PREMATURE MALE MORTALITY AND THE ECONOMIC WELL-BEING OF HOUSEHOLDS

POLINA KUZNETSOVA

The paper examines the impact of the death of family members, including men of working age, on the economic well-being of their households. It is shown that the data from the Russian Monitoring of Economic Condition and Health (RLMS) can, despite a certain systematic error in registering the deaths of respondents, be used to assess the mortality rate of men and people of working age.

The RLMS data showed that in the year when a family member dies, the average real per capita household income grows. That is, the effect of a decrease in family size turns out to be stronger than the effect of a drop in total income. The fact is that the economic problems of the household associated with the loss of family members do not begin in the year of death, but much earlier. Therefore, a wider time range was considered, from five years before the death of a family member to five years after it. Regression analysis of the processes of getting into and out of poverty showed that the death of family members has a negative impact on the well-being of other members of the household. If a man of working age dies, the risks of falling into poverty increase for 1-5 years before and 1-5 years after this event.

Key words: *mortality, panel data, poverty, survival analysis, household structure, RLMS..*

INTRODUCTION

The paper examines the relationship between male mortality in working age and the well-being of Russian households. The phenomenon of high male mortality in Russia is widely known and well-studied (Shkolnikov et al. 2013; Grigoriev et al. 2020). Premature male mortality and a large gender gap in life expectancy are largely explained by the greater prevalence of irrational behaviors among men, such as smoking, alcohol consumption, and insufficient attention to their own health (Andreev 2001; Kossova et al. 2020; Denisova 2010).

Being very common in working age, male mortality has a direct impact on the structure of households, increasing the share in it of single-parent families with children (Zakharov, Churilova 2013) and households with single women. Single-parent families with underage children are traditionally among the most vulnerable in terms of both income poverty and deprivation (Grishina 2018). The answer to the question of how the death of a family member affects the well-being of households without minor children is less obvious.

POLINA KUZNETSOVA (polina.kuznetsova29@gmail.com), RUSSIAN PRESIDENTIAL ACADEMY OF NATIONAL ECONOMY AND PUBLIC ADMINISTRATION, RUSSIA.
THIS ARTICLE WAS PREPARED AS PART OF THE RESEARCH WORK OF THE STATE ASSIGNMENT OF THE RANEPA.

Negative events in the life of households, which include, along with divorce, the death of a family member, play an important role in poverty formation (Anikin, Tikhonova 2014). Information on the extent to which the contribution of working-age men determines the income of the households in which they live is presented in table 1. As the size of the family grows, the contribution of working-age men to income becomes larger compared to other members of the household. For example, in 2019, for households of two people, the contribution of men to the income of the households in which they lived was approximately the same as that of women. At the same time, for a family of four, the income share of men aged 15-59 was 57% of family income, which is noticeably higher than for women aged 15-54 and elderly household members.

Table 1. Contribution of family members to household income by sex and age (for households where family members of the corresponding sex and age live), % of household income

	1 person	2 people	3 people	4 people	5 and more people
Income share of men aged 15-59	100	56	56	57	53
Income share of women aged 15-54	100	56	46	39	36
Income share of men aged 60 and over	100	53	40	32	23
Income share of women aged 55 and over	100	55	43	34	23

This study presents an attempt by the author to look at the impact that the death of a family member has on the well-being of the remaining members of the household. In contrast to the work by Denisova (Denisova 2010), which considers the death of a respondent as a dependent variable and identifies the factors influencing it, we will study this relationship in the opposite direction: the focus of this work is the well-being of households, which is affected (or perhaps not affected) by the death of one of the adult family members - men and women of different ages.

The basis of the empirical study was RLMS retrospective data from 2001 through 2019. The article is structured as follows. First, a review of the literature and a discussion of the problems that arise in the analysis of mortality using sociological survey data are presented. Then the data and research methodology are described. Next, the results of a regression analysis of the relationship between mortality and the economic well-being of households are presented. Finally, brief conclusions are drawn.

LITERATURE REVIEW

Hypotheses about events that influence getting into and out of poverty are based on the theory of human capital by G. Becker and J. Mincer (Becker 2009a; Mincer 1993) and the theory of demand for children by G. Becker (Becker 2009b). These two theories define the main factors of household income and size that make up per capita income, including gender, age, family members' human capital levels, and family demographics (McKernan and Ratcliffe 2005).

There is a wealth of empirical research examining the drivers of poverty. The most common approach to the study of poverty involves the use of data for a specific moment, for a given time slice, to estimate the extent of poverty. In such an econometric model, the probability of poverty at a given point in time is considered as a function of the current values of various individual and household characteristics (i.e., without taking into account the change in factors over time).

This intuitively and methodically simple approach makes it possible to answer a number of fundamentally important questions, including what is the prevalence of poverty among various socio-demographic groups. However, this method does not take into account changes that occur over time. This requires a dynamic analysis of poverty using panel data.

The modern scientific literature presents a wide range of methods for quantifying the relationship between mortality and well-being over time. To identify the consequences of events in the life of a household (divorce, death of a family member), one can use, among others, such methods as the analysis of survival in a certain state at the onset of events (survival analysis), first applied to the study of poverty at work (Bane, Ellwood 1986); linear panel regression with fixed effects, including observations several years before and after an experimental event, such as the death of a spouse, divorce, separation, etc. (Leopold 2018); probit or logit models for finding factors in the probability of being poor, the conditional probability of the poor being chronically poor, and the probability of getting into and out of poverty (Lindquist, Lindquist 2012); an improved method taking into account the aging of the data panel (Cappellari, Jenkins 2002; Fusco, Islam 2012), etc.

The results of empirical studies in various countries suggest that poverty is a heterogeneous phenomenon. In developed countries, episodic poverty is more common, when households experience income deficit for only a very short time, as is typical, for example, of young people (Bane and Ellwood 1986; Lindquist and Lindquist 2012; Fusco and Islam 2012; Jenkins and Van Kerm 2014). However, some groups, including children and members of ethnic and national minorities, are more likely to remain in poverty for a long time (Cappellari and Jenkins 2002). In developing countries, it is more difficult to get out of poverty, and therefore chronic poverty is the most common (Haq, Arif 2004; Ozdamar, Giovanis 2017; Yamauchi, Buthelezi, Velia 2006).

In countries with a high level of social development, children are usually protected economically from such serious events as the illness or death of a parent/parents. For example, in Sweden, children who have lost their parents are entitled to a generous pension from the state social security system; in addition, private life insurance is widespread, covering 2/3 of the country's population (Lindquist, Lindquist 2012). As a result, the breakdown of the family or the loss of a job by parents contributes much more to falling into poverty than mortality or morbidity.

In this study, we are interested in how mortality affects well-being. However, as follows from the theory of demand for health by M. Grossman (Grossman 1972), the relationship between health and income and, as a result, between mortality and income, is two-way. There is a possibility of an inverse relationship between income and mortality, when the deterioration in the well-being of the household has a negative impact on the health of family members and subsequently becomes the cause of death. Duleep (1986) shows, using American data, that low income significantly increases the risk of male mortality, and the presence of an additional influence of income on the risks of ill health and disability contributes to this negative relationship. This duality is mentioned in (Jusot 2006), which examines the nature of the relationship between income and mortality in France. The results show that the risk of death is strongly correlated with income level regardless of occupational status.

At the same time, a number of empirical studies have shown that the impact of income on mortality, in contrast to the impact of income on health, is at the least not great (Snyder and Evans

2006; Evans and Moore 2011; Ahammer, Horvath, Winter-Ebmer 2015). How can this be explained? The presence and extent of the socio-economic gradient in health and mortality depend on the effectiveness of different areas of national health systems. In the case of mortality, the socioeconomic gradient is driven more by the effectiveness of acute health care, while the relationship between income and health is driven mainly by disease prevention and early diagnosis (Adams et al. 2003).

Another area of research closely related to this work is the analysis of the well-being of widows. The bulk of the work in this area has been carried out on the basis of data from developed countries and, therefore, is focused on the problems of older people (65 years and older). This topic was most popular in the last quarter of the twentieth century, when the problem of poverty of widows in Western countries was much more acute. Beginning in the 1990s, the poverty rate among widows began to decrease sharply, facilitated by an increase in the level of education of women, an increase in their work experience, a change in the structure of marriage (women with higher socioeconomic status were more likely to be married than women with lower status) and an increase in social support (Munnell, Eschtruth 2018; Munnell, Sanzenbacher, Zulkarnain 2019).

A number of studies on the well-being of widows have been carried out using data from African countries, where widowhood is caused by premature male mortality, primarily as a result of the HIV epidemic. The death of a breadwinner reduces the chances of children, especially girls, to continue their education (Yamauchi, Buthelezi, Velia 2006). Widowed women are more likely to go to work, which in turn can lead to reduced time for housework and child rearing, thus worsening the conditions for human capital formation in orphaned children (Mather 2011).

This study differs from most studies on the topic of mortality and income. We are studying the event of a death in the household, which in itself is a rare object of study. The Russian specificity of the consequences of the death of one of the family members also plays an important role. In developed countries, the overwhelming majority of widows of deceased men are elderly; accordingly, the focus of research on the topic is shifted towards pensions, social security and other problems of the elderly. We, however, due to the peculiarities of the analysis of mortality based on sociological survey data, are more interested in the consequences of the death of family members of working age. In the poorest developing countries, widowed women are significantly younger than in the developed countries of the West, but nevertheless, the problems they face are significantly different from those of Russian households that have experienced the death of a man of working age.

For this study, the most methodologically close works are two by Irina Denisova, devoted to the analysis of factors of male mortality (Denisova 2010) and to the identification of characteristics that contribute to households moving into and out of poverty (Denisova 2007). Both studies were performed on panel data from the Russian Monitoring of the Economic Situation and Health of the Population (RLMS); duration analysis was used for regression estimates. The work (Denisova 2010) also presents detailed arguments in favor of using data from a longitudinal sociological survey to study mortality.

Based on the results of the literature review, a list of potential factors for use in econometric analysis was identified. Along with the socio-demographic characteristics of the household used in the work of I. Denisova (listed in Table 2 below), these are variables containing information on

the time before and after the death of family members. Following the German study of the short and long-term consequences of divorce (Leopold 2018), we consider 5 time intervals: 1) 5–3 years before the death of a family member; 2) 2–1 years before death; 3) the year of death; 4) 1–2 years after death; 5) 3–5 years after death.

THE ANALYSIS OF MORTALITY USING RLMS DATA: MAIN PROBLEMS AND LIMITATIONS

In order to answer the main question of the study (how the death of a family member affects the well-being of the household), specific mortality data are needed. Aggregated data of official statistics provide detailed information about its age structure, the contribution of various causes of death, the regional component, and so on, but do not allow us to find out what kind of family the deceased lived in and how the family and immediate relatives of the deceased lived before and after their death.

The hypotheses of the study involve connecting information about the individual characteristics of the deceased and their family members to the mortality data. Official data on mortality in this case cannot be used, since they contain very little information about the deceased (sex, age, type of locality and cause of death). The information of interest to us about individuals and the households in which they live is contained in the nationally representative RLMS survey, but when using data from sociological surveys, the question arises of how reliable the mortality estimates obtained from them are.

Can RLMS data be used for mortality analysis? How accurately is the death of a respondent recorded in the survey? Generally speaking, the answers to these questions are not obvious. In international research practice, the analysis of mortality actively uses individual characteristics of the deceased, but also additional data sources to clarify mortality, for example, the National Death Index in the United States (Mehta, House, Elliott 2015) or data from the national death register in Sweden (Syden and Landberg 2017). In the RLMS, mortality in households that disappeared from the sample is not specified, which leads to a systematic error (Denisova 2010; Chernysheva and Furmanov 2013). This study also attempts to answer the question of whether the RLMS data can be used to analyze the mortality of the population as a whole and of specific sex and age groups.

Earlier works suggest that this is possible. Thus, in (Perlman, Bobak 2008) it is noted without further clarification that the mortality rates according to the RLMS data generally correspond to official indicators. A more detailed comparison of mortality rates according to the RLMS data and according to the official statistics of Rosstat is presented in the study of microfactors of mortality (Denisova 2010). According to the author's estimates, it is mostly single respondents who disappear from the field of view of RLMS interviewers, most of whom are elderly people, in connection with which the mortality rates calculated according to RLMS data in 1994–2007 were 25-30% lower than the official ones.

We compared the RLMS mortality rates with official statistics (Figure 1). As can be seen, the RLMS noticeably underestimates the mortality of men and women of all ages (Figure 1, graphs

in the first row). If we limit ourselves only to respondents of working age (Figure 1, bottom row of graphs), then the level of differences is significantly reduced.

Figure 1 also clearly distinguishes periods of gradual increase in mortality, measured on the basis of RLMS data, corresponding to the aging of the base, followed by periods of its sharp decrease, caused by the replenishment of the base, when new households are included in the sample. It should also be noted that recently the mortality curves according to Rosstat and mortality calculated according to the RLMS data have been converging.

An important limitation of the RLMS is the systematic error in estimating the mortality of single respondents. Since information about the death of a family member is collected from the words of other household members, "deaths of household members in households consisting of one or two people (especially if they are headed by elderly people) are not included in the regular survey procedure, since household data are not found by address" (Denisova 2010: 341)). The effect of such an underestimation of mortality is clearly visible in Figure 1. The underestimation of female mortality in general, despite the good quality of similar estimates at working age, suggests that the main discrepancies occur at older ages. It can be assumed that the majority of small-sized households that "disappeared" from the coverage area of the survey as a result of the death of respondents are single women of older ages.

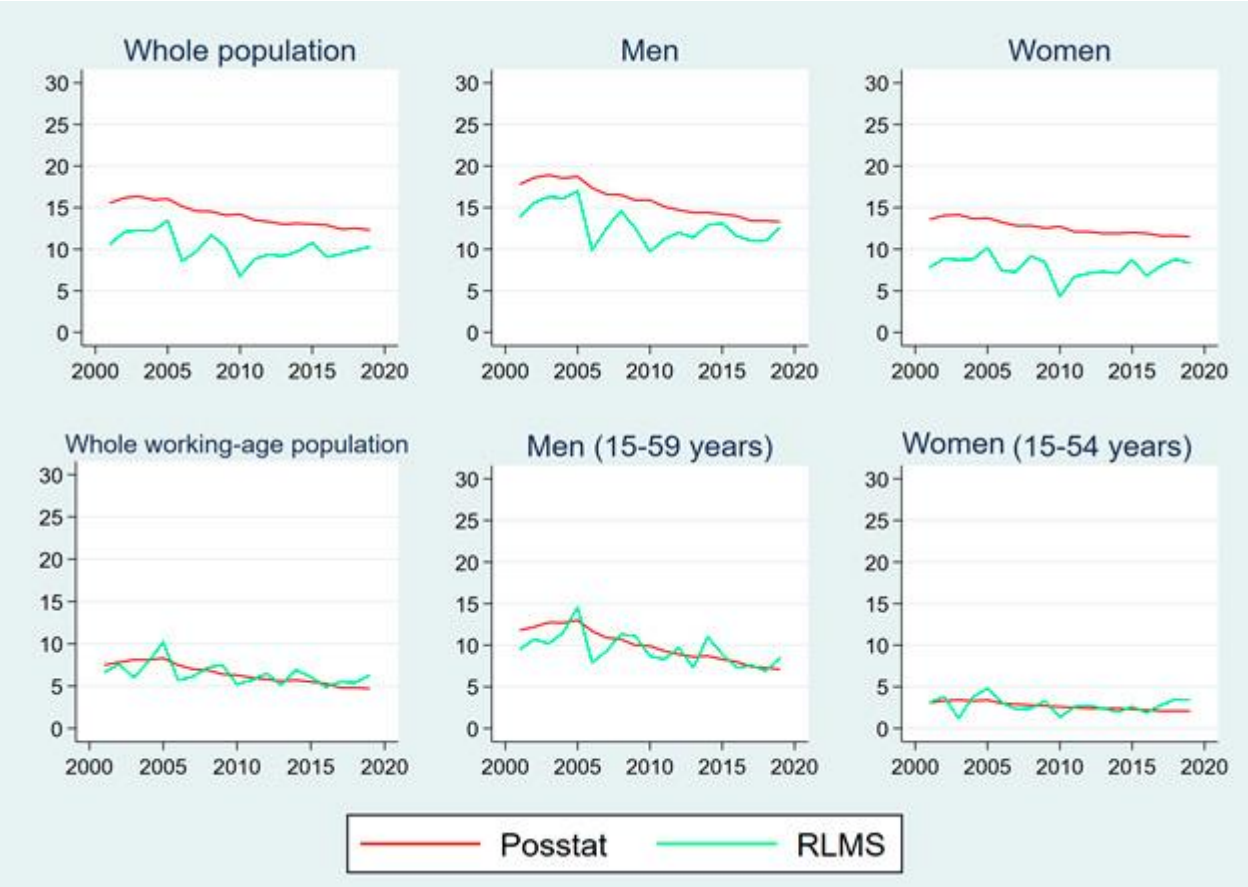

Figure 1. Mortality rates (official statistics and calculations based on RLMS data) for different age groups, 2001–2019

Source: Author's calculations based on RLMS data and official statistics.

Taking into account the peculiarities of collecting data on the death of respondents in the RLMS, significant improvement in the accuracy of mortality estimates can be achieved through a certain limitation of the sample. First, it seems rational to include data in the samples starting from 2001, when the variable with information about the reason for the absence of a household member in the current round was significantly refined. In addition, the shift to consideration of working ages also significantly brings the RLMS mortality estimates closer to official statistics.

DATA AND METHODOLOGY

As an empirical basis for the study, data from the Russian Monitoring of the Economic Situation and Health of the Population (RLMS NRU HSE) were used. We used data from an unbalanced panel of 2001-2019, and in order to take into account differences in the last two decades, we separately considered samples for 2001-2009 and 2011-2019. The use of these three samples allows one to get an idea of the dynamics of the well-being of households of various types in different economic periods: rapid economic growth in the early and mid-2000s, the global crisis of 2008 and post-crisis adaptation of 2009-2013, as well as the consequences of the events of 2014, expressed, in particular, in the decline and stagnation of real incomes of the population.

The variable “Death of a household member” is presented in the RLMS using three variables, including: 1) 4 response options (1995–2000); 2) about 70 response options, most of which specify the cause of death (2001-2008); 3) about 100 meaningful response options, most of which specify the cause of death (2009–2018). The calculations used RLMS data starting from 2001, i.e., for the second and third variants of the variable.

In order to take into account differences in regional prices, we used a correction factor equal to the ratio of regional subsistence minimums and the subsistence minimum in the reference region. A region with a living wage close to the median (Saratov region) was chosen as a reference. To switch to real prices in the panel sample (we considered the period from 2001 to 2019), we used the inflation coefficient obtained on the basis of the dynamics of the subsistence minimum in the reference region.

The movement of households into and out of poverty was determined using the indicator of income poverty. A household was considered poor if its average per capita income was below the regional subsistence minimum for the third quarter of the year under review.

Several groups of characteristics of the demographic composition of the family, the quality of the human capital of household members and their status in the labor market, as well as the individual characteristics of the head of the family were considered as independent variables explaining the change in the level of household well-being in the regression analysis. Respondents' health was determined on the basis of a question about their self-assessment. We considered that the respondent had poor health if the answer to the question “Tell me, please, how do you assess your health?” was "Bad" or "Very bad".

To determine the relationship between family well-being and the event of death of one of the household members, variables containing information on the immediate event of death and on the time periods before and after it were included in the regression analysis.

The RLMS data contain detailed information on the family ties of the respondents, which makes it possible to use various typologies of households in calculations (Abanokova 2015; Denisova 2007). In the course of the regression analysis, we used the typology of households based on the gender and age characteristics of the head of the family. We considered 4 types of households, namely those headed by: 1) a man of working age; 2) a woman of working age; 3) a man of retirement age; 4) a woman of retirement age. The head of the family is the respondent with the highest individual income. In the absence of information on income, the reference household member is considered the head of the household - the person who is most aware of the composition and budget of the household, on whose words the answers to the household survey questionnaire are based. Households headed by men of working age were considered as a reference category.

Regression analysis of the processes of moving into and out of poverty was carried out using a semi-parametric Cox model in discrete time (Cox 1972; Klein, Moeschberger 2003). For a discrete random variable T, reflecting the duration of the state of poverty or non-poverty, the risk function λ is defined as follows:

$$\lambda(t)=P(T=t \mid T\geq t) \quad (1)$$

For a state that lasted *t* years, this function reflects the probability of its termination within the next year. The discrete Cox model defines the functional form of the relationship between risk and explanatory variables as follows (Klein, Moeschberger 2003: 259):

$$\frac{\lambda(t,X,\beta)}{1-\lambda(t,X,\beta)} = \frac{\lambda_0(t)}{1-\lambda_0(t)}\exp(\beta' X), \quad (2)$$

where X is the vector of explanatory variables, β the estimated coefficients, $\lambda_0(t)$ the basic risk function (reflecting the risk in the absence of the impact of explanatory variables, i.e. when $\beta' X = 0$). The vector X contains information about the socio-demographic composition of the household, as well as information about the time of death of family members of different ages.

The RLMS data on poverty dynamics are incomplete due to truncation on the left, interval censoring, and censoring on the right. Truncation on the left occurs when households were already in a state of non-poverty/poverty at the time they were included in the sample. Censoring on the right is observed for incomplete episodes of transition into poverty/non-poverty, when the household has remained non-poor/poor. The use of duration analysis methods makes it possible to solve the problem of estimate bias, which arises both as a result of truncation on the left and censoring on the right (Ratnikova, Furmanov 2014). Interval censoring occurs because in some cases there are gaps in household observations, due to which it is not possible to understand at what exact moment the event of interest to us occurred. A small number of missing observations have been removed.

When modeling households falling into poverty, we calculate the time from the moment when the household is at risk of the event under study. This corresponds to the moment when the value of the variable "the household is poor" turns out to be 0. The transition to poverty, corresponding to the end of the episode of non-poverty, occurs when the value of the variable changes from 0 to 1. The exit from poverty was modeled similarly.

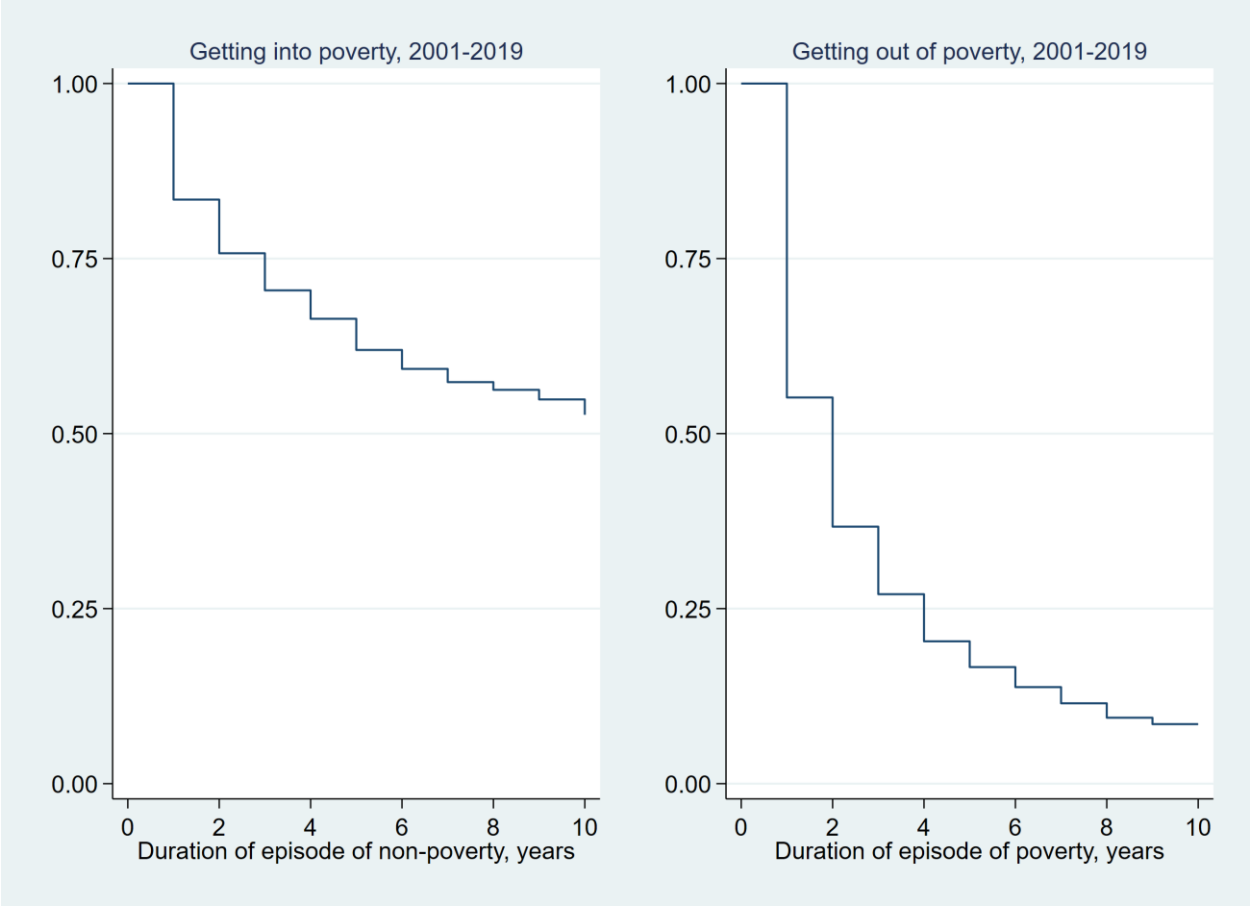

Figure 2 Estimated survival function for getting into and out of poverty, 2001-2019

Source: Author's calculations based on RLMS data

For each of the three time periods (2001-2010, 2011-2019, and 2001-2019), two samples were considered: for getting into poverty and for getting out of it. To take into account multiple transitions into and out of poverty, we split the series of observations of such households into several (according to the number of transitions). The sample for falling into poverty in 2001-2019 contains 20,547 households, of which 5,848 were transitioning from non-poverty to poverty. The moving-out-of-poverty sample contains 11,964 households, of which 8,253 households have already moved out of poverty. Information on the number of samples for 2001-2010 and 2011-2019 is given in the Appendix (tables A1 and A2).

To include in the analysis information about the periods before and after the death of a family member, 5 time periods were considered: 1) 5–3 years before the death of a family member; 2) 2–1 years before death; 3) the year of death; 4) 1–2 years after death; 5) 3–5 years after death.

Kaplan-Meyer diagrams give an idea of the dependent variables of our study - the duration of periods of poverty and non-poverty. Figure 2 shows the survival functions for entering and exiting poverty in 2001-2019. According to the data presented, the probability of falling into poverty after the 1st year out of poverty (Figure 2, diagram on the left) is 17%, after the 2nd year - 24%, after the 3rd year - 30%. Over half of all households (53%) in the 2001-2019 sample never fell into poverty.

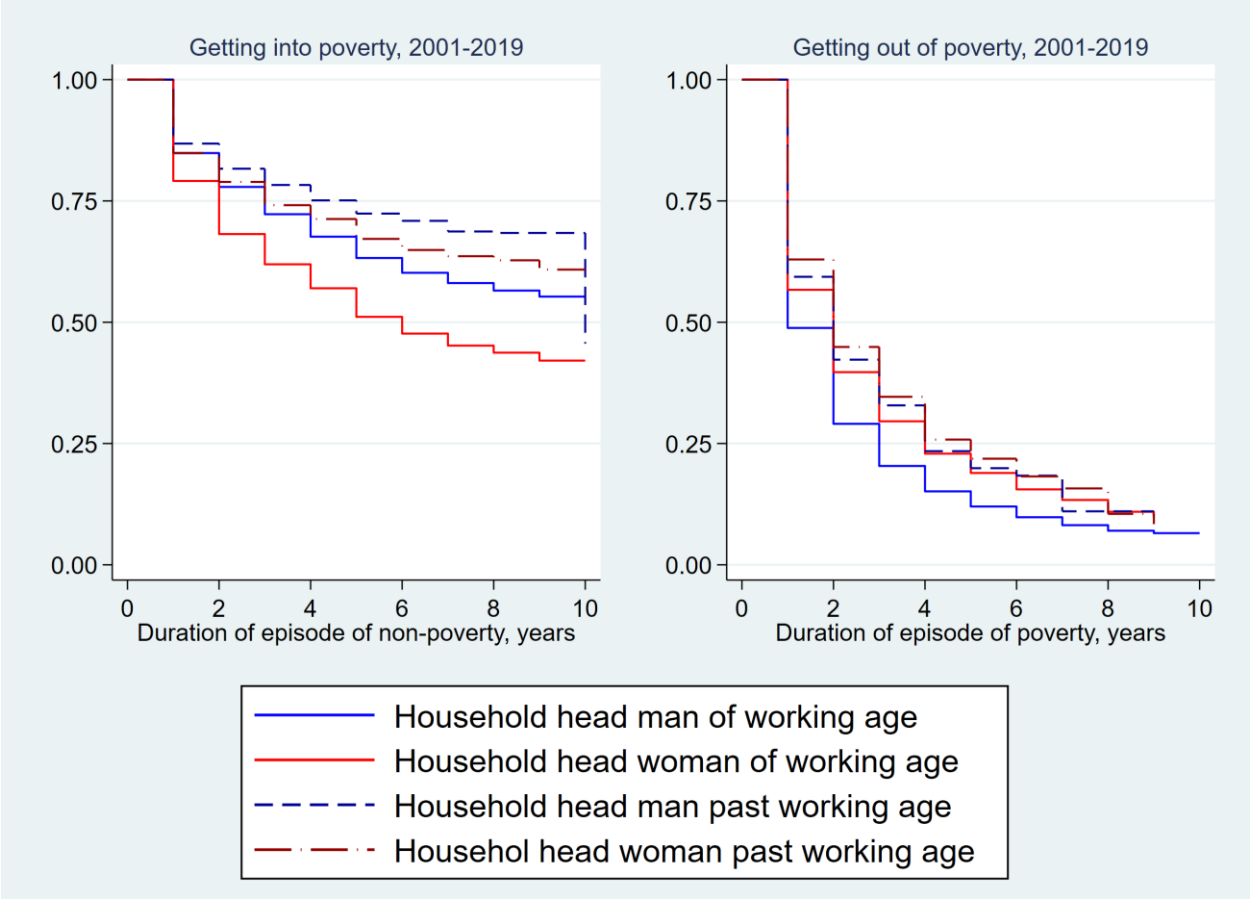

Figure 3 Estimated survival function for getting into and out of poverty by type of household, 2001 2019

Source: Author's calculations based on RLMS data.

By contrast, the chance of moving out of poverty is significantly higher, as shown by the rapidly declining survival curve (Figure 2, diagram on the right). The probability of ceasing to be poor after 1 year of being in poverty is 45%, after 2 years - 63%, after 3 - 73%.

Figures 3 and 4 illustrate the survival functions of households according to the type of household and whether they experienced the death of an adult family member during the observation period. Households headed by women of working age are most at risk of falling into poverty. Similar risks for households headed by working-age men are comparable to the probability of falling into poverty for households in which the head of the family is a pensioner. At the same time, male-headed households are significantly more likely to get out of poverty than other households.

Households that experienced the death of an adult family member during the observation period show greater risks of falling into poverty and are also less likely to quickly (after 1 or 2 years of poverty) move out of it.

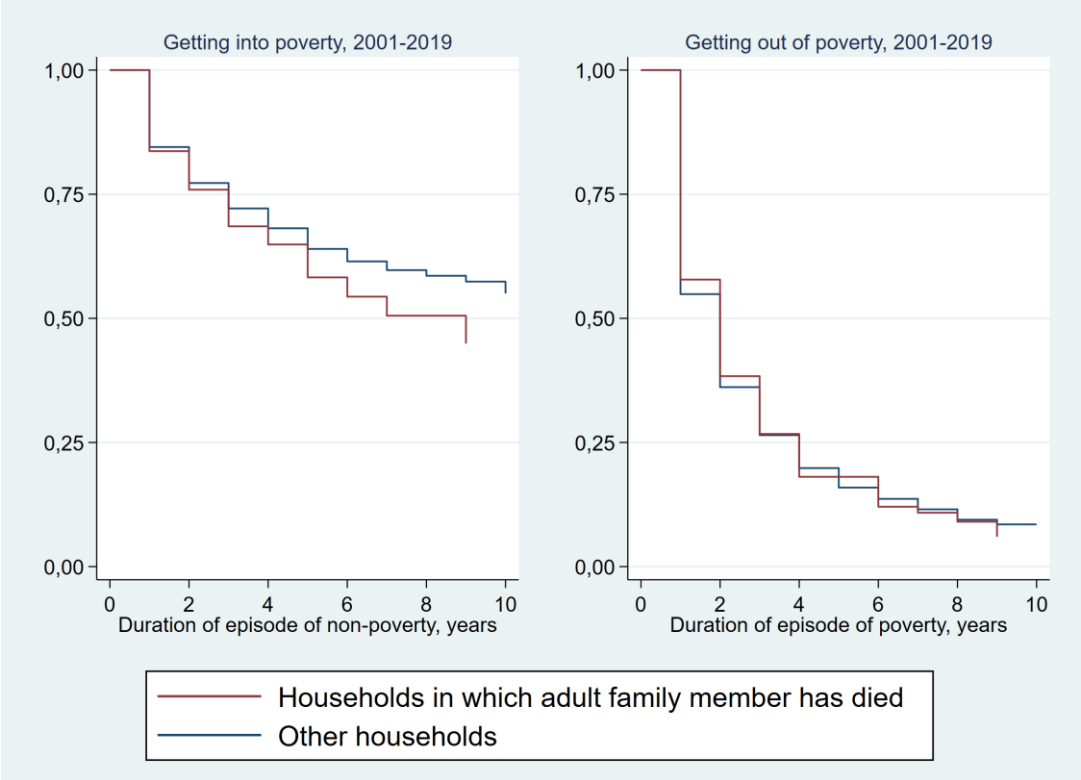

Figure 4. Estimate of the survival function for getting into and out of poverty, depending on whether the death of a family member occurred in the household, 2001 2019

Source: Author's calculations based on RLMS data.

Table 2 presents the sample means for the variables included in the regression analysis. Average time spent in non-poverty at the time of falling into poverty for the 2001-2019 sample is 2.75 years, which is noticeably longer than the average duration of poverty at the exit from it (1.83 years).

Table 2. Sample means of variables included in the regression analysis, 2001-2019

Variable	Getting into poverty	Getting out of poverty
Length of stay in non-poverty, years	2.75	
Length of stay in poverty, years		1.83
Household size, persons	2.76	3.07
Number of children under age 7, persons	0.22	0.28
Number of children aged 7 to 18, persons	0.31	0.45
Head of family woman of working age	0.28	0.32
Head of family woman past working age	0.25	0.20
Head of family man past working age	0.10	0.08
Head of family man of working age (missing variable)	0.37	0.40
Share of employed persons	0.38	0.34
Share of unemployed persons	0.03	0.04
Share of persons with higher education	0.20	0.12
Share of pensioners	0.44	0.33
Share of household members with poor health	0.14	0.14
Household lives in the city	0.73	0.60
3-5 years before the death of a man aged 21-60	0.002	0.004
1-2 years before the death of a man aged 21-60	0.004	0.006
Year of death of a man aged 21-60	0.006	0.01
1-2 years after the death of a man aged 21-60	0.008	0.011
3-5 years after the death of a man aged 21-60	0.007	0.005

Variable	Getting into poverty	Getting out of poverty
3-5 years before the death of a household member past working age	0.005	0.009
1-2 years before the death of a household member past working age	0.007	0.013
Year of death of a household member past working age	0.020	0.024
1-2 years after the death of a household member past working age	0.026	0.028
3-5 years after the death of a household member past working age	0.019	0.015
Number of observations	20547	11964
Number of censored observations	14699	3711

Source: Author's calculations based on RLMS data.

RESULTS

The impact of the death of family members on the well-being of households of various types

How does the death of men and women of different ages affect the well-being of the remaining members of households? To find an answer to this question, one can look at the dynamics of real income and poverty of the household in which the deceased lived during the 5 years before and after his death.

Figure 5 graphically presents information on the dynamics of the poverty level among households that survived the death of a man of working age. Real incomes of households in the year of death of one of the family members, regardless of the sex and age of the deceased, grow. This is most likely due to the low income of this person shortly before death, and therefore in the year of death, due to a decrease in family size, per capita income increases. We should also note the low number of a series of events of interest to us, primarily the deaths of women of working age. In general, from 2001 through 2019 there are 192 such cases in the sample, no more than 15 cases per year.

Figure 5. Dynamics of average real per capita income of households after the death of a family member, 2001-2019

Source: Author's calculations based on RLMS data.

Figure 6. Poverty dynamics among households after the death of a family member, 2001-2019

Source: Author's calculations based on RLMS data.

The relationship between the death of family members and the poverty of the households in which they lived is graphically presented in Figure 6. In the 2010s, the poverty rate of households that had lost a family member is significantly lower than in the previous decade, but this does not change the pattern of the impact of death on poverty. The effect of reducing

poverty directly in the year of death of a family member is observed in almost all cases, regardless of the observation period or of the sex and age of the deceased. The only exception is families where a pensioner died; for the period 2011-2019 they showed a slight increase in poverty.

As we can see, the dynamics of per capita income and poverty in households that survived the death of one of the family members indicate that the effect of a decrease in family size prevails over the effect of a decrease in income. This is most likely due to the fact that the well-being of households deteriorates not in the year of a person's death, but earlier. How fair this assumption is can be judged by the results of the analysis of poverty or income factors, taking into account the heterogeneity of individuals and households included in the sample. This was done using regression analysis.

REGRESSION ANALYSIS OF THE IMPACT OF THE DEATH OF FAMILY MEMBERS ON HOUSEHOLD POVERTY

In the duration regression model, we estimate the chances of the event under study, i.e., getting into or out of poverty, depending on the duration of the episode of non-poverty (poverty) that preceded such a transition. To do this, we consider observations with completed episodes, i.e., those cases where the state of non-poverty at some point ended in a transition to poverty. For them, the risk of falling into poverty is estimated as the conditional probability that the survival period will end at time t, provided that it does not end earlier. At the same time, we evaluate survival functions for unfinished episodes. The calculations used a semi-parametric Cox model - a proportional hazard model where the hazard function is the product of the baseline hazard function and the hazard ratio, which shifts the baseline hazard depending on the characteristics of the observed household. The results of assessing the factors of falling into poverty are presented graphically (Figure 7) and in tabular form (Table A1 of the Appendix). The results are represented by a regression coefficient (the logarithm of the odds ratio), so they can be either positive or negative. Significant factors are those for which the regression coefficient lies on one side of the red line of zero. Regression models were evaluated for 3 time periods: the full sample of 2001-2019, as well as subsamples of 2001-2010 and 2011-2019.

In Figure 7, the results of the survival analysis for the risk of falling into poverty are presented graphically. The points correspond to the values of the logarithm of the hazard ratio, and the segments passing through them correspond to 90% confidence intervals. For factors that significantly increase the risk of a household falling into poverty, the values of the coefficients are positive (located on the right side of each of the graphs in Figure 7), and the confidence interval does not cross the zero line.

According to the calculations, the demographic characteristics of a household have a significant impact on the risks of falling into poverty. Thus, as the size of the household grows, the probability of becoming poor for the 2011-2019 subsample increases significantly. Presence in the household of minor children also increases the likelihood of falling into poverty.

Households headed by women of both working age and retirement age have significantly higher risks of poverty compared to the reference category (men of working age). However, the risks of poverty for women of retirement age are mitigated by the influence of the variable

"proportion of persons of retirement age in the family", and the net effect of the fact that a household is headed by a woman of retirement age contributes to a decrease in the likelihood of falling into poverty.

An expectedly important factor in poverty is the status of household members in the labor market: the risk of poverty increases with an increase in the proportion of unemployed and a decrease in the proportion of employed family members. The presence of higher education among family members reduces the likelihood of falling into poverty. No significant influence on the risk of falling into poverty was found for the factor of poor health of family members. Living in an urban area reduces the risk of falling into poverty.

Of greatest interest in this study are the variables associated with the death of the respondents. Due to the small number of deaths of women of working age in the RLMS sample, information on such deaths was not included in the model. When information about the year of death of one of the household members is added to the model, practically nothing changes: only the death of family members of retirement age due to the loss of a guaranteed income by the household, the pension of the deceased, significantly contributes to an increase of poverty. The coefficients for the year of death of men of working age turned out to be insignificant for all versions of the model.

It can be assumed that the risks of falling into poverty increase not at the time of death of a not yet old person, but earlier, at the moment when he has significant health problems. The inclusion in the model of variables for the periods before and after the death of household members (3–5 years and 1–2 years before and after death) makes it possible to test this hypothesis. Figure 7 clearly shows the impact of the death of men of working age on poverty: increased risks of falling into poverty 1-5 years before death and 1-5 years after it. For families in which a family member of retirement age has died, the risks of falling into poverty are also highest 3-5 years and 1-2 years before the death.

It can also be assumed that the risks of falling into poverty after the death of men of working age are somewhat underestimated due to the fact that in such households its type is highly likely to change - from a household headed by a man of working age to a household headed by a woman.

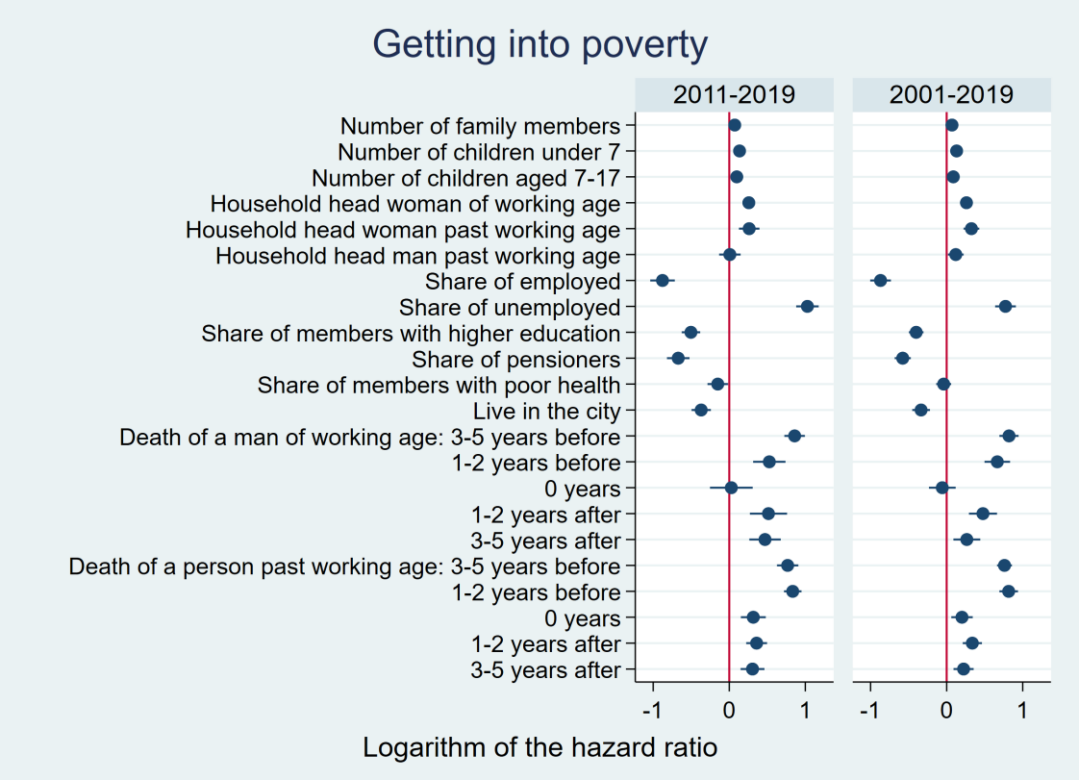

Figure 7. Results of the analysis of the length of stay in non-poverty, 2011-2019 and 2001-2019

Source: Author's calculations based on RLMS data.

The analysis of the process of a household getting out of poverty examined the same set of factors as the analysis of getting into it; however, the relationships found are not always a mirror image of earlier results. The results of the proportional risk model for households moving out of poverty are presented in Appendix Table A2 and Figure 8.

The influence of family composition factors is predictable: the chances of getting out of poverty are significantly reduced for families with a large number of minor children, the unemployed and people with low self-assessment of health, while, on the contrary, they increase if there are more working people, pensioners and family members with higher education in the family. Households headed by men of working age have a higher chance of moving out of poverty than all other types of households. It should also be noted that the absolute value of the impact of these factors on the chances of getting out of poverty is generally noticeably lower than for the chances of falling into poverty.

An interesting and somewhat unexpected effect of the death of an adult family member is observed 3-5 years and 1-2 years before the event of his death. The probability of getting out of poverty at this moment increases, and this effect is observed in the case of the death of both pensioners and men of working age. This may be due to an increase in income due to the start of disability benefits, although the effect of the variable "proportion of household members in poor health" for all three samples was insignificant (there is empirical evidence that self-reported health correlates significantly with objective indicators of health status, which include having a disability (Wu et al. 2013)).

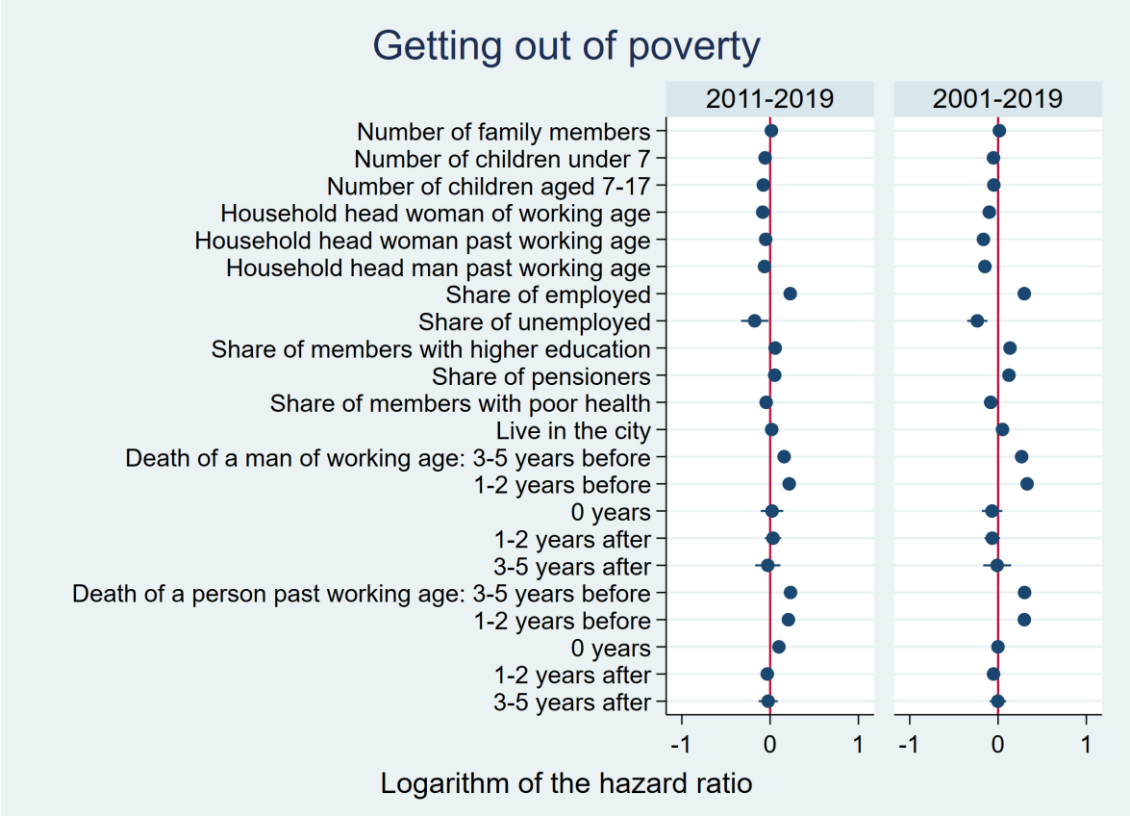

Figure 8. Results of the analysis of the length of stay in poverty, 2011-2019 and 2001-2019

Source: Author's calculations based on RLMS data.

CONCLUSION

Empirical analysis of the relationship between mortality and well-being requires the use of data from a panel of a representative sociological survey. In Russia, there is only one source of such data: the Russian Monitoring of the Economic Situation and Health of the Population of the National Research University Higher School of Economics (RLMS). The study showed that the error in estimating mortality using RLMS data is systematic and is mainly concentrated in certain (older) age groups.

Regression analysis of duration applied to the RLMS data for 2001-2019 made it possible to identify factors influencing the probability of households getting into and out of poverty. According to the calculations, the risks of falling into poverty are lower if there are employed persons, pensioners, and persons with higher education in the household. The risks of falling into poverty are higher if the household has unemployed persons or minor children, or if the head of the household is a woman. The absolute effect of the impact of factors on getting out of poverty turned out to be noticeably smaller than for the risks of falling into it.

We studied separately the impact on poverty and household income of the death of family members depending on their gender and age (men of working age, as well as people older than working age). It was shown that the death of men of working age has a significant impact on poverty: there are increased risks of falling into poverty 1-5 years before death and 1-5 years after it.

Thus, it was possible to prove that the death of men of working age negatively affects the well-being of households. Generally speaking, this conclusion is not obvious. It was shown that in the year of the death of a family member of working age, the per capita income of the rest of the household members increases, and the risks of poverty decrease, i.e., the effect of a decrease in the size of a household prevails over the effect of a decrease in its income. However, a study of household well-being not only in the year of death of a family member, but also for 5 years before and after this event, shows a noticeable increase in the risk of falling into poverty for households in which a man of working age dies.

The results obtained in the course of the study can be used in the development of social policy measures. It has been shown that a decrease in household size in the year of death of a family member does not suggest a deterioration in the financial situation of the remaining household; however, just before the death, and for several years after, such families face increased risks of falling into poverty. For families facing the loss or serious illness of loved ones, the fall into poverty could be prevented by social support measures, both material and non-material (psychological assistance, provision of long-term care services, assistance in finding a job, etc.).

ACKNOWLEDGEMENTS

The author is grateful to two anonymous reviewers for their careful reading of the text and valuable comments.

REFERENCES

Adams P., Hurd M. D., McFadden D., Merrill A., Ribeiro T. (2003). Healthy, wealthy, and wise? Tests for direct causal paths between health and socioeconomic status. *Journal of econometrics*, 112(1), 3-56.

Abanokova K.R. (2015). Changes in the structure of Russian households in 1994-2013 (statistical analysis). *Demographic Review*, 2(1), 125-147. (In Russ.) DOI: https://doi.org/10.17323/demreview.v2i1.1791

Ahammer A., Horvath T. A., Winter-Ebmer R. (2015). The effect of income on mortality: new evidence for the absence of a causal link. *IZA Discussion Paper*, 9176.

Andreev E.M. Mortality of men in Russia. (2001). *Voprosy statistiki*, 7, 27-33. (In Russ.)

Anikin V., Tikhonova N. (2014). Framing Contemporary Russian Poverty in the Context of Different Nations. *Universe of Russia*, 23(4), 59-94. (In Russ.)

Bane M. J., Ellwood D. T. (1986). Slipping into and out of Poverty: the Dynamics of Spells. *Journal of Human Resources*, 20(1), 1-23.

Becker G.S. (2009a). *Human capital: A theoretical and empirical analysis, with special reference to education.* University of Chicago press.

Becker G. S. (2009b). *A Treatise on the Family*. Harvard university press.

Cappellari L., Jenkins S. P. (2002). Who stays poor? Who becomes poor? Evidence from the British household panel survey. The Economic Journal, 112(478), 60-C67. https://doi.org/10.1111/1468-0297.00028

Chernysheva I.K., Furmanov K.K. (2013). Russian monitoring of the economic situation and health of the population as a source of data on mortality: opportunities and limitations. *Demoscope Weekly*, № 567-568. (In Russ.).

Cox D.R. (1972). Regression models and life-tables. *Journal of the Royal Statistical Society: Series B (Methodological)*, 34(2), 187-202.

Evans W. N., Moore T. J. (2011). The short-term mortality consequences of income receipt. *Journal of Public Economics*, 95 (11-12), 1410-1424

Denisova I. (2007). Entry to and exit from poverty in Russia: Evidence from longitudinal data. *Working Papers w0098, New Economic School (NES)*.

Denisova I. (2010). Adult mortality in Russia. *Economics of Transition*, 18(2), 333-363.

Duleep H.O. (1986). Measuring the effect of income on adult mortality using longitudinal administrative record data. *Journal of Human Resources*, 238-251.

Evans W. N., Moore T. J. (2011). The short-term mortality consequences of income receipt. *Journal of Public Economics*, 95 (11-12), 1410-1424

Fusco A., Islam N. (2012). Chapter 14 Understanding the Drivers of Low-Income Transitions in Luxembourg. In J.A. Bishop, J.A., R.Salas (Eds.) *Inequality, Mobility and Segregation: Essays in Honor of Jacques Silber* (*Research on Economic Inequality, Vol. 20*) (pp. 367-391). Emerald Group Publishing Limited, Bingley. DOI: https://doi.org/10.1108/S1049-2585(2012)0000020017.

Grigoriev P., Jasilionis D., Klüsener S., Timonin S., Andreev E., Meslé F., Vallin J. (2020). Spatial patterns of male alcohol-related mortality in Belarus, Lithuania, Poland and Russia. *Drug and alcohol review*, 39(7), 835-845.

Grishina E.E. (2018). Different Aspects of Poverty among Families with children. *ECO Journal*, 525(3), 7-26. (In Russ.)

Grossman M. *The demand for health: a theoretical and empirical investigation*. Columbia University Press, 1972.

Haq R., Arif G.M. (2004). Transition of Poverty in Pakistan: Evidence from the Longitudinal Data. *The Pakistan Development Review*, Pakistan Institute of Development Economics, 43(4), 895-909.

Jenkins S.P., Van Kerm P. (2014). The relationship between EU indicators of persistent and current poverty. *Social indicators research*, *116*(2), 611-638. DOI: https://doi.org/10.1007/s11205-013-0282-2

Jusot F. (2006). The shape of the relationship between mortality and income in France. *Annales d'Economie et de Statistique*, 89-122.

Klein J. P., Moeschberger M. L. (2003). *Survival analysis: techniques for censored and truncated data* (Vol. 1230). New York: Springer.

Kossova T., Kossova E., Sheluntcova M. (2020). Gender gap in life expectancy in Russia: The role of alcohol consumption. *Social Policy and Society*, 19(1), 37-53.

Leopold T. (2018). Gender differences in the consequences of divorce: A study of multiple outcomes. *Demography*, 55(3), 769-797. https://doi.org/10.1007/s13524-018-0667-6

Lindquist M.J., Lindquist G.S. (2012). The dynamics of child poverty in Sweden. *Journal of Population Economics*, *25*(4), 1423-1450.

Mather D. (2011). Working-age Adult Mortality, Orphan Status, and Child Schooling in Rural Mozambique. *Food Security International Development Working Papers 119320*, Michigan State University, Department of Agricultural, Food, and Resource Economics.

McKernan S.M., Ratcliffe C. (2005). Events that trigger poverty entries and exits. *Social Science Quarterly*, 86, 1146-1169. DOI: https://doi.org/10.1111/j.0038-4941.2005.00340.x

Mehta N.K., House J.S., Elliott M.R. (2015). Dynamics of health behaviours and socioeconomic differences in mortality in the USA. *J Epidemiol Community Health*, 69(5), 416-422. DOI: https://dx.doi.org/10.1136%2Fjech-2014-204248

Mincer J. (1993). *Studies in human capital* (Vol. 1). Edward Elgar Publishing.

Munnell A. H., Eschtruth A. D. (2018). Modernizing Social Security: Widow benefits. *Center for Retirement Research at Boston College, Issue in Brief, No. 18-17*, Chestnut Hill, Mass.: September 2018. http://hdl.handle.net/2345/bc-ir:108142

Munnell A. H., Sanzenbacher G., Zulkarnain A. (2019). Why has poverty declined for widows? *Center for Retirement Research at Boston College, Issue in Brief*, No. 19-4, Chestnut Hill, Mass.: February 2019. http://hdl.handle.net/2345/bc-ir:108360

Ozdamar O., Giovanis E. (2017). The causal effects of survivors' benefits on health status and poverty of widows in Turkey: Evidence from Bayesian Networks. *Economic Analysis and Policy*, 53, 46-61. DOI: https://doi.org/10.1016/j.eap.2016.11.001

Perlman F., Bobak M. (2008). Determinants of self rated health and mortality in Russia–are they the same? *International Journal for Equity in Health*, 7(1), 19. DOI: https://doi.org/10.1186/1475-9276-7-19

Ratnikova T., Furmanov K. (2014). *Panel data and duration analysis*. Moscow: HSE. (In Russ.)

Shkolnikov V.M., Andreev E.M., McKee M., Leon D.A. (2013). Components and possible determinants of the decrease in Russian mortality in 2004-2010. Demographic research, 28, 917-950. DOI: https://dx.doi.org/10.4054/DemRes.2013.28.32

Snyder S. E., Evans W. N. (2006). The effect of income on mortality: evidence from the Social Security notch. *Review of Economics and Statistics*, 88 (3), 482-495.

Sydén L., Landberg J. (2017). The contribution of alcohol use and other lifestyle factors to socioeconomic differences in all-cause mortality in a Swedish cohort. *Drug and alcohol review*, 36(5), 691-700. DOI: https://doi.org/10.1111/dar.12472

Yamauchi F., Buthelezi T., Velia M. (2006). Gender, labor, and prime-age adult mortality: evidence from South Africa. FCND discussion papers 208, International Food Policy Research Institute (IFPRI).

Wu S., Wang R., Zhao Y., Ma X., Wu M., Yan X., He J. (2013). The relationship between self - rated health and objective health status: A population-based study. *BMC public health*, 13(1), 1-9. DOI: https://doi.org/10.1186/1471-2458-13-320

Zakharov S.V., Churilova E.V. (2013). Single Motherhood in Russia: Statistical and Demographic Analysis of its Prevalence and Formation Patterns. *Universe of Russia. Sociology. Ethnology*, 22(4), 86-117. (In Russ.)

APPENDIX

Table A1. Factors contributing to a household getting into poverty (Cox semiparameter regression)

	Model 1 (2001-2010)	Model 2 (2011-2019)	Model 3 (2001-2019)
Size of household	0.078***	0.072***	0.070***
	[0.019]	[0.015]	[0.013]
Number of children under age 7	0.058	0.136***	0.132***
	[0.040]	[0.042]	[0.035]
Number of children aged 7-18	0.029	0.099***	0.088***
	[0.031]	[0.038]	[0.030]
Sex and age of head of household (omitted variable: head of household male of working age)			
Head of family woman of working age	0.284***	0.258***	0.260***
	[0.051]	[0.039]	[0.033]
Head of family woman past working age	0.241***	0.262***	0.326***
	[0.062]	[0.082]	[0.063]
Head of family man past working age	0.324***	0.008	0.120*
	[0.075]	[0.086]	[0.064]
Share of employed persons	-0.903	-0.878***	-0.869***
	[0.093]	[0.098]	[0.083]
Share of unemployed persons	0.473***	1.027***	0.774***
	[0.015]	[0.090]	[0.083]
Share of persons with higher education	-0.301**	-0.504***	-0.401***
	[0.070]	[0.074]	[0.057]
Share of family members of retirement age	-0.511***	-0.671***	-0.577***
	[0.085]	[0.090]	[0.065]
Share of household members with poor health	0.078	-0.151*	-0.039
	[0.074]	[0.082]	[0.057]
Live in the city	-0.231***	-0.369***	-0.336***
	[0.089]	[0.077]	[0.071]
3-5 years before the death of a man aged 21-60	0.171	0.0859***	0.820***
	[0.274]	[0.082]	[0.077]
1-2 years before the death of a man aged 21-60	0.841***	0.527***	0.666***
	[0.106]	[0.129]	[0.102]
Year of death of a man aged 21-60	-0.029	0.027	-0.057
	[0.162]	[0.171]	[0.107]
1-2 years after the death of a man aged 21-60	0.399**	0.0516***	0.477***
	[0.186]	[0.148]	[0.112]
3-5 years after the death of a man aged 21-60	-0.405	0.470***	0.265**
	[0.390]	[0.126]	[0.107]
3-5 years before the death of a family member of retirement age	0.0530**	0.768***	0.760***
	[0.208]	[0.085]	[0.059]
1-2 years before the death of a family member of retirement age	0.631***	0.0834***	0.815***
	[0.136]	[0.070]	[0.074]
Year of death of a family member past working age	0.037	0.316***	0.202**
	[0.143]	[0.100]	[0.086]
1-2 years after death of a family member of retirement age	0.338**	0.360***	0.338***
	[0.135]	[0.083]	[0.077]

	Model 1 (2001-2010)	Model 2 (2011-2019)	Model 3 (2001-2019)
3-5 years after the death of a family member of retirement age	0.196	0.306***	0.223***
	[0.203]	[0.095]	[0.080]
Number of observations	7355	12242	20547
Number of subjects	7355	12242	20547
Number of transitions to poverty	2084	3310	5848
Pseudo-maximum likelihood logarithm	-16567.70	-25080.73	-48856.26

Source: Author's calculations based on 2001 RLMS data.

*Notes: *, **, *** - value at 10, 5 and 1% level, standard errors are given in parentheses*

Table A2. Factors contributing to a household getting out of poverty (Cox semiparameter regression)

	Model 1 (2001-2010)	Model 2 (2011-2019)	Model 3 (2001-2019)
Size of household	0.009	0.014**	0.015**
	[0.010]	[0.007]	[0.006]
Number of children under age 7	-0.093***	-0.056***	-0.051***
	[0.031]	[0.019]	[0.019]
Number of children aged 7-18	-0.038**	-0.077***	-0.047***
	[0.019]	[0.015]	[0.011]
Sex and age of head of family (missing variable: head of family man of working age)			
Head of family woman of working age	-0.101***	-0.084***	-0.099***
	[0.018]	[0.019]	[0.011]
Head of family woman past working age	-0.268***	-0.050*	-0.166***
	[0.041]	[0.029]	[0.027]
Head of family man past working age	-0.201***	-0.063*	-0.149***
	[0.050]	[0.039]	[0.039]
Share of employed persons	0.373***	0.228***	0.297**
	[0.047]	[0.036]	[0.033]
Share of unemployed persons	-0.256***	-0.175*	-0.235***
	[0.095]	[0.094]	[0.070]
Share of persons with higher education	0.196***	0.057**	0.136***
	[0.040]	[0.026]	[0.026]
Share of family members of retirement age	0.188***	0.052*	0.123**
	[0.037]	[0.028]	[0.022]
Share of household members with poor health	-0.030	-0.045	-0.083***
	[0.032]	[0.034]	[0.026]
Live in the city	0.117**	0.018	0.050
	[0.057]	[0.021]	[0.033]
3-5 years before the death of a man aged 21-60	0.243***	0.159***	0.267***
	[0.092]	[0.030]	[0.045]
1-2 years before the death of a man aged 21-60	0.361***	0.216***	0.330***
	[0.042]	[0.035]	[0.032]
Year of death of a man aged 21-60	-0.193	0.021	-0.068
	[0.128]	[0.077]	[0.070]
1-2 years after the death of a man aged 21-60	-0.213*	0.033	-0.066
	[0.121]	[0.058]	[0.053]
3-5 years after the death of a man aged 21-60	-0.166	-0.027	-0.010

	Model 1 (2001-2010)	Model 2 (2011-2019)	Model 3 (2001-2019)
	[0.099]	[0.087]	[0.095]
3-5 years before the death of a family member of retirement age	0.0245***	0.231***	0.300***
	[0.070]	[0.018]	[0.026]
1-2 years before the death of a family member of retirement age	0.351***	0.207***	0.298***
	[0.041]	[0.019]	[0.026]
Year of death of a family member past working age	0.005	0.100***	-0.001
	[0.052]	[0.037]	0.035
1-2 years after the death of a family member of retirement age	0.094	-0.032	0.051
	[0.083]	[0.046]	[0.041]
3-5 years after the death of a family member of retirement age	-0.029	-0.022	0.002
	[0.111]	[0.066]	[0.057]
Number of observations	6525	4786	11964
Number of subjects	6525	4786	11964
Number of transitions to non-poverty	4035	3638	8253
Pseudo-maximum likelihood logarithm	-31182.49	-27029.19	-68603.83

Source: Author's calculations based on 2001 RLMS data.

*Notes: *, **, *** - value at 10, 5 and 1% level, standard errors are given in parentheses*