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ESTIMATING THE RELATIONSHIP BETWEEN RATE OF TIME PREFERENCES AND HEALTHY LIFESTYLE IN RUSSIA

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ESTIMATING THE RELATIONSHIP BETWEEN RATE OF TIME PREFERENCES AND HEALTHY LIFESTYLE IN RUSSIA[4]

This paper aims to reveal the relationship between rate of time preferences (RTP) and healthy lifestyles of Russians. This rate shows individual preferences for the distribution of consumption over time. We examine such healthy and unhealthy behavior as smoking, drinking alcohol, doing physical exercise and having medical check-ups. The research is based on data from a survey which was conducted by the Yuri Levada Analytical Center in 2011. Our findings suggest that the RTP along with such factors as age, gender, marital status, income, health status and employment status influence the lifestyle of Russians.

Key words: rate of time preferences, individual discount rate, healthy lifestyle, smoking, drinking, physical exercises, medical check-ups, Russia.

JEL: D9, I1

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1. Introduction

Promoting healthy lifestyles is a government priority in many countries of the world. The costs of unhealthy behavior are significant economically, and so this area is investigated in numerous research papers. A wide range of public policies are designed to promote healthy individual behavior. Policy tools include a variety of restrictive, prohibitive, and stimulating measures. Selecting the most effective policy measures involves a detailed analysis of the factors defining the healthy and unhealthy behavior of individuals.

Recent studies suggest that rate of time preferences (RTP) or individual discount rates (IDR) play a key role in examining a healthy lifestyle. RTP shows individual preferences for receiving utility from consumption in the present rather than in the future. A high RTP indicates an impatient person who is likely to delay any activity associated with costs to far future periods. Any activity which brings utility will be shifted to the present moment (Bradford et al., 2010).

Research papers provide evidence that RTP is related to many types of individual choices regarding their health, for example smoking and drinking (Ida, Goto 2009; Harrison et al. 2009), healthy eating (Komlos et al. 2004), doing physical exercise (Bradford 2010), having medical check-ups (Picone et al. 2004). Studies suggest that obesity and drinking are positively related to the RTP (Richards, Hamilton 2012). Smokers discount future utility more than nonsmokers (Yamane et al. 2013). Individuals who are not engaged in physical activity, all things being equal, have higher RTP than others (Bradford et al. 2010). Similarly, a low demand for medical check-ups is associated with high RTP (Bradford et al. 2010).

Despite a considerable amount of research estimating RTP and defining the relation between this rate and individual choices about healthy behavior, there is a lack of studies in Russia. There is no confirmation of the influence of RTP on healthy lifestyle choices because of the difficulty in measuring time preferences. However, the extension of current understanding could lead to the better use of budget resources and to reducing the risk of poor decision-making in the public sector.

This paper focuses on examining the relationship between RTP and the healthy or unhealthy behavior of Russians. First of all we estimate the rate itself and then investigate the relationship between this rate and the lifestyles of Russians.

2. Literature review

A common way to estimate RTP is conducting an experiment where an individual is offered a sum of money and chooses whether to delay receiving the money and get a higher amount later or to take the lesser sum immediately. This experiment can be either a real choice

(that is, money is given) or a hypothetical choice in a form of a survey. Answers of respondents provide insights about their RTP.

Research design may include a choice of money as well as the choice of other goods. The main criticism of a hypothetical experiment lies in the fact that in real life people's behavior might be substantially different from trends they indicate when answering a questionnaire. However in a hypothetical experiment, one can interview a much larger number of respondents and obtain more representative results.

Harrison and coauthors used a survey with money experiment to elicit individual discount rates in Denmark (Harrison et al. 2002). Grignon, in France, used a hypothetical experiment (Grignon 2009). Borghans and Golsteyn used the same in their investigation of time discounting and the body-mass index in the Netherlands (Borghans & Golsteyn 2006), and Bradford used money time preference questions (Bradford 2010). Estimating individual time preferences with the help of a questionnaire faces a set of problems. First, the way of formulating the questions strongly affects the results. Generally, money gains are discounted more than money losses (Benzion et al. 1989; Chapman & Elstein 1995). Moreover, the size of money prize influences individual time preferences. As a rule, individuals are inclined to value insignificant sums less than significant amounts of money (Thaler 1981; Benzion et al. 1989). Second, people have different discount rates for different goods. For instance, Bradford has pointed out that individuals use different rates for money and health outcomes (Bradford 2010). Individuals might be highly impatient with one good and more patient with another one (Frederick et al. 2002; Yamane et al. 2013). Third, if an individual is not absolutely sure that later payment will be forthcoming his RTP will include compensation for the risk of default (Harrison et al. 2002). Fourth, the RTP are not constant over time (Tasset et al. 1999). Many authors agree that individuals are more impatient waiting for utility in the short-term than in the long-term (Angeletos et al. 2001; Grignon 2009). Inconsistency in time preferences means difficulties in choosing policy measures based on estimated RTP. Lastly, it is important to avoid the influence of an alternative market return. In answering questions about money, individuals may have in mind an alternative market return and desire compensation for waiting which is not less than this return. In such cases the result will not reflect pure time preferences (Harrison et al. 2002). To overcome this difficulty Coller and Williams in their study "Eliciting individual discount rates" suggest taking into account alternative investments that individuals have in mind while answering a questionnaire (Coller & Williams 1999).

In addition, high RTP can be explained by the fact that individuals prefer certainty when considering benefits and prefer uncertainty when considering costs (Kahneman & Tversky 1979). For instance, both giving up smoking and undertaking physical exercise are present costs

for an individual. However, future benefits in the form of improved health are highly uncertain for an individual, even if they are well predicted for the society as a whole. Thus, there is a high probability that an individual will refuse healthy behavior since he or she prefers certainty related to benefits and uncertainty related to costs (Fuchs 1982). Unavailability to delay the receipt of utility into the future leads to a higher value of RTP.

In the literature on individual time preferences we find a variety of predictive factors. The most common are socio-economic characteristics, such as age, education, income, health status. The current practice of estimating time preferences suggests taking into account gender differences. For instance, Bradford (2010) argues that men have lower RTP than women. Scharff and Viscusi (2011) reach the same conclusion.

Research presents a lot of evidence that RTP relates to individual healthy behavior. Grossman (1972) showed that RTP is useful for an analysis of individual choice of healthy or unhealthy behavior. Fuchs studied the relationship between RTP and individual decisions on smoking and doing physical exercise (Fuchs 1982; Fuchs 1991). Fuchs argued that individuals with relatively low RTP are more willing to invest in their own health, for instance, such individuals are more likely to do physical exercise. This finding is supported by other authors. An increase of RTP leads to reduced investment in health improvement (Ehrlich & Chuma 1990) and increased consumption of addictive products like cigarettes and alcohol (Becker & Murphy 1988). On the contrary, low RTP results in lower consumption of addictive products (Bishai 2001). Madden and coauthors revealed that individuals with relatively high RTP are more likely to take opioids, than individuals with relatively low rates (Madden et al. 1999). Ida and Goto (2009) showed that high RTP results in a higher probability of smoking, drinking and gambling for an individual. In addition, drinkers discount delayed monetary rewards more than non-drinkers.

Economists also investigate the relationship between RTP and medical check-ups. For instance, Bradford and coauthors show a difference in individual behavior depending on their RTP. Having medical check-ups means that an individual bears the costs at the present moment in return for a probable reduction in illness in the future. Individuals with relatively high RTP are unwilling to bear the costs at the present moment. In comparison with individuals with relatively low rates, they are unlikely to take appropriate steps for the prevention of diseases such as exercising, reducing their weight, or eating healthy food (Bradford et al. 2010).

Considering unhealthy behavior, there is evidence that high RTP is related to smoking (Mitchell 1999; Reynolds et al. 2003; Reynolds et al. 2004; Reynolds 2005; Ohmura et al. 2005). These authors conclude that smokers have higher RTP than nonsmokers (Baker et al. 2003) or smokers are more impatient than nonsmokers (Ida & Goto 2009). Khwaja and coauthors (2007)

show that smokers are more present-oriented than non-smokers. A high RTP shows individual inclination to risky behavior, and smokers are more likely to take other health risks (Khwaja et al. 2007). This suggestion of Khwaja is based on the research of Hersch and Viscusi (1998). Smokers are more likely to choose risky jobs and to sustain injuries than nonsmokers. Moreover, people who smoke are less likely to check their blood pressure (Hersch & Viscusi 1998). Scharff & Viscusi (2011) and Yamane et al. (2013) also confirm that smokers demonstrate greater time discounting than nonsmokers.

There is empirical evidence to analyze the relationship between RTP and smoking separately for men and women. Harrison has shown that male smokers have considerably higher RTP than nonsmoking men but this conclusion does not hold for women (Harrison et al. 2009).

The literature confirms that individuals with relatively low RTP are more inclined to healthy behavior, than individuals with higher rates.

RTP is not the only factor which affects healthy lifestyle. According to Cockerham (2005), age and gender influence healthy lifestyles. The significance of gender is supported by Ida and Goto (2009) and Grignon (2009). In addition Ida and Goto (2009) provide evidence that age, and RTP, have an impact on smoking and drinking. Stickley and Carlson (2009) also consider age groups while estimating determinants of smoking.

Different studies suggest that the health status of an individual has a significant impact on his healthy behavior. The most significant attributes of a health status are body-mass index (Smith et al. 2005) and self-rated health (Tsai et al. 2010). Svedberg et al. (2006) concludes that self-rated health is associated with smoking and a lack of exercise.

Employment status and RTP have a significant impact on drinking (Ida & Goto, 2009). Kitchin (1981) found that employment status has a significant effect on alcohol consumption and Mullahy and Sindelar (1996) show that employment status is related to problem drinking. Employment status is used as a control variable in the research of time preferences and smoking conducted by Grignon (2009).

The significance of educational level is studied by Stickley and Carlson (2009), Grignon (2009), and Shankar et al. (2010). Park and Kang (2008) show that higher levels of education are associated with doing regular exercise and getting regular health checkups. Shankar and coauthors (2010) also conclude that smoking and being less physically active are associated with low income.

Stickley and Carlson (2009) and Macy and coauthors (2013) reveal that marital status predicts smoking behavior. Bolin et al (2006) consider family structure and children in a household, examining investment in health of men and women. The impact of household structure on healthy behavior among men and women is investigated by Takeda et al. (2004).

Rice et al. (1998) conclude that household structure has a significant effect on the drinking behavior of household members.

The importance of taking into account regional differences in estimating health behaviors is pointed by Li et al. (2012). The authors infer that geographical divisions are related to differences in behavior due to socio-economic factors.

The literature shows that all choices of healthy or unhealthy behavior are related to each other. For instance, Insohanni et al (1993) found that smoking and drinking are interconnected. Goel and Morey (1995) concluded that cigarettes and liquor are substitutes in consumption. Ida and Goto (2009) surveyed Japanese adults and found a strong significant interdependency between smoking and drinking. Stickley and Carlson (2009) revealed that binge drinking is an important determinant of smoking.

Serraino and coauthors (1988) found that regular physical activities prevent young people from smoking and provide incentives to stop tobacco consumption. Mancini et al. (2006) support the view that drinking alcohol and tobacco consumption are related to doing exercise. The results of Liangpunsakul and coauthors (2010) show that alcoholics are habitually less active.

Urbanoski (2003) shows that drinkers use less health checkups than non-drinkers. Kunz (1997) revealed a negative relation between alcohol consumption and the number of visits to health professionals. Ettner and coauthors (2010) conclude that heavy drinkers invest less in health activities in comparison with abstainers.

3. Hypotheses and the data

We put forward the following hypotheses about the relationship between RTP and healthy behavior of Russians:

1. RTP is positively related to alcohol consumption. Our study extends the investigation of the relationship between RTP and drinking by dividing alcohol consumption into strong (vodka) and weak (beer) alcoholic drinks;
2. Individuals with high RTP are more likely to smoke than individuals with low rates;
3. RTP is negatively related to the demand for medical check-ups;
4. Individuals with high RTP are less physically active than individuals with low rates. We use engagement in sport to estimate the physical activity of an individual.

Data for testing hypotheses were obtained from a study by the Yuri Levada Analytical Center, “A Study of the Population on the Development of Healthy Lifestyles and Specification of Government Guarantees of Healthcare in 2011”. This survey enables us to construct a multistage stratified probability sample which represents the adult population of Russia. The sample includes individuals 15 years and older. Stages of sampling are given below.

The first stage involves a preliminary stratification of settlements (36 strata). Criteria for stratification are geographical basis, population size, and administrative status. Distribution of the total size of the sample among all strata is proportional to the weight of each stratum (number of adults).

The second stage includes the selection of questionnaire stations. The criterion for selection is that one station should give answers of about 8-10 respondents on average. In rural areas two settlements are selected. In urban areas we utilize from 1 to 5 questionnaire stations (2-3 on average). Exceptions are Moscow and St. Petersburg, where 36 and 16 questionnaire stations are selected, respectively.

For the selection of questionnaire stations we use a probabilistic approach from complete lists of polling stations of the city or of settlements in the specified rural area. In total, it is 320 settlements, including 174 cities and towns, and 146 villages.

The third stage is the selection of households with three obligatory visits to each selected address.

The fourth stage includes the selection of respondents. In a selected household one respondent is interviewed personally at home. The criterion is the nearest birthday. Interviews were conducted on working days in the evening, and all day at weekends to ensure equal probability of including employed and unemployed population.

Overall, the sample consists of 4001 respondents: 1378 men and 2623 women. The design of sampling provides a statistical error of variable estimates (for dichotomous traits) of not more than 2.3% at a confidence level of 95%. The sample is representative of gender, age, educational level, place of residence, and size of a population settlement. Table 1 shows descriptive statistics of the sample.

Tab. 1. Descriptive statistics of the main respondents' characteristics

	Age	Size of a household	Children	Monthly income (thousand rubles)
Mean	44,95	2,43	0,36	10,91
Median	45,00	2,00	0,00	8,75
Maximum	93,00	10,00	6,00	166,66
Minimum	15,00	1,00	0,00	0,25
Std, Dev,	18,52	1,19	0,68	8,71

Table 1 demonstrates that the mean age of respondents is 45 years. Half of all households consist of two persons. Most of the households do not include children under 15 years. The average per capita income of a household is 10,915 rubles a month. This sum is substantially lower than 20,700 rubles, which is the average per capita income according to the data of the Federal State Statistics Service for 2011. Therefore, there is a downward bias according to

population income. Along with respondent income we pay attention to his self-assessed income. Only 315 households respond that they "can hardly make ends meet," and "don't have enough money even for food". The largest number of respondents (50%) "have enough money for food and clothes, but buying durable goods (a TV set, a refrigerator, etc.) is a problem for them."

We examine respondent educational level separately from other characteristics, since in Russia education is regarded in terms of education levels instead of total years of education. The majority of respondents in the sample (42%) have vocational education. 30% of individuals have higher and incomplete higher education. 16% and 12% of respondents have secondary and incomplete secondary education, respectively.

Overall, a representative respondent of the sample is a woman of 45 years. She has a secondary or higher education, and her income is below the national average. The size of a household is 2 persons. She does not have children under 15.

4. Measures for the RTP and indicators of a healthy or unhealthy behavior

In this study two questions were asked in order to estimate their RTP:

1. Would you prefer to get a money prize of 10000 rubles now or 12000 rubles a year from now?
2. At what amount (at least) should the prize be increased for you to agree to get it a year from now?

Results of the survey shows that the vast majority of respondents (3292 from 4001) prefer to take 10000 rubles immediately. 475 respondents agree to take 12000 rubles in a year from now, and 234 respondents have no opinion.

Respondents with no opinion and who do not agree to wait the prize have the following preferences for the prize increase (diagram 1).

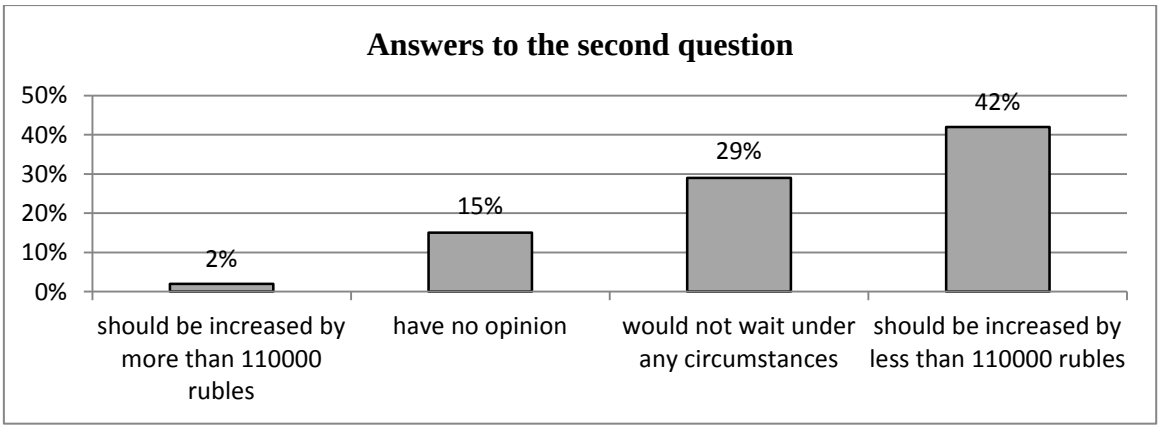

Diagram 1. Respondent preferences for the increase of the prize

Diagram 1 shows that about 29% of the respondents do not agree to wait under any conditions. It means that they have an infinite RTP. 2% of the respondents indicate unfeasibly large values that are more than 110,000 rubles. 15% of the respondents have no opinion on this question. Perhaps, many Russians associate the option of delaying with a high risk of default.

Considering the respondents who agree to wait for one year and indicate a desired sum of less than 110000 rubles, that the majority of these respondents are willing to take the prize within the limits of 25000 rubles. For most of them the size of the desired prize is in a range from 10,000 to 15,000 rubles. Consequently, their RTP is from 100% to 150%. These values are unreasonably high in comparison with an alternative market return. Further we use the distribution of respondent answers to examine the relationship between RTP and healthy behavior of Russians.

In our research we use the following variables for the RTP:

"Now" is a dummy variable which takes a value of 1 for respondents who prefer to take the money (10,000 rubles) immediately and a value of 0 for those respondents who decide to take 12,000 rubles one year later. Further we consider respondents for whom "Now"=1 as individuals with a higher RTP, and the rest as respondents with low rates.

"Never" is a variable which takes a value of 1 for both respondents who do not agree to wait for the prize and respondents who indicate the sum of the desired prize higher than 110,000 rubles. We suppose that they have an infinite RTP. For the rest of respondents the variable "Never" takes a value of 0.

"IR" is a variable which takes values equal to the sum indicated by respondents in the answer to the second question: from 2,000 to 110,000 rubles. This is an "extra prize" to 10000 rubles.

"Ln(IR)" is a variable which is the logarithm of "IR".

Along with RTP, different factors influence healthy behavior of individuals. We include the following variables as controls: age, marital status, educational level, employment status, health status. We consider age as both a continuous variable and a set of dummy variables for the following age groups: from 15 to 25 (variable "age25"), from 26 to 35 (variable "age35"), from 36 to 45 (variable "age45"), from 46 to 55 (variable "age55"), from 56 to 65 (variable "age65"), and over 65 (variable "age_pens"). For the health status we use indicators of self-reported health and chronic diseases.

Second, we take into account the size and structure of a household: the total number of household members, how many are employed, and the number of children under 15. Average per capita income and self-assessed household income is also examined as both a continuous variable and income quintiles.

Third, we consider the place where an individual resides: Federal District and type of population center. Population centers are divided into Moscow and St. Petersburg, large cities (more than 300,000 people), medium and small cities (less that 300,000 people), and rural settlements.

Diagram 2 presents the scheme of variables used in models. Categorical variables are included in models as dummy variables. The variable "Health" is used for some models as explanatory variable, but for others as a dependent one. It enables us to take into account the possible endogeneity of the factor.

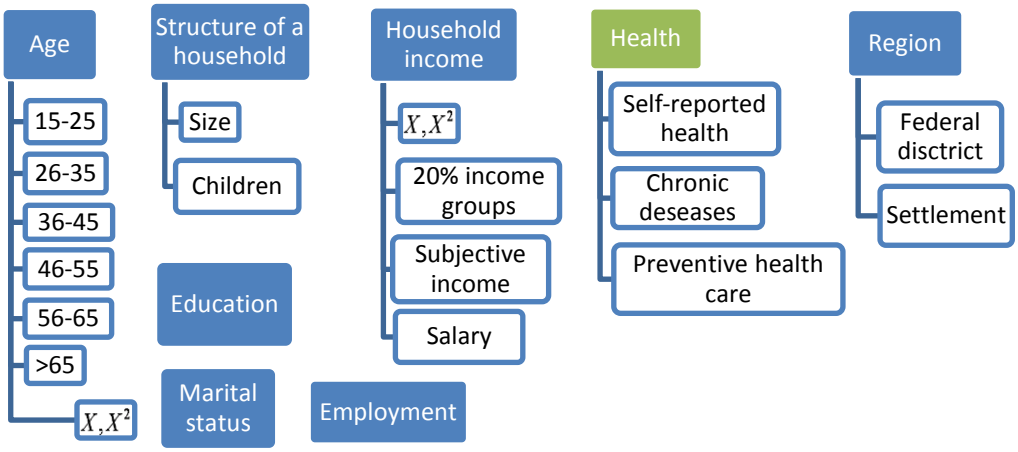

Diagram 2. The scheme of variables used in the study

The dependent variables in models are characteristics of healthy behavior. We consider a self-assessment of a healthy lifestyle and measures of a healthy lifestyle that are indicated by smoking, drinking, doing exercise and having medical check-ups.

A self-assessment of a healthy lifestyle is based on respondent answers to the question: "Can you say that you maintain a healthy lifestyle?" According to answers we construct a variable Health_life, which characterizes the propensity to a healthy lifestyle.

$$\text{Health\_life} = \begin{cases} 1, \text{definitely yes} \\ 2, \text{probably yes} \\ 3, \text{probably no} \\ 4, \text{definitely no} \end{cases}$$

Measures of a lifestyle are the following binary variables:

Prophyl_no =1, if a respondent does not have medical check-ups, and 0 otherwise;

no_Sport =1, if a respondent never participates in sport, and 0 otherwise;

Smoke =1, if a respondent is a smoker, and 0 otherwise;

Drink =1, if a respondent drinks alcohol, and 0 otherwise;

Drink beer =1, if a respondent drinks beer more often than twice a week, and 0 otherwise;

Drink vodka =1, if a respondent drinks vodka more often than twice a week, and 0 otherwise.

In order to check the robustness of results we apply two approaches to modeling the relationship between an indicator of RTP which is an "extra prize" to 10000 rubles and health behavior of an individual. The first approach implies estimating ordered probit model to examine the relationship between RTP and the self-assessment of a healthy lifestyle. The second approach includes estimating the system of binary equations in order to investigate the relationship between measures of unhealthy lifestyle (drinking alcohol, smoking, not having medical check-ups, not doing sports) and an indicator of a higher RTP.

4.1. RTP and self-assessment of a healthy lifestyle

This section is devoted to the analysis of the relationship between RTP and individual attitudes towards their health. First of all we consider the influence of RTP on the self-assessment of lifestyle. Respondent answers to the question concerning a healthy behavior are presented in diagram 3.

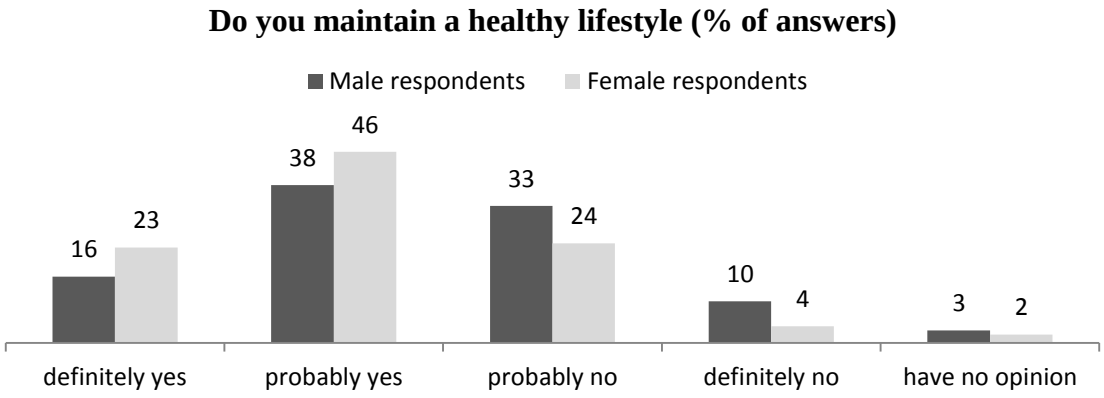

Diagram 3. Distribution of respondent answers to the question about maintaining a healthy lifestyle

The majority of respondents believe that they maintain a healthy lifestyle. Among women the percentage maintaining a healthy lifestyle is higher than that of men. The majority of both men and women choose the answer “probably yes”. Women answered “definitely yes” (23%) and “probably no” (24%) in almost equally proportions. Men answered “definitely yes” (16%) half as often as “probably no” (33%) suggesting that men are more inclined to unhealthy behavior than women.

Diagrams 4 and 5 show mean and median of the “extra prize” (the variable “IR”) for men and women who choose different answers to the question about a healthy lifestyle.

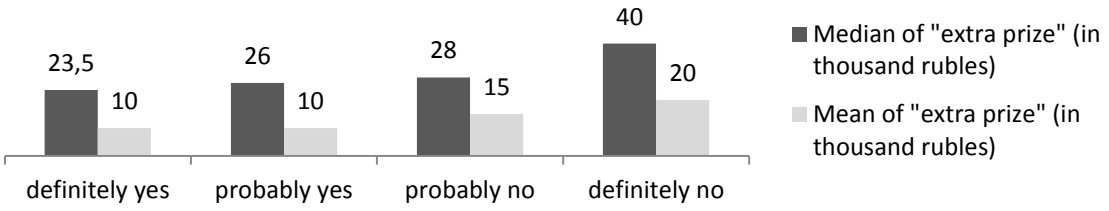

Diagram 4. Mean and median of an "extra prize" for female respondents

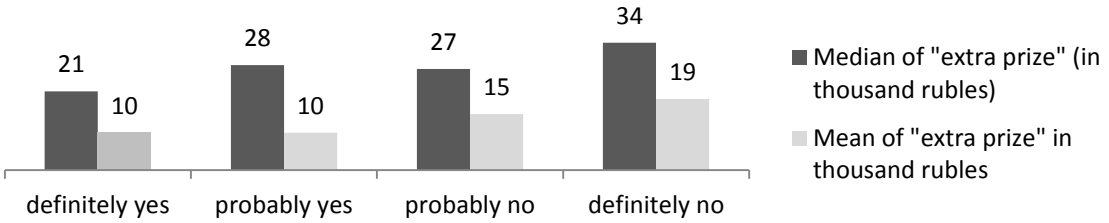

Diagram 5. Mean and median of an "extra prize" for male respondents

Diagrams 4 and 5 demonstrate that the desired "extra prize" is higher for those respondents who have an unhealthy lifestyle.

Since the variable "Health_life" takes ordered values, the basic model for further analysis is an ordered probit model (model 1). Explanatory variables are age, marital status, educational level, household income, employment status, health status, place of residence, and a variable Ln(IR) which is a measure for the RTP. We specify that this model is estimated on the subsample of respondents who do not agree to wait for the prize of 12,000 rubles. These respondents have a higher RTP.

Model 1

$$Health\_life_i^* = x_i'\beta + \beta_{IR} \cdot \ln(IR_i) + \varepsilon_i, \qquad \varepsilon \sim N(0, \quad \sigma^2)$$

We interpret the variable $Health\_life_i^*$ as the propensity to an unhealthy lifestyle. Then the probability that an individual chooses the answer k to the question about a healthy lifestyle equals:

$$P(Health\_life_i = k) = \Phi(\alpha_k - x_i'\beta - \beta_{IR} \ln(IR)) - \Phi(\alpha_{k-1} - x_i'\beta - \beta_{IR} \ln(IR)), \qquad (1)$$

$k=1,2,3,4$ $\alpha_0 = -\infty$, $\alpha_4 = +\infty$.

Hypothesis to be tested is H_0: $\beta_{IR} = 0$ (RTP does not influence individual choice of healthy or unhealthy behavior).

Research papers on the determinants of a healthy lifestyle suggest that the hypotheses for men and women should be tested separately (Takeda et al. 2004; Stickley and Carlson 2009). We run an LR-test about integration of men and women in one model and reject this option, since Prob(LR)<0.01. Model specification is verified by an LR-test and Brant-test. Both tests confirm

that the model is adequate and specified correctly. Boundaries of α do not depend on explanatory variables.

Results are given in table 2 which presents the final set of factors after testing the hypothesis for unnecessary variables (for details see Appendix 1).

Tab. 2. Influence of individual characteristics on the propensity to unhealthy lifestyle (coefficients of model 1)

Variables	Men	Women
lnIR	**0.0823*** **	**0.0457** **
	(0.0285)	**(0.0214)**
age	0.0368***	
	(0.0127)	
age_squared	-0.000545***	-0.000139***
	(0.000140)	(2.19e-05)
Higher education		-0.188***
		(0.0630)
Cohabitation	0.345**	0.346**
	(0.155)	(0.139)
No children younger than 15 years		-0.195**
		(0.0792)
Size of a household		-0.0632**
		(0.0301)
Self-rated health “very good”	-1.217***	-0.999***
	(0.198)	(0.157)
Self-rated health “good”	-0.643***	-0.379***
	(0.0948)	(0.0696)
Can buy really expensive items	-1.087**	
	(0.523)	
Moscow or Saint-Petersburg		0.329***
		(0.0984)
Central Federal District	0.205**	
	(0.0886)	
Far-East Federal District		0.435***
		(0.133)
Observations	763	1,414
Pseudo R2	0.0609	0.0401

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

We confirm the hypothesis of the positive relation between RTP and the propensity for an unhealthy lifestyle. For men and women the influence of the rate on unhealthy behavior is significant.

We interpret coefficients in table 2 as marginal effects of the propensity to unhealthy lifestyles on corresponding variables. The positive coefficient indicates that this propensity increases with the growth of the corresponding variable. The negative coefficient denotes a decrease. For men, factors that promote unhealthy lifestyle are young age, cohabitation, not having a “good” or “very good” health, not having high incomes, and living in the Central Federal District. For women, these factors are young age, not having higher education,

cohabitation, having children younger than 15 years, small number of household members, not having a "good" or "very good" health, living in capitals or in the Far-East Federal District.

Next we examine the influence of RTP on the probability of having an unhealthy lifestyle for men and women. We compare the probabilities of having an unhealthy lifestyle and the marginal effects on the logarithms of RTP for the same values of explanatory variables equal to the median of the sample (table 3). A representative of the sample is a 45-year respondent with secondary education and an average income level, living in Moscow or St. Petersburg, employed, not married, has no children under 15 years, and report their health as "average". The "extra prize" is 10000 rubles for a representative respondent.

Tab. 3. Probabilities of maintaining an unhealthy lifestyle and their marginal effects on "extra prize"[1] calculated at mean

	men		women	
	Probability	**marginal effect**	**Probability**	**marginal effect**
Possibly no	0.324***	0.0000701**	0.256***	0.000112**
Definitely no	0.111*	0.000239***	0.022**	0.0000695**
observations	763	763	1,414	1,414

*** p<0.01, ** p<0.05, * p<0.1

[1] The change in the probability in response to the change of the desired "extra prize" by 1%.

Marginal effects for men and women are small in absolute values, since ratio of maximum to minimum sum of the desired prize equals 55:1 in the sample. However these effects are significant. With the same individual characteristics, the probability of unhealthy behavior is higher for men than for women. A one percent increase in the sum of the desired "extra prize" leads to a more substantial growth in the probability of unhealthy behavior for men in comparison with women.

4.2. RTP and indicators of a healthy lifestyle

In this section we examine the influence of RTP on indicators of smoking, drinking, doing sport and having medical check-ups. Diagrams 7 and 8 show the proportions of male and female respondents who are not involved in sports, smoke, drink alcohol, and do not have medical check-ups. These proportions are calculated by subsamples of individuals, who prefer to take the prize of 10000 rubles immediately ("Now"=1) and who agree to take 12000 rubles in a year ("Now"=0).

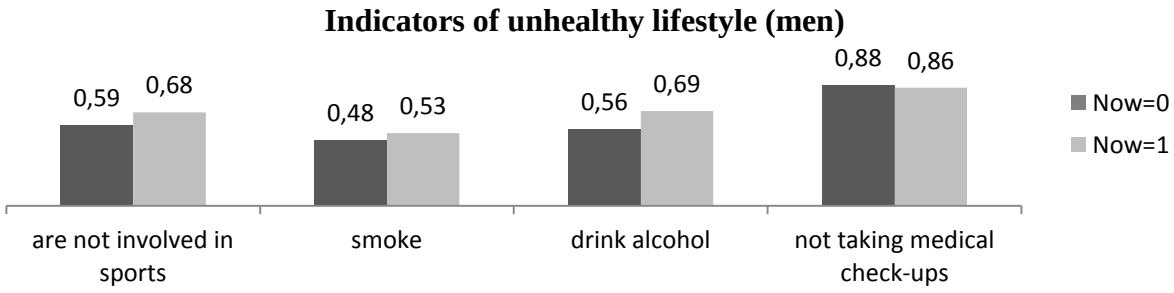

Diagram 7. Health behavior of male respondents

Diagram 8. Health behavior of female respondents

There is a relationship between indicators of a healthy lifestyle and the RTP. It should be added that many respondents drink alcohol less than once a month (44% of women and 31% of men). Very few respondents take medical check-ups regularly.

A disadvantage of model 1 is that the variable health and RTP are included in the model as exogenous variables. Breaking this assumption could lead to inconsistent results. In order to take into account the possible endogeneity of RTP and the variable for health, we estimate the system of binary equations (model 2), where dependent variables are indicators of a healthy lifestyle (Y_1, Y_2, Y_3, Y_4), a higher RTP (Y_5), and "health" (Y_6).

We examine different specifications of equations. We take into account self-reported health, and an indicator of chronic diseases. The variable "Health_good" takes the value of 1, if respondent health as reported as "good" or "very good", and 0 otherwise. The variable "Chronic_no" takes a value of 1, if the respondent has no chronic disease and 0 otherwise.

Model 2

$$Y_1 = \mathrm{Pr}ophyl\_no, Y_2 = Sport\_no, Y_3 = Smoke, Y_4 = Drink, Y_5 = Now,$$
$$Y_6 = Health\_good / Chronic\_no$$

$$Y_k = \begin{cases} 1, & если \quad Y_k^* > 0 \\ 0, & если \quad Y_k^* \le 0 \end{cases} \quad k = 1,...,5$$

$$\begin{cases} Y_1^* = x'\beta_1 + \gamma_{15}Y_5 + \gamma_{16}Y_6 + \varepsilon_1 \\ Y_2^* = x'\beta_2 + \gamma_{25}Y_5 + \gamma_{26}Y_6 + \varepsilon_2 \\ Y_3^* = x'\beta_3 + \gamma_{35}Y_5 + \gamma_{36}Y_6 + \varepsilon_3 \\ Y_4^* = x'\beta_4 + \gamma_{45}Y_5 + \gamma_{46}Y_6 + \varepsilon_4 \\ Y_5^* = x'\beta_5 + \gamma_{56}Y_6 + \varepsilon_5 \\ Y_6^* = x'\beta_6 + \varepsilon_6 \end{cases} \quad (2)$$

It is assumed that random errors in the system have a joint normal distribution with zero vector of mathematical expectations and covariance matrix given below.

$$\mathrm{cov}(\varepsilon) = \begin{pmatrix} 1 & \rho_{12} & \rho_{13} & \rho_{14} & \rho_{15} & \rho_{16} \\ & 1 & \rho_{23} & \rho_{24} & \rho_{25} & \rho_{26} \\ & & 1 & \rho_{34} & \rho_{35} & \rho_{36} \\ & & & 1 & \rho_{45} & \rho_{26} \\ & & & & 1 & \rho_{56} \\ & & & & & 1 \end{pmatrix} \quad (3)$$

This system enables us to take into account that health status might influence RTP and selected indicators of a healthy lifestyle as a factor and through random error. At the same time, RTP might influence the indicators of a healthy lifestyle. The greatest interest consists in coefficients γ_{k5} and correlation coefficients $\rho_{k5} = 0$. The system (3) is estimated by the maximum likelihood method.

We test the hypothesis that there is no relationship between RTP and indicators of a healthy lifestyle

$$H_0 : \gamma_{k5} = 0 \quad and \quad \rho_{k5} = 0$$

The system is broken into blocks when the corresponding coefficients γ_{kj} equal to zero.

When estimating model 2 for men we divide alcohol consumption into two types and consider two indicators: consumption of strong alcoholic drinks (“Drink vodka”) and consumption of weak alcoholic drinks (“Drink beer”). The values of these indicators are 1 if a respondent consumes the corresponding drinks at least three times a week.

Estimates of coefficients of the system are given in Appendix 2. The first step involves estimating binary equations for selection of significant factors and reducing the number of estimated coefficients. The second step includes estimating the system of three equations:

$(Y_k, Y_5, Y_6), \quad (k = \overline{1,4})$

With the help of this system we determine the equations where coefficients γ_{k5} and γ_{k6} are statistically significant. If possible, we proceed to estimating the system in blocks of two or three equations.

We test the hypotheses about the adequacy of the model with the help of likelihood-ratio test or Wald test. Corresponding values of LR statistics and Pseudo R^2 for binary equations are

given in Appendix 2. All models are significant for any reasonable level of significance. Variations in coefficients of explanatory variables do not exceed their standard deviations. This confirms the robustness of the estimates. The interpretation of β coefficients is beyond the scope of our study.

In models for men all coefficients γ_{k5} are insignificant (p>0.2). Therefore, the relation between indicators of a healthy lifestyle and a higher RTP is defined only by the correlation of random errors in the corresponding equations of the system. Among coefficients γ_{k6} only γ_{26} and γ_{56} are different from zero (for detail see Appendix 2, tables 2.3 and 2.5).

Tab. 4. Values of γ coefficients different from zero

	Sport_no	Now
γ_{26} Health_good	-0.473***	
	(0.0795)	
γ_{56} Chonic_no		-0.310***
		(0.0997)

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

Table 4 shows that individuals with self-rated "good" health are less likely to have a higher RTP. At the same time they are more likely to be engaged in sports. Respondents with no chronic disease are likely to not have a higher RTP.

The correlation matrix of errors is given below. Correlation coefficients are significant with few exceptions. Coefficients confirm expected relationships between the relevant factors.

Tab. 5. Correlation matrix of errors estimated in model 2 for men

	Prophyl_ no	Sport_no	Smoke	Drink beer	Drink vodka	Health_good / Chronic_no	Now
Prophyl_no	1						
Sport_no	**0.18*** **	1					
	(0.06)						
Smoke	**0.23*** **	**0.23*** **	1				
	(0.06)	(0.06)					
Drink beer	**0.23** **	**0.05**	**0.25*** **	1			
	(0.09)	(0.08)	(0.09)				
Drink vodka	**0.13***	**0.10***	**0.23*** **	**0.33*** **	1		
	(0.07)	(0.06)	(0.07)	(0.08)			
Health_good / Chronic_no	**-0.14** **	**-0.12**	**-0.20*** **	**-0.051**	**-0.21*** **	1	
	(0.06)	(0.10)	(0.06)	(0.08)	(0.06)		
Now	**0.019**	**0.085**	**0.13** **	**0.25*** **	**0.13** **	**-0.02**	1
	(0.07)	(0.06)	(0.06)	(0.11)	(0.06)	(0.058)	

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

For men smoking, drinking, the lack of sport activities and not having medical check-ups are positively related to each other. The highest correlation is for drinking vodka and drinking

beer (0.33). The indicator "good" health is negatively related to the lack of good habits and bad habits except drinking beer. There is no significant relationship between indicators of drinking beer and "good" health / no chronic disease.

A relatively high RTP increases the probability of respondents smoking, and drinking vodka and beer. Considering the correlation of coefficients between indicators for higher RTP and unhealthy behavior, we find the highest coefficient (0.25) for drinking beer. We do not find a statistically significant relationship between indicators for higher RTP and having medical check-ups and doing sport for men.

We reveal the following estimation results of model 2 for women (for detail see Appendix 3). It should be noticed that the number of female respondents who indicate that they drink vodka is very small. Consequently, we do not divide alcohol consumption into drinking vodka and drinking beer for women.

In models for women, as opposed to models for men, coefficients γ_{15} and γ_{45} are significant. Among coefficients γ_{k6} only γ_{16} and γ_{26} are statistically different from zero.

Tab. 6. Values of γ coefficients different from zero

	Prophyl_no	Sport_no	Drink
Now	0.226***		0.231***
	(0.0794)		(0.0832)
Health_good	0.223***	-0.251***	
	(0.0587)	(0.0636)	

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

Detailed results are presented in Appendix 3, tables 3.3, 3.4, 3.6.

Estimation of correlation matrix of errors is presented below.

Tab. 7. Correlation matrix of errors estimated in model 2 for women

	Prophyl_no	Sport_no	Smoke	Drink	Health_good / Chronic_no	Now
Prophyl_no	1					
Sport_no	**0.15*** **	1				
	(0.03)					
Smoke	**0.12*** **	**0.13*** **	1			
	(0.04)	(0.05)				
Drink	**0.15*** **	**0.038**	**0.25*** **	1		
	(0.03)	(0.03)	(0.05)			
Health_good / Chronic_no	**-0.04**	**-0.06**	**-0.19*** **	**-0.12*** **	1	
	(0.09)	(0.09)	(0.05)	(0.03)		
Now	**0.018**	**-0.089**	**0.11***	**-0.031**	**0.05**	1
	(0.10)	(0.10)	(0.06)	(-0.10)	(0.07)	

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

Similarly to our findings for men, there is a positive correlation of all forms of unhealthy behavior for women. We observe the highest correlation between smoking and drinking alcoholic beverages although correlation coefficients are lower than those of men.

"Good" health is negatively related to smoking and drinking. We use an indicator "Chronic_no" in estimating equations with a variable "Drink".

We show that a higher RTP is positively related to all bad habits for women just as for men. A higher rate is positively related to not having medical check-ups. We find no relationship between a higher RTP and engagement in sports for women.

We summarize the results as follows:

1. The hypothesis on the relationship between RTP and drinking alcohol is accepted for both men and women. We show that an increase in RTP is associated with higher alcohol consumption. The division of alcohol consumption into drinking strong (vodka) and weak (beer) alcoholic drinks is significant for men. Despite this there is no correlation between self-reported "good" health and drinking beer, the relationship between RTP and consumption of weak alcoholic drinks is significant.
2. We confirm the relationship between the high RTP and the probability of being a smoker for both men and women.
3. High RTP of women is related to a low demand for medical check-ups. Possibly, the rejection of this hypothesis for men is explained by the general disinclination of men to take medical check-ups in Russia.
4. The hypothesis on a negative relationship between RTP and physical activity of an individual is rejected in our research. For men and women RTP and physical activity are not related to each other. We concede that the use of another indicator for physical activity might lead to a different result.

5. Conclusions

We show a positive relationship between the RTP and unhealthy lifestyles for both men and women in Russia. A positive relationship is confirmed by estimating two fundamentally different models. Therefore we consider this result robust. An econometric analysis shows that high RTP relates to increased consumption of addictive products. For women high RTP relates to a low demand for medical check-ups. Our findings will be useful for government agencies, since they inform public policy aimed at promoting healthy lifestyles. Moreover they provide a platform for the future research papers by adding to the current understanding of a healthy or unhealthy behavior of Russians.

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Appendix 1

VARIABLES	Men Full	Men Short	Women Full	Women Short
age	0.00541	0.0368***	0.0159	
	(0.0214)	(0.0127)	(0.0139)	
age_squared	-0.000174	-0.000545***	-0.000335**	-0.000139***
	(0.000256)	(0.000140)	(0.000163)	(2.19e-05)
married	-0.110		-0.0153	
	(0.115)		(0.0782)	
cohabitation	0.287*	0.345**	0.339**	0.346**
	(0.171)	(0.155)	(0.146)	(0.139)
widow/widower	-0.444		0.0549	
	(0.276)		(0.112)	
child_no	0.0453		-0.180**	-0.195**
	(0.123)		(0.0847)	(0.0792)
Size of a household	-0.00800		-0.0579*	-0.0632**
	(0.0484)		(0.0335)	(0.0301)
education_higher	-0.0911		-0.103	-0.188***
	(0.157)		(0.124)	(0.0630)
education_secondary	-0.0755		0.186	
	(0.162)		(0.130)	
education_vocational	-0.0375		0.0673	
	(0.150)		(0.122)	
unempl	0.00567		-0.0436	
	(0.130)		(0.0757)	
student	-0.471**		0.0350	
	(0.205)		(0.149)	
pensioner	-0.411		0.187	
	(0.260)		(0.172)	
Have enough money only for food	-0.0652		-0.0601	
	(0.179)		(0.126)	
Have enough money for clothes	-0.200		-0.0735	
	(0.167)		(0.122)	
Have enough money for durables	-0.252		0.000218	
	(0.181)		(0.140)	
Can buy really expensive items	-1.157**	-1.087**	-0.261	
	(0.556)	(0.523)	(0.371)	
Self-rated “very good” health	-1.274***	-1.217***	-1.033***	-0.999***
	(0.239)	(0.198)	(0.187)	(0.157)
Self-rated “good” health	-0.730***	-0.643***	-0.428***	-0.379***
	(0.161)	(0.0948)	(0.117)	(0.0696)
Self-rated “middle” health	-0.0793		-0.0614	
	(0.143)		(0.102)	
Self-rated “very poor” health	0.352		0.0833	
	(0.410)		(0.263)	
Moscow	0.160		0.347**	0.329***
	(0.183)		(0.143)	(0.0984)
Saint-Petersburg	0.376		0.447*	0.329***
	(0.334)		(0.245)	(0.0984)
Large city	0.0296		-0.0483	
	(0.115)		(0.0868)	
Medium and small city	0.106		0.0399	

	(0.107)		(0.0775)	
Central Federal District	0.566***	0.205**	0.192	
	(0.214)	(0.0886)	(0.168)	
South Federal District	0.420*		0.263	
	(0.220)		(0.169)	
Volga Federal District	0.489**		0.222	
	(0.213)		(0.163)	
Ural Federal Disrtict	0.447*		0.0865	
	(0.243)		(0.191)	
Siberian Federal District	0.252		0.200	
	(0.222)		(0.170)	
Far-East Federal District	0.473*		0.619***	0.435***
	(0.257)		(0.199)	(0.133)
lnIR	0.0896***	0.0823***	0.0472**	0.0457**
	(0.0295)	(0.0285)	(0.0217)	(0.0214)
α_1	-0.656	-0.147	-0.637	-1.123***
	(0.631)	(0.395)	(0.448)	(0.249)
α_2	0.704	1.184***	0.746*	0.254
	(0.630)	(0.396)	(0.448)	(0.248)
α_3	1.872***	2.332***	2.045***	1.546***
	(0.632)	(0.401)	(0.451)	(0.252)
Log likel-d	-886.52	-899.61	-1569.28	-1575.37
LR	142.83	116.65	142.04	129.86
Prob(LR)	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0746	0.0609	0.0433	0.0401
Observ-ns	763	763	1,414	1,414

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

Appendix 2

Estimating coefficients of the model 2 for men

Tab. 2.1 Probit models with all variables

Variables	full probit Prophyl_no	full probit Sport_no	full probit Smoke	full probit Drink beer	full probit Drink vodka	full probit Now	full probit Health_good
age35	0.135	0.335**				0.515**	
	(0.170)	(0.166)				(0.227)	
age45	-0.0175	0.448**				0.0434	
	(0.182)	(0.183)				(0.232)	
age55	-0.286	0.338*				-0.0680	
	(0.180)	(0.183)				(0.228)	
age65	-0.123	0.457**				-0.0653	
	(0.192)	(0.198)				(0.246)	
age_65+	0.138	0.476**				0.0666	
	(0.210)	(0.217)				(0.281)	
age			0.0837***	0.0933**	0.162***		-0.0953***
			(0.0233)	(0.0431)	(0.0314)		(0.0192)
age^2			-0.00109***	-0.00127**	-0.00179***		0.000599**

			(0.000282)	(0.000540)	(0.000380)		(0.000237)
married	-0.154	0.193	-0.190	-0.317*	-0.606***	-0.0106	0.176*
	(0.116)	(0.120)	(0.116)	(0.184)	(0.145)	(0.157)	(0.106)
cohabit	-0.173	0.155	0.182	-0.150	-0.233	-0.159	0.189
	(0.190)	(0.195)	(0.197)	(0.267)	(0.222)	(0.235)	(0.170)
widower	-0.139	-0.320	-0.0374	-0.00427	0.570*	0.379	-0.131
	(0.237)	(0.243)	(0.236)	(0.464)	(0.326)	(0.359)	(0.293)
child_no	0.167	-0.0422	-0.107	0.347	0.199	-0.239	0.0426
	(0.146)	(0.151)	(0.141)	(0.223)	(0.177)	(0.198)	(0.116)
Size of a household	-0.024	-0.0759	-0.0709	0.0759	0.0554	-0.0246	0.00518
	(0.0553)	(0.0577)	(0.0553)	(0.0833)	(0.0695)	(0.0732)	(0.0452)
education higher	-0.117	-0.300*	-0.194	-0.269	-0.233	-0.0782	0.496***
	(0.168)	(0.172)	(0.174)	(0.284)	(0.221)	(0.219)	(0.153)
education secondary	-0.245	0.00649	0.0289	-0.281	-0.391*	-0.0264	0.179
	(0.169)	(0.177)	(0.179)	(0.290)	(0.225)	(0.218)	(0.158)
education vocational	-0.137	0.132	-0.130	-0.401	-0.239	-0.0620	0.213
	(0.151)	(0.158)	(0.159)	(0.259)	(0.197)	(0.197)	(0.146)
monthly income	1.09E-05	-5.42e-06	-1.75e-05***	-2.25e-05**	-6.73e-07	-7.71e-06	
	(7.24e-06)	(6.69e-06)	(6.72e-06)	(1.10e-05)	(7.45e-06)	(7.95e-06)	
unempl	-0.134	-0.208	-0.290**	-0.0851	-0.0918	-0.127	
	(0.125)	(0.131)	(0.130)	(0.219)	(0.169)	(0.164)	
student	-0.204	-0.599**	-0.728***		-0.378	0.00337	
	(0.259)	(0.272)	(0.274)		(0.496)	(0.318)	
smoking parents	0.291***	0.215**	0.637***	-0.0516	0.574***	-0.0799	-0.101
	(0.0941)	(0.0973)	(0.0952)	(0.156)	(0.126)	(0.126)	(0.0826)
Moscow	-0.18	0.456*	-0.193	-0.374	0.155	-0.348	-0.214
	(0.220)	(0.241)	(0.223)	(0.403)	(0.265)	(0.276)	(0.184)
Saint-Petersburg	0.264	-0.323	-0.235	1.187**	0.675	0.576	-0.453
	(0.352)	(0.334)	(0.327)	(0.492)	(0.443)	(0.547)	(0.279)
Large city	0.195	0.103	-0.127	0.415**	-0.121	0.162	-0.0455
	(0.131)	(0.136)	(0.133)	(0.211)	(0.166)	(0.167)	(0.114)
Medium and small city	0.00646	-0.108	-0.107	0.328*	0.148	0.303**	-0.116
	(0.112)	(0.118)	(0.116)	(0.190)	(0.141)	(0.150)	(0.105)
Central Federal District	-0.184	0.236	-0.0462	0.200	-0.195	0.0703	-0.136
	(0.201)	(0.204)	(0.203)	(0.315)	(0.254)	(0.300)	(0.173)
South Federal District	-0.124	0.254	0.0577	0.00675	0.0986	-0.0369	0.102
	(0.213)	(0.215)	(0.215)	(0.327)	(0.260)	(0.308)	(0.180)
Volga Federal	-0.231	0.177	-0.106	-0.124	0.0413	-0.665*	0.0169

District						*	
	(0.200)	(0.204)	(0.203)	(0.327)	(0.256)	(0.284)	(0.172)
Ural Federal District	-0.0582	0.289	0.231	0.235	-0.303	0.108	0.216
	(0.242)	(0.249)	(0.251)	(0.350)	(0.292)	(0.355)	(0.203)
Siberian Federal District	-0.148	0.235	0.102	-0.383	-0.181	0.0153	-0.233
	(0.210)	(0.216)	(0.214)	(0.349)	(0.261)	(0.313)	(0.185)
Far-East Federal District	-0.0707	0.194	-0.0673	-0.339	0.0258	-0.574	-0.0681
	(0.268)	(0.271)	(0.278)	(0.497)	(0.350)	(0.354)	(0.231)
Now	0.0153	0.142	0.144	0.665*	0.379*		
	(0.138)	(0.143)	(0.142)	(0.334)	(0.192)		
Health good	-0.325	-0.508***	-0.368***	-0.244	-0.360***	-0.128	
	(0.113)	(0.113)	(0.115)	(0.170)	(0.135)	(0.146)	
No chronic diseases	0.307***	-0.100	0.0756	0.263	0.0919	-0.437**	
	(0.103)	(0.108)	(0.105)	(0.162)	(0.125)	(0.143)	
Constant	-0.159	0.322	-0.638	-2.593***	-3.514***	1.889***	2.195***
	(0.375)	(0.383)	(0.569)	(0.993)	(0.764)	(0.524)	(0.436)
Log likel-d	-557.15	-537.79	-534.51	-186.05	-353.74	-292.49	-537.79
LR	70.34	172.06	169.47	45.83	110.23	71.06	172.06
Prob(LR)	0.0000	0.0000	0.0000	0.0095	0.0000	0.0000	0.0000
Pseudo R2	0.0594	0.1379	0.1368	0.1095	0.1448	0.1083	0.1379
Observ-ns	894	900	900	564	582	854	1,307

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

Tab. 2.2 Probit models with only significant coefficients

Variables	short binary Prophyl_no	short binary Sport_no	short binary Smoke	short binary Drink beer	short binary Drink vodka	short binary Now	short binary Health_good
age25		-0.491***					
		(0.105)					
age35						0.380***	
						(0.127)	
age55	-0.274**						
	(0.113)						
age			0.0678***	0.0671**	0.108***		-0.0810***
			(0.0174)	(0.0282)	(0.0174)		(0.0132)
age^2			-0.000831***	-0.000856***	-0.00109***		0.000443***
			(0.000190)	(0.000320)	(0.000184)		(0.000145)
married	-0.150*	0.139*	-0.288***	-0.332**	-0.450***		0.139
	(0.0894)	(0.0832)	(0.0993)	(0.144)	(0.0985)		(0.0856)
education		-					0.310***

higher		0.369***					
		(0.0842)					(0.0833)
monthly income	1.57e-05***		-1.81e-05***	-1.63e-05*			
	(5.80e-06)		(5.59e-06)	(8.44e-06)			
student		-0.756***	-0.726***				
		(0.161)	(0.260)				
smoking parents	-0.247**	0.190**	0.711***		0.500***		
	(0.104)	(0.0770)	(0.0926)		(0.0998)		
Moscow		0.289*				-0.364**	
		(0.147)				(0.167)	
Saint-Petersburg				1.130***	0.661**		
				(0.380)	(0.279)		
Large city				0.427**			
				(0.184)			
Medium and small city				0.376**		0.272***	
				(0.165)		(0.102)	
Volga Federal District						-0.504***	
						(0.104)	
Far-East Federal District						-0.600***	
						(0.186)	
Now				0.703*	0.275*		
				(0.319)	(0.156)		
Health good		-0.473***	-0.376***		-0.380***		
		(0.0795)	(0.107)		(0.104)		
No chronic diseases						-0.285***	
						(0.0983)	
Constant	0.0860	0.617***	-0.951**	-2.198***	-2.618***	1.383***	1.973***
	(0.129)	(0.0901)	(0.392)	(0.568)	(0.376)	(0.0964)	(0.257)
Log likel-d	-570.52	-546.31	537.85	-206.28	-490.21	-458.92	-546.31
LR	43.6	155.04	162.79	31.82	113.19	61.83	155.04
Prob(LR)	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
Pseudo R2	0.0368	0.1243	0.1314	0.0716	0.1064	0.0631	0.1243
Observ-ns	894	1,307	900	856	821	1,293	1,378

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

Tab. 2.3 Estimation of γ coefficients and ρ coefficients in systems with dependent variable "Now"

Variables	short probit Now	system Chronic_no, Now	system Prophyl_no, Now	system Sport_no, Now	system Smoke, Now	system Drink beer, Now	system Drink vodka, Now
Chronic_no	-0.310***	-0.300***	-0.467***	-0.291***	-0.466***	-0.287*	-0.208

	(0.0997)	(0.101)	(0.124)	(0.104)	(0.123)	(0.152)	(0.130)
Rho12		0.0241	0.0185	0.0854	0.130**	0.246***	0.128**
		(0.0576)	(0.0684)	(0.0597)	(0.0659)	(0.113)	(0.0653)
Log likel-d	-463.81	-1152.69	-837.11	-1132.53	-815.75	-396.62	-754.65
LR	52.59	353.76	96.11	203.89	169.96	51.54	121.74
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0631						
Observ-ns	1,293	1,293	848	1225	851	603	821

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

Tab. 2.4 Estimation of ρ coefficients in systems with variable "Prophyl_no"

	short probit Prophyl_no	system Sport_no, Prophyl_no	system Smoke, Prophyl_no	system Drink beer, Prophyl_no	system Drink vodka, Prophyl_no	system Now, Prophyl_no	system Health good, Prophyl_no
Health_good	-0.473***	-0.490***	-0.468***	-0.432***	-0.398***	-0.501***	-0.648***
	(0.0795)	(0.0981)	(0.0975)	(0.117)	(0.0980)	(0.172)	(0.164)
rho		0.181***	0.227***	0.226**	0.133*	0.0185	-0.140**
		(0.0560)	(0.0557)	(0.0880)	(0.0691)	(0.0684)	(0.0610)
Log likel-d	-570.52	-1075.81	-1111.07	-580.78	-739.71	-837.11	-1023.73
LR	43.6	135.2	164.47	50.26	102.53	96.11	261.92
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0368						
Observ-ns	894	894	894	605	606	848	894

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

Tab. 2.5 Estimation of ρ coefficients in systems with variable "Sport_no"

	short binary Sport_no	system Prophyl_no Sport_no	system Smoke Sport_no	system Drink beer, Sport_no)	system Drink vodka, Sport_no	system Now, Sport_no	system Health_good, Sport_no
rho		0.181***	0.232***	0.0526	0.100*	0.0854	0.120
		(0.0560)	(0.0556)	(0.0807)	(0.0572)	(0.0597)	(0.101)
Log likelihood	-546.31	-1075.81	-1056.11	-554.88	-1027.91	-1137.53	-1455.53
LR	155.04	135.2	211.56	76.59	157.56	194.89	463.14
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1243						
Observ-ns	1,307	894	900	609	866	1225	1307

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

Tab. 2.6 Estimation of ρ coefficients in systems with variable "Smoke"

	short binary Smoke	system Prophyl_no, Smoke	system Sport_no, Smoke	system Drink beer, Smoke	system Drink vodka, Smoke	system Now, Smoke	system Health_good, Smoke
rho		0.227***	0.232***	0.253***	0.228***	0.130**	-0.200***
		(0.0557)	(0.0556)	(0.0897)	(0.0698)	(0.0659)	(0.0610)
Log likel-d	-546.31	-1111.07	-1056.12	-559.67	-715.65	-815.75	-1008.21
LR	155.04	164.47	211.56	103.59	144.54	169.96	337.83
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1243						

Observ-ns	900	894	900	608	609	851	900

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

Tab. 2.7 Estimation of ρ coefficients in systems with variable "Drink beer"

	short binary Drink beer	system Prophyl_no, Drink beer	system Smoke, Drink beer	system Sport_no, Drink beer	system Drink vodka, Drink beer	system Now, Drink beer	system Health good, Drink beer
rho		0.226**	0.253***	0.0526	0.330***	0.246***	-0.0517
		(0.0880)	(0.0897)	(0.0807)	(0.0848)	(0.113)	(0.0806)
Log likel-d	-224.28	-580.78	-559.67	-554.88	-561.56	-396.62	-571.52
LR	31.82	50.26	103.59	76.59	102.39	51.54	153.61
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0662						
Observ-ns	633	605	608	609	603	603	633

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

Tab. 2.8 Estimation of ρ coefficients in systems with variable "Drink vodka"

	short binary Drink vodka	system Prophyl_no, Drink vodka	system Sport_no, Drink vodka	system Smoke, Drink vodka	system Drink beer, Drink vodka	system Prophyl_no, Drink vodka	system Now, Drink vodka	system Health_ good, Drink vodka
rho		0.133*	0.100*	0.228***	0.330***	0.133*	0.128**	-0.212***
		(0.0691)	(0.0572)	(0.0698)	(0.0848)	(0.0691)	(0.0653)	(0.0599)
Log likel-d	-517.21	-739.7	-1027.91	-715.65	-561.56	-739.7	-754.65	-990.87
LR	123.19	102.53	157.56	144.54	102.39	102.53	121.74	276.18
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1064							
Observ-ns	866	606	866	609	603	606	821	866

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

Appendix 3

Estimating coefficients of the model 2 for women

Tab. 3.1 Probit models with all variables

VARIABLES	full probit Prophyl_no	full probit Sport_no	full probit Smoke	full probit Drink	full probit Now	full probit Health good
age35				-0.0972	-0.287*	
				(0.117)	(0.147)	
age45				-0.101	-0.127	
				(0.122)	(0.158)	
age55				-0.141	0.00890	
				(0.119)	(0.158)	
age65				-0.371***	-0.0455	
				(0.126)	(0.165)	
age65+				-0.793***	0.0899	
				(0.148)	(0.192)	
age	-0.0386***	0.0256**	0.0564**			-0.0855***
	(0.0117)	(0.0126)	(0.0263)			(0.0141)

age^2	0.000380***	-0.000261*	-0.00102***			0.000545***
	(0.000134)	(0.000146)	(0.000326)			(0.000169)
married	-0.0899	0.0117	-0.304***	-0.0307	-0.0325	-0.000464
	(0.0717)	(0.0757)	(0.107)	(0.0735)	(0.0948)	(0.0755)
cohabit	0.111	0.144	0.567***	0.310**	-0.0312	-0.0902
	(0.141)	(0.150)	(0.177)	(0.149)	(0.182)	(0.149)
widow	-0.143	0.165	-0.0159	-0.178*	-0.0344	-0.0557
	(0.0949)	(0.105)	(0.154)	(0.0967)	(0.125)	(0.116)
child_no	0.107	0.00209	0.0622	-0.113	-0.232**	-0.0230
	(0.0801)	(0.0835)	(0.116)	(0.0856)	(0.110)	(0.0820)
Size of a household	0.0216	0.0308	-0.0282	-0.0147	0.0480	0.00730
	(0.0311)	(0.0334)	(0.0476)	(0.0321)	(0.0426)	(0.0332)
education higher	-0.119	-0.0996	-0.210	0.0231	0.0438	0.517***
	(0.108)	(0.118)	(0.234)	(0.112)	(0.136)	(0.131)
education secondary	-0.0874	0.118	0.186	0.195*	0.0986	0.203
	(0.112)	(0.124)	(0.239)	(0.117)	(0.143)	(0.138)
education vocational	0.0215	-0.0440	0.0954	0.0630	0.0486	0.233*
	(0.103)	(0.113)	(0.228)	(0.107)	(0.130)	(0.130)
unempl	0.140**	0.0259	5.50e-06	-0.314***	-0.109	-0.184**
	(0.0685)	(0.0735)	(4.95e-06)	(0.0728)	(0.0935)	(0.0728)
student	-0.312**	-0.489***	0.0288	-0.594***	-0.200	0.101
	(0.146)	(0.146)	(0.105)	(0.149)	(0.183)	(0.147)
monthly income			-0.530**			
			(0.225)			
Have enough money only for food	0.000688	-0.277**		0.0577	0.196	
	(0.108)	(0.128)		(0.113)	(0.138)	
Have enough money for clothes	-0.0896	-0.275**		0.0733	-0.00525	
	(0.106)	(0.126)		(0.111)	(0.133)	
Have enough money for durables	-0.0310	-0.547***		0.159	-0.0251	
	(0.126)	(0.143)		(0.131)	(0.158)	
Can buy really expensive items	-0.649*	-0.218		-0.629	-0.600	
	(0.353)	(0.367)		(0.426)	(0.365)	
smoking parents	0.116**	0.105*	0.381***	0.279***	0.0574	-0.248***
	(0.0541)	(0.0577)	(0.0883)	(0.0557)	(0.0700)	(0.0596)
Moscow	0.251*	0.000636	0.852***	0.474***	-0.102	-0.0265
	(0.131)	(0.138)	(0.202)	(0.136)	(0.166)	(0.138)
Saint-Petersburg	0.250	-0.282	0.137	-0.0749	0.0919	-0.173
	(0.192)	(0.194)	(0.285)	(0.198)	(0.287)	(0.199)
Large city	0.260***	-0.0444	0.512***	0.0743	0.0232	-0.147*
	(0.0783)	(0.0848)	(0.128)	(0.0806)	(0.102)	(0.0864)
Medium and small city	0.0293	-0.184**	0.211*	0.00166	-0.0807	-0.0253
	(0.0682)	(0.0745)	(0.117)	(0.0712)	(0.0883)	(0.0768)
Central Federal District	-0.0724	0.0491	-0.336*	-0.442***	-0.248	-0.265**
	(0.120)	(0.126)	(0.204)	(0.125)	(0.175)	(0.132)
South Federal District	0.0840	0.103	0.0605	-0.505***	-0.625***	-0.247*
	(0.126)	(0.133)	(0.206)	(0.132)	(0.175)	(0.135)

Volga Federal District	-0.219*	0.133	-0.318	-0.211*	-0.428**	-0.150
	(0.119)	(0.126)	(0.196)	(0.124)	(0.171)	(0.129)
Ural Federal Disrtict	-0.276**	0.207	-0.183	-0.543***	-0.00208	-0.210
	(0.137)	(0.147)	(0.222)	(0.142)	(0.204)	(0.150)
Siberian Federal District	-0.123	0.242*	-0.166	-0.141	-0.0386	-0.169
	(0.125)	(0.133)	(0.201)	(0.131)	(0.186)	(0.135)
Far-East Federal District	0.113	-0.0639	-0.0351	-0.0587	-0.517**	-0.245
	(0.173)	(0.177)	(0.255)	(0.178)	(0.220)	(0.183)
Now	0.224***	-0.150*	0.257*	0.215**		
	(0.0809)	(0.0882)	(0.139)	(0.0846)		
Health good		-0.197***	-0.301***		-0.0116	
		(0.0686)	(0.0974)		(0.0851)	
No chronic diseases	0.226***			-0.194***		
	(0.0599)			(0.0620)		
Constant	0.628*	0.387	-1.720***	0.561**	1.583***	2.209***
	(0.331)	(0.359)	(0.615)	(0.260)	(0.318)	(0.340)
Log likelihood	-1,542.55	-1,319.31	-582.08	-1,427.63	-836.27	-1,209.44
LR	102.56	170.40	285.85	370.71	78.59	699.04
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0322	0.0607	0.20	0.1149	0.0449	0.2242
Observations	2,331	2,331	1,718	2,331	2,331	2,464

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

Tab. 3.2 Probit models with only significant variables

VARIABLES	full probit Prophyl_no	full probit Sport_no	full probit Smoke	full probit Drink	full probit Now	full probit Health good
age35					-0.267***	
					(0.0939)	
age65+				-0.305***		
				(0.0836)		
age	-0.0339***	0.0177*	0.0651***	-0.736***		-0.0666***
	(0.00926)	(0.00961)	(0.0202)	(0.108)		(0.00893)
age^2	0.000322***	-0.000159	-0.00113***			0.000303***
	(9.38e-05)	(9.79e-05)	(0.000234)			(9.74e-05)
married			-0.335***	0.313**		
			(0.0907)	(0.142)		
cohabit			0.549***	-0.167*		
			(0.172)	(0.0852)		
widow		0.164*				
		(0.0916)				
child_no					-0.293***	
					(0.0838)	
education higher			-0.302***	0.145*		0.302***
			(0.0927)	(0.0785)		(0.0611)
education vocational				-0.317***		
				(0.0691)		
unempl	0.129*		7.05e-06	-0.526***		
	(0.0658)		(4.53e-06)	(0.116)		

student	-0.231*	-0.457***			-0.226**	
	(0.131)	(0.120)			(0.112)	
monthly income			-0.460**			
			(0.206)			
Have enough money only for food		-0.248**			0.185**	
		(0.117)			(0.0781)	
Have enough money for clothes		-0.234**				
		(0.112)				
Have enough money for durables		-0.520***		0.286***		
		(0.126)		(0.0551)		
Can buy really expensive items	-0.586*			0.474***	-0.609*	
	(0.336)			(0.124)	(0.340)	
smoking parents	0.109**		0.373***			-0.248***
	(0.0534)		(0.0870)			(0.0587)
Moscow	0.154		0.674***			
	(0.109)		(0.179)			
Saint-Petersburg		-0.374**				
		(0.148)				
Large city	0.195***		0.354***	-0.306***		
	(0.0634)		(0.0986)	(0.0736)		
Medium and small city		-0.161***		-0.375***		
		(0.0569)		(0.0813)		
Central Federal District			-0.248**		-0.204**	
			(0.123)		(0.0928)	
South Federal District				-0.399***	-0.583***	
				(0.0989)	(0.0996)	
Volga Federal District	-0.206***		-0.256**		-0.412***	
	(0.0656)		(0.108)		(0.0929)	
Ural Federal District	-0.257***					
	(0.0947)					
Siberian Federal District		0.152*		0.234***		
		(0.0802)		(0.0835)		
Far-East Federal District				-0.161***	-0.479***	
				(0.0597)	(0.160)	
North-West Federal District				0.306***		0.188**
				(0.102)		(0.0947)
Now	0.207***	-0.124	0.221			
	(0.0799)	(0.0841)	(0.137)			
Health good		-0.221***	-0.304***			
		(0.0660)	(0.0964)			
No chronic diseases	0.225***					
	(0.0588)					
Constant	0.557**	0.676**	-1.703***	0.306***	1.668***	1.764***
	(0.239)	(0.264)	(0.440)	(0.102)	(0.0999)	(0.188)
Log likelihood	-1553.67	-1398.43	-586.81	-1434.83	-899.76	-1217.06
LR	80.31	158.12	276.38	356.31	75.40	683.81

Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0252	0.0535	0.19	0.1105	0.0402	0.2193
Observations	2,331	2,474	1,718	2,331	2,474	2,464

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

Tab. 3.3 Estimation of γ coefficients and ρ coefficients in systems with variable "Now"

Variables	full probit Now	system Health good, Now	system Health good, Now	system Prophyl_no, Now, Chronic_no	system Sport_no, Now, Health good	system Smoke, Now	system Drink, Now, Chronic_no
Health good	-0.0116	0.0291					
	(0.0851)	(0.127)					
rho		-0.0263	0.0538	0.0175	-0.0899	0.1056*	-0.0313
		(0.0676)	(0.0691)	(0.102)	(0.0970)	(0.0580)	(0.0980)
Log likel-d	-836.27	-1990.25	-1990.28	-3746.41	-3305.40	-2024.28	-3625.12
LR	78.59	608.66	609.04	600.00	782.74	581.55	890.75
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0449						
Observ-ns	2,331	2,331	2,331	2,331	2,331	1,718	2,331

standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Tab. 3.4 Estimation of ρ coefficients in systems with variable "Prophyl_no" and "Sport_no"

Variables	short probit Prophyl_no	system Prophyl_no, Now,Chronic_no	short probit Prophyl_no	system Sport_no, Now, Health good	system Prophyl_no,	Sport_no
Now	0.207***	0.175	-0.124	0.0315	0.226***	
	(0.0799)	(0.202)	(0.0841)	(0.198)	(0.0794)	
Health good / Chronic_no	0.225***	0.294*	-0.221***	-0.320**	0.223***	0.251***
	(0.0588)	(0.156)	(0.0660)	(0.157)	(0.0587)	(0.0636)
rho12		0.0175		-0.0899	0.149***	
		(0.102)		(0.0970)	(0.0342)	
rho13		-0.0426		0.0601		
		(0.0900)		(0.0861)		
Log likelihood	-1553.67	-3746.40	-1398.43	-3305.40	-2873.51	
LR	80.31	600.00	158.12	782.74	228.07	
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	
Pseudo R2	0.0252		0.0535			
Observations	2,331	2,331	2474	2,331	2,331	

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

Tab. 3.5 Estimation of ρ coefficients in systems with variable "Smoke"

Variables	full probit Smoke	system Smoke, Now, Health good	system Smoke, Now, Health good	system Smoke, Prophyl_no	system Smoke, Sport_no	system Smoke, Drink
now	0.257*	0.0224				
	(0.139)	(0.234)				
Health_good	-0.301***	0.0645				

	(0.0974)	(0.177)				
rho12		0.0929	0.1056*	0.119***	0.128***	0.253***
		(0.100)	(0.0580)	(0.0444)	(0.0491)	(0.0486)
rho13		-0.220**	-0.192***			
		(0.0919)	(0.0493)			
Log likelihood	-582.08	-1626.55	-2024.28	-1812.42	-1626.55	-1631.60
LR	285.85	274.14	581.55	225.58	274.14	399.80
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.20					
Observations	1,718	1,718	1,718	1,795	1,795	1,718

standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Tab. 3.6 Estimation of γ coefficients and ρ coefficients in systems with variable "Drink"

Variables	short probit drink	system Drink, Now,Chronic_no	system Drink, Chronic	system Drink, Prophyl_no	system Drink, Sport_no	system Smoke, Drink
now	0.234***	0.289	0.231***	0.216***	0.242***	0.106
	(0.0835)	(0.195)	(0.0832)	(0.0830)	(0.0834)	(0.0980)
Chronic_no	-0.161***	0.112				
	(0.0597)	(0.137)				
rho12		-0.0313	-0.117***	0.148***	0.0379	0.255***
		(0.0980)	(0.0345)	(0.0333)	(0.0341)	(0.0485)
rho13		-0.175**				
		(0.0807)				
Log likelihood	-1434.83	-3625.12	-2785.27	-2987.40	-2755.20	-1631.60
LR	356.31	890.75	811.07	391.01	487.65	399.80
Prob(LR)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1105					
Observations	2,331	2,331	2,331	2,331	2,331	1,718

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

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