, and this retrospective report may have been influenced by recall bias. Finally, the study is not representative of Slovak adolescents living in non-urban areas, and therefore generalisation of the results to the entire Slovak adolescent population is limited.

Implications

Our findings and findings from other studies[17] suggest that routines for dealing with SRH early in life may be an important strategy to prevent morbidity in the adult population. SRH predicts allostasis, which is the adaptive regulatory process that maintains homeostasis during exposure to physical, psychosocial and environmental challenges or stressors, and this association may be related to health via mechanisms of sustained activation of multiple bodily systems associated with cardiovascular disease as well as other chronic diseases.[40] Our outcomes show that in addition to MHP, health-compromising lifestyle factors, such as unhealthy diet and physical inactivity, are also important determinants of SRH. This may have implications for public health policy and practice, as many of the factors influencing SRH can be changed via tailored interventions.

Key points

- An overwhelming majority of Slovak urban adolescents (more than 95%) reported their health as (very) good/excellent.
- Engagement in PA is one of the most important lifestyle determinants which crucially affect both positive and inverse perceptions of one's own health not only in adulthood but already in adolescence.
- The significant relationship between SRH and SB (especially watching TV), despite the fact that adolescents spend more time with using PC, was confirmed.
- One of the key public health tasks of whole society is to motivate young people to be physically active on daily basis by ensuring a secure environment and creating new opportunities for their leisure time activities.

References

1 Breidablik HJ, Meland E, Lydersen S. Self-rated health during adolescence: stability and predictors of change (Young-HUNT study, Norway). *Eur J Public Health* 2009;19:73–8.

2 Viner R, Booy R. Epidemiology of health and illness. *BMJ* 2005; 330: 411–4.

3 Björner JP, Kristensen TO, Orth-Gomér K, Tibblin G, Sullivan M, Westerholm P. Self rated health. A useful concept in research. *Prev Clin Med* 2012; Forskningsradsnämnden, Ord & Form AB; Uppsala, Sweden.

4   Piko B. Health-related predictors of self-perceived health in a student population: the importance of physical activity. *J Commun Health* 2000;25:125–37.

5   Breidablik HJ, Meland E, Lydersen S. Self-rated health in adolescence: a multifactorial composite. *Scand J Public Health* 2008;36:12–20.

6   Cavallo F, Dalmasso P, Ottova-Jordan V, et al. Trends in self-rated health in European and North-American adolescents from 2002 to 2010 in 32 countries. *Eur J Public Health* 2015;25:13–5.

7   Bailis DS, Segall A, Chipperfield JG. Two views of self-rated general health status. *Soc Sci Med* 2003;56:203–17.

8   Levinson D, Kaplan G. What does self-rated mental health represent. *J Public Health Res* 2014;3:287.

9   Kessler RC, Berglund P, Demler O, et al. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey replication. *Archiv Gen Psychiatry* 2005;62:593–602.

10   Herman KM, Sabiston CM, Tremblay A, Paradis G. Self-rated health in children at risk for obesity: associations of physical activity, sedentary behaviour and BMI. *J Phys Ac Health* 2014;11:543–52.

11   Hamilton MT, Hamilton DG, Zderic TW. Role of low energy expenditure and sitting in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease. *Diabetes* 2007;56:2655–67.

12   Gorely T, Marshall SJ, Biddle SJ. Couch kids: correlates of television viewing among youth. *Int J Behav Med* 2004;11:152–63.

13   Hogan MJ, Strasburger VC. Media and prosocial behaviour in children and adolescents. In: Nucci L, Narvaez D, editors. *Handbook of Moral and Character Education*. London, United Kingdom: Routledge. 2008; 554–70.

14   Chakravarthy MV, Booth FW. Eating, exercise, and "thrifty" genotypes: connecting the dots toward an evolutionary understanding of modern chronic diseases. *J Appl Physiol* 2004;96:3–10.

15   Lees SJ, Booth FW. Sedentary death syndrome. *Can J Appl Physiol* 2004;29:447–60.

16   Burstrom B, Fredlund P. Self rated health: is it as good a predictor of subsequent mortality among adults in lower as well as in higher social classes? *J Epidemiol Community Health* 2001;55:11:836v–840.

17   Vie TL, Hufthammer KO, Holmen TL, et al. Is self-rated health a stable and predictive factor for allostatic load in early adulthood? Findings from the Nord Trøndelag Health Study (HUNT). *Soc Sci Med* 2014;17:1–9.

18   Peterson U, Bergstrom G, Demerouti E, et al. Burnout levels and self-rated health prospectively predict future longterm sickness absence: a study among female health professionals. *J Occup Environ Med* 2011;53:788–93.

19   Pope D, Katreniak Z, Guha J, et al. Collecting standardized urban health indicator data at an individual level for schol–aged children living in urban areas: methods from EURO–URHIS 2. *Eur J Public Health* 2017;27:36–41.

20   Beaton D, Bombardier C, Guillemin F, et al. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 2000;25:3186–91.

21   Ware JE, Kosinski M, Keller SD. *SF-36 Physical and Mental Summary Scales: A User's Manual*. Boston: The Health Institute; 1994.

22   Goodman R. Psychometric properties of the strengths and difficulties questionnaire. *J Am Acad Child Adolesc Psychiatry* 2001;40:1337–45.

23   Currie C, Zanotti C, Morgan A, et al. *Social determinants of health and well-being among young people. Health Behaviour in School-aged Children (HBSC) Study*. ISBN 978 92 890 1423 6.

24   Currie C, Gabhainn SN, Godeau E, et al. *Inequalities in Young People's Health: HBSC International Report from the 2005/2006 Survey (Health Policy for and Adolescents, No.5)*. Copenhagen, Denmark: 2008. WHO Regional Office for Europe. ISBN 978 92 890 7195 6.

25   Sevcikova L, Novakova J, Hamade J, et al. Growth and developmental trends in Slovak children and youth during last decades. In: Vagnerova J, Riedlova J, Blaha P. *International Anthropological Congress: Antropology and Society*. Abstracts. Praha, Charles University, Faculty of Science 2003;233:187.

26   Vingilis ER, Wade TJ, Seeley JS. Predictors of adolescent self-rated health. Analysis of the National Population Health Survey. *Can J Public Health* 2002;93:193–7.

27   Jerdén L, Burell G, Stenlund H, et al. Gender differences and predictors of self-rated health development among Swedish adolescents. *J Adolesc Health* 2011;48:143–50.

28   Vingilis E, Wade TJ, Adlaf E. What factors predict student self-rated physical health? *J Adolesc* 1998;21:83–97.

29   Anson O, Paran E, Neumann L, Chernichovsky D. Gender differences in health perceptions and their predictors. *Soc Sci Med* 1993;36:419–27.

30   Krause L, Lampert T. Relation between overweight/obesity and self-rated health among adolescents in Germany. Do socio-economic status and type of school have an impact on that relation? *Int J Environ Res Public Health* 2015;12:2262–76.

31   Wells M, Mitchell K. How do high-risk youth use the Internet? Characteristics and implications for prevention. *Child Maltreat* 2008;13:227–34.

32   Strasburger VC, Jordan AB, Donnerstein E. Health effects of media on children and adolescents. *Pediatrics* 2010;125:756–67.

33   Ravens-Sieberer U, Wille N, Erhart M, et al. Prevalence of mental health problems among children and adolescents in Germany: results of the BELLA study within the National Health Interview and Examination Survey. *Eur Child Adolesc Psychiatry* 2008;17:22–33.

34   Meltzer H, Gatward R, Goodman R, Tamsin F. The mental health of children and adolescents in Great Britain. Office for National Statistics. London: The Stationery Office. 2000, ISBN 0 11 621373 6.

35   Atilola O, Singh Balhara YP, Stevanovic D, et al. Self-reported mental health problems among adolescent in developing countries: results from an international pilot sample. *J Dev Behav Pediatr* 2013;34:129–37.

36   Herman KM, Hopman WM, Sabiston CM. Physical activity, screen time and self-rated health and mental health in Canadian adolescents. *Prev Med* 2015;73:112–6.

37   Mountjoy M, Andersen LB, Armstrong N, et al. International Olympic Committee consensus statement on the health and fitness of young people through physical activity and sport. *Br J Sports Med* 2011;45:839–48.

38   Dumith SC, Gigante DP, Domingues MR, Kohl HW 3rd, Physical activity change during adolescence: a systematic review and a pooled analysis. *Int J Epidemiol* 2011;40:685–98.

39   World Health Organization: *Global recommendations on physical activity for health*. 2010, Geneva, Switzerland; World Health Organization. Available from: http://apps. who.int/iris/bitstream/10665/44399/1/9789241599979_eng.pdf [10 January 2017, date last accessed].

40   McEwen BS, Gianaros PJ. Stress- and allostasis induced brain plasticity. *Annu Rev Med* 2011;62:431–45.