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RESEARCH ARTICLE

Determinants of health of Russia's population based on daily time allocation data

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Abstract

The paper considers the determinants of health of Russia's population with regard to the allocation of the daily time fund, while controlling for the basic socio-demographic characteristics of individuals. The paper aims to identify the relationship between health and the structure of daily time use by Russian households. An integral health index was constructed using the principal component analysis based on the data of the Sample Observation of Daily Time Use by the Population, and its relationship with the main types of daily activity was tested. The study showed that the population health is a function of time allocation decisions. Individual health is adversely affected by working more than 7.95 hours per day. However, women can devote more time to paid work than men without compromising their health. The findings are robust and can be used to inform regulatory decisions.

Keywords

health, time allocation, time budgets

JEL codes: J18, J22, I18.

Introduction

Population health is one of the most important qualitative and quantitative characteristics of society, a prerequisite for sustained and comprehensive social activity. Physical, mental, social health is the foundation of public well-being, a major component of the quality of human capital, and a key factor in the formation of demographic processes (Rimashevskaya et al. 2011). There is no single universal indicator that would provide complete and accurate information on the health of individuals. Public health studies can be based on life expectancy at birth, morbidity, health encounter data, and other indicators. Researchers have identified many different factors that influence health. These include biological, socio-demographic,

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environmental and others. However, decisions made by individuals regarding their time allocation (overtime both at home and in the labour market) can affect health (fatigue, stress, dysfunction). Health problems, in turn, affect labour productivity, lead to a failure to meet professional requirements, as well as slow down reproduction of population and growth of human capital.

In the modern world, especially in developed countries, conventional criteria (such as the level of education, since more and more people today have a university degree) are no longer sufficient to explain certain regularities in the economic and demographic behaviour of different population groups. There is a need to search for and study some new indicators that could bring us closer to explaining behaviour of people from different socio-demographic groups. Daily time allocation is one of the most informative indicators to date. This indicator is closely related to the demographic and consumer behaviour, labour market behaviour, and individual characteristics.

This paper assumes that the study of population health can be complemented by examining the daily time allocation structure. We focus on the time spent on basic activities (paid work, unpaid work for own use, housekeeping, childcare, sleep, leisure, and basic needs), while controlling for basic socio-demographic characteristics of individuals (gender, age, marital status, etc.).

Time is a form of human wealth. Time is allocated and consumed in accordance with the level of development of productive forces and the nature of production relations (Patrushev 1996). In the broadest sense, the time budget is defined as the allocation of the daily time fund of the entire population or its individual socio-demographic groups by the directions of its use (Burova et al. 2003). The time budget method generates objective information on the actual behaviour (Karakhanova 2016), and enables comparative analysis across space and time by using a common accounting unit (Gershuny 1989; Szalai 1967). Control over time allocation and time use is necessary to understand the cause-and-effect relationships between different types of activities (Merz 2010), and to monitor the impact of behaviour change on individuals' quality of life.

Time-use (TU) studies in the context of health are the study of behaviour that enhances or harms health (Bauman et al. 2019). These are used to identify time-use-related factors correlating with health and to assess behavioural trends. The study of daily time allocation patterns allows to use previously unused methods for studying population health and to assess the effects of public health interventions by the government, as well as inform recommendations for the follow-up actions.

The utility of time budget methodology in the context of public health has been confirmed in the literature (Wolfe & Haveman 1983; Gimenez-Nadal & Ortega-Lapiedra 2013; Podor & Halliday 2012; Juster & Stafford 1991; Yamada et al. 1999; Stalling et al. 2020). However, very few studies are available of health assessment made using the entire structure of daily time allocation. As a rule, their authors delve deeper into the study of a particular aspect, such as market/non-market work, childcare, leisure, etc. Most studies look at gender economics and sociology, which record and analyse the impact of gender differences in time allocation on various aspects of life, including women's and men's health.

Most commonly, researchers have studied the relationship between health and market or non-market activities. Wolfe and Haveman proved that time allocation has a significant impact on women's health (Wolfe & Haveman 1983). Ordinary least-squares regressions of the determinants of change in women's health were constructed using a sample of more than two thousand women aged 25-65 from the Michigan Panel Study PSID. Time used on

market work was found to have no negative health impact. However, a negative health impact was found of combining domestic duties, childcare and market work. Apart from the duration of work, deterioration of health can be largely attributed to the nature of market work, as well as surrounding environment and habits (Wolfe & Haveman 1983).

A link between health and time spent on market or non-market work was also found by a time-use survey conducted in Spain in 2002-2003 (Gimenez-Nadal & Ortega-Lapiedra 2013). Better health ratings, according to the model presented in the survey, are associated with an increase in market work, with a reduction in time spent on non-market work to avoid a "double workday" for women. Borrell et al. also wrote about the impact of increased workload on women: in contrast to men, the number of hours of domestic work for women is statistically significant and has a negative impact on their health (Borrell et al. 2004). The women's working day can extend by nearly 40% due to the time spent on housekeeping and related activities (Kalabikhina & Shaikenova 2018).

Let us turn to the studies that looked at the relationship between the aggregated categories of activities and health.

A study examining the relationship between the health self-rating and the entire time allocation patterns in six European countries (France, Germany, Italy, the Netherlands, Spain, the UK) found that better health perceptions were associated with more time spent on paid work and less time spent on self-care, sleep, and non-market work for both men and women, and less time spent on leisure for men (Gimenez-Nadal & Molina 2015).

Podor and Halliday assessed the impact of health on time allocation patterns (Podor & Halliday 2012). The study used the data from the American Time Use Survey (ATUS), with focusing on the Eating & Health Module, which includes a question on the self-reported health status variable (SRHS). Apart from the health variable, the authors included race, education level, age, and number of children in the analysis. Although self-reported health status is a subjective variable, the SRHS has been shown to correlate highly with morbidity and predict mortality. The results obtained indicate a positive relationship between health self-rating and time allocated to housekeeping and market work, whereas the relationship of health and time spent on sleep and leisure is negative. Moreover, it has been shown that "poor" health ratings caused additional 300 hours of unproductive activities (sleep, leisure) per year.

"Self-ratings" are used as a measure of health in the literature, as described above (Robone et al. 2011; Bound 1991). Some authors have found convincing evidence that self-rated health is reliable as a measure of health and predictor of mortality (Idler & Benyamini 1997; Podor & Halliday 2012). However, in view of the on-going debate about how objective the indicator is, we will rely on a set of dependent variables. In order to answer the research question of whether time allocation is related to health, we will use, in addition to self-rated health, such indicators as chronic diseases and health-related restrictions to build models to be used here; they will be incorporated in an integral index, which, in our opinion, is more objective than self-rated health.

The main hypothesis of the study is that overstrain in certain activities (various kinds of work: paid work, unpaid work for own use[1] , housekeeping, childcare) relates to relatively poor health. Overstrain is defined as an excessive amount of time spent on the above work types.

1 This activity includes growing agricultural or garden crops for own use; farm animal husbandry and production of animal products for own use; forestry and logging for own use, etc. The variable "unpaid work for own use" aggregates the time spent by individuals on these.

The use of different health indicators, the consideration of the entire daily time structure by aggregated categories, and the first use of Russian data for this purpose are the main contributions to the revealing of the relationship between health and a relatively high level of paid and/or unpaid work.

Data and methods

To test the hypothesis, we used data from the 2019 Sample Observation of Daily Time Use by the Population.

The variables selected for analysis are presented in Table 1.

The data preprocessing included several steps:

1. Categorizing of time allocation-related activities.

The following aggregated categories were identified:

- Paid work
- Unpaid work for own use
- Housekeeping
- Childcare
- Basic needs
- Leisure
- Sleep

Table 1, Appendix A, describes the daily activity types and their respective categories.

2. Merging of microdata sets.

Data from interviewer-completed questionnaires (89,459 observations) were merged with the data from the diaries completed by individuals about their daily time allocation (152,527 observations). The merger was done using the area household number, household member's individual code number, respondents' gender and age.

3. Removal of missing values.

Where a respondent failed to produce an answer to the survey questions, the respective individuals' rows were excluded from the analysis (less than 10% of the observations were thus excluded). For example, individuals who failed to respond about their health self-rating, marital status, health-related restrictions (limited ability to see, hear, remember, move independently) were removed.

4. Data cleaning to remove anomalous values of variables.

Where outputs contradicted common sense, the respective rows were removed, for example, those for the individuals who reportedly spent more than 950 minutes sleeping on the day of the survey.

5. Limiting the sample by age (20-65 years)

Young and middle-aged people were the target audience. The older a person gets, the more likely they are to feel unwell, regardless of how busy they are at any job. To avoid focusing on natural patterns, the analysis includes observations for individuals aged between 20 and 65 years.

6. Categorising dependent variables.

Health self-ratings, chronic diseases, and disabilities.

7. Dividing the data obtained into two parts, depending on whether the diary was completed on a weekday or at the weekend. For further analysis, the weekday sample with a higher risk of overwork was used.

The final weekday sample contains 53,774 observations, of which 59.4% are women and 40.6% are men. Most respondents reside in the city (68.8%). 62.6% of the sample have no college degree, 36.4% have college degree, and 1% hold post-graduate degrees. The average age of the sample is 45 years.

To calculate an objective health indicator using the principal component analysis (PCA), an integral health index was constructed from three variables: the health self-rating (1-5), the attribute of chronic diseases (0-1), and the induced variable aggregating health-related disabilities (limited ability to see, hear, remember, and move independently) (0-4) (Figure 1). Hereinafter, «health» refers to the calculated integral health index.

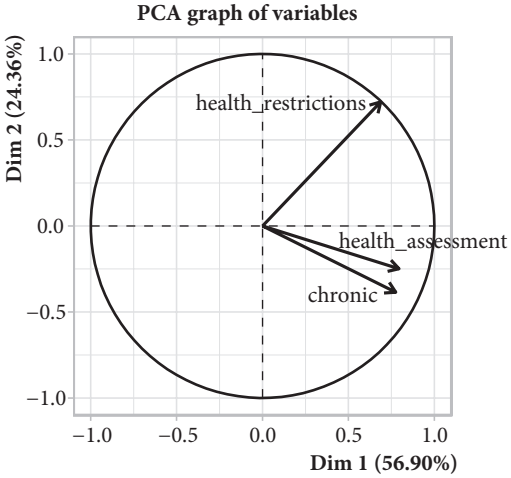

Figure 1. PCA variables. Source: compiled by the author based on the 2019 Sample Observation of Daily Time Use by the Population.

That it is appropriate to use the principal component analysis for the dataset under study was confirmed using Bartlett's test, which checks whether the observed variables are correlated using the observed correlation matrix with respect to the identity matrix. The test was found to be statistically significant (p-value = 0.00). The weight of the first component was 56.9%, of the second component, 24.4%. Table 2 gives the contributions of each of these variables to the integral index. The index values for the sample are in the range between 0.55 and 8.76. The lower the index value, the better the health.

At the modelling stage, regressions were constructed with the integral health index as a dependent variable and the following basic socio-demographic characteristics of individuals as regressors:

- Age
- Gender
- Type of settlement
- Marital status
- Average income per household member
- Level of education

Table 1. Description of variables

Variable	Type	Description
health_assessment	Ordinal	Self-rated health, where 1 is very good, 5 is very poor
type_of_locality	Binary	Code of settlement type, where 1 - urban, 0 - rural
Gender	Binary	Respondent's gender (1 - male, 0 - female)
Age		Respondent's age
family_status	Ordinal	Marital status
type_of_family_unit	Ordinal	Type of family unit
feeling_rush	Ordinal	Having a sense of hurry (1 - always, 3 - never)
educational_level	Ordinal	Level of education
chronic_diseases	Binary	Attribute of chronic diseases
limited_ability_to_see	Binary	Attribute of a limited ability to see (even with glasses, if worn)
hearing_limitation	Binary	Attribute of a limited ability to hear (even with a hearing aid, if used)
limited_ability_to_move independently	Binary	Attribute of a limited ability to move independently (walking, climbing stairs, standing)
memory_limitation	Binary	Attribute of a limited ability to remember or focus attention
household_composition	Ordinal	Household composition (number of persons)
average_income_per household member	Quantitative	Value of average income per household member
sign_of_the_poor	Binary	Attribute of low-income population
single-parent family	Binary	Attribute of a single-parent family
housekeeping	Quantitative	Number of minutes spent on housekeeping
childcare	Quantitative	Number of minutes spent on parenting
leisure	Quantitative	Number of minutes spent on recreation and related activities
sleep	Quantitative	Number of minutes spent sleeping
basic_needs	Quantitative	Number of minutes spent on meeting basic needs
paid_work	Quantitative	Number of minutes spent on paid work
unpaid_work	Quantitative	Number of minutes spent on unpaid work for own use
health_category	Ordinal	Health self-rating: 1 - Good, 2 - Satisfactory, 3 – Poor
education_category	Ordinal	Level of education: 1 - no college degree, 2 – college degree, 3 – post-graduate degree

Source: compiled by the author

Table 2. Weights of health indicators in making up the integral indicator

Contribution of variables	Health self-assessment	Chronic diseases	Health restrictions
Health self-rating	0.79	-0.25	-0.55
Health-related restrictions	0.69	0.72	0.08
Attribute of chronic disease	0.78	-0.39	0.50

Source: calculated by the author based on the 2019 Sample Observation of Daily Time Use by the Population.

As well as the time (in minutes) spent on:

- Childcare
- Housekeeping
- Paid work
- Unpaid work for own use
- Sleep
- Basic needs
- Leisure

Additionally, the model included the following regressors: the square of the number of minutes spent on paid work (assuming a nonlinear relationship between health and time allocation), an attribute of low income, and an attribute of having a feeling of hurry.

The models were constructed for the entire sample, separately for subsamples for men and women. To better identify "overstrain" and reveal the non-linearity of the total time spent on housekeeping, childcare, paid or unpaid work, an aggregated variable (C4) integrating all the four activities was constructed.

An ordered probit with a similar set of regressors was constructed to compare results for the categorical variable of health self-rating. The dependent variable "Health self-rating" is categorical due to an uneven allocation of respondents' self-ratings.

Descriptive statistics

On average, respondents reported satisfactory health. Only 1,909 (3.6%) out of 53,774 persons reported very good health. Most respondents (25,650) reported satisfactory health that sometimes affects their ability to work (Figure 2). 4.2% of the respondents rated their health as "poor" or "very poor."

22.1% of the respondents had a chronic health condition, 15.0% faced health-related restrictions. It should also be noted that 29.1% of the respondents felt constantly pressed for time.

The average value of the integral health index for the entire sample is 1.742, which corresponds to a satisfactory health state that sometimes affects the ability to work. The median is 1.637. Figure 3 gives the distribution of the integral health index by gender (a box plot). The index should be interpreted as follows: the higher the index value, the poorer the respondent's health. The median value of the integral index, as well as the inter-quartile range and limits of reference values are higher for women (poorer health) than for men.

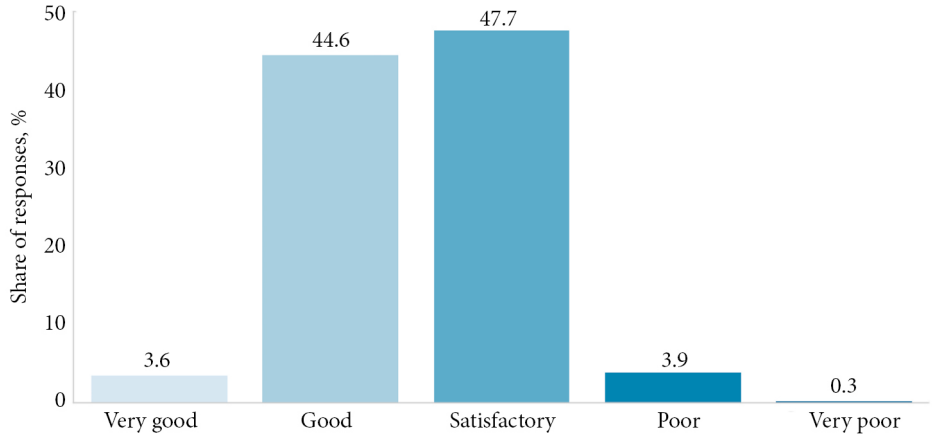

Figure 2. Allocation of responses regarding health self-rating. *Source*: compiled by the author based on the data from the 2019 Sample Observation of Daily Time Use by the Population

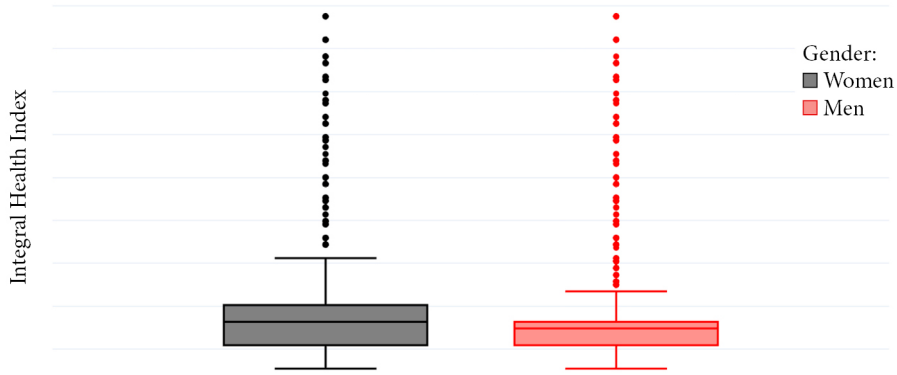

Figure 3. Allocation of values of the integral health index by gender (1 - men, 0 - women). *Source*: compiled by the author based on the data from the 2019 Sample Observation of Daily Time Use by the Population.

Figures 4 and 5 give the daily time use patterns on weekdays for men and women, respectively.

Women and men spend comparable amounts of time on sleep and basic needs, but men, on average, spend more time on paid work and leisure while less on housekeeping and childcare (see Figures 4 and 5). These results can be explained by deeply rooted societal attitudes that place the burden of childcare and housekeeping almost entirely on women, whereas men take on more financial responsibility. Meanwhile, Russian data have shown that egalitarian time allocation in the household is associated with a higher income per household member and, therefore, better overall well-being (Kalabikhina et al. 2022).

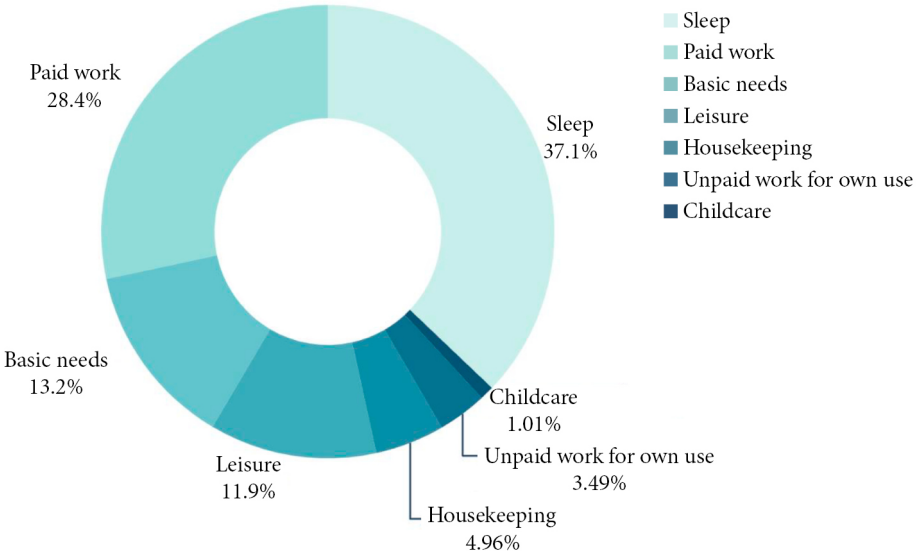

Figure 4. Daily time use by men (averaged values). *Note*: The description of aggregated activities from the legend is given in Table 1. *Source*: compiled by the author based on the data from the 2019 Sample Observation of Daily Time Use by the Population.

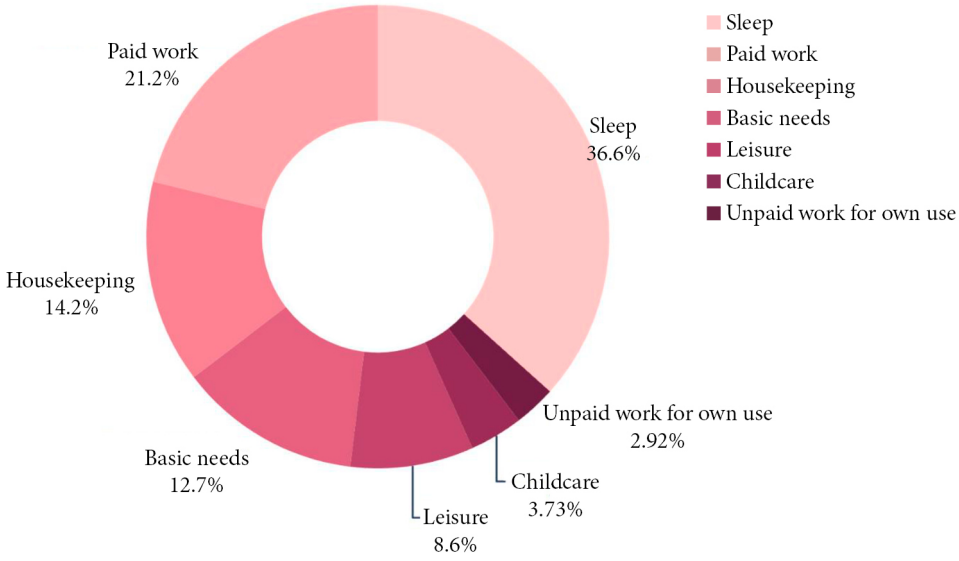

Figure 5. Daily time use by women (averaged values). *Note*: The description of aggregated activities from the legend is given in Table 1. *Source*: compiled by the author based on the data from the 2019 Sample Observation of Daily Time Use by the Population.

Relatively good health is associated with less time spent on unpaid work for own use, housekeeping, basic needs, leisure, and sleep, and more time spent on childcare and paid work (Figure 1, Annex B). Among individuals with poorer health, the marital status "widower/widow" (14.8%) and the family unit type "single-parent family" (35.9%) are more common compared to the other categories. Most individuals in this category have no college degree (69.6%). Their average income per household member (19.5 thousand rubles per month) is also the lowest among all the categories under consideration. Health-related restrictions are expectedly more common in this category (see Table 1, Annex B, for more details on descriptive statistics).

Results

Estimation of regressions for the integral health index showed a non-linear relationship between paid work and health both for the entire sample and separately for men and women. Increasing the amount of time (minutes) spent on paid work has an initially positive and, after a certain threshold, negative effect on health. For the entire sample, time spent on paid work is positively related to health up to a threshold of 477 minutes (7.95 hours), after which it negatively relates to health. A separate boundary for women is much higher at 566 minutes (9.4 hours), while it is 415 minutes (6.9 hours) for men.

The number of minutes spent on unpaid work for own use is insignificant both for the entire sample and separately for men and women. For men, time spent on housekeeping and childcare is not significant, while for women a positive relationship with the health index was found. The more time women spend on housekeeping and childcare, the better their health on average; no non-linear relationship was found (see Table 3).

Time spent on basic needs, leisure and sleep is negatively related to health. The more time is spent on these, the poorer the health (on average, other things being equal).

Age and the attribute (sign) of poverty are negatively related to health. Gender matters in general models, with women's health being poorer.

Place of residence is not significant for men, while women living in cities have better health on average. The level of education and average income per household member are positively related to the integral health index. The higher the respondents' level of education and their average income per household member, the better their health.

The model estimates for health self-ratings are generally similar to those for the integral health index. However, for self-assessment, time spent on unpaid work for own use is significantly and negatively related to the dependent variable, while the paid work and childcare variables are no longer significant. In contrast to the above results, time spent on housekeeping is associated with a higher probability of poorer health. Time spent sleeping is not significant for this dependent variable.

As shown in the methodology section, the main daily activities include housekeeping, childcare, paid work, and unpaid work for own use. The total time spent on the main activities should be considered to determine the total overstrain. By merging the times spent on the four main activities into a single time measure, it is possible to reveal the relationship of different types of work in general with health and to conclude that the relationship between the total amount of time and health is not a linear one. For the entire sample, the threshold beyond which the integral health index gets poorer with time is 520 minutes (8.7 hours). For women, health is on average better as the aggregate time of the activities in question

Table 3. Model estimations for different dependent variables

No.	1	2	3	4
Method:	Ordinary Least-Squares	Ordered probit	Ordinary Least-Squares	Ordinary Least-Squares
Dependent variable:	Integral health index (both genders)	Health self-rating (both genders)	Integral health index (women)	Integral health index (men)
Constant	0.347001 *** (0.058062)	-	0.472734*** (0.080353)	0.042017 (0.081786)
Age	0.029103*** (0.000378)	0.046975*** (0.000564)	0.030930*** (0.000502)	0.027001*** (0.000589)
Gender	-0.144190*** (0.009461)	-0.181366*** (0.013524)	-	-
Locality	-0.025876*** (0.008773)	-0.033082*** (0.012383)	-0.032155*** (0.011658)	-0.013363 (0.013324)
Family_status	0.022711*** (0.002290)	0.023685*** (0.003324)	0.013469*** (0.003056)	0.031781*** (0.003704)
Average_income per_household_member	-0.002471*** (0.000296)	-0.005549*** (0.000439)	-0.002501*** (0.000421)	-0.002612*** (0.000421)
Education_category	-0.041420 *** (0.008103)	-0.182439*** (0.011623)	-0.034203*** (0.010610)	-0.051078*** (0.012609)
Childcare	**-0.000237*** (6.32E-05)**	**-8.86E-05 (9.36E-05)**	**-0.000322*** (7.64E-05)**	**0.000228 (0.000175)**
Housekeeping	**-000104** (5.19E-0.5)**	**0.000224*** (7.37E-05)**	**-0.000271*** (6.82E-05)**	**0.000120 (9.10E-05)**
Paid_work	**-0.000974*** (5.69E-05)**	**-2.54E-05 (5.74E-05)**	**-0.000984*** (8.14E-05)**	**-0.001029*** (8.02E-05)**
Paid_work^2	**1.02E-06*** (5.68E-08)**	-	**8.69E-07*** (8.77E-08)**	**1.24E-06*** (7.68E-08)**
Unpaid_work	**-7.50E-05 (5.32E-05)**	**0.000243*** (7.44E-05)**	**-7.93E-05 (7.66E-05)**	**-9.69E-05 (7.34E-05)**
Sleep	0.000353*** (5.43E-05)	5.44E-05 (7.69E-05)	0.000187** (7.47E-05)	0.000580*** (7.89E-05)
Basic_needs	0.000828*** (6.91E-05)	0.000815*** (9.83E-05)	0.000510*** (9.29E-05)	0.001317*** (0.000104)
Leisure	0.000799*** (5.13E-05)	0.001048*** (7.33E-05)	0.000606*** (7.40E-05)	0.000985*** (7.06E-05)
Sign_of_the_poor	0.063923*** (0.011483)	0.072409*** (0.016451)	0.083236*** (0.015411)	0.039084** (0.017119)
Feeling_rush	-0.056348*** (0.010150)	-0.026797* (0.014192)	-0.031975** (0.014011)	-0.081506 (0.014637)
R^2 / Pseudo R^2	0.232698	0.170543	0.226736	0.238256
S.E.	0.878396	-	0.893589	0.853460
No. of observations	53774	53774	31954	21820

Source: compiled by the author based on the data from the 2019 Sample Observation of Daily Time Use by the Population.

Note: High values of the integral index are interpreted as "poor" health (while low values, correspondingly, as "good" health). Therefore, the minus sign in the model means a positive relationship with health.

increases to 575 minutes (9.6 hours) and then becomes poorer. For men, the same threshold is lower at 7.6 hours. The direction of the association and the significance of the other variables are similar to the previously demonstrated specifications (see Table 4).

The quality of the models constructed is confirmed by their general significance – Prob(F-statistic) in all the models is equal to 0.000, as well as by the significance of almost all the regressors individually. The Durbin-Watson statistic in all the models is close to 2, indicating the absence of autocorrelation. The Centred VIF values do not exceed 10, so the problem of multicollinearity was also not identified.

Table 4. Estimates of pooled regression models for main activities

No.	5	6	7
Method:	Ordinary Least-Squares	Ordinary Least-Squares	Ordinary Least-Squares
Dependent variable:	Integral health index	Integral health index (women)	Integral health index (men)
Constant	0.374300*** (0.057588)	0.568171*** (0.080519)	0.016878 (0.080418)
Age	0.030312*** (0.000342)	0.031989*** (0.000448)	0.028251*** (0.000544)
Gender	-0.173240*** (0.008101)	-	-
Locality	-0.036686*** (0.008601)	-0.044279*** (0.011417)	-0.021727 (0.013088)
Family_status	0.019815*** (0.002252)	0.007786*** (0.002967)	0.033057*** (0.003553)
Average_income_per household_member	-0.002772*** (0.000291)	-0.003066*** (0.000408)	-0.002891*** (0.000417)
Education_category	-0.051809*** (0.008038)	-0.043810*** (0.010477)	-0.053252*** (0.012577)
C4	**-0.001582*** (7.57E-05)**	**-0.001888*** (0.000124)**	**-0.001381*** (9.55E-05)**
C4^2	**1.52E-06*** (6.96E-08)**	**1.63E-06*** (1.14E-07)**	**1.52E-06 (8.89E-08)**
Sleep	0.000603*** (5.48E-05)	0.000480*** (7.54E-05)	0.000754*** (7.96E-05)
Basic_needs	0.000984*** (6.89E-05)	0.000656*** (9.24E-05)	0.001420*** (0.000103)
Leisure	0.000958*** (5.02E-05)	0.000812*** (7.17E-05)	0.001101*** (6.97E-05)
Sign_of_the_poor	0.073083*** (0.011437)	0.092496*** (0.015349)	0.044631*** (0.017060)
Feeling_rush	-0.070936*** (0.010043)	-0.045039*** (0.013865)	-0.093953*** (0.014538)
R^2 / Pseudo R^2	0.233176	0.227503	0.237910
S.E.	0.878098	0.893104	0.853595
No. of observations	53774	31954	21820

Source: compiled by the author based on the data from the 2019 Sample Observation of Daily Time Use by the Population.

Limitations

Endogeneity is a key limitation: just as individuals' allocation of daily time affects health, so too can health affect time allocation decisions. Individuals in poor health could spend more time on sleep and basic needs, but less time on work, childcare, and housekeeping. Such limitations were described in the literature previously (Wolfe & Haveman 1983; Gimenez-Nadal & Molina 2015). However, since we do not consider cause and effect here, even though the above does not distort the interpretation of the results, it does narrow down the possibilities for inferring the direction of the association.

The cross-sectional nature of the data is another limitation: we are dealing with static information for a specific calendar year, without being able to observe dynamic changes.

The constructing of an integral health index and the use of indicators of chronic diseases and disabilities increase the objectivity of the dependent variables under study. However, these variables are also derived from subjective responses and are not documented.

The limited availability of indicators also hampers the study of the health determinants. This study focused on the daily time use by the population, while a broad representation of a variety of individual characteristics has not been a widespread practice. Having more extensive information on the respondents' behaviour (e.g., eating habits, alcohol or tobacco use) in the same study would allow for refinement of the present findings.

Conclusion

The paper summarises the health determinants of Russia's population considering the allocation of the daily time fund, while controlling for the basic socio-demographic characteristics of individuals (gender, age, marital status, level of education, average income per household member).

The hypothesis that overstrain from certain activities is related to health has been confirmed. Thus, working time exceeding 477 minutes per day has a negative impact on individuals' health. However, women can invest slightly more time in paid work than men without compromising their health. Health deterioration for women starts at 566 minutes of work time, while it starts at 415 minutes for men. This may be due to the nature of work: men are more likely to work in harsher working conditions, therefore, the threshold for men is lower. The increase in time spent on unpaid work for own use has a negative effect only on individuals' self-rating of health, and no association was found with a more objective indicator.

Individuals tend to be in poorer health when spending more than 520 minutes (8.7 hours) cumulatively on the four main activities (work of various kinds) – paid work, unpaid work, housekeeping, and childcare. Men's health is better at a maximum of 7.6 hours a day and women's at 9.6 hours.

Women's health is better on average if they spend more time on housekeeping and childcare, with no non-linearity found. We can assume that women living in households with a traditional role allocation model are not burdened by the need to spend extra time on paid work.

Respondents who spend much time on sleep, leisure, and basic needs have poorer health. The result is similar to (Gimenez-Nadal & Molina 2015). Both feedback and unhealthy leisure habits may be relevant in this case.

Better educated people, as well as individuals with higher average income per household member, have better health. Age and poverty are also associated with poorer health.

Despite the limitations of endogeneity and a lack of data on individuals' behavioural characteristics, the results obtained are robust and can inform regulatory decisions. The specific design of economic policy interventions will depend on the objectives pursued, be it to increase the welfare of individuals, or to increase the number of employable people, or to improve their quality of life. The main recommendation points are as follows:

- Improving the well-being (and equality) of people with limited ability to work: extra pay for unworked hours for medically fragile people (along with having proper controls in place over the assignment of the status of limited ability to work);
- Increasing freedom of choice and improving the quality of life for medically fragile people: assistance in self-care through provision of labour-saving technologies (a dishwasher, a washing machine, delivery of food and daily necessities, etc.); promotion of employment of people with disabilities; development of workplace and transportation infrastructure;
- Solidarity in health preservation: incentives for employees not to overwork through non-payment of working hours in excess of a set limit; a system of penalties for managers; reduced financial compensation for leave not taken.

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Appendix A

Table A1. Categorising time-allocation activities

Paid work	Work in corporations, government, or non-profit organisations; Growing crops, animal breeding, forestry, and other commercial home-based activities; Paid consumer services; Auxiliary paid activities, net of breaks in service.
Unpaid work for own use	Growing agricultural or garden crops, animal breeding, hunting, forestry, fishing, etc. for own use.
Housekeeping	Cooking and serving food, cleaning after cooking and eating; Storage and preservation of edibles and other food-related activities; Cleaning of premises and surrounding area; Caring for plants and pets; Repair of personal or household items, home renovation; Washing, drying, ironing; Paying household bills and other household budget-related duties; Sourcing and purchasing of goods and services, and related activities; Transportation of goods and people and other unpaid consumer services provided to household and family members.
Childcare	Childcare, including providing meals, bathing, physical care; Medical care for children; Parenting, teaching, socializing and reading with children; Playing games and sports with children; Babysitting (passive care)
Sleep	Night sleep (core sleep); Short sleep/nap; Other sleep-related activities.
Leisure	Communication, interaction with people; Reading; Participation in community celebrations, rituals, social events, and other community-related activities (including traveling and commuting); Performance of civil and related duties; Meditation, prayer, participation in religious worship; Attendance at cultural or sporting events, exhibitions, parks/gardens, and other activities related to attendance at cultural, entertainment or sporting events; Hobbies, visual, literary and performing arts; Games and other forms of leisure, and related activities; Watching television, activities involving the use of media; Activities related to reflection, rest and relaxation; The number of minutes spent exercising.
Meeting basic needs	Eating meals/snacks, personal hygiene and grooming, self-care, receiving outside self-care and health services (including transportation).

Source: compiled by the author based on the data from the 2019 Sample Observation of Daily Time Use by the Population.

Appendix B

Table A2. Descriptive statistics for the categories of the integral health index

Variable	Better health (integral index values below 1.09) - 1st quartile	Average health (integral index values from 1.09 to 2.02) - 2nd and 3rd quartiles	Poorest health (integral index values above 2.02) - 4th quartile
Age	38.2 (± 10.7)	47.8 (± 11.5)	53.1 (± 10.6)
Gender			
Women	54.8%	60.6%	65.5%
Men	45.2%	39.4%	34.5%
Type of locality			
Urban	73.4%	65.6%	64.8%
Rural	26.6%	34.4%	35.2%
Level of education			
No college degree	54.3%	68.5%	69.6%
College degree	44.6%	30.8%	29.5%
Post-graduate degree	1.1%	0.7%	0.9%
Marital status			
In a registered marriage	58.8%	60.3%	54.9%
Never been married	15.8%	7.6%	7.4%
Divorced	13.4%	15.8%	15.6%
In an unregistered marriage	6.6%	5.5%	5.3%
Widower/widow	3.2%	8.8%	14.8%
Separated	2.2%	2.0%	1.9%
Type of family unit			
Married couple with children under 18 years of age	41.8%	26.5%	13.6%
Single-parent family	25.7%	27.9%	35.9%
Married couple	23.2%	39.0%	46.4%
Single-parent family with children under 18 years of age	9.2%	6.6%	4.0%
Feeling of rush, pressed for time			
Sometimes	51.9%	49.9%	45.1%
Always	32.1%	29.7%	24.1%
Never	15.9%	20.4%	30.8%
Chronic diseases			
Some	0.1%	7.1%	27.8%
None	99.9%	92.9%	72.2%
Health-related restrictions			
A few	-	-	12.2%
Just one	-	0.3%	41.5%
None	100%	99.7%	46.3%
Household composition, persons	2.8 (± 1.15)	2.5 (± 1.1)	2.2 (± 1.0)
Average income per household member, thousand rubles	21.3 (± 15.9)	19.7 (± 13.9)	19.5 (± 12.9)

Source: calculated by the author based on the 2019 Sample Observation of Daily Time Use by the Population.

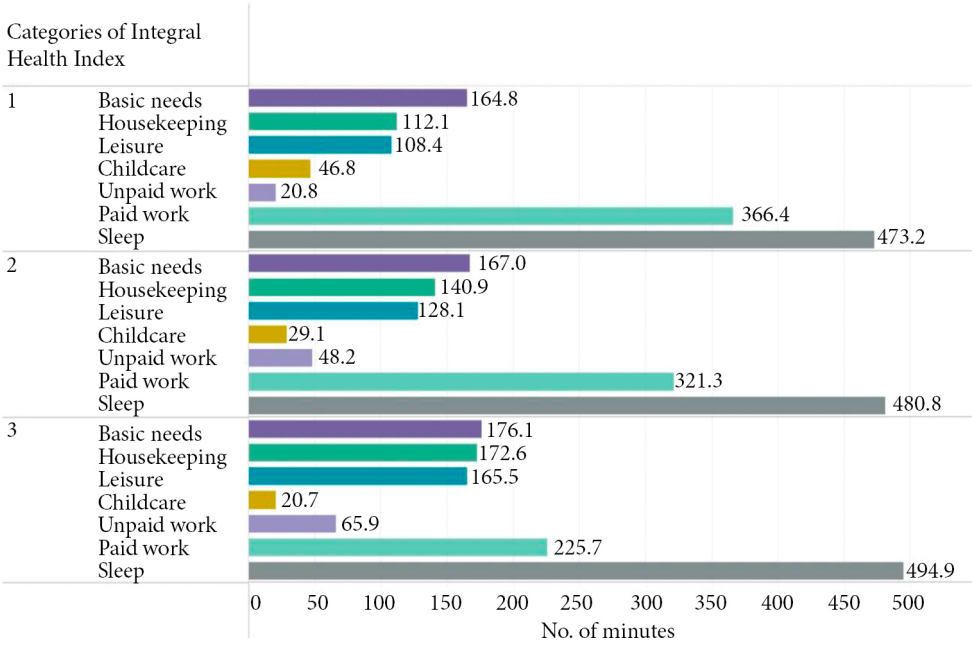

Figure A1. Average time spent on different activities for the categories of the integral health index (1 – corresponds to best health – 1st quartile, 2 corresponds to satisfactory health – 2nd and 3rd quartiles, 3 corresponds to poorest health – 4th quartile). *Source:* calculated by the author based on the 2019 Sample Observation of Daily Time Use by the Population.

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