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THE FACTORS OF PHYSICAL ACTIVITIES IN RUSSIAN YOUTH: EVIDENCE FROM MICRO-DATA

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THE FACTORS OF PHYSICAL ACTIVITIES IN RUSSIAN YOUTH: EVIDENCE FROM MICRO-DATA[4]

Physical activity is considered today as a leading factor in health and well-being in developed countries. With decreasing levels of alcohol and tobacco consumption, widespread sedentary lifestyles have taken centre stage among the predictors of non-communicable diseases. That is why Russia, along with other countries, has adopted the "Physical activity strategy for the WHO European Region 2016–2025". Young people are among the target groups of public policy promoting physical activity.

This paper investigates physical activity among young people aged 15 to 24 years. The empirical study is based on a descriptive and econometric analysis of micro-data from the Russia Longitudinal Monitoring Survey (RLMS), 2000–2016. The research shows that 50% of young men and 65% of young women do not exercise on a regular basis. Both for men and for women, the probability of physical activity is positively related to their educational level, household income, and residence in capital cities. Negative relations were found between the probability of physical activity and smoking, status of married person, and employed and non-employed status. The results for alcohol consumption, body mass index and self-assessed health are inconclusive for this age group.

The results confirm the necessity of better-targeted public policy motivating physical activity in youth. Overall, policy measures motivating young people to take part in physical activity will have a long-term effect. Habits developed in youth often persist into adulthood. The result will be a gain in the health and longevity of the Russian population.

JEL Classification: I31, I38.

Keywords: physical activity; young people; healthy lifestyle; Russia.

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Introduction

The World Health Organization (WHO) places special emphasis on physical activity as a leading factor in health and well-being in the European Region, 'with particular attention to the burden of non-communicable diseases associated with insufficient activity levels and sedentary behaviour' (WHO, 2016, p. 2). In most European countries, including Russia, one observes declining trends in alcohol and tobacco consumption, especially evident among younger groups of the population. However, people exercise less; their jobs are mostly sedentary; they use automobiles or public transport instead of walking. Along with the increasing consumption of unhealthy and fast foods, these habits are leading to a growth in obesity and numerous health problems. 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". One of its guiding principles is to promote a life-course approach. Thus, governmental policies to enhance physical activity should be aimed at all age groups, starting with the younger members of society.

According to statistical data, almost 40% of Russian young people aged 15–29 do not exercise regularly[5]. Among other causes of low physical activity are the popularity of ICT among children and youth, computer-based pastimes, and the substitution of computer games for sports activities (Shishkin et al., 2017). Low physical activity leads to a number of adverse outcomes both for individual health (such as obesity, heart and musculoskeletal system diseases, stress), and for society as a whole (a fall in labour productivity, a rise of the financial burden on healthcare systems) (WHO, 2010). Regular physical exercise at a young age has a significant impact on youth health, and on their quality of life (MacKelvie et al., 2002). Further, an active lifestyle habit formed at a young age increases the probability of physical activities in later life (Telama et al., 2005).

In recent years, the Russian government has paid particular attention to physical activity and sports in the country. A number of important documents have laid the groundwork for policies to stimulate the population's physical activity[6], including special measures aimed at the younger generations. However, for an efficient and targeted policy the behavioural factors motivating physical activities and the barriers for healthy behaviours should be taken into account (McDaid et al., 2014). Research has addressed certain aspects of the lifestyles of Russian

[5] https://www.minsport.gov.ru/sport/physical-culture/statisticheskaya-inf/

[6] Decree of the Government of the Russian Federation "On approval of the Regulations on the All-Russia Sports and Physical Complex "Ready for Labor and Defense" №540 of 11.06.2014; Strategy of Physical Training and Sport Development in the Russian Federation within the period till 2020; Federal Target Program Development of Physical Education and Sports in the Russian Federation for 2016-2020.

youth (Zasimova, Kolosnitsyna, 2011; 2012; Zasimova et al., 2017; Kozyreva et al., 2016; Khorkina et al., 2018).

In this paper we investigate the distinctive features and factors of physical activity among modern Russian youth. The empirical study is based on data from the Russia Longitudinal Monitoring Survey (RLMS), 2000–2016. We use econometric modelling to test the hypotheses. The paper concludes with recommendations for public policy motivating physical activities among young people.

The determinants of physical activity in youth: a literature review

Gender and Age

Considering the determinants of physical activity, some authors emphasize respondents' age and gender. Sallis et al. (2000) reviewed the literature on the correlates between the physical activity of children and adolescents (ages 13–18). Based on an analysis of 54 studies, published between 1970 and 1998, the authors conclude that the physical activity of individuals in this age group is consistently related to such variables as sex: males are more physically active than females, and age: physical activity normally diminishes with age. An analysis of 30 similar studies undertaken in the period between 2004 and 2010 is provided in Uijtdewilligen et al. (2010). This review found different results – physical activity increases with age, while gender does not influence physical activity in the 13–18 age group. Sagatun et al. (2008) established that Norwegian schoolgirls aged 15–18 were less physically active than boys of the same age. In a recent study of the determinates of physical activity of Moroccan adolescents aged 14–19, El-Ammari et al. (2017) revealed similar gender differences: girls were less active than boys; however, no consistent relationship was established between age and the physical activity of respondents. Studies based on Russian data demonstrate that the physical activity of young people diminishes with age. According to descriptive statistical data, physical activity of Russian young people aged 14–17 is higher than that of those aged 18–24 (Kozyreva et al., 2016); young people aged 16–20 are more physically active than those aged 21–24 (Khorkina et al., 2018). Khorkina et al. (2018) also demonstrated that young Russian males aged 16–24 are more active than females of the same age.

Body Mass Index (BMI)

Micklesfield et al. (2017) analysed the variables related to the physical activity of young South African women (18–23) and revealed a positive association between moderate to vigorous physical activity and BMI. However, the authors of other similar studies did not find an unequivocal relationship between physical activity and BMI for young people 13–18 (Sallis et al., 2000; Uijtdewilligen et al., 2010; Van Der Horst et al., 2007).

Health

Studies of healthy behaviours conducted by Russian researchers revealed that the self-assessed health status of young Russians 16–24, in contrast to older age groups, has a weak positive correlation with their level of physical activity. In 2017, the share of respondents who rated their health as "good" among physically active young people was only 10% higher than that of physically inactive youth (Zasimova et al., 2017). Another Russian study (Khorkina et al., 2018) revealed a positive correlation between the diminishing share of physically active young Russian 16–24 and a deterioration of their health. The literature review by Trost et al. (2002) reported that a similar conclusion was made by the authors of four studies on the determinants of physical activity of American women aged 18 years and over: bad health was identified as a barrier for physical activity.

Diet

"A review of correlates of physical activity of children and adolescents" (Sallis et al., 2000) revealed an ambiguous relationship between a healthy diet and physical activity: while four of the studies found a positive correlation between a healthy diet and the physical activity of children and adolescents, three other studies found no such relation.

Unhealthy Habits

The studies reviewed in Sallis et al. (2000) did not reveal a consistent relationship between bad habits (such as use of tobacco and alcohol) and physical activity for adolescents 13–18. In later research, an inverse relationship was confirmed – in Higgins et al. (2014) the analysis of factors related to the physical activity of young people in Canada (12–24) revealed that alcohol and tobacco use were inversely related with physical activity irrespective of the sex of respondents. A similar relationship between tobacco use and the physical activity of adolescent girls was established in Biddle et al. (2005). A number of research papers report positive correlation between physical activities and alcohol use among young people (Buscemi et. al., 2011; Dunn, Wang, 2003; Pate et al., 1996).

Education

Russian authors analysed 2017 data on the physical activity of 360 young Russians 16–24 (Khorkina et al., 2018). They found no relationship between physical activity and education level; however, the maximum shares of physically active young men were recorded in the group with higher education (including incomplete higher education) and incomplete secondary education (74%). 62% of girls with incomplete secondary education self-assessed themselves as

physically active. Studies of the determinants of the physical activity of youth often address an age group of similar educational level (such as schoolchildren, or university students); usually these respondents do not have regular employment. Therefore education level and employment status are not normally considered as variables related to the physical activity of respondents. However, the studies of physical activity determinants of wider age groups (incorporating both adults and young people) introduce these variables and assess their possible relation to physical activity. Out of 38 studies of the physical activity determinants for the adult population reviewed in (Trost et al., 2002), 11 authors assessed the relation between respondent education and his/her physical activity; a positive relationship had been established in all 11 cases.

Employment

The literature review of the studies of the determinants of physical activity of adolescents under 19 years old reported that no consistent relationship between paid work and physical activity was established – in three cases a positive correlation was revealed, while in four other studies no statistically significant relationship was found (Ferreira et al., 2007). A study of 15–16 years old Irish students revealed that working students are less physically active (Vilhjalmsson; 1998). Similar results were obtained in a Russian study (Khorkina et al., 2018): non-employed Russians in the 16–24 age range are 1.3 times more physically active than those with paid work (for male respondents) and girls were almost twice as active; an obvious explanation is a lack of time for working respondents.

Income

Different studies did not establish a consistent relationship between income and the physical activity of young people. According to (Crespo et al., 1999; Ferreira et al., 2007; Gordon-Larsen et al., 2000; Lowry et al., 1996; Sagatun et al., 2008; Woodfield et al., 2002), physical activity is higher for young people living in wealthier families. However, other studies did not establish a consistent relationship between household income and physical activity of youth (El-ammari et al., 2017; Sallis et al., 2000).

Household size

A review of 84 studies of the determinants of physical activity of young people did not provide any references to studies establishing consistent relationship between the level of physical activity of young people 13–18 and household size (Ferreira et al., 2007). However, a study of Russian authors revealed that the share of active young people 16–24 is lower for those living alone in comparison with those living with other household members (Khorkina et al., 2018). One possible interpretation for this result is the positive influence of parents and other household members on their propensity for sport (Khorkina et al., 2018).

Residence /Type of Settlement

An analysis of the determinants of physical activity of South African adolescents and young adults showed that physical activity was lower in the urban sample than the rural sample (Micklesfield et al., 2017; Peer et al. 2013). Regis et al. (2016) arrived at a similar result based on the study of Brazilian students 14–19. Adolescents in rural areas had higher levels of physical activity. The analysis of the lifestyles of Russian students aged 18 to 24 (Zasimova, Kolosnitsyna, 2012) showed that the physical activity of students diminishes in direct proportion to the distance between locations where they graduated from the secondary school from capital cities. However, the study of lifestyles of young Canadians (2,697 highschool students) did not establish a significant statistical difference in the level of physical activity between students of urban and rural schools (Plotnikoff et al., 2004). A review of 84 studies devoted to the physical activity determinants of youth published between 1982 and 2007 did not establish a consistent relationship between the physical activity of young people and the place of their residence (Ferreira et al., 2007).

Infrastructure

Numerous studies on the determinants of physical activity in youth stress that alongside personal factors external parameters, such as an infrastructure of the place of residence, work or studies, the availability of sports facilities should also be taken into account (Sallis et al., 1992; Spence, Lee, 2006; Welk, 1999). Spence and Lee (2006, p. 10) stress that external factors become especially important, since "individuals adapt, or vary their behaviours or characteristics in response to available, changing resources in the extra individual environment". WHO guidelines emphasize the development of sports facilities with growing urbanization (WHO, 2010; WHO, 2017). Sports facilities are of special importance for youth living in low-income families. A study of the physical activity of Canadian students 12–18 revealed that the physical activity of young people from poorer families (with low income, living in districts with less developed infrastructure) is critically dependent upon an availability of accessible sports facilities in the immediate vicinity of their home (Humbert et al., 2006).

The factors of physical activity in Russian youth: an empirical analysis

Research hypotheses, data and variables

Based on the literature review we hypothesized that the level of physical activity of Russian youth is determined by the following groups of factors:

H1: demographic and biological characteristics;

H2: health status and life style;

H3: socioeconomic factors;

H4: household characteristics;

H5: factors in the external environment.

The group of demographic and biological characteristics incorporates the *sex* and *age* of respondent and his/her body mass index (*BMI).*

The second group of factors comprises the following characteristics of young people: *self-assessed health status (SAH), smoking, the consumption of alcohol, regular meals.*

The group of factors reflecting socioeconomic characteristics included *education, employment status,* and *household per capita income.*

Household characteristics comprised *the family status of respondent* and *household size.*

External environment factors characterize the respondent's place of residence (*settlement type* and *infrastructure*).

To test the hypotheses we used RLMS HSE[7] panel data from waves 9–25, (2000–2016). The sample consisted of respondents from 15 to 24 falling under the UN classification into youth group[8]: 37,167 observations (19,702 observations on women; 17,465 observations on men). The design of RLMS is the following. If in a certain year it is impossible to collect information from some respondents, new ones with the same idiosyncratic features replace them, preserving the representativeness of the sample but unbalancing the panel. If we use the balanced panel, we will face sample attrition year by year, and therefore an attrition bias. In a long-run perspective (in our case, 17 years), there will be no (or insignificant numbers of) youngers in the sample. Therefore, our choice is unbalanced representative dataset with enough observations for accurate regression analyses. Within the generated panel, the minimum number of respondents participated in 2000–2001 surveys (5% of the sample for each of these years), the maximum number of respondents represent 2010–2014 surveys (on average, 7% of the total number of respondents) (Appendix A). Further, in 2007–2008 the RLMS questionnaires did not include information on physical activity, so the sample for our analysis was reduced. In regression modelling, we used pooled data on only those respondents who gave answers to all the relevant questions. The total number of observations dropped to 21,703 (10,317 observations on men and

[7] https://www.hse.ru/en/rlms/

[8] https://www.un.org/development/desa/youth/what-we-do/faq.html

11,386 observations on women). Appendices B and C represent the descriptive data on the sample used later in the regression analysis.

Two dependent variables were constructed[9]:

1) The variable "*The probability of physical activity"*, describes the fact of being involved in physical activity. The variable is based on the response to the question from the RLMS questionnaire: "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;
- pleasure walking;
- heel-and-toe walk;
- bicycling;
- swimming;
- dancing, aerobics, shaping, yoga;
- basketball, volleyball, football, hockey;
- badminton, lawn or table tennis;
- wrestling, boxing, karate;
- other physical activity?"[10]

The variable was assigned 1 if the respondent had done at least one of the listed types of activities in the past 12 months, and 0 otherwise.

2) The variable "*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:

$$IPA = \sum_i (number\ of\ training\ sessions\ per\ month * duration\ of\ one\ session\ (min))/\ 60),$$

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

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

Measures and descriptive statistics of the aggregated sample

Based on the data collected, the share of young Russians involved in physical activity grew in 2000–2016 and in 2016 was 62% for men and 49% for women; it was 1.4 times higher for men and 1.6 times higher for women than in 2000 (Figure 1). Men were more physically active than women throughout the 2000–2016 period were.

[9] Descriptive statistics for all the variables is presented in Appendices B and C.
[10] RLMS HSE questions are presented in Appendix D.

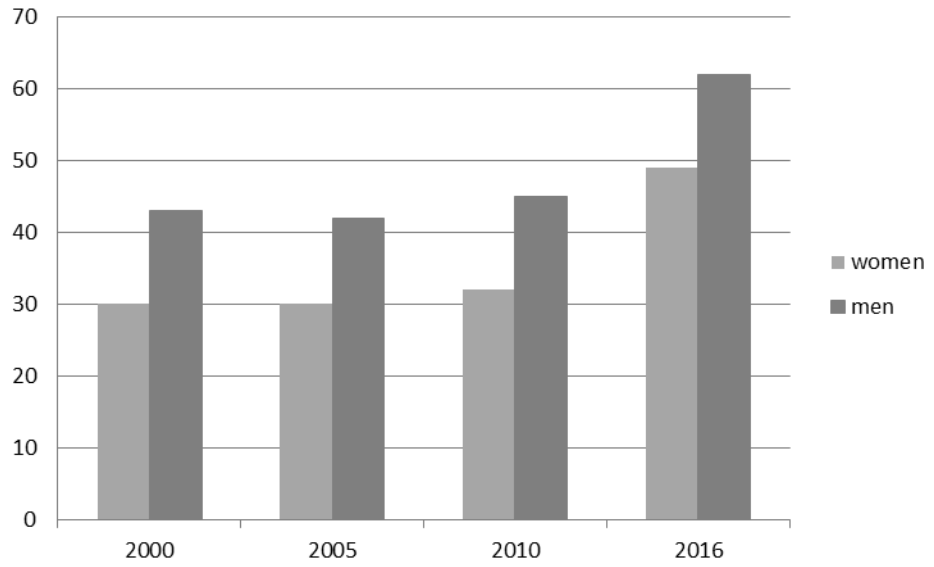

Figure 1. Shares of young men and women in the 15-24 age range involved in any type of physical activity, out of the total number of youth in this age range, 2000, 2005, 2010, 2016 (per cent)

Source: authors' estimates based on the RLMS HSE for respective years.

The dynamics for age and sex demonstrates that in the period 2000–2016, the share of physically active youth grew in all the age groups under consideration (Figures 2–3). Young people in the 15–17 age range were the most active; those 22 to 24 were the least active.

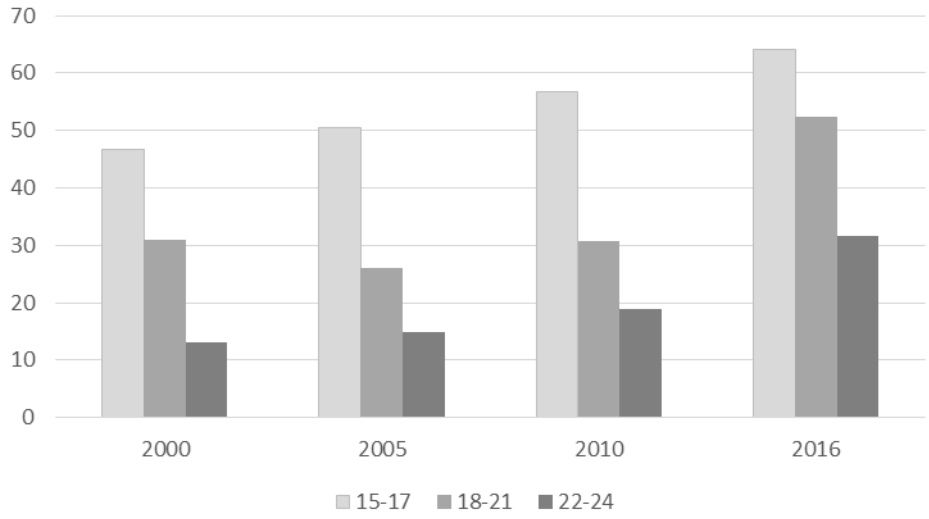

Figure 2. Share of physically active young women by age groups, out of the total number of women in a respective age group, 2000, 2005, 2010, 2016 (per cent)

Source: authors' estimates based on the RLMS HSE for respective years.

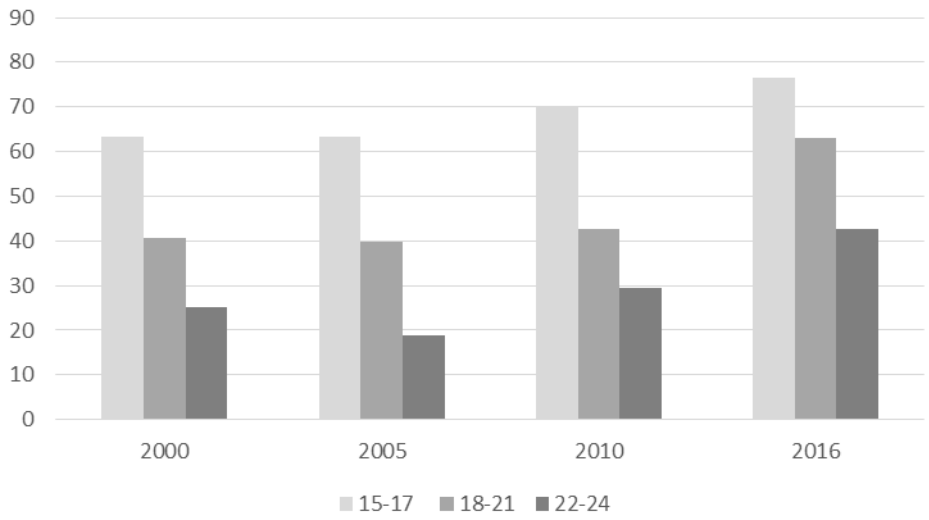

Figure 3. Share of physically active young men by age groups out of the total number of men in a respective age group, 2000, 2005, 2010, 2016 (per cent)

Source: authors' estimates based on the RLMS HSE for respective years.

Physical activity was gender dependent. In 2016, young men in the 15 to 24 age range were most active in team sports (basketball, volleyball, football and hockey) (26%), and exercise machine training (25%); men were twice as active as women. Women preferred walking (15%), jogging, skating or skiing (14%). The share of women doing dancing, aerobics, shaping and yoga was 10 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, per cent)

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

An important step in the study is characterizing physically active young people depending on individual factors and household parameters. Table 2 represents the shares of physically active respondents among those who had answered the relevant questions.

Table 2. Characteristics of physical activity among men and women in the 15-24 age range, depending on different factors, 2000-2016, aggregated sample (per cent)[11]

	Share of physically active respondents, % (number of respondents equal to 100%)	
	men	**women**
Total	48.9 (15291)	35.3 (17208)
Demographic and biological characteristics		
Age:		
15-19 years	63.8 (7495)	48.9 (7885)
20-24 years	34.6 (7796)	23,7 (9323)
BMI:		
Underweight (BMI <18,5)	54.7 (1269)	41.0 (2545)
Normal weight (18,5≤BMI<25)	51.0 (10375)	37.0 (11355)
Pre-obesity (25≤BMI<30)	43.0 (2033)	25.0 (1575)
Obesity (BMI≥30)[12]	38.7 (1614)	25.5 (1733)
Health and life style		
Self-assessed health (SAH):		
Good, very good	52.3 (310)	36.5 (480)
Average, not bad and not good	42.9 (4660)	33.7 (6806)
Bad and very bad	34.2 (10236)	35.0 (9856)
Regular meals:		
Yes	57.3 (3591)	38.5 (3925)
Rather regular	50.5 (2292)	40.9 (2335)
Rather irregular and irregular	46.9 (1982)	41.2 (2371)
Smoking:		
Smokes	34.0 (6469)	23.0 (2754)
Does not smoke	60.0 (8764)	37.7 (14427)

[11] Per cent of men and women dependent on individual/household characteristics assessed as physically active

[12] BMI classification based on WHO definitions: http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Alcohol:		
Consumes	38.6 (5492)	31.4 (4554)
Does not consume	50.7 (5401)	33.5 (7409)
Socioeconomic factors		
Education:		
No secondary education certificate	56.9 (6139)	45.7 (5355)
Complete secondary or vocational education	41.4 (5402)	30.6 (6007)
Technical/Incomplete higher education	46.8 (2816)	30.4 (4123)
Complete higher education (including scientific degree)	46.8 (916)	31.0 (1712)
Employment status[13]:		
Secondary school student	71.6 (3531)	58.6 (3421)
University student	65.9 (3949)	50.2 (4609)
Employed	30.4 (5285)	23.0 (5029)
Non-employed	29.4 (2475)	14.3 (4111)
Household income per capita in 2000 prices (in Roubles):		
Up to R4300	44.0 (3641)	28.6 (4346)
R4301 – R7700	46.4 (3583)	33.0 (4095)
R7701 – R12800	49.8 (3604)	38.4 (3945)
Over 12800	54.0 (3716)	40.8 (3941)
Household characteristics		
Family status:		
Not married	53.4 (12539)	43.2 (11645)
Married (registered marriage)	24.0 (1562)	16.6 (3538)
Civil marriage	35.0 (1178)	22.7 (2012)
Household size:		
One person	59.6 (396)	43.2 (648)
Two persons	46.9 (2265)	34.9 (2797)
Three persons	47.6 (4307)	34.0 (4979)
Four persons	54.0 (4399)	38.9 (4389)
Five and more persons	44.7 (3924)	32.3 (4395)

[13] Employment status is the main occupation according to individual's own answer. 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.

Environment factors		
Place of residence:		
Capitals (Moscow and St.-Petersburg)	56.7 (1767)	47.8 (1892)
Regional centers (apart from Moscow and St.-Petersburg)	52.9 (4650)	39.2 (5567)
Cities, towns (apart from regional centers)	49.5 (3641)	32.0 (4361)
Rural settlements	42.4 (5233)	29.5 (5388)
Infrastructure:		
Available sports facilities	50.3 (13308)	35.9 (15135)
Unavailable sports facilities	39.9 (1935)	31.2 (2010)

Numbers of observations in parentheses.

Table 2 shows that men are generally more physically active than women. Physical activity diminishes with age: young Russians 15–19 allocate more time to different types of physical activity than those aged 20–24. This is true for men and women alike – the share of physically active young men 15–19 was 64%, or 1.8 times higher than the share for the age group 20–24 years (35%). For women the respective shares were 49 and 24%.

Young respondents with a low BMI (BMI<18.5) recorded maximal physical activity, physical activity tends to diminish in both gender groups with higher BMI.

Physical activity is consistently related to self-assessed health – it increases in the group with better health, and this trend is more conspicuous for young men.

It is possible to assume that respondents doing sport are more prone to a healthy lifestyle. In fact, smokers (both men and women) are less physically active than non-smokers. The same is true for alcohol consumption – consumers are less physically active. The relation between physical activity and nutrition is ambiguous – young men who eat regular meals are more physically active, while physical activity of girls is unrelated to the regularity of meals.

The descriptive statistics do not reveal any relationship between the physical activity of respondents and their education level. While both males and females who did not graduate from secondary education were more physically active (57% for boys and 46% for girls), in other educational subgroups the share of physically active consisted of 42–47% for males and 30–31% for females.

Employment status is an important correlate of the physical activity of young Russians. Young respondents continuing their studies were the most active – for school students the level of physical activity was 72% for boys and 59% for girls, probably due to compulsory physical training lessons at school. Physically active respondents consisted of more than half of university students in the sample. The share of physically active men in the employed and non-employed

groups were similar (30%), 23% of employed women were physically active – or 1.6 times more than non-employed women (14%).

The level of physical activity grows with per capita household income. The share of physically active males living in wealthier families is 1.2 times higher than of those living in poorer households; the multiple was 1.4 for girls. Young respondents living in wealthier families presumably use paid sports facilities (with payments made by both themselves and their parents). 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 higher levels of physical activity than respondents living in larger households.

The availability of free sports facilities at the place of residence and at the place of work and/or studies is an important determinant of physical activity. The share of physically active youth with access to sports facilities is higher in comparison to respondents living in areas lacking such infrastructure (males are 1.3 times more physically active, and females 1.2 times). However, the availability of sports facilities is strongly correlated with the place of residence – in large cities it is higher than in small settlements. Thus, we cannot use both variables in the regression model simultaneously.

Finally, the descriptive analysis shows that the share of physically active males and females was higher in Moscow (including New Moscow) and St. Petersburg in comparison to those living outside these cities. The smaller the place of residence, the less the physical activity of its young inhabitants.

Regression Analysis and Results

To estimate the main factors influencing physical activity, we chose the Heckman model. 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 (1979). At the first step, we estimate a model of probability for being physically active, with the binary dependent variable (1 active, 0 inactive): the "participation equation". The marginal effects estimated for this model reveal the directions and magnitudes of correlations between dependent and independent variables. At the second step, we estimate an OLS model for the degree of physical activity measured in hours: the "intensity equation". This reveals connections between the continuous variable of physical activity and various factors described above. According to Heckman, the number of independent variables in the second (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 physical activities. The proposed methodology is applied to 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. A dummy for years of observation has been included in the model to take into account unobserved time-related effects.

We estimated the models for young men and women separately. The Chow test confirmed the appropriateness of separate estimations for gender groups (LR chi^2 = 249, Prob > chi^2 = 0,000). The regressions estimates for young men and women gave similar results. However, a number of coefficients were statistically different (see Appendix E). The correlation matrices of the variables chosen did not show multicollinearity (Appendices F and G). Table 3 presents the results of the Heckman model estimates[14]. 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 also 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

	Men		**Women**	
Variable	**Physical activity probability (marginal effects)**	**Physical activity intensity (ln)**	**Physical activity probability (marginal effects)**	**Physical activity intensity (ln)**
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	reference group	reference group	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)
Self-assessed health:				
Bad, very bad	reference group	reference group	reference group	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)

[14] The variable of household size was not included in the models as it proved to be strongly correlated with the variable of household's income per capita. Thus, to avoid multicollinearity, we included in final specification only average income variable.

	Men		Women	
Variable	**Physical activity probability (marginal effects)**	**Physical activity intensity (ln)**	**Physical activity probability (marginal effects)**	**Physical activity intensity (ln)**
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)
Education:				
No secondary education certificate	reference group	reference group	reference group	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 income per capita in 2000 prices in Roubles, ln)		-0.012		-0,004
		(0.009)		(0.010)
Employment status:				
Secondary school student	reference group	reference group	reference group	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)
Family status:				
Not married	reference group	reference group	reference group	reference group
Married (registered marriage)	-0.048***	-0.002	-0.074***	0.045
	(0.018)	(0.062)	(0.020)	(0.056)
Civil marriage	0.022	0.013	-0.04***	-0.067
	(0.019)	(0.059)	(0.022)	(0.054)
Place of residence:				
Capitals (Moscow and St.-Petersburg)	reference group		reference group	
Regional center (apart from Moscow and St.-Petersburg)	-0.015		-0.084***	
	(0.018)		(0.016)	

	Men		Women	
Variable	**Physical activity probability (marginal effects)**	**Physical activity intensity (ln)**	**Physical activity probability (marginal effects)**	**Physical activity intensity (ln)**
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 chi 2	146.83***		258.29***	
rho	45.71***		36.66***	
Number of observations	10317	10317	11386	11386

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses.

The models estimates let us draw the following conclusions:

1. The probability of physical activity decreases with age for both males and females; for males the decrease is more conspicuous. However, respondent age does not relate to the intensity of physical activity.
2. The correlation of BMI and physical activity probability depends upon gender. While an increase of BMI from 18.5 to 30 increases the probability of physical activity for males, it does not increase the probability for females. However, an increase of BMI for males is linked with a reduction of the intensity of physical activity: in the normal weight group the intensity decreases by 17% on average, relative to the underweight group; in the pre-obesity group the reduction is 11.4%. However, for females with BMI over 30, physical activity probability decreases by 3% relative to those underweight. For females, BMI is not consistently related to the intensity of physical activity.
3. For males who self-assessed their health as "good" or "very good" the probability of physical activity is 10% higher than for those who assess their health as "bad" or "very bad". For females, no consistent relationship was established between health self-assessment and physical activity. The self-assessment of health does not influence the intensity of physical activity for males or females.
4. Smoking reduces the probability of physical activity for both males and females (by 11% for males and 7% for females). However, the intensity of physical activity is higher for both smoking males and females (on average 9.8% higher for males and 21.9% higher for females).
5. Alcohol consumption for females increases the probability or physical activity by 4.3%; however, this factor does not influence the intensity of physical activity. For males alcohol

consumption is correlated with the intensity of physical activity (an increase of 7.6%), 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. For university graduates the probability of physical activity is 20% higher compared to those who did not finish secondary school. The intensity of physical activity is unrelated to education level.
7. Growing 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 for young respondents, both men and women: for university students, it is lower than for school students. For fully employed young respondents the probability of physical activity decreases even further, as well as for non-employed. The intensity of physical activity of young men not studying in secondary school is higher than for school students (the intensity for university students is 9.7% higher, for employed 36.7% higher, for non-employed 59.3% higher). The intensity of physical activity of non-employed females is 37.4% higher than for schoolgirls.
9. The probability of physical activity of officially married young respondents, both men and women, is lower in comparison with those who are not married. This is also true for females in civil marriages, while for young men civil marriage is not a significant factor for a reduction in physical activity.
10. Residence outside of Moscow and St. Petersburg reduces the probability of physical activity for both males and females – the smaller the settlement, the lower the probability of physical activity (apart from young men residing in regional centres – the differences with men residing in capitals was insignificant). A decrease in physical activity is more pronounced among rural dwellers compared to residents of capitals (the difference in physical activity probability is 17.8% for females and 11.6% for males).

Discussion and Conclusions

Based on the results of the empirical analysis, all groups of factors (hypotheses H1–H4) are in some way related with the physical activity of young Russians in the 15–24 age range. Education level, per capita family income and non-smoking status are among the factors positively related with the probability of physical activity. The correlation of the probability of physical activity was negative for such factors as age, status of employed or non-employed (vs. school students), registered marriage and residence in small towns or rural settlements.

Some factors associated with physical activity are subject to gender differences. For females alcohol consumption is positively related with the probability of physical activity, while for males it correlates with the intensity of physical activity. Civil marriage does not influence the physical activity of young men; while for young women both civil and registered marriage decreases the probability of physical activity. Age was a stronger influencer of the probability of physical activity for males than for females. Conversely, for females, a reduction in the probability of physical activity is more conspicuous in the transition from school to university, employed or non-employed compared with that for males. The level of higher education is strongly correlated with physical activity for males than for females.

These results are in general agreement with the conclusions of earlier studies, based on both international (Ferreira et al., 2007; Gordon-Larsen et al., 2000; Lowry et al., 1996; Micklesfield et al., 2017; Sagatun et al., 2008; Sallis et al., 2000; Trost et al., 2002; Woodfield et al., 2002) and Russian data (Zasimova, Kolosnitsyna, 2011; 2012; Zasimova et al., 2017; Kozyreva et al., 2016; Khorkina et al., 2018). However, we identified certain discrepancies in the degree of influence of some factors on the physical activity of Russian youth and young inhabitants of other countries. In the first instance, it applies to the higher physical activity of youth living in capital cities (Moscow and St. Petersburg) in comparison with residents of other areas. This result might be attributed to the better availability of physical activity facilities for young men living in capitals.

We also note the positive correlation between alcohol consumption and the probability of physical activity for females (and the intensity of physical activity for males). Similarly, being a smoker, while associated with a reduction in the probability of physical activity, is positively associated with the intensity of physical activity. Most international studies had either no established consistent relationship between these factors (Sallis et al., 2000), or had found a reverse relationship (Biddle et al., 2005; Higgins et. al., 2014). They explain the higher levels of physical activities among young individuals without bad habits by their overall propensity for a healthy lifestyle. Some research papers reveal a contradictory positive correlation at first glance between drinking alcohol and the physical activities of adult males and females (French et al., 2009). The authors explain such a connection in different ways: 1) risk loving which leads to a sensation-seeking lifestyle, including heavy drinking and extreme sports; 2) socializing and drinking at parties after group sports activities; 3) intentional compensation of the high calorie intake from alcohol by increased physical activity (French et al., 2009).

Several research papers indicate a positive relation between physical activity and unhealthy habits among youth in different countries. In particular, such relations were found for drinking alcohol (Buscemi et. al., 2011; Dunn, Wang, 2003; Pate et al., 1996) and for smoking

(Verkooijen et. al., 2008). Aside from the reasons mentioned above, the correlation of bad habits and physical activity could be explained by the specificity of age category of respondents – young people are multitasking, combining at their leisure training sessions, bars and night clubs, sports events and dancing. Verkooijen et. al. (2008) 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. Our study also shows that, while the health self-assessment of youth remains high, "bad" habits do not come into conflict with "good" ones.

As mentioned, international studies normally do not consider the influence of education level and employment status of young men and women on physical activity. They deal with homogenous age groups (school students or university students), and assume that the vast majority of respondents do not work. In our sample, apart from school students and university students, we encounter a significant share of respondents employed and non-employed but not studying – 35% of respondents in the age range of 15 to 24 reported that they were employed. Once an indicator for employment status was introduced into the analysis, we noticed that physical activity tended to decrease for all groups (university student, employed, non-employed) compared with school students. That result can be explained by both the compulsory physical training lessons in Russian schools and the better availability of leisure time for physical culture and sports for school students. Respondents were more physically active, the higher her/his education level. This might be attributed to a better health awareness of respondents with higher education, as well as aspirations to a healthy lifestyle.

As highlighted in the literature review, authors normally do not establish a correlation between the family status of respondents and their physical activity (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 physical activity can be attributed to better availability of leisure time in case of unmarried respondents.

Our study has a number of constraints. Research into the determinants of the physical activity of youth (Sallis et al., 2000) stress that nutrition is essential in the analysis. However, the questions on respondent's nutrition were included in the RLMS HSE questionnaire only in 2010. Therefore, attempts to include nutrition into an econometric model would cut the surveyed period and research timeframe. 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 respondent's predisposition for physical activity. However, once the factor of per capita household income (calculated as total household income divided by the number of persons living in a household) and the variable of household size were simultaneously introduced

into 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 environmental factors (infrastructure, availability of sports facilities, etc.) rightly assuming their possible influence upon youth's proclivity for physical activity (Sallis et al., 1992; Spence, Lee, 2006; Welk, 1999). Our research indicates that the vast majority of respondents in the 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.

Public policy

Enhancing the physical activity of the population is one of the strategic goals of the Russian government within the framework of the National project "Demography". A number of special measures have already been introduced; however, this research shows that 50% of young men and 65% of young women do not exercise on a regular basis. Compared to statistical data from developed countries, these results place Russia among the countries with a low level of physical activities in youth (Active Lives Survey 2015–16, 2016; Eurobarometer, 2014).

All the programmes of active lifestyle normally include the development of sports infrastructure and the urban environment (Bull et al., 2014 Kelly et al., 2009; WHO, 2012; WHO, 2017). The majority of young Russians aged 15–24 (about 90%) live in settlements with well developed sports facilities. Only half of young men and about 30% of young women among those who have access to sports facilities are physically active. Hence, additional measures are necessary to motivate young people to exercise. In particular, the experience of the youth movement WorkOut[15] should be disseminated throughout the country. This project includes the outside exercise in the company of peers, with the aid of a professional instructor. Today among the leaders in this movement are Moscow and St. Petersburg (with 1400 and 300 playing fields, respectively). However, in other regions the movement is not that popular with smaller numbers of places for training and a lack of professional support[16]. According to our results, the most urgent necessity is improving sports infrastructure and special programmes in rural settlements and small towns.

Our results show also that the physical activity of young people halves when they move from school/university to employment. Sedentary work, especially common to large cities, and a lack of leisure time explain the reduction in physical activity. To enhance the physical activity of

[15] https://workout.su/info
[16] https://workout.su/areas

the young working population, the government could apply special instruments motivating employers. Companies providing sports facilities/training at the working place, or subsidizing employee fitness centre memberships should get governmental grants on a tender basis, or social tax advantages (Zasimova et al., 2014).

Marital status is a factor in low levels of physical activity for both spouses. In light of this, physical activity programmes should be developed to let young men and women exercise together in the same type of activities, or in different activities, but at the same time. Those fitness centres and other sports facilities providing discounts for couples and families with children should get support in a form of reduced taxes or subsidies.

The study revealed important results – the positive relationship between household income and the probability of physical activity. Even in the presence of free outdoors 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 educational spending.

Our results do not suggest a one-to-one dependence between physical activities and unhealthy habits, such as alcohol drinking and smoking. Those findings give reasons for separate public policies addressing different types of youth behaviours. Overall, better-targeted policy measures motivating young people to be physically active will have a long-term effect. The habits developed in youth often persist into adulthood. The result will be a gain in health and longevity of Russian population.

Literature

Active Lives Survey 2015-16 (2016). Retrieved from http://www.sportengland.org/media/11498/active-lives-survey-yr-1-report.pdf

Bauman A., Reis R., Sallis J., Wells J., Loos R., Martin B. (2012). Correlates of Physical Activity: Why Are Some People Physically Active and Others Not? *Lancet.* Vol. 380, pp: 258–271.

Biddle S., Whitehead S., O'Donovan T., Nevill M. (2005). Correlates of Participation in Physical Activity for Adolescent Girls: A Systematic Review of Recent Literature. *Journal of Physical Activity and Health*, Vol. 2, pp. 423–434.

Bull F., Milton K., Kahlmeier S., Arlotti A., Backovic-Jurican A., Belander O., Berlic N., Colitti S., Martin B., Martin E., Kalkman I., Marques A., Meerwaldt J., Mota J., Pereira M., Poličnik R., Santos R., Vasankari T., Vlasveld A. (2014). *National Policy Approaches to*

Promoting Physical Activity: Seven Case Studies from Europe. Final Technical Report. Retrieved from http://www.panh.ch/hepaeurope/materials/hepa_pat_files/HEPA%20PAT%20PROJECT_Final%20Technical%20Report_PART%201.pdf

Buscemi J., Martens M., Murphy J., Yurasek A., Smith A. (2011). Moderators of the Relationship Between Physical Activity and Alcohol Consumption in College Students. *Journal of American College Health*. Vol. 59. No. 6, pp. 503-509.

Crespo C.J., Ainsworth B.E., Keteyian S.J., Heath G.W., Smit E. (1999). Prevalence of physical inactivity and its relation to social class in U.S. adults: Results from the Third National Health and Nutrition Examination Survey, 1988-1994. *Medicine & Science in Sports & Exercise.* Vol. 31. No. 12, pp. 1821–41827.

Dunn M., Wang M. (2003). Effects of physical activity on substance use among college students. *American Journal of Health Studies*. Vol. 18. No. 2, pp. 126-132.

El-ammari A., El kazdouh H., Bouftini S., El fakir S., El achhab Y. (2017). Level and potential social-ecological factors associated with physical inactivity and sedentary behavior among Moroccan school-age adolescents: a cross-sectional study. *Environmental Health and Preventive Medicine.* Vol. 22. No. 47, pp. 47−56.

Eurobarometer (2014). *Sport and physical activity*. Retrieved from https://ec.europa.eu/health//sites/health/files/nutrition_physical_activity/docs/ebs_412_en.pdf

Ferreira I., van der Horst K., Wendel-Vos W., Kremers S., van Lenthe F., Brug J. (2007). Environmental Correlates of Physical Activity in Youth – A Review and Update. *Obesity Reviews.* Vol. 8. No 2, pp. 129–154.

French M., Popovici I., Maclean J. (2009). Do Alcohol Consumers Exercise More? Findings from a National Survey. *American Journal of Health Promotion.* Vol. 24. No. 1, pp. 2-10.

Gordon-Larsen P., McMurray R.G., Popkin B.M. (2000). Determinants of Adolescent Physical Activity and Inactivity. *Patterns Pediatrics.* Vol. 105. No. 6, pp. E83−E90.

Heckman J. (1979). Sample selection bias as a specification error. *Econometrica*. Vol 47. No 1, pp. 153–161.

Higgins J.W., Gaul C., Gibbons S., Van Gyn G. (2003). Factors influencing physical activity levels among Canadian youth. Canadian journal of public health. *Revue canadienne de santé publique.* Vol. 94, pp. 45−51.

Humbert M., Chad K., Spink K., Muhajarine N., Anderson K., Bruner M., Girolami T., Odnokon P., Gryba C. (2006). Factors that influence physical activity participation among high- and low-SES youth. *Qualitative health.* Vol. 16. No 4, pp. 467–483.

Kelly P., Cavill N., Foster C. (2009). *An Analysis of National Approaches to Promoting Physical Activity and Sports in Children and Adolescents*. Copenhagen: WHO Regional Office for Europe.

Khorkina N.A., Lopatina M.V., Kostina Y.V. (2018). Fizicheskaya aktivnost' rossiyskoy molodezhi i vozmozhnosti gosudarstvennoy politiki [Russian Youth Physical Activity and Public Policy]. *Public Administration Issues.* No 2, pp. 177–200 (in Russian).

Kozyreva P.M., Smirnov A.I., Sokolova S.B. (2016). Rasprostranennost' praktik zdorovogo obraza zhizni [The Spread of Healthy Lifestyle Practices]. *Vestnik RLMS-HSE*. No. 6, pp.96–117 (in Russian).

Lowry R., Kann L., Collins J., Kolbe L. (1996). The Effect of Socioeconomic Status on Chronic Disease Risk Behaviors among US Adolescents. *JAMA.* Vol. 276. No. 10, pp. 792−797.

MacKelvie K., Khan K., McKay H. (2002). Is there a critical period for bone response to weight bearing exercise in children and adolescents? A systematic review. *British Journal of Sports Medicine.* Vol. 36. No. 4, pp. 250−257.

McDaid D., Oliver F., Merkur Sh. (2014). *What do We Know about the Strengths and Weakness of Different Policy Mechanisms to Influence Health Behaviour in the Population? The Regional Office for Europe of the World Health Organization and European Observatory on Health Systems and Policies*. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0003/270138/PS15-web.pdf?ua=1

Micklesfield L.K., Munthali R.J., Prioreschi A., Said-Mohamed R., van Heerden A, Tollman S., Kahn K., Dunger D., Norris S.A. (2017). Understanding the Relationship between Socio-Economic Status, Physical Activity and Sedentary Behaviour, and Adiposity in Young Adult South African Women Using Structural Equation Modelling. *International Journal of Environmental Research and Public Health.* Vol. 14. No. 10, pp. 1271−1291.

Pate R., Heath G., Dowda M., Trost S. (1996). Associations between physical activity and other health behaviors in a representative sample of US adolescents. *American Journal of Public Health*. Vol. 86. No. 11, pp. 1577-1581.

Peer N., Bradshaw D., Laubscher R., Steyn N., Steyn K. (2013). Urban–rural and gender differences in tobacco and alcohol use, diet and physical activity among young black South Africans between 1998 and 2003. *Global Health Action.* Vol. 6. No. 1, pp. 19216-19225.

Plotnikoff R.C., Bercovitz K., Loucaides C.A. (2004). Physical Activity, Smoking, and Obesity Among Canadian School Youth. *Canadian Journal of Public Health.* Vol. 95. No. 6, pp. 413−418.

Regis M.F., Oliveira L.M., Santos A.R., Leonidio A D., Diniz P.R., Freitas C.M. (2016). Urban versus rural lifestyle in adolescents: associations between environment, physical activity levels and sedentary behavior. *Einstein (Sao Paulo*). Vol. 14. No. 4, pp. 461−467.

Sagatun A., Kolle E., Anderssen S.A., Thoresen M., Søgaard A.J. (2008). Three-year follow-up of physical activity in Norwegian youth from two ethnic groups: associations with socio-demographic factors. *BMC Public Health. Vol.* 22. No. 8, pp. 419-427.

Sallis J., Simons-Mortan B., Stone E., Corbin C., Epstein L., Faucette N. et al. (1992). Determinants of physical activity and interventions in youth. *Medicine and Science in Sports and Exercise.* Vol. 24. No. 6, pp. 248−257.

Sallis J.F., Prochaska J.J., Taylor W.C. (2000). A Review of Correlates of Physical Activity of Children and Adolescents. *Medicine & Science in Sports & Exercise.* Vol. 32. No. 5, pp. 963−975.

Shishkin S, Vlassov V., Boyarsky S., Zasimova L., Kolosnitzyna M., Kuznetsov P., Ovcharova L., Sazhina Sv., Stepanov I., Khorkina N., Shevski V,. Sheiman I., Jakobson L. (2017). *Zdravoohranenie: sovremennoe sostojanie i vozmozhnye scenarii razvitija. Doklad k XVIII aprel'skoj mezhdunarodnoj nauchnoj konferencii po problemam razvitija jekonomiki i obshhestva* [Healthcare: Current State and Possible Scenarios of Development. Report on XVIII April International Academic Conference] (ed. S. Shishkin). Moscow: HSE (in Russian).

Spence J., Lee R. (2003). Toward a Comprehensive Model of Physical Activity. *Psychology of Sport and Exercise.* Vol. 4. No. 1, pp. 7−24.

Telama R., Yang X., Viikari J., Valimaki I., Wanne O., Raitakari O. (2005). Physical Activity from Childhood to Adulthood A 21-Year Tracking Study. *American Journal of Preventive Medicine.* Vol. 28. No 3, pp. 267−273.

Trost S.G., Owen N., Bauman A.E., Sallis J.F., Brown W. (2002). Correlates of adults' participation in physical activity: review and update. *Medicine & Science in Sports & Exercise.* Vol. 34. No. 12, pp. 1996−2001.

Uijtdewilligen L., Nauta J., Singh A.S., van Mechelen W., Twisk J.W., van der Horst K., Chinapaw M.J. (2011). Determinants of physical activity and sedentary behavior in young people: a review and quality synthesis of prospective studies. *British Journal of Sports Medicine.* Vol. 45. No. 14, pp. 896–905.

Van Der Horst K., Paw M.J., Twisk J.W., Van Mechelen W. (2007). A brief review on correlates of physical activity and sedentariness in youth. *Medicine & Science in Sports & Exercise.* Vol. 39. No. 8, pp. 1241−1250.

Verkooijen K., Nielsen G., Kremers S. (2008). The Association between Leisure Time Physical Activity and Smoking in Adolescence: An Examination of Potential Mediating and Moderating Factors. *International Journal of Behavioral Medicine*. Vol. 15. No. 2, pp. 157-163.

Vilhjalmsson R., Thorlindsson T. (1998). Factors related to physical activity: a study of adolescents. *Social Science & Medicine.* Vol. 47. No. 5, pp. 665-675.

Welk G. (1999). The Youth Physical Activity Promotion Model: A Conceptual Bridge between Theory and Practice. *Quest.* Vol. 51. No 1, pp. 5–23.

WHO (2010). *Global Recommendations on Physical Activity for Health*. World Health Organization. Retrieved from http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/

WHO (2012). *Young and Physically Active: A Blueprint for Making Physical Activity Appealing to Youth*. World Health Organization. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0005/175325/e96697.pdf?ua=1

WHO (2016). *Physical activity strategy for the WHO European Region 2016-2025*. WHO Regional Office for Europe, Copenhagen. Retrieved from http://www.euro.who.int/__data/assets/pdf_file/0010/282961/65wd09e_PhysicalActivity Strategy_150474.pdf

WHO (2017). *Towards More Physical Activity in Cities*. World Health Organization. Retrieved from http://www.euro.who. int/__data/assets/pdf_file/0018/353043/2017_WHO_Report_FINAL_WEB.pdf?ua=1

Woodfield L., Duncan M.,Al-Nakeeb Y., Nevill A. (2002). Sex, Ethnic and Socio-Economic Differences in Children's Physical Activity. *Pediatric Exercise Science.* Vol. 14. No. 3, pp. 277−285.

Zasimova L.S., Kolosnitsyna M.G. (2011). Formirovanie zdorovogo obraza zhizni u rossijskoj molodezhi: vozmozhnosti i ogranichenija gosudarstvennoj politiki (po materialam vyborochnyh issledovanij) [Creation of the Healthy Lifestyle for Russian Young People: Possibilities and Limits of the State Policy (from the materials of the optional analysis)]. *Public Administration Issues.* No. 4, pp. 116–129 (in Russian).

Zasimova L.S., Kolosnitsyna M.G. (2012). Determinanty zdorovogo obraza zhizni rossijskih studentov [Determinants of the Healthy Lifestyle of the Russian Students]. In: *XII Aprel'skaja mezhdunarodnaja nauchnaja konferencija po problemam razvitija jekonomiki i obshhestva* [XII April International Academic Conference on Economic and Social Development]. Part 3. (ed. E. Yasin). Moscow: HSE, pp. 125–153 (in Russian).

Zasimova L.S., Khorkina N.A., Kalinin A.M. (2014). Rol’ Gosudarstva v razvitii programm ukrepleniya zdorovjya na rabochem meste [State’s Role in Promotion of Worksite Wellness Programs]. *Public Administration Issues*. No. 4, pp. 69–94 (in Russian).

Zasimova L.S., Kolosnitsyna M.G., Krasil'nikova M.D. (2017). Izmenenie povedenija rossijan v otnoshenii zdorovogo obraza zhizni (po rezul'tatam sociologicheskih oprosov 2011 i 2017 gg.) [Behavioral Change of the Russian towards Healthy Lifestyle (based on the data from population survey of 2011 and 2017)]. *Working paper* WP8/2017/02, Institute for Public Administration and Governance, Moscow: HSE (in Russian). Retrieved from https://wp.hse.ru/data/2017/04/13/1168169672/WP8_2017_02-f.pdf

Appendix A

Number of observations in RLMS-HSE representative sample by years and genders, 2000-2016

Year	Number of observations (total sample)	Share of total sample (%)	Number of observations, men	Share of total men's sample (%)	Number of observations, women	Share of total women's sample (%)
2000	1700	4,57	771	4,41	929	4,72
2001	1897	5,10	854	4,89	1043	5,29
2002	2005	5,39	917	5,25	1088	5,52
2003	2023	5,44	932	5,34	1091	5,54
2004	2015	5,42	951	5,45	1064	5,40
2005	1950	5,2	945	5,41	1005	5,10
2006	2333	6,28	1094	6,26	1239	6,29
2007	2257	6,07	1066	6,10	1191	6,05
2008	2079	5,59	966	5,53	1113	5,65
2009	1985	5,34	913	5,23	1072	5,44
2010	2937	7,90	1373	7,86	1564	7,94
2011	2877	7,74	1368	7,83	1509	7,66
2012	2768	7,45	1285	7,36	1483	7,53
2013	2458	6,61	1172	6,71	1286	6,53
2014	2047	5,51	998	5,71	1049	5,32
2015	1954	5,26	952	5,45	1002	5,09
2016	1882	5,06	908	5,20	974	4,94
Total	**37167**	**100**	**17465**	**100**	**19702**	**100**

Appendix B

Descriptive statistics of the continuous variables in regression models

Variable	Men		Women	
	Number of observations	Mean value	Number of observations	Mean value
Age (years)	10317	20.1	11386	20.2
Average household income per capita in 2000 prices (Rub.)	10317	6343,88	11386	5981,27
Intensity of physical activity (hours per month)	10317	3.59	11386	2.35

Appendix C

Descriptive statistics of the categorical variables included in regression models

Variable	Men		Women	
	Number of observations	Share of total (%)	Number of observations	Share of total (%)
Total	**10317**	**100**	**11386**	**100%**
Body mass index (BMI):				
underweight (BMI <18,5)	742	7	1521	13
normal weight (18,5≤MBI<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
nonsmoker	4758	46	9015	79
Alcohol:				
consumes alcohol	5252	51	4359	38
does not consume alcohol				
Education:				
no secondary education certificate	3426	33	2707	24
complete secondary or vocational education	3978	39	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	23	2908	26
employed	4437	43	4074	36
non-employed	1690	16	2766	24
Family status:				
not married	7901	77	7111	62
married (registered marriage)	1388	13	2687	24
civil marriage	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	24	3006	26
rural settlements	3266	32	3087	27
Physical activity:				
yes	4568	44	3692	32
no	5749	56	7694	68

Appendix D

RLMS-HSE questions used to estimate physical activity and other variables

Types of physical activity and physical activity degree

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

Height

What is your height in centimeters?

Weight

How many kilograms do you weigh?

Self-rated health

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

Whether it is possible for you to eat always regularly but no rarely than 3 times a day?

Yes

Yes more than no

No more than yes

Never manage

Educational level

General or incomplete secondary school

Complete secondary school

Professional courses of driving, tractor driving, accounting, typing etc.

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

Institute, university, academy including bachelor's degree

Institute, university, academy including master's degree

Post-graduate course, residency

PhD degree

Doctoral degree

Employment status

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 under 3 years old, not interrupting employment

A housewife, caring for other family members, raising children

Temporarily not employed other reasons and looking for a job

Temporarily not employed other reasons and not looking for a job

A farmer

An entrepreneur

Working at an enterprise, organization, collective farm, state farm, or cooperative

Working at other than an enterprise, organization, collective farm, state farm, or cooperative

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: wages, pensions, stipends, and any other money received, including hard currency converted into rubles

Marital status

What is your marital status?

Never married

First marriage

Second marriage

Divorced

Widower/widow

Married, but don't live together

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 E

Heckman model: statistical difference between coefficients in models for males and females

Variable	Physical activity probability (marginal effects)	Physical activity intensity (ln)
Age	+***	–
Body mass index (BMI):		
underweight (BMI <18,5)	reference group	reference group
normal weight (18,5≤MBI<25)	+***	+*
pre-obesity (25≤BMI<30)	+***	+*
overweight (BMI≥30)	–	–
Self-assessed health (SAH):		
good or very good	reference group	reference group
average, not good and not bad	–	–
bad or very bad	+*	–
Smoking:		
smokes	+*	+*
Alcohol:		
consumes	+***	–
Education:		
secondary school student	reference group	reference group
higher education student	–	–
employed	–	–
non-employed	–	–
Average household income per capita in 2000 prices (Rub.) (ln)	–	–
Employment status		
secondary school student	reference group	reference group
higher education student	–	–
employed	–	+*
non-employed	+***	–
Family status		
not married	reference group	reference group
married (registered marriage)	+*	–
civil marriage	+***	–
Place of residence		
capitals (Moscow and St.-Petersburg)	reference group	
regional centers (apart from Moscow and St.-Petersburg)	+***	
cities, towns (apart from regional centers)	+***	
rural settlements	+***	

+ difference is statistically significant;
− difference is statistically insignificant
*** p<0.01, ** p<0.05, * p<0.1

Appendix F

Correlation matrix, males

	IPA (ln)	Physical activity probability	Age	BMI	SAH	Smoking	Alcohol	Education	Income (ln)	Employment	Family status	Place of residence
IPA (ln)	1.000											
Physical activity probability	0.913*	1.000										
Age	-0.316*	-0.326*	1.000									
BMI	-0.088*	-0.089*	0.185*	1.000								
SAH	0.102*	0.095*	-0.043*	-0.024*	1.000							
Smoking	-0.251*	-0.255*	0.313*	0.097*	-0.076*	1.000						
Alcohol	-0.103*	-0.122*	0.303*	0.051*	-0.049*	0.294*	1.000					
Education	-0.105*	-0.101*	0.584*	0.079*	-0.005	0.062*	0.155*	1.000				
Income (ln)	0.094*	0.078*	0.095*	-0.004	0.049*	-0.071*	0.123*	0.104*	1.000			
Employment	-0.342*	-0.361*	0.686*	0.160*	-0.049*	0.338*	0.241*	0.408*	0.007	1.000		
Family status	-0.179*	-0.183*	0.452*	0.125*	-0.018*	0.237*	0.176*	0.179*	0.007	0.285*	1.000	
Place of residence	-0.114*	-0.103*	-0.059*	0.035*	0.039*	-0.006	-0.096*	-0.156*	-0.232*	0.064*	-0.036*	1.000

* $p<0.05$

Appendix G

Correlation matrix, females

	IPA (ln)	Physical activity probability	Age	BMI	SAH	Smoking	Alcohol	Education	Income (ln)	Employment	Family status	Place of residence
IPA (ln)	1.000											
Physical activity probability	0.959*	1.000										
Age	-0.278*	-0.291*	1.000									
BMI	-0.104*	-0.099*	0.133*	1.000								
SAH	0.037*	0.028*	-0.031*	-0.021*	1.000							
Smoking	-0.104*	-0.113*	0.170*	0.058*	-0.098*	1.000						
Alcohol	-0.005	-0.021*	0.192*	-0.007	-0.054*	0.256*	1.000					
Education	-0.121*	-0.122*	0.631*	0.027*	-0.006	-0.012	0.132*	1.000				
Income (ln)	0.130*	0.103*	0.060*	-0.072*	0.082*	-0.011	0.104*	0.087*	1.000			
Employment	-0.353*	-0.364*	0.690*	0.160*	-0.031*	0.206*	0.131*	0.447*	-0.025*	1.000		
Family status	-0.223*	-0.228*	0.473*	0.110*	-0.052*	0.185*	0.095*	0.234*	0.026*	0.479*	1.000	
Place of residence	-0.140*	-0.119*	-0.058*	0.088*	0.063*	-0.107*	-0.124*	-0.151*	-0.231*	0.038*	-0.009	1.000

* $p<0.05$

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