СОЦИОЛОГИЯ МОЛОДЕЖИ

DOI: 10.14515/monitoring.2020.5.1578



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For citation:
Kolosnitsyna M. G., Khorkina N. A., Lopatina M. V. (2020) Factors Affecting Youth Physical Activities: Evidence from Russia. *Monitoring of Public Opinion: Economic and Social Changes.* No. 5. P. 578—601. https://doi.org/10.14515/monitoring.2020.5.1578.
Правильная ссылка на статью:
Колосницына М. Г., Хоркина Н. А., Лопатина М. В. Факторы физической активности российской молодежи // Мониторинг общественного мнения: экономические и социальные перемены. 2020. № 5. С. 578—601. https://doi.org/10.14515/monitoring.2020.5.1578. (In Eng.)

FACTORS AFFECTING YOUTH PHYSICAL ACTIVITIES: EVIDENCE FROM RUSSIA

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Abstract. The article provides an assessment of the factors that may affect the probability and intensity of physical activity among young Russians aged 15–24. The analysis is based on the data from the Russian Longitudinal Monitoring Survey (RLMS), 2000–2016 ($N = 21{,}703$). Econometric analysis shows that there is a positive relationship between the physical activity probability and the indicators such as educational level, household per capita income, and living in capital cities. There is also a negative relationship between the probability of

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Аннотация. В статье проводится оценка факторов, способных оказать влияние на вероятность занятий физической активностью и их интенсивность в группе молодых россиян в возрасте от 15 до 24 лет. Эмпирический анализ основан на данных Российского мониторинга экономического положения и здоровья населения (РМЭЗ) НИУ ВШЭ за период 2000—2016 годов. Панельная выборка включала 21 703 наблюдения. В ходе эконометрического анализа была установлена положительная взаимосвязь между вероятно-

physical activity and individual's characteristics such as smoking, family status (marriage), employment status (having a job). Relationship between the probability and intensity of physical activity and such features as alcohol consumption, body mass index and subjective health assessment is inconclusive. Implementation of measures aimed at increasing the physical activity of young Russians taking into account the stimulating or restraining factors may increase the productivity of physical exercise and further improve health condition and contribute to a longer lifespan in Russia.

Keywords: probability of physical activity, intensity of physical activity, healthy lifestyle, young people, RLMS-HSE

Acknowledgments. The project was funded by the HSE Basic Research Program (2018).

стью занятий физической активностью молодых россиян и такими показателями как уровень образования, среднедушевой доход домохозяйства, проживание в столичных городах. Также была выявлена отрицательная взаимосвязь между вероятностью занятий физической активностью и такими индивидуальными характеристиками респондентов как курение, семейный статус (проживание в браке), трудовой статус (наличие работы). В то же время не установлено однозначной зависимости вероятности физической активности и ее интенсивности от таких характеристик как потребление алкоголя, индекс массы тела и субъективная оценка здоровья. Реализация мероприятий по активизации образа жизни молодых жителей нашей страны с учетом факторов, способных оказать как стимулирующее, так и сдерживающее влияние на их физическую активность, поможет повысить их результативность и в дальнейшем будет способствовать как улучшению здоровья российского населения, так и росту продолжительности жизни в нашей стране.

Ключевые слова: вероятность занятий физической активностью, интенсивность физической активности, здоровый образ жизни, молодежь, РМЭЗ НИУ ВШЭ

Благодарность. Статья подготовлена в рамках проекта Программы фундаментальных исследований Национального исследовательского университета «Высшая школа экономики» (2018).

Introduction

In most developed countries, one observes declining trends in alcohol and tobacco consumption, especially evident among younger groups of the population. However, people exercise less, use automobiles or public transport instead of walking, and their jobs are mostly sedentary. Within the WHO European policy framework for health and well-being, Russia, among other countries, has adopted the Physical Activity Strategy for the WHO European Region 2016–2025[1]. One of its guiding principles is to promote a life-course approach. Governmental policies to enhance physical activity (PA) should be aimed at all age groups, starting with the younger members of society. Research has addressed certain aspects of the lifestyles of Russian youth [Levin et al., 1999; Zasimova, Kolosnitsyna, 2011; Varlamova, Goncharova, Sokolova, 2015; Khorkina et al., 2018]. However, the evidence on factors related to the physical activity within this age group in Russia is still quite limited.

Considering the determinants of physical activity in youth, many authors emphasize age and gender [Sallis, Prochaska, Taylor, 2000; Sagatun et al., 2008; Uijtdewilligen et al., 2011; Lämmle, Worth, Bös, 2012; Al-Hazzaa et al., 2014]. Studies based on Russian data demonstrate that PA of young people diminishes with age, and males are more active than females of the same age [Levin et al., 1999; Khorkina et al., 2018]. The authors name body mass index (BMI) and self-assessed health (SAH) among the variables related to PA [Sallis, Prochaska, Taylor, 2000; Trost et al., 2002; Uijtdewilligen et al., 2011; Micklesfield et al., 2017; Khorkina et al., 2018]. An ambiguous relationship was found between PA and bad habits such as tobacco and alcohol consumption [Sallis, Prochaska, Taylor, 2000; Dunn, Wang, 2003; Higgins et al., 2003; Biddle et al., 2005; Buscemi et al., 2011]. Education level as a correlate for PA is less widespread in the literature devoted to youth. However, in Russia, the maximum share of physically active young men belongs to the group with higher education [Khorkina et al., 2018]. The relationship between paid work and PA seems inconsistent [Vilhjalmsson, Thorlindsson, 1998; Ferreira et al., 2007; Khorkina et al., 2018], as well as the connection between household income and physical activity of its young members [Sallis, Prochaska, Taylor, 2000; Ferreira et al., 2007; Sagatun et al., 2008; El-Ammari et al., 2017; Khorkina et al., 2018]. Numerous studies on the determinants of PA in youth also stress that environmental conditions such as the availability of sports facilities should also be taken into account [Sallis et al., 1992; Spence, Lee, 2003; Zasimova, Kolosnitsyna. 2011; Peer et al., 2013; Micklesfield et al., 2017].

This paper aims to investigate the factors of probability and intensity of physical activity in Russian youth. Based on previous, somewhat inconclusive research results, we hypothesized that the following five groups of factors affect PA:

1) demographic and physical characteristics *(sex, age,* and *BMI);*

2) health status and lifestyle *(SAH, smoking, alcohol consumption);*

3) socioeconomic factors *(education, employment status,* and *household per capita income);*

[1] Physical Activity Strategy for the WHO European Region 2016–2025. (2016) Copenhagen: World Health Organization. URL: http://www.euro.who.int/__data/assets/pdf_file/0010/282961/65wd09e_PhysicalActivityStrategy_150474.pdf (accessed: 15.10.2020).

4) household characteristics *(marital status of the respondent);*
5) environmental factors *(place of residence).*

Methods

Data and variables

To test the hypotheses, we used micro-data from the Russian Longitudinal Monitoring Survey (RLMS-HSE), years 2000–2016. RLMS-HSE is a household-based, nationally representative survey, conducted annually by the Higher School of Economics and ООО "Demoscope" together with the Carolina Population Center, the University of North Carolina at Chapel Hill, and the Institute of Sociology of the Federal Center of Theoretical and Applied Sociology of the Russian Academy of Sciences[2]. The survey has a longitudinal design and repeated samples. Its questionnaires provide rich information on individuals' health, well-being, and other characteristics.

Our sample consisted of respondents aged 15–24, falling under the UN classification into the youth group. In 2007–2008, the RLMS-HSE questionnaires did not include information on physical activity, so the sample for our analysis was reduced ($N = 32{,}499$). For the regression modelling, we used pooled data on only those respondents who gave answers to all the relevant questions. The total number of observations was 21,703 (10,317 observations on men and 11,386 on women).

Two dependent variables were constructed[3]:

1) *The probability of physical activity* (*PPA*) describes the fact of being involved in physical activity. It is based on the response to the question: "Please choose the types of activity you practiced at least 12 times in the last 12 months. Possible options: jogging, skating, skiing; using exercise machines; etc." (11 options including "other activity"). The variable was assigned 1 if the respondent had done at least one of the listed activities in the past 12 months, and 0 otherwise.

2) *The intensity of physical activity* (*IPA*) is defined as the total number of hours per month that the respondent spends on physical exercise and was calculated in the following way:

$$\text{IPA} = \Sigma_i(\textit{number of training sessions per month} \times \textit{duration of one session (min)})/60),$$

where *i* is one of the selected types of physical activity.

Data on the hours of physical exercises were analysed for the respondents who had been involved in at least one type of physical activity.

Modelling

Estimating the main factors influencing the probability and intensity of physical activity, we observe two different groups: those who are physically active and those who are not. Therefore, we face a self-selection process. To correct for possible selection bias, we use the two-stage method suggested by Heckman [Heckman, 1979]. In the first step, we estimate a model of PPA, with the binary dependent variable: the "participation equation". The marginal effects estimated for this mod-

[2] Russian Longitudinal Monitoring Survey — Higher School of Economics (RLMS-HSE). URL: https://www.hse.ru/en/rlms/ (accessed: 15.10.2020).

[3] RLMS HSE questions are presented in Appendix A.

el reveal the directions and magnitudes of correlations between the dependent and independent variables. In the second step, we estimate an OLS model for IPA measured in hours (in natural logarithms): the "intensity equation". This reveals connections between the continuous variable of the IPA and various factors. According to Heckman [ibid.],the number of independent variables in the intensity equation should be one less than in the participation equation. The Heckman model controls for the interrelation of two processes: an individual chooses whether to exercise or not and how many hours to spend on the PA. The proposed methodology is applied to the pooled panel data, which enables us to account for unobserved individual-related effects since these effects could influence the decisions on the participation in and intensity of physical activity. Dummies for the years of observation have been included in the models to take into account unobserved time-related effects. The models for men and women were estimated separately since we assume possible gender differences in the factors of physical activity. All the analyses were carried out using Stata for Windows version 13.

Results

Descriptive statistics

Based on the data collected, we find that the share of young Russians involved in physical exercises was growing in 2000–2016. In 2016, it reached 62 % for men and 49 % for women; compared to 2000, it was 1.4 and 1.6 times higher for men and women, respectively (Figure 1). Besides, men were more physically active than women throughout the period.

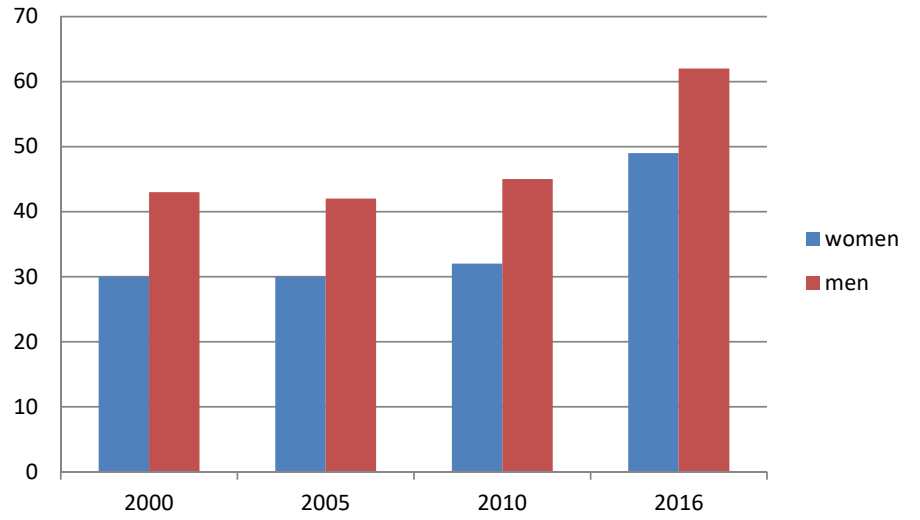

Figure 1. Shares of young men and women in the 15–24 age range involved in any type of physical activity, out of the total number of youth in this age range, %

Dynamics for age and sex groups demonstrates that in the period 2000–2016, the share of physically active youth has grown in all the age groups under consideration (Figures 2–3). Young people in the 15–17 age range were the most active; those in the "senior" group aged 22–24 were the least active.

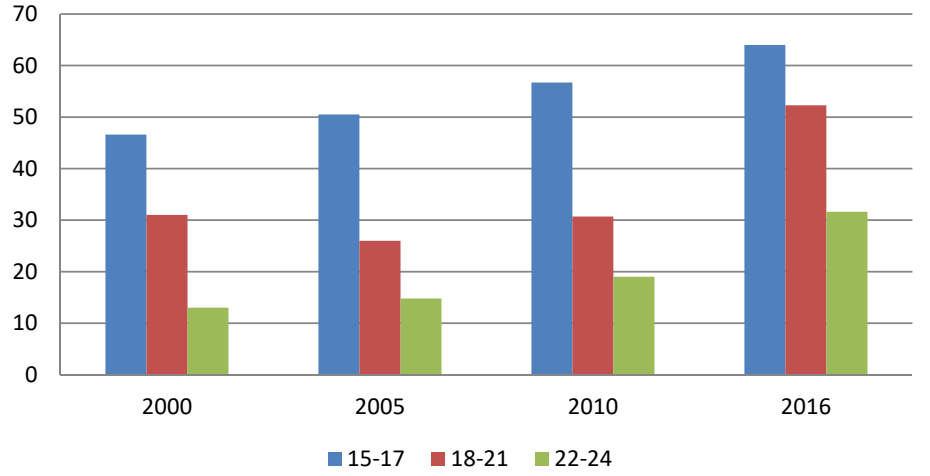

Figure 2. Share of physically active young women by age groups, out of the total number of women in the respective age groups, %

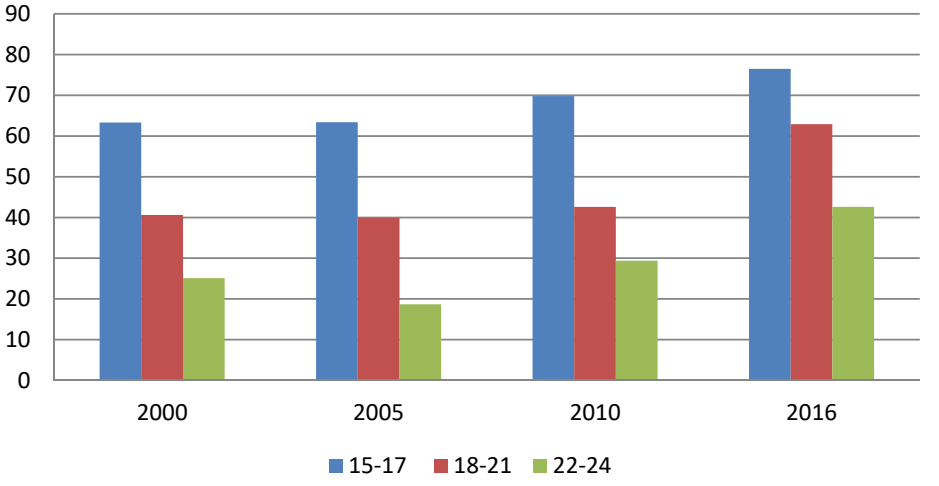

Figure 3. Share of physically active young men by age groups, out of the total number of men in the respective age groups, %

Physical activity was gender-dependent. In 2016, young men in the 15–24 age range were more active in basketball, volleyball, football, hockey; and exercise machine training. The share of men practicing these activities was 26% and 25%, respectively. Overall, men were twice more active than women. Women preferred walking (15%),

jogging, skating, or skiing (14%). The share of women practicing dancing, aerobics, shaping, and yoga was ten times higher than that of men, which could be explained by the traditionally high popularity of these activities among women (Table 1).

Table 1. ***Types of physical activity among men and women in the 15–24 age range, 2016 (probability of physical activity of a certain type, %)***

Types of physical activity	Men	Women
jogging, skating, skiing	18	14
training with exercise machines	25	13
walking	11	15
power walking	0.6	0.6
cycling	11	9
swimming	10	8
dancing, aerobics, shaping, yoga	1	10
basketball, volleyball, football, hockey	26	13
badminton, lawn or table tennis	2	1
wrestling, boxing, karate	6	0.4
other physical activity	8	10

The descriptive data on the probability of physical activity among men and women in the aggregated sample (2000–2016) are given in Table 2.

Table 2. ***Probability of physical activity among men and women in the 15–24 age range, depending on different characteristics, 2000–2016, aggregated sample (N = 32,499)***

	Men		**Women**	
	Physically active, %	**Physically inactive, %**	**Physically active, %**	**Physically inactive, %**
Total sample	48.9	51.1	35.3	64.7
Demographic and physical characteristics				
Age:				
15–19 years*	63.8	36.2	48.9	51.1
20–24 years	34.6	65.4	23.7	76.3
BMI:				
Underweight (BMI < 18,5)**	54.7	45.3	41.0	59.0
Normal weight (18,5 ⩽ BMI < 25)	51.0	49.0	37.0	63.0
Pre-obesity (25 ⩽ BMI < 30)	43.0	57.0	25.0	75.0
Obesity (BMI ⩾ 30)	38.7	61.3	25.5	74.5

	Men		Women	
	Physically active, %	**Physically inactive, %**	**Physically active, %**	**Physically inactive, %**
Health and lifestyle				
Self-assessed health (SAH):				
Good, very good	52.3	47.7	36.5	63.5
Average, not bad and not good	42.9	57.1	33.7	66.3
Bad and very bad	34.2	65.8	35.0	65.0
Regular meals:				
Yes	57.3	42.7	38.5	61.5
Rather regular	50.5	49.5	40.9	59.1
Rather irregular and irregular	46.9	53.1	41.2	58.8
Smoking:				
Smokes	34.0	66.0	23.0	77.0
Does not smoke	60.0	40.0	37.7	62.3
Alcohol:				
Consumes	38.6	61.4	31.4	68.6
Does not consume	50.7	49.3	33.5	66.5
Socioeconomic factors				
Education:				
No secondary education certificate	56.9	43.1	45.7	54.3
Complete secondary or vocational education	41.4	58.6	30.6	69.3
Technical/Incomplete higher education	46.8	53.2	30.4	69.6
Complete higher education (including scientific degree)	46.8	53.2	31.0	69.0
*Employment status***:*				
Secondary school student	71.6	28.4	58.6	41.4
University student	65.9	34.1	50.2	49.8
Employed	30.4	69.6	23.0	77.0
Non-employed	29.4	70.6	14.3	85.7
Household monthly income per capita in 2000 prices (in roubles):				
Up to 4300	44.0	56.0	28.6	71.4
4301–7700	46.4	53.6	33.0	67.0

	Men		Women	
	Physically active, %	**Physically inactive, %**	**Physically active, %**	**Physically inactive, %**
7701–12800	49.8	50.2	38.4	61.6
Over 12801	54.0	46.0	40.8	59.2
Household characteristics				
Family status:				
Not married	53.4	46.6	43.2	56.8
Married (registered marriage)	24.0	76.0	16.6	83.4
Cohabitation	35.0	65.0	22.7	77.3
Household size:				
One person	59.6	40.4	43.2	56.8
Two people	46.9	53.1	34.9	65.1
Three people	47.6	52.4	34.0	66.0
Four people	54.0	46.0	38.9	61.1
Five and more people	44.7	55.3	32.3	67.7
Environmental factors				
Place of residence:				
Capitals (Moscow and St. Petersburg)	56.7	43.3	47.8	52.2
Regional centres (apart from Moscow and St. Petersburg)	52.9	47.1	39.2	60.8
Cities, towns (apart from regional centres)	49.5	50.5	32.0	68.0
Rural settlements	42.4	57.6	29.5	70.5
Infrastructure:				
Available sports facilities	50.3	49.7	35.9	64.1
Unavailable sports facilities	39.9	60.1	31.2	68.8

* It means that 63.8% of men aged 15–19 are physically active; 36.2% of men aged 15–19 are physically inactive.

** BMI classification based on WHO definitions. See: Obesity and Overweight. (2020) *World Health Organization*. April 1st. URL: http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight (accessed: 15.10.2020).

*** Employment status is the main occupation according to the respondent's answer to the open-ended question. The four groups are mutually exclusive: non-employed are not students; students are not employed, even if they have part-time jobs, and so on.

Descriptive data show also that intensity, as well as the probability of physical activity, diminishes with age. Young Russians aged 15–19 allocate more time to different types of physical activity than those aged 20–24; this is true for both men and women. Young respondents with insufficient BMI have maximum probability of physical activity. As BMI grows, the probability of physical activity tends to diminish in both gender

groups. The PPA is consistently related to SAH — it is higher in the group with better health, and this trend is more pronounced in the case of young men.

Respondents doing sports are more prone to a healthy lifestyle: smokers and consumers of alcohol are less physically active. The relation between the probability of physical activity and nutrition is ambiguous — young men who eat regular meals are more physically active, while the probability of physical activity of girls is unrelated to the regularity of meals.

The descriptive statistics do not show any relationship between the probability of PA of the respondents and their education level. While both males and females who did not graduate from secondary school were more physically active, in other educational subgroups the share of physically active people was smaller.

Employment status is an important correlate of the probability of physical activity of young Russians. School students were the most active, probably due to compulsory physical training classes. The share of physically active men and women in the employed and non-employed groups was smaller than among school and university students.

The probability of physical activity grows with per capita household income. Young respondents living in wealthier families presumably use paid sports facilities; they also have more leisure time.

The share of physically active young people among those not legally married is more than twice that of those officially married. Young men and women living alone have a higher probability of physical activity than respondents living in larger households.

The availability of sports facilities is an important determinant of the probability of PA. The share of physically active youth with access to sports facilities is higher in comparison to the fraction of respondents doing activities in areas lacking such infrastructure. The availability of sports facilities is strongly correlated with the place of residence — in large cities, it is higher than in small settlements.

Finally, the descriptive analysis shows that the share of physically active males and females is higher in Moscow and St. Petersburg in comparison to those living outside the capitals. The smaller the place of residence, the less the probability of physical activity of its young inhabitants.

Econometric models estimates

We estimated the Heckman models for young men and women separately. The descriptive data on the sample used in the regression analysis are given in Appendices B and C.

The Chow test confirmed the appropriateness of separate estimations for gender groups (LR $chi^2 = 249$, Prob > $chi^2 = 0.000$). The regression estimates for young men and women gave similar results. However, several coefficients were statistically different. The correlation matrices of the variables chosen did not show multicollinearity. The values of *Wald chi*^{2} and *rho* confirm the significance of the estimated models. The values of λ are -0.772 for males and -0.603 for females and are significant, which means that the participation and intensity equations are interrelated. Hence, the Heckman model is an adequate instrument for our analysis.

Table 3. ***Regression analysis results: Heckman model***

Variable	PPA (marginal effects)	IPA (ln)	PPA (marginal effects)	IPA (ln)
	Men		Women	
Demographic and physical characteristics				
Age	0.036***	−0.014	−0.020***	0.006
	(0.003)	(0.011)	(0.003)	(0.011)
Body mass index:				
Underweight (BMI < 18,5)	reference group			
Normal weight (18,5 ⩽ BMI < 25)	0.086***	−0.175***	0.014	−0.035
	(0.02)	(0.058)	(0.013)	(0.043)
Pre-obesity (25 ⩽ BMI < 30)	0.090***	−0.121*	−0.010	0.066
	(0.024)	(0.071)	(0.019)	(0.069)
Obesity (BMI ⩾ 30)	0.010	−0.048	−0.032*	0.009
	(0.024)	(0.072)	(0.018)	(0.064)
Health and lifestyle				
Self-assessed health:				
Bad, very bad	reference group			
Average, not bad and not good	0.019	−0.146	0.002	−0.001
	(0.038)	(0.120)	(0.025)	(0.087)
Good, very good	0.096***	−0.188	−0.014	−0.003
	(0.037)	(0.119)	(0.026)	(0.087)
Smoking:				
Smokes	−0.111***	0.093***	−0.071***	0.198***
	(0.011)	(0.035)	(0.013)	(0.046)
Alcohol:				
Consumes	0.001	0.074**	0.043***	0.035
	(0.011)	(0.034)	(0.009)	(0.034)
Socioeconomic factors				
Education:				
No secondary education certificate	reference group			
Complete secondary or vocational education	0.048***	0.073	0.033**	0.009
	(0.011)	(0.044)	(0.014)	(0.053)
Technical/Incomplete higher education	0.119***	−0.030	0.075***	0.030
	(0.017)	(0.055)	(0.016)	(0.063)
Complete higher education (including scientific degree)	0.227***	−0.036	0.194***	−0.128
	(0.024)	(0.081)	(0.022)	(0.085)
Income (household income per capita in 2000 prices in roubles, ln)	0.041***	0.152	0.031***	0.038
	(0.006)	(0.159)	(0.005)	(0.164)
Income square (household monthly income per capita in 2000 prices in roubles, ln)		−0.012		−0,004
		(0.009)		(0.010)

Variable	PPA (marginal effects)	IPA (ln)	PPA (marginal effects)	IPA (ln)
	Men		Women	
Employment status:				
Secondary school student	reference group			
University student	−0.044**	0.093*	−0.074***	−0.004
	(0.019)	(0.051)	(0.020)	(0.058)
Employed	−0.278***	0.313***	−0.296***	0.102
	(0.022)	(0.072)	(0.023)	(0.084)
Non-employed	−0.267***	0.466***	−0.33***	0.318***
	(0.022)	(0.074)	(0.022)	(0.093)
Household characteristics				
Family status:				
Not married	reference group			
Registered marriage	−0.048***	−0.002	−0.074***	0.045
	(0.018)	(0.062)	(0.020)	(0.056)
Cohabitation	0.022	0.013	−0.04***	−0.067
	(0.019)	(0.059)	(0.022)	(0.054)
Environmental factors				
Place of residence:				
Capitals (Moscow and St. Petersburg)	reference group			
Regional center (apart from Moscow and St. Petersburg)	−0.015		−0.084***	
	(0.018)		(0.016)	
Cities, towns (apart from regional centers)	−0.061***		−0.179***	
	(0.017)		(0.017)	
Rural settlements	−0.116***		−0.178***	
	(0.017)		(0.017)	
Wald chi²	146.83***	258.29***		
rho	45.71***	36.66***		
Number of observations	10317	10317	11386	11386

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Standard errors in parentheses.

Table 3 presents the results of the Heckman model estimates.

1. The probability of physical activity decreases with age for both males and females; for males, the decrease is more pronounced. Respondent's age does not relate to the intensity of PA.

2. The correlation of BMI and the probability of physical activity depends upon gender. An increase of BMI from 18.5 to 30 increases the probability of PA for males but does not increase it for females. An increase in BMI for males is linked to the reduction of the intensity of PA. For females with BMI over 30, the probability of PA decreases relative to those underweight. For females, BMI is not consistently related to the intensity of physical activity.

3. For males with "good" or "very good" health, the probability of physical activity is higher than for those who assess their health as "bad"/"very bad". For females, no

consistent relationship was established between SAH and the probability of PA. SAH does not influence the intensity of PA for males or females.

4. Smoking reduces the probability of physical activity for both males and females. However, the intensity of PA is higher for both male and female smokers.

5. Alcohol consumption for females increases the probability of physical activity and does not influence its intensity. For males, alcohol consumption is correlated with the intensity of PA, while it does not influence the probability of physical activity.

6. Education is a factor positively correlated with the probability of physical activity for both genders, but unrelated to the intensity of PA.

7. Per capita family income is positively correlated with the probability of physical activity for both genders.

8. Employment status consistently relates to the probability of physical activity of young respondents, both men and women: for university students, it is lower than for school students. For fully employed respondents, the probability of PA decreases even further, as well as for the non-employed. The intensity of PA of young men who graduated from secondary school is higher than for school students. The intensity of PA of non-employed females is higher than for female school students.

9. The probability of physical activity of officially married men and women is lower in comparison with those who are not married. This is also true for females in cohabitation, while for young men cohabitation is not a significant factor for the reduction in the probability of PA.

10. Residence outside of capitals reduces the probability of physical activity for both males and females — the smaller the settlement, the lower the probability. The only exception was young men residing in regional centres — the difference with men residing in capitals was insignificant. A decrease in probability is more pronounced among rural dwellers.

Discussion

Based on the results of the analysis, all five groups of chosen factors are in some way related to the probability and intensity of physical activity of young Russians in the 15–24 age range. These results, in general, agree with the conclusions of earlier studies [Levin et al., 1999; Sallis, Prochaska, Taylor, 2000; Trost et al., 2002; Ferreira et al., 2007; Sagatun et al., 2008; Zasimova, Kolosnitsyna, 2011; Micklesfield et al., 2017; Khorkina et al., 2018]. However, we identified certain discrepancies in the degree of influence of some factors on the probability and intensity of PA of Russian youth and young inhabitants of other countries.

Among *demographic and physical characteristics*, age and weight are negatively related to the PPA. While numerous studies confirm gender variations in the PA probability and intensity [Sallis, Prochaska, Taylor, 2000; Sagatun et al., 2008; Uijtdewilligen et al., 2011; Lämmle, Worth, Bös, 2012; Al-Hazzaa et al., 2014], we also reveal that certain factors associated with the PPA and IPA are subject to gender differences. For girls, alcohol consumption is positively related to the PPA, while for boys, it correlates with the IPA. Cohabitation does not influence the PPA and IPA of young men; for young women, both cohabitation and registered marriage decrease PPA. Age proved to be a stronger predictor of the PPA for boys than for girls. Conversely, in the case of girls, the

reduction of the PPA is more pronounced as we move from a group of schoolchildren to the groups of university students, employed or non-employed, compared with the same difference for boys. Higher education is more strongly correlated with the PPA for boys than for girls.

Concerning *health status* and *lifestyle*, we note the positive correlation between alcohol consumption and the PPA for females (and the IPA for males). Similarly, being a smoker, while associated with a reduction in the PPA, is positively associated with the IPA. Most international studies had either established no consistent relationship between these factors [Sallis, Prochaska, Taylor, 2000] or found a reverse relationship [Biddle et al., 2005; Higgins et al., 2014]. Several research papers indicate a positive relation between PA and unhealthy habits among youth in different countries: for drinking alcohol [Dunn, Wang, 2003; Buscemi et al., 2011] and for smoking [Verkooijen, Nielsen, Kremers, 2008]. The correlation of bad habits and the PA could be explained by the specificity of the age category of respondents — young people in their leisure time are combining training sessions, bar and night club visits, sports events, and dancing. Verkooijen, Nielsen, and Kremers also mention motivational considerations: for young males, sports activities and smoking are connected with a feeling of friendship; for young females, smoking is associated with losing weight [ibid.]. Our study also shows that, while SAH of the young remains high, "bad" habits do not come into conflict with "good" ones.

Socioeconomic factors — education level and per capita household income — are both positively related to the PPA. This result is quite predictable: well-educated people are normally better informed about the gains of healthy lifestyles; higher incomes make it possible to spend money on paid sports activities. Besides, education and income are interrelated. However, most international studies do not consider paid work as a possible factor of the youth's PA. The authors tend to study homogenous age groups (schoolchildren, university students) and assume that the vast majority of respondents do not work. In our sample, apart from schoolchildren and students, we encounter a significant share of employed and non-employed but not studying respondents — 35 % of respondents in the age range 15–24 have reported that they were employed. Once an indicator for the employment status had been introduced into the analysis, we noticed that the PPA tended to decrease for all the groups (student, employed, non-employed) compared with schoolchildren. This result can be explained by both compulsory physical training classes in the Russian school curriculum and more leisure time for physical culture and sports in the case of schoolchildren.

Household characteristics. Authors normally do not find any correlation between the family status of the respondents and their PA [Bauman et al., 2012]. However, we arrived at different results. Officially married young Russians of both genders are less physically active than those not married. The difference in the PPA can be attributed to more leisure time in the case of unmarried respondents. Besides, we got an additional unexpected result concerning the difference between official marriage and cohabitation. For young women, cohabitation decreases the PPA as well as the official marriage, but for young men, cohabitation has no connection with the PPA.

Among the *environmental factors*, the negative correlation with the PPA was found for the residence in small towns/rural settlements. The higher PPA of youth living in

the capital cities is evident in comparison with the residents of other areas. This result might be attributed to the better availability of the PA facilities for young men living in the capitals (more stadiums, sports grounds, fitness centres, gyms, swimming pools, skating rings, etc.).

Strengths and Limitations

This study adds to the literature on the factors of physical activity in Russian youth. Existing studies are not numerous. They address either young children and teenagers (6–18 years old) [Levin et al., 1999] or groups of students including those who are not officially classified as "young" (15–30 years old) [Zasimova, Kolosnitsyna, 2011]. Some of the studies are based on the data from one-time population surveys with rather limited samples [Levin et al., 1999; Khorkina et al., 2018] or provide the results of descriptive analysis only, not using econometric instruments [Khorkina et al., 2018]. The strength of this study is the use of a large sample from the nation-wide longitudinal survey. Our sample represents the group of people in the age range 15–24, falling under the UN classification into the youth group. We use rich and the most recent data from 2000 to 2016, which allow to reveal the changes in Russian society's attitudes towards a healthy lifestyle. Another strength is the method of econometric modelling. It gives us a possibility to control for self-selection processes since we can estimate the factors of physical activity intensity for those respondents only who have chosen to exercise. The econometric estimates also allow us to compare the roles of different factors, other things being equal.

Our study has some limitations. Research on the determinants of the youth's physical activity stresses that nutrition is essential [Sallis, Prochaska, Taylor, 2000]. However, the questions on the respondent's nutrition were included in the RLMS-HSE questionnaire only in 2010. Therefore, attempts to include nutrition into the econometric model would cut the surveyed period and the research time frame. Some authors stress that another important factor is household size [Ferreira et al., 2007; Khorkina et al., 2018], assuming that the immediate family might strongly influence the respondent's predisposition for physical activity. However, once the factor of per capita household income (calculated as the total household income divided by the number of persons living in the household) and the variable of household size were simultaneously used in the model, we predictably recorded the multicollinearity of these indicators. Therefore, in the final version of the model, we kept only the per capita income variable. Some authors also take into account the availability of sports facilities assuming their possible influence upon youth's proclivity for physical activity [Sallis et al., 1992; Spence, Lee, 2003]. The vast majority of respondents in our sample (around 90%) live in the areas with good sports infrastructure. That was the reason not to include the variable "availability of infrastructure" into the regression analysis, since it does not demonstrate sufficient variation and closely correlates with the type of settlement.

Conclusions and Policy Implications

Our research shows that while the majority of young Russians live in the settlements with well-developed sports facilities, only half of the young men and about one-third of young women are physically active. This means that special mechanisms should be

applied to motivate young people to exercise. In particular, sociological polls could help to reveal the preferred types of activities in this age group and to adjust the existing infrastructure correspondingly.

According to our results, even in the presence of free outdoor facilities, young people with low incomes exercise less. To motivate members of low- and moderate-income households to do regular physical activity, a mechanism of tax deductions could be introduced, by analogy with healthcare and education spending.

The probability of physical activity of young people halves when they move from school/university to employment. To enhance the physical activity of young employees, companies providing sports facilities/training at the workplace or subsidizing fitness centre memberships should get governmental grants or tax advantages.

Our findings show that marital status is a factor of a lower probability of physical activity for both spouses. For married couples and cohabitants, sports programmes should be developed to promote exercising for men and women together in the same type of activities, or different activities at the same time.

The results of this study do not suggest a one-to-one dependence between the probability/intensity of physical activity among young people and unhealthy habits, such as drinking alcohol and smoking. Our findings give reasons for separate public policies addressing different types of youth behaviours — physical activity, smoking, and alcohol consumption. Overall, better-targeted policy measures motivating young people to be physically active will have a long-term effect.

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Appendices

Appendix A. RLMS-HSE questions used to construct the variables

Variable	Question(s)	Answers
PPA, IPA	I will now list various kinds of physical activities. Will you please tell me in which of them you engaged in the last 12 months at least 12 times? For each activity you engaged in, during how many months, how many times per month, and how many minutes per time did the activity last?	Jogging, ice skating, skiing Using exercise equipment Pleasure walking Heel-and-toe walk Bicycling Swimming Dancing, aerobics Basketball, volleyball, soccer, hockey Badminton, tennis (including table tennis) Fighting, boxing, karate Something else
BMI	1) What is your height in centimetres? 2) How many kilograms do you weigh?	
SAH	How would you evaluate your health? It is:	Very good Good Average — not good, but not bad Bad Very bad
Alcohol	In the last 30 days, have you consumed alcoholic beverages?	Yes/No
Smoking	Do you now smoke?	Yes/No
Nutrition	Is it possible for you to eat always regularly but no rarely than three times a day?	Yes Yes more than no No more than yes Never manage
Education	What is your highest education level which is confirmed by a certificate or diploma?	General or incomplete secondary school Complete secondary school Vocational training school without secondary education Vocational training school with secondary education, technical trade school Technical community college, medical, music, pedagogical, art training school Institute, university, academy including specialist diploma, bachelor's degree, master's degree Post-graduate course, residency PhD degree Doctoral degree

Variable	Question(s)	Answers
Employment status	Which answer best describes your primary occupation at present? Choose only one answer.	A high school or vocational school student A university or technical school student Unable to work for health reasons, disabled Retired and not working On maternity leave On official leave for looking after a child A housewife Temporarily not employed for other reasons and looking for a job Temporarily not employed for other reasons and not looking for a job A farmer An entrepreneur Working at an enterprise, organization, etc.
Income	What was the monetary income of your entire family in the last 30 days? Include here all the money received by all members of the family.	
Marital status	1) What is your marital status? 2) Do you live with a partner to whom you are not officially married?	Never married First marriage Second marriage Divorced Widower/widow Married, but don't live together Yes, you live with a partner and consider yourself husband and wife Yes, you live with a partner but don't consider yourself husband and wife No, you do not live with a partner
Infrastructure	In this population center, are there any parks or sports complexes where residents can engage in sports: play soccer or hockey, ice skate, ski, swim, etc.?	Yes/No

Appendix B.
Descriptive statistics of the continuous variables in regression models (mean values)

Variable	Men (*N* = 10,317)	Women (*N* = 11,386)
Age (years)	20.1 (2,8)*	20.2 (2,7)
Average household income per capita per month in 2000 prices (roubles)	2710.6 (2698.1)	2694.7 (2515.8)
Intensity of physical activity (hours per month)	10.5 (19,6)	5.8 (13.6)

* Standard deviations in parentheses.

Appendix C.
Descriptive statistics of the categorical variables in regression models

Variable	Number of observations	Share of total (%)	Number of observations	Share of total (%)
	Men		Women	
Total	10317	100	11386	100
Body mass index (BMI):				
Underweight (BMI < 18,5)	742	7	1521	13
Normal weight (18,5 ⩽ BMI < 25)	6877	67	7388	65
Pre-obesity (25 ⩽ BMI < 30)	1465	14	1103	10
Overweight (BMI ⩾ 30)	1233	12	1374	12
Self-assessed health (SAH):				
Bad or very bad	196	2	357	3
Average, not good and not bad	3416	33	5039	44
Good or very good	6705	65	5990	53
Smoking:				
Smoker	5559	54	2371	21
Non-smoker	4758	46	9015	79
Alcohol:				
Consumes alcohol	5252	51	4359	38
Does not consume alcohol	5065	49	7027	62
Education:				
No secondary education certificate	3426	33	2707	24
Complete secondary or vocational education	3978	38	4172	37
Technical/incomplete higher education	2227	22	3221	28
Complete higher education (including scientific degree)	686	7	1286	11
Employment status:				
Secondary school student	1775	17	1638	14
Higher education student	2415	24	2908	26
Employed	4437	43	4074	36

Variable	Number of observations	Share of total (%)	Number of observations	Share of total (%)
	Men		Women	
Non-employed	1690	16	2766	24
Family status:				
Not married	7901	77	7111	62
Married (registered marriage)	1388	13	2687	24
Cohabitation	1028	10	1588	14
Place of residence:				
Capitals (Moscow and St. Petersburg)	1233	12	1279	11
Regional centers (apart from Moscow and St. Petersburg)	3388	33	4014	35
Cities, towns (apart from regional centers)	2430	23	3006	27
Rural settlements	3266	32	3087	27
Physical activity:				
Yes	4568	44	3692	32
No	5749	56	7694	68