Better off living with family or alone? Men's living arrangements, partnership status and health in Russia

Natalia V. Permyakova [1], Jennifer A. Holland [1], Brienna Perelli-Harris [1]

[1]Department of Social Statistics and Demography, University of Southampton

Short Abstract

Substantial research has examined the causes of premature male mortality such as heavy drinking in Russia, but few studies have investigated how living arrangements and family may be associated with health. Russia is a unique case in comparison to the West, with high divorce rates and a high proportion of men living in intergenerational households. The aim of this study is to establish whether there is a significant relationship between living arrangements, partnership status and men's health in contemporary Russia.

We test whether: unpartnered men are unhealthier than partnered men; unpartnered men living alone are unhealthier than other men; among those living in intergenerational households, unpartnered men are the least healthy group compared to partnered men or others. We also test whether men's health differs by wealth quintiles within living arrangements. Nominal models with self-rated health as the outcome were estimated separately for each research question using the Russian Longitudinal Monitoring Survey (RLMS 2013-2014).

Our results show that the significant relationship between men's health and living arrangements disappears after controlling for family covariates. However, we uncover a significant difference between partnered and unpartnered men living in intergenerational households in the wealthiest quintile. Given the complexity of living arrangements in Russia, this analysis is the first step to disentangling the relationship between living arrangements and men's health. Our study points to the importance of family income and partnership status

in maintaining positive health among Russian men living in intergenerational households. Further research needs to investigate the direction of causality.

Introduction

Premature male mortality in Russia has received a lot of attention in the social and health sciences: Russia has had one of the lowest male life expectancies compared to other post-Soviet and Western countries since the collapse of the Soviet Union (Shkolnikov et al, 1998; 2013). While many scholars concentrate on the continuing contribution of unhealthy lifestyles to mortality among working-age men (e.g. Leon et al, 2009), possible effects of family structure on men's health have been missed in Russian research.

Many scholars have found that family structure and living conditions interlink with the health status of men together with social influences and economic opportunities (e.g. Courtenay, 2000; Ferrer et al, 2005; Koskinen et al, 2007; Lohan, 2007; Takeda et al, 2004). Russia has a unique combination of these factors, which can contribute to men's health disadvantage. During the economic changes with financial problems and expensive living costs in the 1990s, the complexity of Russian living arrangements was characterised with a growth in the proportion of intergenerational households to 30% and remains the same in contemporary Russia together with an increased share of adults living alone (Ovcharova & Prokofieva, 2009; Prokofieva, 2015).

Russia is a unique case of poor men's health and high proportion of intergenerational households living in a small living space in comparison to the West (Ovcharova & Prokofieva, 2009). We argue that living arrangements can play an important role in the health status of Russian men. The main research question of this study is whether living arrangements and partnership status are significantly associated with men's health status in contemporary Russia. This paper presents a cross-sectional analysis based on three research questions, where each of them shows different aspects of living arrangements: 1)

Are unpartnered men less likely to report good health status comparing to partnered men in Russia? 2) Are unpartnered men living alone less likely to report good health status comparing to all other men in Russia? 3) Are unpartnered men living in intergenerational households less likely to report good health status comparing to partnered men living in intergenerational households and comparing to all other men in Russia? We use the Russian Monitoring Longitudinal Survey (RLMS) to fill the gap in the Russian research on men's health and living arrangements. We need to disentangle the basic relationship between these two phenomena acknowledging the social selection effect.

Theoretical Background

Family and health

Family is one of the most important determinants of men's health: family members can provide emotional and instrumental support for men and affect their health behaviours through social control (Lohan, 2007; Umberson, 1987; Umberson et al, 2010). The majority of studies on family structure and health of adults show a significant contribution of family to men's health (e.g. Ferrer et al, 2005; Takeda et al, 2004; Turagabeci et al, 2007), although some scholars find a small impact of family structure on individual's health across the life course (e.g. Power et al, 1998). Individuals share their life experiences and trajectories within a family, where multiple socio-economic disadvantages accumulate over time and have a negative effect on men's health behaviours diminishing their health (Williams, 2003; Shapiro & Cooney, 2007). Adults at different life-stages transition to various types of living arrangements (living alone, with parents, in a nuclear family, with an adult child, etc.). In relation to social support and family-related stress, living with a partner, child, parent or grandparent as the closest relatives can influence on individual's health behaviour and increase the risk of reporting the same diseases at different life stages due to shared

environmental and risk factors (Brenn, 1997; Di Castelnuovo et al, 2009; Hippisley-Cox et al, 2002; Hippisley-Cox & Pringle, 1998). These findings highlight the importance of analysing the relationships between individual's health and family structure.

The Russian case

Researchers have found that the sharp decrease in male life expectancy in Russia from its highest in the 20th century of 69.6 years in 1990 to the lowest of 57.5 years in 1994 (FSSS, 2015) was associated with both poor healthy behaviours and family disruption, particularly among working-age men (Cockerham, 2000; Saburova et al, 2011). Heavy drinking among working-age Russian men led to a high level of cardiovascular diseases and premature deaths since the regime collapse (Leon et al, 2009; Zaridze et al, 2014), often related to family conflicts and high divorce rates (Keenan et al, 2011; 2013). In the 1990s, premature alcohol-related mortality in Russia was higher among unmarried and working-class men (Cockerham, 2000; Pridemore et al, 2010).

One of the mechanisms operating between cumulative disadvantages in family and health-related behaviour over the life course is stress and a lack of social support (Umberson et al, 2010). This was also the case for Russian working-age men due to the high unemployment rate in the 1990s (Cockerham, 1999; Pietilä & Rytkönen, 2008). Changes in the Russian economic regime brought not only stress but also the high level of men's social exclusion within families (Ashwin & Lytkina, 2004) causing an increase in alcohol consumption among men who felt they were 'breadwinner failures' being unable to provide for family (Kay & Kostenko, 2006). As a result, family relationships had a significant effect on the health of both spouses in Russia in terms of their family processes in decision-making, labour participation and work-family balance (Cubbins & Szaflarski, 2001). Taken together, literature on men's health and family in Russia underlines the importance of family for men's health showing that this relationship can exist in both directions.

Partnership status

Social science widely established the protective effect of marriage and cohabitation on an individual's health (Waite & Gallagher, 2002). This association is especially strong for men (Gove, 1973; Ben-Shlomo et al, 1993). Applying the life course approach to longitudinal data, Williams & Umberson (2004) find a significant influence of transitions into marriage on men's health status, as opposed to women. Partners tend to be a primary source of emotional support and social control of health behaviours for men even more than for women and losing a spouse is associated for men with worse health lifestyle (Kiecolt-Glaser & Newton 2001; Robles & Kiecolt-Glaser, 2003; Umberson, 1992). Recent studies show that both married and cohabiting men have lower mortality rate in comparison to unpartnered men, especially among working-age men (e.g. Koskinen et al, 2007). Hughes & Waite (2002) found that living with a partner as a couple only or with children has the most protective effect against ill-health among middle-aged men, whilst the effect is reversed for unpartnered men in other types of family structure.

Based on our first research question, we expect that unpartnered men are more disadvantaged in terms of their health status in comparison to partnered men in Russia. Although most of the Russian studies on men's health behaviours and outcomes did not show a significantly protective effect of living with a spouse (e.g. Bobak et al, 1998; Cockerham, 1999; Jukkala et al, 2008), other scholars find that marital status together with socio-economic class of Russian men plays an important protective role against premature male alcohol-related mortality (Pridemore et al, 2010). In association with unemployment, lower social class, lower educational level and less social support (Plavinski et al, 2003; McKee & Shkolnikov, 2001), unmarried Russian men were at higher risk of premature mortality even during the Soviet era (Watson, 1995). After the collapse of the Soviet Union, working-age married men were less likely to die from circulatory diseases compared to unmarried men if

they were economically active and had higher education (Shkolnikov et al, 2004). These findings show the importance of partnership status for men's health in Russia, particularly taking into account their economic disadvantage. In relation to this, the analysis will also investigate the effect of family income as an objective measure of household's economic well-being on the relationship between living arrangements and men's health in Russia.

The established effect of marital transitions on individual's health can have a reverse relationship, where adults with poorer health behaviours and outcomes are more likely to stay unpartnered or transition to separation and divorce (Robards et al, 2012). The health-related selection effect can play an important role in the distribution of men by age and household structure, where middle-aged adults living alone can be especially vulnerable to multiple partnership dissolutions in terms of their mental well-being (Demey et al, 2013; 2014). This could be explained by social selection among adults, where those with poor relationship skills and low socio-economic status are more likely to have multiple marital transitions and less likely to have frequent social contacts with family members (Shapiro, 2012). Previous studies on family and health show the importance of a careful interpretation of the relationships between living arrangements and men's health, where social selection can reverse the direction of causality.

Living alone

One of the important changes in family patterns of the Western societies during the Second Demographic Transition was an increase in the proportion of adults living alone. For example, among young adults in some European countries and the United Kingdom, the increased popularity of one-person households was related to a rise in divorces and postponement of marriage, but was mostly pronounced among young adults of a higher social level (Hall et al, 1997). Among those countries, an increasing proportion of older population living alone was found to be related to several factors, among which are not only economic

opportunities and social norms, but also a possible ability of older people to live separately from family members due to an improvement in their health status (Grundy, 2001).

Here, it is important to acknowledge the possible effect of social and health selection on the decision of an individual to live alone together with gender differences, where men tend to live alone less than women do (Grundy, 2001). On the example of the United Kingdom, recent studies show that young men are more likely to live with parents compared to women due to economic disadvantage (Stone et al, 2011). Middle-aged men living alone in Britain are especially vulnerable in terms of socio-economic resources and health status if they are childless, low educated and economically inactive (Falkingham et al, 2012; Demey et al, 2013). Moreover, marriage plays an important role in the association between living alone and adult health; for instance, unmarried older adults are more likely to live alone if they report better health and less long-term illnesses comparing to those moving to live with others (Young & Grundy, 2009).

The regime collapse in 1992 postponed a shift towards a solo living family pattern in Russia later than in the developed countries. In the beginning of the 2000s, the proportion of one-person households started to increase from 22% in 2002 to 26% in 2010 (FSSS, 2001-2013). However, the distribution of family members by the household size in Russia is uneven between men and women as was found in other Western societies. Russian men are less likely to live alone than women, where among adults aged 18 years old and over only 9% of men live alone in comparison to 14% of women living in a unpartnered-person household in Russia (FSSS, 2001-2013). Moreover, the proportion of Russian men living alone increases with age up to 15% among men aged 65 years old and over, but still remains lower than for women (FSSS, 2001-2013). Yet, none of the Russian studies have focused on the mechanisms operating behind the possible association between solo living and health of Russian men. Mortality studies related to living arrangements in different countries show that

working-age men especially differ in their health by living arrangements compared to women, where men living alone are the most disadvantaged group in comparison to married men and unmarried men living with others (e.g. Koskinen et al, 2007). A recent study of adult men in Russia and the eight other post-UUSR countries shows that solitary drinking is associated with middle-aged and older unpartnered men living alone in a bad financial situation, as well as with less social support and poor health status (Stickley et al, 2015). Hence, in our second research question we expect that unpartnered Russian men living alone are the most disadvantaged group in terms of their health status in comparison to all other men in Russia. However, we acknowledge that social selection can affect the direction of this relationship where men can live alone due to poor health or vice versa.

Intergenerational families

Historically, the development of the family systems differs across Europe, where 'St. Petersburg – Trieste' line implemented by John Hajnal (1953, 1965) divides the European continent by East – West countries based on the differences in marriage and fertility patterns. In contrast to later marriages and fertility postponement in the Western part from Hajnal's line (Western and Northern Europe), the tendency to live in multigenerational households characterises the Eastern part (Southern and Eastern Europe) together with stronger family ties and intergenerational support (Daatland et al, 2011; Reher, 1998). In the Russian Empire in the nineteenth century, the average household size among serfs tended to be over nine people, who were usually children and other relatives like grandparents (Hajnal, 1982). In contemporary Russia, the average size of a family consisting of minimum two individuals is 3.1 people per household, where 66% of adult men live with two or more (FSSS, 2001-2013). Moreover, 23% of families in Russia consist of four or more people, where one third of these households live in a dwelling with only two living rooms (FSSS, 2001-2013). Based on the 2010 Russian Census, one third of Russian families are still intergenerational households

(FSSS, 2001-2013; 2015). Russia has a much higher proportion of intergenerational households in comparison to the West, e.g. only 1.1% in the United Kingdom (ONS, 2015).

Many scholars point at the importance of parental support and extended family for men's health as the most important resource of social control (Robertson, 2007; Turagabeci et al, 2007). However, studies show that living in a nuclear family is more beneficial for men's health than an extended family (Denton & Walters, 2004) and men's quality of life and healthy lifestyles can be worsened by bigger family size and more than two generations in a family (Takeda et al, 2004). The quality of marital and intergenerational ties and their changes can be one of the mechanisms operating behind the relationship between intergenerational living arrangements and men's health. For example, less cooperation in intergenerational relationships (parents or adult children) was found among those adults who had two or more marriages or cohabitations (Shapiro, 2012). Divorce plays an important role for intergenerational relationships, particularly its timing (Shapiro & Cooney, 2007). In addition, men's health disadvantage living in intergenerational families can be mediated by socio-economic status of family members: for example, in Russia intergenerational households were associated with lower educational level of family members in comparison to nuclear families and adults living alone (Prokofieva, 2015). Negative associations between intergenerational living arrangements and men's health in Russia can be related to the stress caused by the small physical household size and financial burden. Drawing on the lack of studies on the possible relationship between living in an extended family and poor men's health in Russia, in the third research question of this paper we expect that being unpartnered and living in an intergenerational household is associated with poorer health among Russian men after taking into account their demographic, socio-economic and family characteristics.

Data and methods

Data source and analysis sample

The analysis of the relationship between living arrangements and men's health is based on the cross-sectional sample of the 22nd round (2013-2014) of the Russian Longitudinal Monitoring Survey (RLMS) (Higher School of Economics et al, 1992 – present). The RLMS is a unique annual survey in Russia, which covers social, economic and health aspects of the Russian population. The RLMS is based on a multi-stage probability sample with stratification with followed-up (panel) and representative (cross-sectional) samples; full description of the RLMS sampling design can be accessed on the official web-site (http://www.cpc.unc.edu/ projects/rlms-hse).

We included in our study those men who were aged 18 years and older and whose reports on partnership (whether marital or cohabiting) status matched between individual and household datasets of the RLMS 2013-2014 survey. We consider a man as an adult if his age is 18 years or older due to the start of the official age of mandatory conscription of men in the Russian Federation. From the original sample (21,753 individuals in 8149 households), we pulled out 7,525 adult men aged 18 years old or over, and then we excluded 539 men whose reports on partnership status did not match between individual and household datasets. From the remaining sample of 6,986 men, we excluded 85 men with missing information in the main health outcome of this study, a unpartnered question on men's current self-rated health (SRH) status. Due to the definition of minors as being aged 16 years old or younger and not being related to a man as a partner in this study, we also excluded one man who did not meet our criteria due to living with a partner aged 16 years old. For the cross-sectional analysis on the population level, final weighted sample of the study consisted of 5,168 men[1].

Dependent variable: self-rated health status

[1] After applying individual post-stratified weights, the study sample lost 1,732 men due to zero p-weights. See the Methodology section for more details on the construction of the RLMS p-weights.

For the assessment of men's health in Russia, we used a measure of self-rated health (SRH) status previously recognised as a strong predictor of mortality (Idler & Benyamini, 1997). A unpartnered question 'How would you evaluate your health?' was based on the 5-point Likert scale from 'very poor' to 'very good'. We re-constructed SRH status from 5 to 3 categories due to a low proportion of men who reported 'very good' or 'very bad' SRH status stratified by age (Appendix 1) and because of the result of the model-selection statistics[2] based on two ordinal models using the original and recoded 'SRH status' variables. The new variable of SRH status consisted of 2,895 (42%) adult men who reported 'very good/good' health status, 3,330 (48%) adult men who reported 'average' health status and 675 (10%) adult men who reported 'bad/very bad' health status.

Main independent variables: living arrangements and partnership status

To answer three research questions in this study, we stratify adult men by living arrangements and partnership status in three separate models as 'unpartnered vs partnered men', 'unpartnered men living alone vs all others', and 'unpartnered men living in intergenerational households vs partnered men living in intergenerational households vs all others'. The main source of information on living arrangements and partnership status is the household roster with the number of family members and types of relationships between them. All of the groups of men's living arrangements can include men living with at least one minor as well. In this study, we define a minor as a household member aged 16 years old or younger. The definition of an intergenerational household in the study includes men who are living in the same household with at least one parent or grandparent or adult child.[3] However, we do not count parents-in-law or children-in-law in the definition of an intergenerational household.

[2] Both the Akaike information criterion (AIC) and Bayesian information criterion (BIC) point to the model with 3-categorical 'self-rated health status' health outcome as the best-fitting model.

[3] We do not distinguish between biological- and step-parents/ grandparents/ children due to a very low count of the latter relationships.

Table 1. Distribution of 5,168 men aged 18 years and over by three covariates of living arrangements in relation to three research questions, RLMS 2013-2014

Research questions	**Living arrangements**			
	Grouped by	Categories of men	N of men	%, weighted
Are unpartnered men less likely to report good health status comparing to partnered men?	Partnership status	Unpartnered	1,394	28.2
		Partnered	3,774	71.8
Are unpartnered men living alone less likely to report good health status comparing to all other men?	Unpartnered living alone or not	Yes	265	5.0
		No (others)	4,903	95.0
Are unpartnered men living in intergenerational households less likely to report good health status comparing to partnered men living in intergenerational households and comparing to all other men?	Living in an intergenera-tional household or not	Yes, unpartnered	1,039	21.5
		Yes, partnered	1,377	26.4
		No (others)	2,752	52.2

Table 1 shows the descriptive statistics for each of three research questions. In the RLMS 2013-2014 as well as on the population level of Russia, the proportion of partnered adult men is as twice big as the proportion of unpartnered men. Only 5% of adult men are living alone and have no partner (can live with minors aged 16 years old or younger). Almost a half of adult men are living in intergenerational households, among whom about 45% of men are unpartnered. In other words, one fifth of adult men in Russia are living without a partner in intergenerational households (21.5%), whereas more than a quarter of men are living with a partner in intergenerational households (26.4%).

Additional covariates

In this study of the association between men's health and living arrangements in Russia, we control for both individual (demographic and socio-economic) and household (family and residential) characteristics. Based on the previous studies, we assume that demographic (age, nationality, and previous marital status), socio-economic (education, economic activity, and army service), and family and residential (region, settlement type, wealth quintile, number of minors, and physical household size) characteristics of men in Russia could potentially mediate or confound the association between men's health and living arrangements.

Demographic characteristics: for the regression analysis based on three research questions in this study, three age splines were constructed in Stata14 using '*mkspline*' option in Stata13 (StataCorp., 2013) to estimate the association between self-rated health status and age of adult men as a piecewise linear function. Among available options of the number and age-points of knots, a model with two knots at age of 27 and 70 years old had the best model-fit across three research questions with the lowest AIC and BIC. Men's nationality is represented by a dichotomous variable with categories of being Russian or another nationality. A dichotomous variable describes whether each man has ever been previously married, where two categories of 'never married' and 'first marriage' marital statuses were merged in to a new category of men who 'have never been previously married' and other four categories of the marital status ('second marriage', 'divorced', 'widower' and 'married, but do not live together') were merged in the second category 'have been previously married'.

Socio-economic characteristics: in order to avoid low counts in original categories, the covariate of the highest educational level is reduced from twelve to six categories. Four categories are kept unmerged, which are 'general or incomplete secondary school (SS)', 'complete SS', 'professional courses (of driving, tractor driving, accounting, typing, etc.)',

and ‘college/training school’. Two categories of ‘vocational training school (VTS) without secondary education (SE)’ and ‘VTS with SE, technical trade school (TTS)’ are merged together as a new category of ‘VTS with or without SE / TTS’. A new category of ‘higher education’ is defined by merging together categories related to the educational level of an Institute, University or Academy including men with a ‘Specialist Diploma’ and less than 1% in each category of a ‘Bachelor’s degree’, ‘Master’s degree’, ‘Post-Graduate course, residency’, ‘PhD degree’ and ‘Doctoral degree’. Men’s economic activity status is based on the question about individual’s primary work at present and indicates those men who were ‘currently working’ and ‘currently not working or on (un)paid leave’ (34%). A dichotomous question ‘Have you been in mandatory army service?’ with answers ‘yes’ and ‘no’ indicates that 60% of adult men from the study sample have already served in the army in Russia.

Family characteristics: for the purposes of the analysis, several main regions of Russia were merged together based on similarities of some regions by the distribution of self-rated health status and family wealth quintiles of adult men in the study sample. Five geographical regions of Russia are presented in this study: Moscow and St. Petersburg (10%), Central, North and North-West (24%), Volga and Ural (32%), North Caucasus (15%), and Siberia and Far East (19%). In addition to geographical regions, a three-categorical variable of settlement types divides men by ‘urban’, ‘pgt’ (‘poselok gorodskogo tipa’, meaning a town with a population size falling between urban and rural criteria) and ‘rural’ areas of Russia. We classify adult men by their family income ‘What was the monetary income of your entire family in the last 30 days?’ including all the types of income (e.g. wage, pension, incidental earnings, etc.). We apply *the OECD (Organisation for Economic Co-operation and Development)-modified scale* to our sample calculating family income *per capita* and dividing the sample in quintiles according to Hagenaars et al (1996), where the household head (in our study, one adult man) is assigned with a value of 1, any additional family

member – with a value of 0.5 and each child (in this study, a minor) – a value of 0.3. Physical household size is a number of family members (including adult men) divided by the total number of living rooms in a dwelling (excluding kitchen, bathroom, etc.). We categorise the calculated variable by 'undercrowded/normal' and 'overcrowded' physical household sizes if the value of the variable is less/equal or higher than '1', respectively. We consider any family member (relative or not, except a partner) as a minor if he/she is aged 16 years old or less and lives in the same household together with an adult man from our final sample. [4]Using the household information on the relationship types and age of each family member, we divide men by those who have 'no minors' (55%), '1 minor' (28%) and '2 or more minors' (17%).

Methodology

Researchers use a measure of self-rated health (SRH) status as a dichotomous, categorical or continuous variable in statistical analysis. Although there are more scholars who find it more practical to analyse SRH status as a binary variable, as well as those using the RLMS data (e.g. Perlman & Bobak, 2008; Rusinova & Safronov, 2013), there is an evidence of its association with loss of analysis's efficiency and information on health (Manor et al, 2000). Testing an ordinal nature of SRH status to choose between an ordinal and nominal logistic regression modelling, the study sample did not meet criteria of a proportionality assumption. Hence, we apply a nominal logistic regression modelling with 95% confidence intervals separately for three research questions of this study. The likelihood of reporting 'bad/very bad' or 'good/very good' health status versus 'average' (reference) category was predicted in several steps by a series of demographic, socio-economic and family covariates. To include residual confounding acknowledging the possibility of having over-adjusted or obscured association between self-rated health status and living

[4] Although we consider men as adults if they are aged 18 years old or over, we do not apply the same rule for their family members to avoid any misreports due to the inclusion of two adult men with a partner aged between 17 and 18 years old in our final sample.

arrangements, in this study we adjust the association for the additional covariates using a stepwise technique interpreting the results with an extra care.

We apply *Chi-square* test in the descriptive analysis of the univariate tabulations between SRH status and independent variables to test the significance level of their association with 95% confidence intervals. To account for clustering of adult men within households in our sample, we estimate robust standard errors using the '*vse(cluster)'* option in the command of nominal regression modelling '*mlogit'* in Stata13 (StataCorp., 2013). To generalise the results of this study on the population level, we apply weights to account for post-stratification of men by age and geographical regions of Russia in the RLMS 2013-2014[5].

Under the missing at random (MAR) assumption, we apply the multiple imputation (MI) procedure using chained equations (White et al, 2011) for the missing values in the 'family wealth quintiles' covariate (4%), as well as in the covariates of nationality, education, economic activity, army service and physical household size (all less than 1%). We use the *'mi impute chained'* command in Stata13 (StataCorp., 2013). In MI my chained equations, the Rubin's rules requires to meet the assumption of asymptotic normality assumption (White et al, 2010), which is implied in the regression analysis based on categorical variables in this study. MI is an important procedure to test whether there is a reduction of the estimates' power in modelling the relationship between self-rated health status and living arrangements when all of the missing values are excluded from the study sample. In general, the purpose of implementing the MI procedure was reinforced by biased estimates in the association between living arrangements and self-rated health when all the missing values were excluded in the sample in comparison to MI results.

[5] The RLMS consists of two samples – cross-sectional (representing the population of Russia) and panel (with followed-up individuals and households). The RLMS team provides post-stratified weights only for the cross-sectional sample with intention to show researchers which part of the sample is representative on the population level, where zero weights indicate those individuals who dropped out from the representative sample and only followed in the panel sample (Higher School of Economics et al, 1994 – present).

Descriptive analysis

Our aim was to assess whether men's self-rated health (SRH) status in Russia would differ by their partnership status, living alone status, and living in intergenerational households by partnership status. Overall, weighted cross-tabulations between SRH status and living arrangements in Table 2 show that more than a half of unpartnered men in Russia were likely to report 'good/very good' SRH status (52.1%) with almost the same figure for partnered men reporting 'average' SRH status (51.3%). Unpartnered men living alone were two times more likely to report 'very bad/bad' SRH status in comparison to men from other types of living arrangements (20.2% comparing to 9.3% respectively); however, unpartnered men living alone did not differ from all of other men in reporting 'average' SRH status (47.5% - 47.7%). Living in an intergenerational household, more than a half of unpartnered men were likely to report 'good/very good' SRH status (57.5%), which was around 20% more in comparison to partnered men (38.4%) living in intergenerational households and those men living in other types of households (38.3%).

Table 2. The distribution of self-rated health status by living arrangements for 5,168 men aged 18 years and over, RLMS 2013-2014, weighted %

Living Arrangements	Self-Rated Health (SRH) status						Total	
	Very bad/bad		Average		Good/very good			
	N	%	N	%	N	%	N	%
Partnership status								
Unpartnered	141	*9.3*	546	*38.5*	707	*52.1*	**1,720**	*100*
Partnered	417	*10.0*	1,957	*51.3*	1,400	*38.7*	**5,180**	*100*
Unpartnered living alone status								
Yes	57	*20.2*	128	*47.5*	80	*32.3*	**265**	*100*
No (others)	501	*9.3*	2,375	*47.7*	2,027	*43.0*	**4,903**	*100*
Living in intergenerational households and partnership status								
Yes, unpartnered	66	*6.1*	383	*36.4*	590	*57.5*	**1,039**	*100*
Yes, partnered	144	*9.8*	717	*51.8*	516	*38.4*	**1,377**	*100*
No (others)	348	*11.4*	1,403	*50.3*	1,001	*38.3*	**2,752**	*100*
Total	**558**	***9.8***	**2,503**	***47.7***	**2,107**	***42.5***	**5,168**	***100***

Note: all three variables of living arrangements are significantly associated with SRH status at the 0.001 significance level.

Appendix 2 shows the significant univariate associations of men's SRH status with all of other covariates on the population level of Russia including the missing values. Confirming the decrease in men's health status with age, middle-aged and older men in Russia had a similar pattern of reporting the 'average' health status (58-59%). By nationality, Russian men were less likely to report 'good/very good' health status in comparison to other men of other nationalities (10% points difference), but both nationality groups had the same percentage of reporting the worst health status (10%). Have never been previously married was associated with better health status among men in Russia, where previously married men were almost twice as likely to report the worst health status. Interestingly, more than 42% in both groups of men with a lower education (general, incomplete or complete SS) and higher education (technical training school, college or higher) were more likely to report 'good/very good' health status. Being economically active was associated with 7 times lower likelihood of reporting 'very bad/bad' health status among men in Russia. Men who had never served in the army were the most likely group to report 'good/very good' health status. Men from North Caucasus tended to be the healthiest group across other regions in Russia, where men had almost the same likelihood of reporting the worst health status. Men living in the PGT settlement type had 10% points higher reports towards better health status in comparison to both urban and rural areas which had almost the same pattern of reporting SRH status. Men with 'good/very good' health status tended to be most of all not only from the 4^{th} and 5^{th} wealth quintiles in Russia, but also surprisingly from the lowest (1^{st}) wealth quintile. Having at least one minor in the household was associated with better SRH status among men in Russia. Opposite to our expectations, living in overcrowded dwellings was associated with better SRH status among adult men in Russia.

Regression analyses

To analyse the relationship between men's self-rated health (SRH) status and living arrangements in Russia, we conducted a regression modelling based on multiple imputation (MI) separately for each of three research questions (see complete-case models in Appendix 3 and the comparison to MI models in Appendices 4 and 5). Table 3 (next page) presents the relative risk ratios with robust standard errors of reporting worse or better health status in comparison to the 'average' SRH status among adult men in Russia. In addition, interaction terms between living arrangements and family wealth quintiles were included in each regression model of three research questions with an aim to find a difference in the relationship between men's self-rated health status and living arrangements across five wealth quintiles.

In general, baseline nominal models of the bivariate relationship between living arrangements and self-rated health for each research question show that adult men in Russia significantly differ by their living arrangements and partnership status in reporting of their self-rated health status. For the first research question, the results show that partnered men are significantly less likely to report 'good/very good' and 'bad/very bad' health statuses (versus 'average') than unpartnered men at the 99% and 90% significance levels, respectively. For the second research question, unpartnered men living alone are significantly less likely to report 'very bad/bad' health status and more likely to report 'good/very good' health status (both versus 'average') than other men at the 99% and 90% significance levels, respectively. For the third research question, partnered men living in intergenerational households and other men (from other types of living arrangements) are significantly less likely to report 'good/very good' health status (versus 'average') comparing to unpartnered men living in intergenerational households at the 99% significance level. In addition, other men are

significantly more likely to report ‘bad/very bad’ health status (versus ‘average’) comparing to unpartnered men from intergenerational households at the 95% significance level.

Table 3. Results of Multinomial Logistic Regression based on multiply imputed (MI) data, Self-Rated Health (SRH) status of adult men in Russia, RLMS 2013-2014, weighted and clustered within households sample of 5,168 adult men

Living arrangements by three research questions in the study	Model 1 (bivariate) *no MI required		Model 2: Model 1 + demographic char-s		Model 3: Model 2 + socio-economic char-s		Model 4: Model 3 + family char-s		Model 5: Model 4 + interaction	
	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good
Research question 1: Partnership status (ref: unpartnered)										
Partnered	0.84	0.55***	0.49***	1.26*	0.72*	1.19	0.76	1.09		
	(0.09)	*(0.04)*	*(0.07)*	*(0.11)*	*(0.11)*	*(0.11)*	*(0.12)*	*(0.11)*		
Research question 2: Unpartnered living alone status (ref: Yes)										
No, others	0.46***	1.33	0.75	1.02	0.80	1.00	0.73	1.00		
	(0.08)	*(0.20)*	*(0.16)*	*(0.17)*	*(0.16)*	*(0.17)*	*(0.16)*	*(0.16)*		
Research question 3: Living in intergenerational households & partnership status (ref: Yes, unpartnered)										
Yes, partnered	1.14	0.47***	0.50***	1.48***	0.87	1.41**	0.97	1.32	0.98	0.91
	(0.18)	*(0.04)*	*(0.10)*	*(0.17)*	*(0.17)*	*(0.16)*	*(0.20)*	*(0.16)*	*(0.29)*	*(0.19)*
No, others	1.36*	0.48***	0.52***	1.22	0.81	1.17	0.91	1.06	0.85	1.11
	(0.20)	*(0.04)*	*(0.10)*	*(0.13)*	*(0.15)*	*(0.12)*	*(0.17)*	*(0.12)*	*(0.26)*	*(0.22)*
Interaction between 'Living in intergenerational households' (ref: 'Yes, unpartnered') and 'family wealth quintiles' (ref: '1st quintile'):										
Yes, partnered # 2nd Quintile									0.92	1.62
									(0.43)	*(0.44)*
Yes, partnered # 3rd Quintile									0.84	1.73
									(0.44)	*(0.52)*
Yes, partnered # 4th Quintile									0.82	1.16
									(0.58)	*(0.36)*
Yes, partnered # 5th Quintile									4.00	2.63*
									(3.84)	*(1.02)*
No, others # 2nd Quintile									1.10	1.02
									(0.51)	*(0.27)*
No, others # 3rd Quintile									0.92	1.11
									(0.46)	*(0.31)*
No, others # 4th Quintile									1.00	0.72
									(0.66)	*(0.22)*
No, others # 5th Quintile									3.33	1.37
									(3.05)	*(0.49)*

Notes: Total N (obs) = 5,168;

Reference category for the equations is 'Average Self-Rated Health status';

Robust standard errors in italic parentheses;

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

The total number of observations is smaller than the original sample of the study due to the post-stratified individual weights, where 1,732 individuals were not included in the representative sample (their 'pweights' were equal zero);

Full results of the models available on request.

After controlling for demographic covariates of age, nationality and previous marital status (Model 2), the significance of the association between self-rated health status and living arrangements disappears only between unpartnered men living alone and others in the second research question. In the first and third research questions, adjusting for demographic characteristics makes the 95% confidence intervals smaller showing the significant difference between unpartnered and partnered men in the probability of reporting 'bad/very bad' health status (versus 'average') at the 99% significance level. In addition, due to the inclusion of age splines the direction of the significant association in reporting 'good/very good' health status reverses from negative to positive in the models for the first and third research questions.

Additional adjusting for socio-economic covariates (education, economic activity and army service) in Model 3 changes the pattern of association in both research questions (but insignificance remains in the second research question). Firstly, relative risk ratios (RRRs) of reporting 'bad/very bad' or 'good/very good' versus 'average' self-rated health status start to get closer towards the value of 1.00 in both cases for partnered men in comparison to unpartnered men in general (research question 1) and particularly living in intergenerational households (research question 3). Model 3 for the first research question still indicates that partnered men are significantly less likely to report 'bad/very bad' versus 'average' health status in comparison to unpartnered men, but the level of significance changes from 99% to 95% and the RRR raises by 33% from 0.485 to 0.719. In relation to the RRR of reporting 'good/very good' versus 'average' health status among partnered versus unpartnered men, the 95% confidence intervals get bigger and partnered men are significantly more likely to report better than average health status only at the 90% significance level. For

partnered men living in intergenerational households, RRR remains at the level of 1.4 (was 1.5 in Model 2) with 99% significance level. However, controlling for both demographic and socioeconomic covariates eliminates the significance ($p>0.1$) of the difference between unpartnered and partnered men living in intergenerational households in reporting 'good/very good' health status as well as other men in reporting both categories of self-rated health status.

Adjusting for family characteristics (geographical region, settlement type, wealth quintile, physical household size and number of minors) together with demographic and socio-economic covariates eliminates the significance of the association between living arrangements and self-rated health status of men in Russia at the 95% level in each of three research questions (Model 4). However, with the 90% significance level partnered men remain to be significantly less likely (RRR=0.8) to report 'bad/very bad' versus 'average' self-rated health status in comparison to unpartnered men in the first research question.

Self-rated health and other covariates

In the fully adjusted and multiply imputed models for each research question (Model 4), adult men are significantly different in reporting self-rated health by age, nationality, education, economic activity, army service, geographical regions, settlement types, family wealth quintiles and number of minors in households at the 95% significance level. Two covariates indicating the status of being previously married and a physical household size are not significantly associated with self-rated health of adult men in Russia in all of the models of three research questions. To summarise, 'bad/very bad' health status of adult men in Russia is associated with being older, having the lowest education level (general or incomplete), economically inactive, have never being in army, living in urban area and having no minors in a household. As for 'good/very good' health status, reporting better than 'average' health status for adult men in Russia is associated with being younger, being of

another than Russian nationality, having lower educational level, attending an army, living in North Caucasus, in PGT or rural settlement types as well as being in the 4th or 5th (highest) wealth quintiles.

Family wealth quintiles and their interactions with living arrangements

Interactions between living arrangements and family wealth quintiles are significant only in the third research question, where the effect of family wealth on self-rated health status is significantly different at the 95% level between those unpartnered and partnered men who live in intergenerational households and are from the 5th (highest) quintile. In other words, the effect of being in the 5th (highest) wealth quintile for partnered men is 2.63 times that for unpartnered men in reporting 'good/very good' versus 'average' self-rated health status (p-value=0.012) among men living in intergenerational families. After including interaction terms between living arrangements and family wealth quintiles in the third research question using multiple imputation, there is no longer a significant association between the 4th and 5th (highest) wealth quintile and 'good/very good' versus 'average' self-rated health status at the 95% level.

Discussion

Few studies have investigated how living arrangements may affect health of men in Russia, especially by partnership status. However, most of the health-related studies in Russia only control for the marital status and family structure of adults (e.g. Bobak et al, 2008) or examine the link between the quality of family ties and adult's health (e.g. Kravchenko et al, 2015). We argue that living arrangements and partnership status can play an important role in the health of Russian men. Russia is a unique case in comparison to the West, with very high divorce rates leading to more unpartnered men, but also a high proportion of men living in intergenerational households, often in very small spaces (Prokofieva, 2015). This leads us to question whether unpartnered men would be better off living in their intergenerational families (with parents/grandparents/adult children) or living alone.

This study investigates three research questions in relation to the association between men's health and living arrangements by partnership status in Russia. First, we test whether unpartnered men have higher risk of reporting poor self-rated health status than partnered men. Second, we assume that unpartnered men living alone report to be less healthy than other men in Russia. Finally, we argue that living in intergenerational households (especially being unpartnered) is associated for men with poorer self-rated health status than other men. Several nominal logistic regression models were estimated separately for each research question.

In general, the adjusted results in this study show that the relationship between men's self-rated health status and living arrangements by partnership status remains with demographic and socio-economic characteristics and disappears after controlling for family covariates. In addition, both fully adjusted and reduced models show no statistically significant difference in self-rated health status between unpartnered men living alone and other men. However, inclusion of interactions between family wealth quintiles and living

arrangements shows that among those living in intergenerational households and being from the highest wealth quintile partnered men are more than 2 times at higher risk of reporting good versus average health status comparing to unpartnered men.

In Russia, previous studies on the link between partnership or marital status and health of men shows contrasting results. On the one hand, self-rated health status as subjective measure of health was not found to be significantly associated with marital status of men (Cockerham, 1999), which was contrary to the association between poor physical functioning and being unpartnered or divorced among men (Bobak et al, 1998). On the other hand, mortality-related studies in Russia show that the risk of death among working-age men is significantly different by educational level, wealth and marital status taken together (Cockerham, 2000; Pridemore et al, 2010; Pridemore & Shkolnikov, 2004; Shkolnikov et al, 1998). Moreover, no differences were found in the Russian male mortality risks and self-rated health status between married and cohabiting men (Pridemore et al, 2010; Ferlander & Mäkinen, 2004). Taking into account only demographic and socio-economic characteristics in the reduced model, this study supports the findings by Pridemore et al (2010) showing a directly protective effect of partnership status for men's health. However, fully adjusted results in this study show that inclusion of variation in men's health status by family wealth quintiles and other household characteristics provides some explanation of the health differences by partnership status among men in Russia by attenuating this significant relationship showed in reduced models. Hence, it can be assumed that only specific groups of partnered and unpartnered men are significantly different in the risk of reporting worse or better health status.

Western studies have shown that unpartnered men living alone are at the highest risk of death and being unhealthy if to compare to other groups of men by living arrangements (Falkingham et al, 2012; Koskinen et al, 2007; Young & Grundy, 2009). In this study, the

results for the second research question do not support the expectations from the literature showing no significant difference between unpartnered men living alone and other men by their self-rated health status in Russia in all fully adjusted and reduced models except the binary relationship. Previous findings (Falkingham et al, 2012; Demey at al, 2013) suggest that poor health status of unpartnered men living alone in comparison to other men can be related to their socio-economic disadvantages and life-course stages like having a low education, being unemployment and middle-aged. At the same time, other studies show that being older and living alone is associated for adults with better health (Grundy, 2001; Young & Grundy, 2009). The results in this study suggest that the risk of reporting poor health status among unpartnered men living alone in Russia could be explained by the associations between self-rated health, living arrangements and demographic characteristics. This is related to the significant bivariate relationship between living arrangements and self-rated health status which disappears after controlling for demographic characteristics in the model for unpartnered men living alone.

Moving to the third research question, the results for adult men from intergenerational households by partnership status show similar results to the first research question. Although previous studies in Japan have shown that living with parents or adult children is associated with better health outcomes (Takeda et al, 2004; Turagabeci et al, 2007), reduced models in this study suggest that partnership status is an important predictor of health status among men living in intergenerational households. Opposite to the results in the second research question based on the reduced model, unpartnered men living in intergenerational households turn to be the most disadvantaged group in their self-rated health status in comparison to both partnered men from intergenerational households and men from other types of living arrangements. However, fully adjusted model suggests that intergenerational living arrangements by partnership status are significantly related to men's

health status not on its own, but through the effect of socio-economic and household-level differences in health status of men in Russia. Indeed, Russian findings show that intergenerational households are associated with lower educational level among adults within families in comparison to other types of family structure (Prokofieva, 2015). In addition to previous findings, this study suggests that socio-economic and family characteristics drive the difference in health status between unpartnered and partnered men across intergenerational households. The same explanation can be applied to self-rated health status of men divided by partnership status in general.

To our knowledge, this study is the first in Russia to attempt to find the effect of living arrangements on the established relationship between men's health and household income. The results uncover a significant difference between partnered and unpartnered men living in intergenerational households in the highest quintile, but no overall difference in the risk of reporting good versus average health status between men from the lowest and highest quintiles among those living in intergenerational households. Previous Russian studies underline a strong significant association between family income and self-rated health status, particularly among men (Bobak et al, 1998; Perlman & Bobak, 2008). It is important to notice that research of the Russian families by Cubbins & Szaflarski (2001) and Kravchenko et al (2015) found family economic satisfaction and the level of household income to be significantly associated with self-rated health of both men and women after adjusting for the subjective quality of family relationships and decision-making. In the fully adjusted model before the inclusion of the interactions, in this study family wealth was significantly associated with men's self-rated health as well which agrees with previous findings. Moreover, Kravchenko et al (2015) found that the level of satisfaction with the family economic situation has a strong relationship with the quality of family relations. Although this study was not able to include the information on the quality of relationships and social

support, the results on the interaction between living arrangements and family income contribute to previous findings indicating that men in the wealthiest intergenerational households in Russia significantly differ in self-rated health status by partnership status and living arrangements.

There can be several explanations why our findings are contrary to the literature. Firstly, health-related selection effect can play an important role in the direction of association between living arrangements and self-rated health. Previous findings show a significant effect of changes in adults' health status on their transitions across different forms of living arrangements (e.g. Brown et al, 2002; Martikainen et al, 2008; Mutchler & Burr, 1991; Sarma et al, 2009; Sarma & Simpson, 2007). It may be that poor health status caused by low socio-economic status and other family-related disadvantages drives adult men in Russia to live not only in intergenerational households, but also without a partner. Using the cross-sectional data from the RLMS 2013-2014 wave, in this study it was impossible to show the direction of causality in the relationship between self-rated health and living arrangements of men in Russia. Previous longitudinal studies from other countries show that changes in living arrangements can play an important role in improvement or deterioration of adult physical and mental health, particularly among men (e.g. Joutsenniemi et al, 2006; Khlat et al, 2014; Meadows, 2009). Even though the fully adjusted results in this study do not show a significantly direct association between males self-rated health status and living arrangements (by partnership status) in Russia, further research needs to investigate longitudinal relationship between these two phenomena which will be the first in the Russian context.

Secondly, other covariates unobserved in this study could mediate the relationship between living arrangements and men's health, such as drinking behaviour. For example, Stickley et al (2015) recently found that unpartnered men living alone in Russia are at higher risk of solitary drinking than men from other types of living arrangements if they have poor

health status and bad financial situation. Another Russian finding by Pridemore et al (2010) shows that living with a partner is associated with lower risk of alcohol-related male mortality if to take into account socio-economic status of men. At the same time, other studies in Russia found no protective effect of partnership status on binge drinking among men on the contrast to women (Jukkala et al, 2008). In relation to intergenerational households, previous Japanese studies have shown the significant relationship between unhealthy behaviours and family structure if men were living with both parents and children (Takeda et al, 2004). Moreover, recent qualitative study by Keenan et al (2015) shows that a spouse and other family members (mostly children) play an important and positive role in the social control of drinking among adult men in Russia. Further analysis based on this study should consider the established negative relationship between hazardous male drinking and their self-rated physical and mental health statuses in Russia, where the association is especially significant with mental health (Dissing et al, 2013). These findings in Russia underline an importance of taking into account the patterns of alcohol consumption in the family studies on men's health.

Another important limitation of this study is inability to show the variation of self-rated health status of men by their living arrangements and partnership status over the life course. In the analysis of this paper, the RLMS data could not be stretched enough to show a significant effect of the interactions between living arrangements and life-course stages on self-rated health of men in Russia (see Appendix 6 for more information). Health-related studies show a significant difference in adult health status and behaviour by their family structure and partnership status across the life course. For example, in Russia men are especially vulnerable in terms of premature alcohol-related mortality if they are unmarried and of working-age (Cockerham, 2000; Pridemore et al, 2010). Moreover, previously mentioned results by Pridemore et al (2010) and Stickley et al (2015) were significant for

middle-aged men, which underlines the importance of analysing the relationship between men's health and living arrangements across the life-course. At the same time, some life-course studies show no significant relation of family structure to inequalities in self-rated health status of adults at different life stages (Power et al, 1998). Based on the previously established findings about the cumulative effect of socio-economic disadvantages over the life course on self-rated health of adults in Russia (Nicholson et al, 2005), further life-course research will be important to explore a possible link between social status, living arrangements and health of men in the Russian context.

The results in this study need to be generalised on the population level with caution. Previous studies based on the RLMS survey pay a special attention to the high attrition rate (e.g. Keenan et al, 2014). Gerry & Papadopoulos (2015) established that attrition in the panel sample of the RLMS survey has a non-random pattern with higher risk of dropping out among young men and those living in urban areas, with poor health, being unmarried with low education and drinkers. At the same time, earlier research by Perlman & Bobak (1998) shows that the distributions of male mortality rates in RLMS are similar to national figures if to analyse adults aged 18 years and older. Although the distribution of adult men by household size in the study sample is similar to the 2010 Census in Russia (FSSS, 2001 – 2013), the interpretation of the results in this study needs to be careful due to possible biases in the analysis based on associations between attrition, self-rated health, demographic and socio-economic characteristics. In addition, the results can be biased due to the subjective nature of the reports on health status sensitive to cultural expectations and personal experiences (Sen, 2002; Suh et al, 2008). Overall association between living arrangements, partnership status and men's health in Russia could be potentially established using the objective health outcomes such as death rates, mental health or physical functioning as it was shown in other studies (Bobak et al, 1998; Joutsenniemi et al, 2006; Koskinen et al, 2007). At

the same time, the longitudinal study in the Russian context based on the RLMS survey by Perlman & Bobak (2008) confirms the strong association between males' self-rated health status and mortality. In addition, potential biases due to the missingness pattern and the reduction of the estimates' power in this study are reduced by conducting the multiple imputation procedure, the results of which suggest that the pattern of missing values in the RLMS survey is not random by living arrangements in the association with self-rated health of men.

Previous Western and Asian studies has shown that living arrangements can have a direct relationship with health of men, especially by partnership status (e.g. Joutsenniemi et al, 2006; Koskinen et al, 2007; Takeda et al, 2004; Turagabeci et al, 2007). Taken all together, the results contribute to the literature, suggesting that the significant relation of men's socio-economic and family characteristics to their self-rated health status can determine some of the association between living arrangements by partnership status and men's health. It may be that men from low socio-economic class are more likely to be unpartnered and less likely to report good health status, where health differences by partnership status are related to social and economic determinants rather than living arrangements in isolation. The same assumption may be applied to those men living in intergenerational households. Moreover, this study reveals complex relationships between partnership status, family income per capita and self-rated health among men living in intergenerational households. This study suggests that intergenerational living arrangements and partnership status have a protective effect on men's health in Russia through being in the highest social class and living with a partner as well. Further research should investigate other mechanisms of family's economic well-being affecting the health disadvantage of unpartnered men in Russia among those who are living in intergenerational households, particularly from the highest wealth quintiles.

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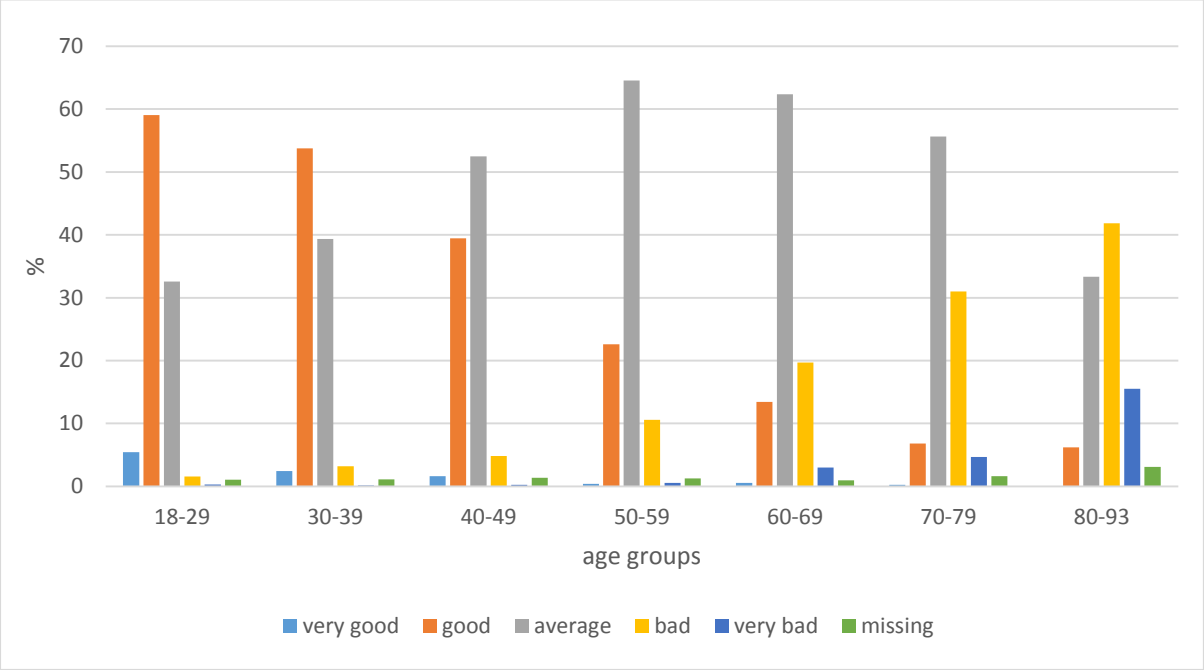
Appendix 1. Distribution of self-rated health status by age groups, unweighted sample of 6,985 men aged 18 years old and over (including missing values), RLMS 2013-2014



Appendix 2. Descriptive statistics of the self-rated health status by independent variables, RLMS 2013-2014, unweighted & weighted sample

Var-s	Self-rated health (SRH) status									Total		
	Very bad/bad			Average			Good/very good					
	N, un-weighted	%, un-weighted (row)	%, weighted (row)	N, un-weighted	%, un-weighted (row)	%, weighted (row)	N, un-weighted	%, un-weighted (row)	%, weighted (row)	N, un-weighted	%, un-weighted (row)	%, weighted (row)
Settlement type											*100%*	*100%*
urban	**467**	*10.1*	*10.4*	**2,276**	*49.4*	*48.5*	**1,863**	*40.5*	*41.1*	**4,606**	*66.8*	*67.3*
pgt	**48**	*11.0*	*10.2*	**172**	*39.4*	*37.8*	**217**	*49.7*	*52.0*	**437**	*6.3*	*6.3*
rural	**160**	*8.6*	*8.3*	**882**	*47.5*	*48.0*	**815**	*43.9*	*43.8*	**1,857**	*26.9*	*26.5*
Geographical region											*100%*	*100%*
Moscow & St.Petersburg	**76**	*10.8*	*11.0*	**334**	*47.2*	*46.6*	**297**	*42.0*	*42.4*	**707**	*10.3*	*10.8*
Central, North, North-West	**167**	*10.2*	*10.1*	**861**	*52.5*	*52.5*	**612**	*37.3*	*37.5*	**1,640**	*23.8*	*24.2*
Volga & Ural	**227**	*10.2*	*10.8*	**1,055**	*47.6*	*47.6*	**934**	*42.2*	*41.6*	**2,216**	*32.1*	*30.3*
North Caucasus	**75**	*7.4*	*6.6*	**408**	*40.0*	*38.2*	**536**	*52.6*	*55.2*	**1,019**	*14.8*	*16.2*
Siberia & Far East	**130**	*9.9*	*10.1*	**672**	*51.0*	*50.6*	**516**	*39.2*	*39.3*	**1,318**	*19.1*	*18.5*
Nationality											*100%*	*100%*
Russian	**568**	*9.8*	*9.8*	**2,874**	*49.4*	*49.3*	**2,372**	*40.8*	*40.9*	**5,814**	*84.3*	*83.9*
another nationality	**102**	*10.0*	*9.8*	**420**	*41.1*	*38.7*	**499**	*48.9*	*51.5*	**1,021**	*14.8*	*15.1*
missing	**5**	*7.7*	*9.1*	**36**	*55.4*	*52.3*	**24**	*36.9*	*38.6*	**65**	*0.9*	*1.0*
Educational level											*100%*	*100%*
General edu/incomplete SS	**99**	*17.7*	*17.9*	**213**	*38.0*	*37.5*	**249**	*44.4*	*44.7*	**561**	*8.1*	*8.0*
Complete SS	**48**	*5.1*	*5.4*	**399**	*42.4*	*39.8*	**495**	*52.6*	*54.7*	**942**	*13.7*	*14.5*
Professional Courses	**97**	*12.4*	*12.2*	**398**	*50.8*	*52.5*	**289**	*36.9*	*35.3*	**784**	*11.4*	*11.1*
VTS with or without SE / TTS	**194**	*11.0*	*11.2*	**941**	*53.1*	*53.5*	**636**	*35.9*	*35.4*	**1,771**	*25.7*	*25.5*
College or Training School	**121**	*9.5*	*9.5*	**621**	*48.6*	*48.1*	**537**	*42.0*	*42.4*	**1,279**	*18.5*	*18.5*
Higher Education	**113**	*7.4*	*7.3*	**746**	*48.5*	*47.2*	**678**	*44.1*	*45.5*	**1,537**	*22.3*	*22.0*
missing	**3**	*11.5*	*14.1*	**12**	*46.2*	*51.2*	**11**	*42.3*	*34.7*	**26**	*0.4*	*0.4*
Economic activity											*100%*	*100%*
currently working	**146**	*3.2*	*3.5*	**2,206**	*48.5*	*48.1*	**2,197**	*48.3*	*48.4*	**4,549**	*65.9*	*65.0*
not working or (un)paid leave	**529**	*22.6*	*21.6*	**1,119**	*47.7*	*47.0*	**698**	*29.8*	*31.4*	**2,346**	*34.0*	*34.9*
missing	**0**	*0.0*	*0.0*	**5**	*100.0*	*100.0*	**0**	*0.0*	*0.0*	**5**	*0.1*	*0.1*
Army service use											*100%*	*100%*
have been	**425**	*10.3*	*10.5*	**2,130**	*51.5*	*51.3*	**1,585**	*38.3*	*38.2*	**4,140**	*60.0*	*59.2*
have not been	**241**	*8.9*	*8.8*	**1,176**	*43.6*	*42.6*	**1,279**	*47.4*	*48.6*	**2,696**	*39.1*	*39.7*
missing	**9**	*14.1*	*12.9*	**24**	*37.5*	*39.5*	**31**	*48.4*	*47.6*	**64**	*0.9*	*1.1*
Previously married or not											*100%*	*100%*
yes	**230**	*14.6*	*15.4*	**895**	*56.7*	*55.6*	**455**	*28.8*	*29.0*	**1,580**	*22.9*	*21.5*
no	**445**	*8.4*	*8.3*	**2,435**	*45.8*	*45.6*	**2,440**	*45.9*	*46.1*	**5,320**	*77.1*	*78.5*
Number of minors (<=16) in HH											*100%*	*100%*
none	**523**	*13.7*	*13.1*	**1,989**	*52.0*	*51.1*	**1,312**	*34.3*	*35.8*	**3,824**	*55.4*	*58.0*
1 minor <=16	**112**	*5.9*	*6.1*	**868**	*45.4*	*44.2*	**934**	*48.8*	*49.7*	**1,914**	*27.7*	*26.7*
2 or more minors <=16	**40**	*3.4*	*3.7*	**473**	*40.7*	*40.9*	**649**	*55.9*	*55.3*	**1,162**	*16.8*	*15.3*
Family wealth quintiles											*100%*	*100%*
1 (lowest)	**141**	*10.4*	*10.1*	**611**	*45.2*	*43.8*	**601**	*44.4*	*46.1*	**1,353**	*19.6*	*21.0*
2	**179**	*13.3*	*12.3*	**654**	*48.6*	*49.1*	**512**	*38.1*	*38.6*	**1,345**	*19.5*	*20.2*
3	**179**	*13.8*	*14.2*	**643**	*49.7*	*49.7*	**472**	*36.5*	*36.1*	**1,294**	*18.8*	*18.7*
4	**103**	*7.8*	*8.1*	**647**	*49.0*	*47.1*	**570**	*43.2*	*44.9*	**1,320**	*19.1*	*18.2*
5 (highest)	**60**	*4.5*	*4.9*	**643**	*48.4*	*49.1*	**625**	*47.1*	*46.0*	**1,328**	*19.3*	*18.1*
missing	**13**	*5.0*	*5.3*	**132**	*50.8*	*49.2*	**115**	*44.2*	*45.6*	**260**	*3.8*	*3.9*
Physical HH size (household size/rooms)											*100%*	*100%*
undercrowded or normal	**163**	*15.1*	*14.8*	**593**	*54.8*	*54.0*	**326**	*30.1*	*31.2*	**1,082**	*15.7*	*16.5*
overcrowded	**511**	*8.8*	*8.8*	**2,737**	*47.1*	*46.5*	**2,565**	*44.1*	*44.7*	**5,813**	*84.3*	*83.4*
missing	**1**	*20.0*	*25.6*	**0**	*0.0*	*0.0*	**4**	*80.0*	*74.4*	**5**	*0.1*	*0.1*

Note: based on the Chi-squared test, all of the independent variables were significantly associated with the self-rated health status of adult men at the 95% significance level.

Appendix 3. Results of Multinomial Logistic Regression based on complete-case data (excluding all of the missing values in the sample), Self-Rated Health (SRH) status of adult men in Russia, RLMS 2013-2014, weighted and clustered within households sample of 4,860 adult men [1, 2]

Living arrangements by three research questions in the study	Model 1 (bivariate)		Model 2: Model 1 + demographic char-s		Model 3: Model 2 + socio-economic char-s		Model 4: Model 3 + family char-s		Model 5: Model 4 + interaction	
	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good	Very Bad/ Bad	Good/ Very Good
Research question 1: Partnership status (ref: unpartnered)										
Partnered	0.84	0.55***	0.52***	1.24*	0.75	1.18	0.77	1.09		
	(0.09)	*(0.04)*	*(0.08)*	*(0.12)*	*(0.11)*	*(0.11)*	*(0.12)*	*(0.12)*		
Research question 2: Unpartnered living alone status (ref: Yes)										
No, others	0.45***	1.34	0.73	1.05	0.77	1.03	0.70	1.01		
	(0.08)	*(0.20)*	*(0.15)*	*(0.19)*	*(0.16)*	*(0.19)*	*(0.15)*	*(0.19)*		
Research question 3: Living in intergenerational households & partnership status (ref: Yes, unpartnered)										
Yes, partnered	1.21	0.45***	0.56**	1.40**	0.96	1.33*	1.04	1.25	1.00	0.84
	(0.20)	*(0.04)*	*(0.12)*	*(0.16)*	*(0.20)*	*(0.16)*	*(0.22)*	*(0.16)*	*(0.30)*	*(0.18)*
No, others	1.43*	0.47***	0.57**	1.18	0.87	1.14	0.96	1.04	0.90	1.07
	(0.22)	*(0.04)*	*(0.11)*	*(0.13)*	*(0.16)*	*(0.12)*	*(0.19)*	*(0.12)*	*(0.28)*	*(0.21)*
Interaction between 'Living in intergenerational households' (ref: 'Yes, unpartnered') and 'family wealth quintiles' (ref: '1st quintile'):										
Yes, partnered # 2nd Quintile									1.08	1.77*
									(0.52)	*(0.49)*
Yes, partnered # 3rd Quintile									0.90	1.80
									(0.49)	*(0.55)*
Yes, partnered # 4th Quintile									0.75	1.14
									(0.53)	*(0.37)*
Yes, partnered # 5th Quintile									3.72	2.63*
									(3.51)	*(1.03)*
No, others # 2nd Quintile									1.19	1.07
									(0.58)	*(0.29)*
No, others # 3rd Quintile									0.91	1.15
									(0.46)	*(0.33)*
No, others # 4th Quintile									0.87	0.73
									(0.58)	*(0.23)*
No, others # 5th Quintile									2.91	1.34
									(2.61)	*(0.49)*

Notes: Total N (obs) = 4,860;

Reference category for the equations is 'Average Self-Rated Health status';

Robust standard errors in italic parentheses;

p < 0.05 ** p < 0.01 *** p < 0.001;

Full results of the models can be found in Appendices 15-17;

[1] Complete-case analysis excludes observations with missing values (410 observations in total);

[2] The total number of observations is smaller than the original sample of the study due to the post-stratified individual weights, where 1,732 individuals were not included in the representative sample (their 'pweights' were equal zero).

Appendix 4. Comparison between complete-case and MI analyses

After applying post-stratified individual weights for Model 1 – Model 3 of each research question, the comparison of the complete-case results between the models with all excluded missing values (number of observations is always 4,860 adult men) and the models with all available observations for those covariates which are included in the model, where:

- Covariate in Model 1 has no missing values with N(obs)=5,168;
- Covariates in Model 2 have in total 49 missing values with N(obs)=5,119;
- Covariates in Model 3 have in total 127 missing values with N(obs)=5,041.

Paying attention to the main covariate of living arrangements in each research question, the comparative results show that their estimates can significantly differ between two types of the complete-case analyses. In the models built for the first and third research questions, estimates' values are lower than the estimates presented from the complete-case analysis excluding any missing values in the sample. Opposite was found in the models for the second research question. Differences in the estimates can mean that observations are missing not completely at random in the sample of this study. Multiple imputation is required to avoid invalid inferences.

Appendix 5 describes the comparison between two types of the complete case-analyses as well as multiply imputed results in terms of the significance level for living arrangements from each research question. In general, Appendix 5 shows that the number of observations included in each model affects the significance of the relationship between self-rated health status and living arrangements of men in each research question. For instance, in a bivariate relationship (M1) for the first research question the p-value of the 'partnership status' variable reduces down close to the cut-off of 0.05 for 95% significance level after including all available observations (even those observations who have missing values in other covariates included in M2 – M4). Opposite to the complete-case analysis excluding any missing values, having all available observations in the bivariate model indicates that unpartnered men are significantly more likely to report 'very bad/bad' health status rather than 'average' health status in comparison to partnered men. To conclude, the MI results have shown that exclusion of men with missing values from the study sample decreases the significance of the association between living arrangements and self-rated health status and increase the significance of the interactions between intergenerational living arrangements and the family wealth quantiles. In this study, multiple imputation helps to reduce the biases in the estimates and identify a clearer pattern of the significance of the association between self-rated health status and living arrangements of adult men in Russia.

Appendix 5. Relative risk ratios (RRRs) and p-values of the multinomial regressions for three covariates of living arrangements of adult men in Russia according to three research questions in the study, RLMS 2013-2014

Research Questions	Models	Category	complete-case analysis excluding all missing values (N=4,860) [1]		complete-case analysis including all available observations [2]		Multiple imputation analysis (50 imputations)	
			Very Bad/Bad RRR	Good/Very Good RRR	Very Bad/Bad RRR	Good/Very Good RRR	Very Bad/Bad RRR	Good/Very Good RRR
R.Q. 1: partnership status (ref: unpartnered)	M1 (bivariate)	Partnered	0.836 (p=0.112)	0.546 (p=0.000)	0.808 (p=0.050)	0.557 (p=0.000)	-	-
	M2: M1 + demographic covariates		0.515 (p=0.000)	1.242 (p=0.020)	0.490 (p=0.000)	1.277 (p=0.007)	0.485 (p=0.000)	1.260 (p=0.011)
	M3: M2 + socio-economic covariates		0.747 (p=0.056)	1.183 (p=0.082)	0.739 (p=0.045)	1.203 (p=0.051)	0.719 (p=0.025)	1.192 (p=0.060)
	M4: M3 + family covariates		0.772 (p=0.102)	1.086 (p=0.441)	-	-	0.755 (p=0.068)	1.088 (p=0.416)
R.Q. 2: unpartnered living alone or not (ref: yes)	M1 (bivariate)	No, others	0.454 (p=0.000)	1.341 (p=0.053)	0.457 (p=0.000)	1.327 (p=0.054)	-	-
	M2: M1 + demographic covariates		0.727 (p=0.131)	1.054 (p=0.765)	0.758 (p=0.185)	1.048 (p=0.784)	0.754 (p=0.173)	1.019 (p=0.913)
	M3: M2 + socio-economic covariates		0.770 (p=0.211)	1.034 (p=0.853)	0.778 (p=0.227)	1.019 (p=0.915)	0.802 (p=0.283)	0.995 (p=0.978)
	M4: M3 + family covariates		0.698 (p=0.099)	1.007 (p=0.971)	-	-	0.731 (p=0.145)	0.961 (p=0.826)
R.Q. 3: living in an intergenerational household or not & partnership status (ref: yes, unpartnered)	M1 (bivariate)	Yes, partnered	1.210 (p=0.249)	0.450 (p=0.000)	1.137 (p=0.414)	0.469 (p=0.000)	-	-
	M2: M1 + demographic covariates		0.559 (p=0.005)	1.399 (p=0.004)	0.496 (p=0.000)	1.484 (p=0.001)	0.496 (p=0.000)	1.483 (p=0.000)
	M3: M2 + socio-economic covariates		0.959 (p=0.839)	1.326 (p=0.019)	0.951 (p=0.802)	1.376 (p=0.007)	0.874 (p=0.495)	1.406 (p=0.004)
	M5: M3 + family covariates + interaction		1.004 (p=0.990)	0.836 (p=0.399)	-	-	0.981 (p=0.950)	0.907 (p=0.638)
	M1 (bivariate)	No, others	1.426 (p=0.022)	0.470 (p=0.000)	1.361 (p=0.036)	0.482 (p=0.000)	-	-
	M2: M1 + demographic covariates		0.570 (p=0.004)	1.181 (p=0.116)	0.525 (p=0.001)	1.217 (p=0.057)	0.523 (p=0.000)	1.215 (p=0.058)
	M3: M2 + socio-economic covariates		0.868 (p=0.454)	1.139 (p=0.231)	0.866 (p=0.442)	1.160 (p=0.164)	0.812 (p=0.250)	1.165 (p=0.147)
	M5: M3 + family covariates + interaction		0.902 (p=0.743)	1.066 (p=0.750)	-	-	0.853 (p=0.609)	1.106 (p=0.608)

[1] missing values for all of the covariates, which are included in Model 2 - Model 5;

[2] Dependent variable (Self-Rated Health status) and independent variable (partnership status) have no missing values in the study sample of adult men; no multiple imputation modelling required;

Notes: Reference category for the equations is 'Average Self-Rated Health status';

P-values are in parentheses;

Full results of the complete-case and multiple imputation analyses (with z- and t-statistics respectively, p-values and 95% confidence intervals) are included in Appendices 15 - 17.

Appendix 6. Sensitivity analysis

In the sensitivity analysis, we used three life-stages as an explanatory variable of age to stratify men in three sub-samples of young (18-39 years old), middle-aged (40-59 years old) and older (60 years old and over) men respectively. The decision to classify adult men by three life-course stages is based on the distribution of their SRH status by 10-years age groups, where: men aged between 18-39 years old have the highest probability to report 'good' SRH status; men aged 40-59 years old are more likely to report 'average' SRH status than younger men, but the probability to report 'good' SRH status is still higher than 'bad' status; after 60 years old, the probability of reporting 'bad' SRH status among older men starts to be higher than 'good' status and it gets over 'average' status after 80 years old.

Living arrangements by partnership status were included as a six-categorical covariate as well as its interactions with three life-stages were added. Six categories of living arrangements were created in two steps of dividing adult men by partnership status and family structure. Firstly, men were grouped by those who are unpartnered and who are living with a partner ('partnered men') whether married or cohabiting based on the combination of reported marital status, cohabitation status and household roster (excluding any misreports or mismatching). Secondly, unpartnered and partnered men were sub-grouped by those who are living alone or in nuclear households, living in intergenerational households and living with others. As a result, the next six categories were created: Unpartnered men living alone (4.93%); Unpartnered men living in intergenerational households (18.35%); Unpartnered men living with others (1.65%); Partnered men living in nuclear households (41.49%); Partnered men living in intergenerational households (25.01%); Partnered men living with others (8.57%).

With the aim of the preliminary regression analysis to find differences in association between self-rated health status and living arrangements of adult men across the life-course, multivariate regression models with interaction terms between six types of living arrangements and three life-course stages were built. However, the regression analyses did not show any significant interactions between living arrangements and age groups suggesting that the RLMS data cannot be 'stretched' enough to find the significant differences in the relationship between living arrangements and self-rated health across the life-course of adult men in Russia. Instead, new groups of adult men were created to avoid low counts of adult men by living arrangements in a regression model and to be able to establish the relationship between living arrangements and self-rated health of adult men. The regression results based on three new covariates of living arrangements in relation to three research questions are presented in the main body of this paper.