



## THE EDUCATION LEVEL AND SOCIO-DEMOGRAPHIC DETERMINANTS OF PHYSICAL ACTIVITY IN CZECH ADULTS

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### ABSTRACT

**Purpose.** Previous research has shown that physical activity (PA) is determined by several variables, such as gender, social economic condition (SES) and place of residence. The main purpose of this study was to study the association between education and PA of the Czech adult population as well as discovering any other socio-demographic factors that may influence PA. **Methods.** A population-based survey conducted in 2008 resulted in 6,989 International Physical Activity Questionnaires (short version) from Czech adults aged 26–69 years. This survey included all regions in the Czech Republic. The data were analysed using frequencies and binomial logistic regression separately for gender and education level. The dependent variables were classified as either the “healthy minimum” and “health promotion” according to the amount of PA criteria the individuals met. **Results.** People with a university education had less PA than other groups of different education levels. The “health promotion” category was met by 9.9% of women and 6.5% of men with elementary education, 67.4% of women and 71.3% of men with a secondary education, and 22.7% of women and 22.2% of men with a university education. The “health promotion” category is also more likely to be met by males (OR 1.33, CI 1.20–1.48,  $p < 0.001$ ), people with elementary (OR 1.67, CI 1.36–2.06,  $p < 0.001$ ) and secondary education (OR 1.60, CI 1.42–1.80,  $p < 0.001$ ), those living with a family with children (OR 1.49, CI 1.07–1.53,  $p < 0.001$ ), living in villages (OR 1.35, CI 1.14–1.60,  $p < 0.001$ ) or small towns (OR 1.27, CI 1.10–1.61,  $p < 0.001$ ), those who have a dog (OR 1.15, CI 1.04–1.27,  $p < 0.05$ ), and those who participate in organized PA (OR 1.30, CI 1.17–1.44,  $p < 0.001$ ). **Conclusions.** There was a surprising low amount of PA among those who studied at a university. Programs that promote PA among university students and future graduates should be considered.

**Key words:** IPAQ, knowledge, gender, lifestyle, education, leisure time

### Introduction

The amount of physical activity (PA) that adults perform usually decreases with age [1]. Other factors that play a role in the decline of PA include socioeconomic status, financial conditions, health, psychological and behavioural variables [2] and educational attainment. The positive effect of education on health comes from the fact that higher educated people usually have better job opportunities, higher annual income, improved housing, better access to nutritious foods and more health insurance. In addition, “higher levels of education could also have direct effects on health through greater health knowledge acquired during schooling and greater personal empowerment and self-efficacy” [3, p. 1503].

The association between the education level and the level of PA in an adult population has been reported by Sallis and Owen [4] and Trost et al. [5], where the relationship between education and PA has found to be positive; the higher education an adult obtains the higher level of PA he/she performs [6]. A general interest

in PA, through the use of pedometers, was found in educated people as part of a multi-strategic community-based intervention [7]. This can be explained by possessing better knowledge and understanding of the effect PA has on a healthy lifestyle. As research showed, higher education attainment is related to an improvement in overall health which may increase the probability of performing PA [8]. However, Bergman et al. [9] discovered that having a university or college degree was negatively associated with higher PA according to the IPAQ scoring protocol they used in Sweden. It was postulated that those with higher education levels may participate in more leisure-time exercise, but due to their less physically demanding professions the total amount of PA was in fact lower.

Therefore, the aim of this study was to define what factors influence an individual's PA level, with emphasis placed on the level of education from a sample population of Czech adults. Regarding this study, the societal, economic and political situation of the Czech Republic before 1989 and after the “Velvet Revolution” is an important factor that needs to be taken into consideration. These changes significantly influenced various spheres of life for Czech citizens as they did for many post-communist countries. Most Central European countries tended to generally copy the societal development

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of western countries in various economic, health and sociological indicators with 10 to 20 years of delay. And, except for technological development, there is even a repetition of the undesirable trends found in Western society such as the rise of obesity, time spent watching television or on the computer, a general decline in PA and unhealthy eating habits. Contemporary trends from Western Europe lead to more time spent at work, higher income, and more possibilities in ways to spend leisure time. For example, in 1984, only 27% of adults (20 to 69 year-olds) practiced PA, however, in 2007 this number increased to 45% [10]. Nonetheless, the problem of balancing time between work, family life, and leisure occurred in many post-communist countries.

In the Czech Republic, a study was conducted [11] on PA with university students. This population segment was found to be sufficiently active with more than 85% meeting their PA recommendation, yet most university students do not have a family or work responsibilities. In a study on Icelandic youth [12], researchers found that lower BMI, overall PA and good dietary habits were associated with higher academic achievement. However, the possibility of a mutual association between PA and education was not considered. Similar results were obtained in a Texas study [13], where students who were physically active were more likely to do well academically, have better attendance and to have fewer disciplinary actions.

In contrast to students, adults who work and have families lead busy lives. In addition, someone with a university education may have more responsibility and may spend more time at work. Such time is often spent sitting at a desk and participating in more sedentary activities such as writing, planning, and consulting. The free time that such individuals may have could conflict with family responsibilities, individual wishes and personal chores, and the PA necessary for a healthy life does not factor as a priority. The potentially stressed lifestyle of those with a university education is justifiably a matter of concern and must be addressed. Roberson and Babic [14] described how adults in central Europe (Croatia) have problems with finding time for PA. Their research also showed the effect urban areas can have on health. The level of physical activity of Czech adults was previously found to be significantly influenced by the size of the locality where one lived – the larger the size of the city the lower total PA [15].

Therefore, the purpose of this study was to find which factors, such as the attained education level, have an effect on the level of PA of Czech adults. We assumed that with an increasing level of education, the amount of actual PA in leisure-time would also increase [16]. In addition, we wanted to know whether adults with different education levels (elementary, secondary and university education) adhere to their PA recommendations (judged by how many of the PA criterion they met) in the Czech Republic. We were also interested in other socio-demographic variables

that may influence individuals of different education in meeting their PA recommendations.

### Material and methods

A survey was conducted in the Czech Republic during the spring of 2008. The participants were randomly chosen based on their residence and represented all Czech regions. A computer program randomly selected 400 participants from an address database from the Ministry of the Interior of the Czech Republic; after the data was updated a representative sample of 250 remained. Trained coordinators visited those living at those addresses and handed out envelopes with the International Physical Activity Questionnaires – Short Version (IPAQ-SV). If they failed to meet the selected individual, they were advised to visit the nearest neighbour. The coordinators explained the meaning of the survey, how to complete the questionnaire as well as the deadline for handing back the completed questionnaires. Participation in the study was voluntary. The coordinators did not compel the questioned individuals to complete all the information and did not check for correctness and completeness.

The questionnaire used was the official Czech short version of the IPAQ [17], used to determine the frequency, type and duration of physical activity of Czech citizens and considered reliable and standardised [18]. It was translated by professional translators and followed the “Guide to Cultural Adaptation and Translation of the IPAQ Instruments”. The collected physical activity data is self-reported and considered suitable for monitoring a population [19]. The sample characteristics are presented in Table 1.

The information collected included the length (in minutes) and frequency (days) of PA (walking, moderate PA and vigorous PA) in different domains (as part of their occupation, transportation, leisure-time, domestic chores and gardening). They also stated the amount of time spent sitting per day, however, this data was not subject to analysis in this study. People also listed personal information (see Appendix), such as gender, age, height and weight, years of education, whether they smoked, place of residence (location), living status, type of living arrangement, whether they owned a dog, car, bike or cottage and the level of participation in organized PA (whether yes or no and if yes how many times per week).

From 10,571 completed questionnaires (IPAQ-SV), we only analysed adult participants who were 26 to 69 years old. In addition, all participants with missing information were excluded from the analyses. After an adjustment of the obtained data according to the Guidelines for Data Processing and Analysis of the IPAQ, a total of 6,989 completed data sets remained. For data analysis we decided not to use the study's original classification of PA based on three levels of physical activity (IPAQ scoring protocol), because it does

not meet the requirement for countries with a higher level of PA in its citizens. For more details see Bauman et al. [20], where 62.9% of adults in the Czech Republic are classified as belonging to a highly active population. Therefore, we oriented our findings on the physical activity recommendations on the analysis done in Healthy People 2010 [21]. A similar study on PA recommendations was published by Bergman et al. [9].

Following this example, we classified three criteria for individuals meeting their PA recommendations according to the results from the questionnaire: 3 × 20 minutes of vigorous PA per week, 5 × 30 minutes of moderate PA per week, and 5 × 30 minutes of walking per week. Then we established one category as a “healthy minimum” for those adults who met only one PA criterion (no matter which one), and one category as “health promotion” for those who met two or three of the PA criteria. These categories were the dependent variables.

We categorized our sample according to gender and the self-reported length of education according to Czech education system – elementary ( $\leq 9$  years of education), secondary (10–13 years of education) or university educated ( $\geq 14$  years of education). We also categorized the sample according to four age groups (26–34, 35–44, 45–54, and 55–69 years old); BMI (less than 25 kg/m<sup>2</sup>

and  $\geq 25$  kg/m<sup>2</sup>), and smokers and non-smokers. We classified the sample as those living in a metropolis (more than 100 thousand inhabitants), city (30,000 to 100,000 residents), town (1,000 to 29,999 residents), or village (less than 1,000 inhabitants). In addition, other factors included if one lives alone or with a partner or with a family with children, if they have a dog, and whether he/she participates in organised PA. Data from the questionnaires were analysed using SPSS Statistics statistical software, version 18.0 (IBM, USA). We analysed the frequencies and percentage separately for gender (Tab. 2). We also incorporated binomial logistic regression for data analysis; the dependent variables were the criteria for PA and the independent criteria were the socio-demographic characteristics.

## Results

The results of our surveys are presented in four tables. The mean characteristics of the men were: age 43.5 ± 10.6 years, height 179.7 ± 7.3 cm, weight 85.2 ± 11.6 kg and BMI 26.4 ± 3.2 kg/m<sup>2</sup>, and in women: age 43.4 ± 10.6 years, height 166.5 ± 6.2 cm, weight 66.6 ± 10.8 kg and BMI 24.0 ± 3.9 kg/m<sup>2</sup>. As shown in Table 1, there were more male participants who were overweight and

Table 1. Sample characteristics of the short version IPAQ

Participant characteristics	Females (N = 3540)		Males (N = 3449)	
	N	%	N	%
Age: 26–34 years	933	26.36	918	26.62
Age: 35–44 years	1144	32.32	1053	30.53
Age: 45–54 years	968	27.34	970	28.12
Age: 55–69 years	495	13.98	508	14.73
BMI < 25	2346	34.82	1201	66.27
BMI $\geq 25$	1194	65.18	2248	33.73
Smokers	843	29.78	1027	23.81
Education – elementary	324	6.49	224	9.15
Education – secondary	2329	63.09	2176	65.79
Education – university	887	30.42	1049	25.06
Large city (> 100,000 residents)	744	21.25	733	21.02
Bigger town (30–100,000 residents)	816	23.80	821	23.05
Small town (1000–29,999 thousand residents)	1396	38.59	1331	39.44
Small village (< 1,000 residents)	584	16.35	564	16.49
House	1687	48.59	1676	47.66
Apartment bloc (Flat)	1853	51.41	1773	52.34
Live alone	240	8.96	309	6.78
Live with a partner	1420	40.59	1400	40.11
Live as family with children	1880	50.45	1740	53.11
Have a dog	1478	40.88	1410	41.75
Participation in organized PA	1227	34.53	1191	34.66
Meeting 1 PA criterion	1550	37.81	1304	43.79
Meeting 2 PA criteria	1000	27.86	961	28.25
Meeting 3 PA criteria	183	9.94	343	5.17

PA – physical activity, N – number of participants

Table 2. Meeting physical activity recommendations by gender and level of education

Level of education	Women (N = 3540)						Men (N = 3449)					
	none		healthy minimum		health promotion		none		healthy minimum		health promotion	
	N	%*	N	%*	N	%*	N	%*	N	%*	N	%*
Elementary education	70	21.6	137	42.3	117	36.1	50	22.3	90	40.2	84	37.5
Secondary education	532	22.9	1000	42.9	797	34.2	461	21.2	785	36.1	930	42.7
University education	205	23.1	413	46.6	269	30.3	330	31.5	429	40.9	290	27.6
Total	807	22.8	1550	43.8	1183	33.4	841	24.4	1304	37.8	1304	37.8

Healthy minimum – meeting one PA criterion; health promotion – meeting two or three PA criteria;  
%\* – percentage within gender and the level of education

Table 3. Unadjusted odds ratio (OR) and 95% confidence intervals (95% CI) for the “Healthy minimum” and “Health promotion” associated with the socio-demographic determinants

Factors	“Healthy minimum” category				“Health promotion” category			
	N	%+	OR	95% CI	N	%+	OR	95% CI
Gender								
Females	2733	77.2	ref.		1183	33.4	ref.	
Males	2608	75.6	1.05	0.94–1.19	1304	37.8	1.33***	1.20–1.48
BMI (kg/m <sup>2</sup> )								
≥ 25	2535	73.6	ref.		1207	35.1	ref.	
< 25	2806	79.1	1.38***	1.22–1.55	1280	36.1	1.15**	1.03–1.28
Smoke								
No	3940	77.0	ref.		1837	35.9	ref.	
Yes	1401	74.9	.88	0.78–1.0	650	34.8	0.91	0.82–1.02
Education								
Elementary	428	78.1	1.61***	1.27–2.03	201	36.7	1.67***	1.36–2.06
Secondary	3512	78.0	1.42***	1.26–1.62	1727	38.3	1.60***	1.42–1.80
University	1401	72.4	ref.		559	28.9	ref.	
N. of residents								
> 100.000	1109	75.1	ref.		454	30.7	ref.	
30.000–100.000	1239	75.7	1.01	0.85–1.19	561	34.3	1.13	0.97–1.31
1.000–29.999	2106	77.2	1.08	0.93–1.26	1020	37.4	1.27***	1.10–1.46
< 1.000	887	77.3	1.09	0.90–1.31	452	39.4	1.35***	1.14–1.60
Living status								
Alone	403	73.4	ref.		157	28.6	ref.	
With a partner	2121	75.2	1.11	0.90–1.37	973	34.5	1.30*	1.06–1.61
Family with children	2817	77.8	1.27*	1.03–1.57	1357	37.5	1.49***	1.21–1.83
Dog								
Don't have	3120	76.1	ref.		1390	33.9	ref.	
Have	2221	76.9	1.04	0.93–1.16	1097	38.0	1.15**	1.04–1.27
Participation in organized PA								
No	3442	75.3	ref.		1552	34.0	ref.	
Yes	1899	78.5	1.20**	1.06–1.36	935	38.7	1.30***	1.17–1.44

PA – physical activity, N – number of participants, OR – unadjusted odds ratio, 95% CI – 95% confidence intervals,

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

%+ – Unadjusted percentage

Table 4. Unadjusted odds ratio (OR) and 95% confidence intervals (95% CI) for “health promotion” in relationship socio-demographic determinants

Factors	Women EE (N = 324)			Men EE (N = 224)			Women SE (N = 2329)			Men SE (N = 2176)			Women UE (N = 887)			Men UE (N = 1049)			
	% <sup>+</sup>	OR	CI	% <sup>+</sup>	OR	CI	% <sup>+</sup>	OR	CI	% <sup>+</sup>	OR	CI	% <sup>+</sup>	OR	CI	% <sup>+</sup>	OR	CI	
Age (years)																			
26–34	49.0	ref.		31.4	ref.		30.7	ref.		45.0	ref.		29.7	ref.		28.1	ref.		
35–44	31.0	0.41*	0.18–0.94	39.0	1.13	0.45–2.80	36.3	1.23	0.98–1.54	43.4	0.93	0.74–1.18	33.3	1.01	0.68–1.50	28.4	0.99	0.66–1.50	
45–54	41.3	0.70	0.32–1.55	42.6	1.37	0.60–3.13	35.5	1.29*	1.00–1.66	44.0	1.00	0.78–1.28	29.6	0.91	0.61–1.34	27.4	1.10	0.74–1.65	
55–69	30.7	0.53	0.24–1.17	35.9	0.92	0.39–2.19	33.5	1.33	0.95–1.85	34.9	0.72*	0.54–0.97	24.3	0.77	0.41–1.45	25.6	1.20	0.72–2.02	
BMI (kg/m <sup>2</sup> )																			
< 25	41.0	ref.		35.0	ref.		34.4	ref.		48.4	ref.		29.5	ref.		30.4	ref.		
≥ 25	32.4	0.75	0.44–1.27	38.4	1.24	0.64–2.42	33.8	0.95	0.78–1.15	40.0	0.71***	0.59–0.86	32.8	1.31	0.92–1.85	25.8	0.81	0.61–1.09	
Smoke																			
no	37.9	ref.		42.9	ref.		35.0	ref.		43.6	ref.		30.3	ref.		28.0	ref.		
yes	32.0	0.71	0.40–1.25	31.4	0.56	0.30–1.03	31.7	0.91	0.74–1.12	41.1	0.93	0.77–1.11	30.4	1.08	0.71–1.65	26.4	1.00	0.71–1.40	
Number of residents (thousands)																			
> 100	28.3	ref.		33.3	ref.		26.9	ref.		41.9	ref.		26.8	ref.		24.7	ref.		
30–100	36.6	1.55	0.71–3.38	41.3	1.18	0.50–2.82	34.8	1.44**	1.10–1.90	37.1	0.81	0.62–1.06	27.7	1.01	0.65–1.55	30.9	1.29	0.88–1.88	
1–29,999	39.3	1.67	0.81–3.47	34.9	0.98	0.45–2.14	36.9	1.51**	1.17–1.94	42.9	1.01	0.79–1.30	35.9	1.36	0.93–1.99	27.8	1.11	0.77–1.59	
< 1	37.0	1.62	0.70–3.74	43.2	1.32	0.50–3.45	35.5	1.37	0.99–1.88	50.2	1.30	0.96–1.75	24.3	0.75	0.42–1.33	26.9	1.06	0.62–1.81	
Living status																			
alone	24.0	ref.		18.5	ref.		18.2	ref.		39.3	ref.		18.9	ref.		33.0	ref.		
with a partner	33.3	1.50	0.69–3.24	38.5	2.17	0.71–6.65	34.3	2.09**	1.32–3.32	41.2	1.11	0.79–1.56	29.8	1.73	0.82–3.68	24.0	0.61	0.36–1.02	
family with children	44.9	2.32**	1.02–5.23	42.0	2.57	0.84–7.83	35.9	2.27**	1.42–3.60	44.5	1.23	0.88–1.72	31.8	1.87	0.89–3.96	29.6	0.81	0.48–1.37	
Home																			
house	36.0	ref.		40.7	ref.		36.7	ref.		45.5	ref.		33.4	ref.		28.8	ref.		
flat	36.3	1.49	0.85–2.62	37.5	0.96	0.49–1.86	32.0	0.93	0.76–1.13	40.1	0.91	0.75–1.11	27.6	0.75	0.54–1.03	26.6	0.90	0.67–1.23	
Dog																			
don't have	31.1	ref.		35.2	ref.		32.5	ref.		41.5	ref.		30.3	ref.		26.6	ref.		
have	42.4	1.73*	1.05–2.84	40.2	1.12	0.62–2.04	36.6	1.16	0.97–1.39	44.8	1.10	0.92–1.32	30.4	0.88	0.64–1.20	29.5	1.19	0.88–1.61	
Participation in organized PA																			
no	36.3	ref.		38.0	ref.		32.1	ref.		42.0	ref.		25.7	ref.		23.5	ref.		
yes	35.3	0.86	0.43–1.72	35.0	0.82	0.39–1.73	38.6	1.39***	1.15–1.68	44.2	1.05	0.86–1.27	35.5	1.57**	1.17–2.11	33.5	1.65***	1.24–2.19	

PA – physical activity

N – number of participants

OR – unadjusted odds ratio

95% CI – 95% confidence intervals

\*  $p \leq 0.05$ ; \*\*  $p \leq 0.01$ ; \*\*\*  $p \leq 0.001$ %<sup>+</sup> – unadjusted percentage



obese than normal weight and more in the 35–44 years old age category. There were more non-smokers and more with a secondary education. In addition, a larger population sample lived in small towns (1 – 29,999 inhabitants), in flats rather than single dwellings, in families with children, and without a dog. Participants aged 35–44 years had the highest total PA score (73.9 MET-hours/week), followed by participants aged 26 to 34 years (72.1 MET-hours/week) and those aged 45 to 54 years (71.1 MET-hours/week). The lowest level of total PA was found in the older age group, 55 to 69 years old (67.6 MET-hours/week). These values are overall higher, except for the older age group, when compared to a Croatian study [22] which used the long version of IPAQ.

Table 2 presents information on the level of PA by one's gender and level of education. Women, regardless of their level of education were more likely to meet their "healthy minimum". Meeting the "health promotion" for women was found to be true for those with elementary education. However, more men with secondary education met the "health promotion" level rather than the "healthy minimum". Men and women with university education were the ones who indicated no PA. According to the IPAQ, 33.4% of women met three PA criteria compared to 37.8% of men. One third of respondents met all the PA criteria. In addition, 22.8% of women and 24.4% of men are considered to be sedentary (not meeting any of their PA recommendations).

Table 3 shows the results of binomial logistic regression on both PA categories. A significant greater number of males met the "health promotion" category than females. Overweight participants are less likely to meet the "healthy minimum" or "health promotion" category; smokers are also less likely to meet the healthy minimum category. Surprisingly, those with a university degree are less likely to meet the "healthy minimum" as well as "health promotion" category. Those who live in smaller cities, such as 30,000 inhabitants or less, are more likely to meet the "health promotion" category. People living with a family with children are more likely to meet both categories; those who live with a partner are more likely to meet "health promotion" as well as people having a dog. Lastly, the sample showed that those who participated in organized physical activity were more likely to meet both categories.

The "healthy minimum" category is more likely to be met by those whose BMI is below 25 kg/m<sup>2</sup>, who do not smoke, have elementary or secondary education, live in a family with children and participate regularly in organized PA (Tab. 3). The "health promotion" category is more likely met by men, people with a BMI below 25 kg/m<sup>2</sup>, do not have a university education, do not live alone, have a dog and participate regularly in organised PA.

We investigated if the category of "health promotion" (adjusted for gender and education) is associated

with the various independent variables obtained from the IPAQ. As presented in Table 4, we separated the men and women according to their education level. Binomial regression analysis showed that in those who have an elementary education, the "health promotion" category is met only by women living with families with children as well as having a dog. Women with secondary education most commonly meet the "health promotion" category if they reside in a town of 100,000 or less as well as live with a partner or family with children. Secondary educated men who have a high BMI did not meet the "health promotion" category at all. Concerning women and men with a university education, only those who participated in some organized physical activity met the health promotion.

In addition, elementary educated women are more likely to meet the "health promotion" category if they live with a family with children and have a dog. Elementary educated men were not influenced by any of the examined variables when meeting the "health promotion" category. Meeting the "health promotion" category in secondary educated men is mainly a mutual interaction of body-mass index (the ideal being below 25 kg/m<sup>2</sup>). Obese or overweight men are less likely to meet the "health promotion" category. In secondary educated women, more variables influenced them meeting their PA recommendations for the "health promotion" category such as place of residence, not living alone and participation in organized PA. With university educated women and men, we found only one independent variable that influenced meeting the "health promotion" category, and this was participating in organized PA. University educated women met the "health promotion" category more likely whether they lived with other adults or with a family with children. Although this result was not statistically significant, it may help persuade people to increase PA in their families or friends.

## Discussion

Studying the various determinants of physical activity was the goal of many studies [23] as well as books [4]. To the best of our knowledge, a study on the level of physical activity with adults considering education level and other socio-demographic determinants has not been previously conducted in the Czech Republic. In the previous studies, evidence on the positive influence of specific determinants has been found, but some of the results from these scientific studies are weak or have mixed conclusions. The determinants that were found to have a positive association on overall physical activity from demographic and biological studies are: gender (male), genetic factors, socioeconomic status (income), and education [4, p. 115–116]. The study also mentioned psychological, cognitive and emotional factors, behavioural attributes and skills, social and

cultural factors (e.g. social support from a partner or family), physical environment factors [24] and physical activity characteristics that may have positive or negative influence on PA. In some of the determinants of PA, there is a lack of evidence (e.g. size of community, parents' education) or the results were found to be inconsistent. Although a number of demographic determinants were obtained from this study's questionnaire, based on the Czech version of the IPAQ-SV, we mainly focused on the education level of the Czech adult population.

Comparable to our study, Špaček [25] studied exercising and non-exercising adults ( $N = 1,124$ ) by noting their gender (male or female), age (young or old), size of location (city, town or village), education and father's education (elementary, apprentice, secondary with state exam or university education). Yet, in contrast to our findings, he found that people with a university education are 4.5 times more likely to exercise than those with elementary education. Špaček's study [25] included university students, whereas the sample from our study contained working adults with a university degree. In his study, exercising adults were more likely to be males, those living in cities, of a younger age, and whose father had a university degree. These factors (in a regression model) explained only 40% of the variance, while the rest of the influences (60%) were unknown or not studied. This positive relationship between more years of education and increased physical activities was reported in other studies as well [2, 26–30]. Bertrais et al. [31] found this positive relationship between education level and meeting PA recommendations, but only in women. In one Croatian study [22], the level of education showed an inverse association with total PA but a positive association with leisure-time PA. We did not study each domain of the PA practised, but the lower total PA in people with a higher education level is probably connected with their sedentary jobs, resulting in more sitting time [29]. Thus, leisure-time PA cannot substitute for the time spent at work even though university graduates might have more leisure-time PA. This could stem from that fact that they have less physically demanding jobs, and as a result their overall PA is less than those with lower education levels.

On the other hand, Mitáš et al. [15] studied the influence of socio-economic status (SES) on PA and included the number of years of finished education as one criterion of SES (others were way of living, material conditions and income). This is congruent with our findings, where Czech adults with a very high SES, both women and men, performed the least amount of PA (in MET-min/week). However, in a study by Al-Hazzaa [32], using the short version of the IPAQ in Riyadh in Saudi Arabia, found that activity levels did not show significant relationships with education level or job hours per week.

According to Bernstein et al. [28], Swiss urban adults (in Geneva) with secondary education are the most sedentary group of men and women (57% of men and 60% of women). Whereas in our research, Czech men with a university degree could be labelled as the sedentary group (31.6%), while sedentary Czech women were those with secondary and university degree (23.2%). Regardless of the education level, PA is evidently less than in Switzerland. Similar to our study, the most active Swiss citizens were those with secondary education (56% of men and 54% of women). The difference between our studies may be explained by the different methods used to collect data. The Geneva study obtained data from persons aged 35–74 years who generally have a higher sedentary lifestyle. In addition, the country of birth may reflect behaviours, genetic factors, cultural habits and social factors.

The “higher physical active” category level of PA in the Bergman et al. study [9] can be compared with our “health promotion” category. The Bergman et al. study found similar results, where people in the more active category are more likely to be male and those with high school education, which is comparable to the Czech secondary education level. Also, people living in villages or small towns are more likely to be physically active. This may be due to the small distances easily reached by walking or cycling, while people living in cities rely on their own car for transportation. Similar results were found in other studies [22, 29, 33], where people living in large towns were less likely to be sufficiently active than those living in small towns. In a French study [31], only women not living in urban areas were more likely to meet their PA recommendations.

Living alone has been shown to be negatively associated with the “health promotion” category. This is congruent with the study by Ståhl et al. [34], where people who perceived low social support from their personal environment (family, friends etc.) were more likely to be sedentary. Interpersonal relationships may influence physical activity and establish new social networks and help individuals learn about physical activity and its benefits [8]. Family or peer influences have been found to have positive association with PA and exercise in other research [23, 35] especially in spontaneous PA programs during leisure time. But, interestingly, in some studies [5, 9] authors also found that having a family or living with a partner may negatively influence the level of PA. Our finding that smokers and obese people are less likely to meet their PA recommendations, regardless of gender, is in accordance with many other studies [9, 23, 26, 28, 31].

There are several limitations of this study that should be taken into consideration. One limitation stems from the fact that the IPAQ questionnaire is a self-reported instrument, yet it appears to have acceptable measurement properties [36]. In addition, it is used in many countries for international comparison

[29, 37]. Although our survey incorporated all regions of the Czech Republic, there was not a consistent amount of returned surveys from each region. For example, Ostrava had a 16.3% participation rate while the Karlovy Vary region only 1.2%.

### Conclusion

Our results surprisingly found that adults from the Czech Republic with a university education, regardless of gender, had a lower PA level than those with lower education levels. Those with a university education may have more time constraints, especially those with children. This can be alleviated with more in-depth physical education at schools and sports clubs that stress the lifelong importance of PA. Furthermore, university sports clubs and physical education classes should offer courses in time management as this would help those with time constraints to budget time for PA. Community health and PA programs that can include children would be an added benefit.

Overall, the physical activity and leisure-time PA of adults is an important topic. We would like to include several suggestions as based on the result of this study.

First, since the research shows that more PA is practised by those who live in small towns; future urban planners ought to consider restructuring our cities to appear like a small town. Reliable roads, lighting, and sidewalks all contribute to the feeling of having a safe atmosphere for outdoor activity. Furthermore, parks can help to contribute to the amount of green space as well as offering a convenient place for exercise. Parks and walking areas could also have an education program with information on walking. Tax incentives, car-sharing as well as advocating public transportation could all promote walking. Placing parking facilities half of a kilometre away from one's residence could promote a natural way to meet daily PA.

Second, a certain amount of restructuring of the physical education system needs to occur in school systems. Physical education needs to focus its curriculum on lifetime health and wellness. The sport preferences of students must coincide with the needs for PA [38].

Third, universities should encourage some type of wellness or fitness class as a requirement for all students. These classes should demonstrate and encourage fitness and sports, such as walking, Nordic walking and overall physical health for one's entire lifetime.

Lastly, businesses and corporations should take an active role to encourage more PA with their employees. Rewarding employees or offering some kind of motivation for those who maintain PA can be encouraged with vacations or days off. The work of physical education teachers should also be found in the workplace. Weekly classes on general health and PA geared for adults can be offered at work, as well as showing how parents can exercise with their children at home. Goal-

oriented individuals may be motivated to use pedometers as way to lose weight and to begin to be physically active. The role of physical education is not to entertain children; physical education should be a viable part of everyone's life and continue throughout one's adult life.

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## Appendix

## INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

\_\_\_\_\_ days per week

No vigorous physical activities → Skip to question 3

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

\_\_\_\_\_ hours per day

\_\_\_\_\_ minutes per day

Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

\_\_\_\_\_ days per week

No moderate physical activities → Skip to question 5

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

\_\_\_\_\_ hours per day

\_\_\_\_\_ minutes per day

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

\_\_\_\_\_ days per week

No walking → Skip to question 7

6. How much time did you usually spend **walking** on one of those days?

\_\_\_\_\_ hours per day

\_\_\_\_\_ minutes per day

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a week day?

\_\_\_\_\_ hours per day  
 \_\_\_\_\_ minutes per day

Don't know/Not sure

### DEMOGRAPHIC QUESTIONS

1. Gender  Man  
 Woman
2. How old were you on your most recent birthday?  
 Number of Years  
 I don't know // I am not sure  
 I refuse to answer
3. How many years of education have you completed?  
 Number of Years  
 I don't know // I am not sure  
 I refuse to answer
4. Do you have a paid job at the present time?  
 Yes  
 No → Go to Question 6  
 I don't know // I am not sure. → Go to Question 6.  
 I refuse to answer → Go to Question 6.
5. If your answer was yes, how many hours weekly do you work at your job?  
 Number of hours per week  
 I don't know // I am not sure  
 I refuse to answer
6. How would you classify the place where you live?  
 A large city (100 000 inhabitants or more)  
 A medium-sized town (30 000 – 100 000 inhabitants)  
 A small town (1,000 – 29,999 inhabitants)  
 A small community or village (less than 1,000 inhabitants)  
 I don't know/ I am not sure  
 I refuse to answer

### Additional information

Height (cm):  Weight (kg):

Place where you live: Town  Postcode  Nationality:

Housing (house-H, block of flats-F):  Smoker (yes-Y, no-N):

Household (live alone-A, family-O, family with children under 18-F):  Do you own a dog (yes-Y, no-N):

Do you have access to any of the following (yes-Y, no-N) Bike  Car  Holiday/weekend home

Organized participation in physical activity: (Please indicate whether you participate in any organized physical activity. If so, how many times a week: Never-N, Once a week-1, 2times a week-2, More than twice a week--)

Which physical activity  do you participate in most regularly?

would you like to participate in?

I don't participate in physical activity!

Thank you for taking the time to complete this questionnaire.