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Research Article

Social, Demographic and Behavioral Predictors of 5-Year Mortality in Subjects Over 85 Years in Moscow

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ABSTRACT

This study is the first prospective observational study with a comprehensive analysis of the social, demographic and behavioral factors of 5-year mortality in persons aged 85 years and older (mean age of 88 years, males 23%) living in Moscow. 229 patients (female 77%) aged 85–94 years (mean age 87.9 ± 2.4 years) were included in the prospective observational study. Anthropometric and vital signs measurements were carried out, and specially designed questionnaires were used to evaluate patient's history, social and behavioral factors. The follow-up period was 5 years. The primary endpoint was death from any cause. 92 (40.2%) patients died during the follow-up period (median 3.67 years). Cox multivariate analysis revealed hazard ratios (HR) of 6.91 (95% confidence interval (CI) of 1.71–27.83, p=0.007) for BMI<18.5 *vs.* 18.5-24.9 kg/m^2, 0.49 (95% CI 0.26–0.92, p=0.026) for BMI 25.0-29.9 kg/m^2 *vs.* 18.5-24.9 kg/m^2, 2.37 (95% CI 1.20–4.67, p=0.013) for the start of the night sleep after midnight *vs.* before midnight, 4.00 (95% CI 1.79–8.91, p=0.001) for nighttime sleep duration ≥ 10 h *vs.* 5-9 h, and 0.28 (95% CI 0.12–0.69, p=0.005) for history of blood donation *vs.* never blood donation. In people aged 85 years and over, J-curve was observed to result in the association of BMI and 5-years mortality. Also, it was found that sleeping habits (going to sleep late and longer night sleep) were independently associated with the increased risk of death while the history of blood donation was associated with lower mortality.

Keywords: Elderly; Mortality; Blood Donation; Sleeping Habits; Demographic

INTRODUCTION

The current demographic is characterized by a ubiquitous aging population with an increase in the proportion of the elderly. Although, two decades ago, such trend was considered a phenomenon exclusive to developed countries, it is now observed all over the world, and Russia is not an exception. Indeed, demographic trends in Russia show an increasing number of seniors. Recently, there has been an increase in the life expectancy. According to data from the Russian national statistics between 2000 and 2015, the average life expectancy in the Russian Federation increased from 65.3 to 71.4 years (from 59.0 to 65.9 years for men and from 72.2 to 76.7 years for women) [1].

Life expectancy is an integrative indicator, which depends on many factors related to both personal health and environmental conditions including gender (sex), genetic and ecological factors, ethnicity and socio-economic factors, availability of healthcare and personal well-being, physical activity, nutrition, etc. Climate and environmental conditions, as well as social and economic factors, can vary significantly across the Russian Federation. The purpose of this study was to evaluate the impact of social, demographic factors, lifestyle and dietary habits on 5-year mortality rates in people aged 85 years and older living in Moscow and the Moscow Region.

RESEARCH METHODOLOGY

This study was organized as a local register of subjects aged 85 years and over who live in Moscow. It was approved by the local Ethics Committee of the Russian Clinical and Research Center of Gerontology the part of Pirogov Russian National Research Medical University of the Ministry of Healthcare of the Russian Federation. All methods were performed in accordance with the relevant guidelines and regulations.

The participants were included in the study during their planned admission (for performed necessary annual medical test and correction medical treatment if necessary) to the Russian Clinical

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and Research Center of Gerontology between 2011 and 2013. At the time of admission, all subjects were in stable condition without evidence of acute illness or decompensation of chronic diseases. All subjects provided their informed consent for participation in the study.

Anthropometric indices and vital signs (included blood pressure) were recorded, and specially designed questionnaires were filled in to collect information on social and behavioral factors, lifestyle, habits, eating patterns and physical activity. Body mass index (BMI) was then calculated as body weight (kg) / [height (m)]^2. A BMI of 18.5-24.9 kg/m^2 was considered as normal body weight; a BMI: 25.0-29.9 kg/m^2 as overweight; a BMI ≥30.0 kg/m^2 as obesity; and BMI <18.5 kg/m^2 as low body weight. At that time the center did not provide complex geriatric assessment for patients.

The study included 229 consecutive patients (177 women) aged between 85 and 94 years. Characteristics of patients are presented in Table 1. The mean age was 87.9 ± 2.4 years, 72% of patients were aged between 85 and 89 years. Duration of the prospective patients' follow-up was five years. In addition, the information on outcomes was collected by telephone contact with the patients themselves or their relatives or caregivers. We estimated the presence of any chronic diseases and calculated Charlson comorbidity index (CCI). Moreover, the number of medications was taken by patients during hospitalization was determined.

Primary endpoint included death from any cause. Statistical analysis of data was performed using the IBM® SPSS® Statistics version 23.0 (SPSS Inc., USA). The type of distribution of quantitative variables was analyzed using a one-sample Kolmogorov-Smirnov test. For parametric data distribution, the results are represented as M ± SD, where M is the mean, SD is the standard deviation; for nonparametric as Me (25%, 75%), where Me is the median, 25%, and 75% are the 25th and 75th percentiles. For intergroup comparisons, the Student's t-test or the Mann-Whitney U test (for quantitative variables) and Pearson's χ^2 or the two-sided Fisher exact test (for qualitative variables) were used. Mortality analysis was performed using the Kaplan-Meier method; the mortality curves were compared using the Mantel-Cox log-rank test. Moreover, the Cox proportional hazards model was used to determine the risk of death. Observations with missing values were excluded from the analysis. Differences were then considered statistically significant at a two-sided $p < 0.05$.

RESULTS

Age and gender

The duration of follow-up varied from 0.03 to 6.03 years; with a median of 3.67 (2.72, 4.54) years. Ninety-two patients (40.2%) died during the follow-up period. The deceased and survived patients did not differ by age and gender.

Social factors

Univariate analysis showed no association between 5-year mortality and any of social factors including the level of education, participation in the World War II, living condition (single, in the family, in a nursing home), marital status, the presence of children, grandchildren and great-grandchildren and their number, family history of mother's and father's longevity.

Smoking and alcohol

The prevalence of current smoking nor alcohol consumption was extremely low -0.9% and 3.1%, respectively, and none of them was associated with an increase in the risk of death during the follow-up.

Nutrition

The Body Mass Index ranged from 17.3 to 37.6 kg/m^2 with a mean value of 26.1 ± 4.3 kg/m^2 (Table 1). Most patients had normal BMI or were overweight (41.3% and 38.8%, respectively). Obesity was observed in 17,9% and low BMI in 2.0%. The J-shaped relationship between BMI and death rate was observed (p for the trend=0.015). The lowest (29.5%) death rate was found in those with BMI 25.0-29.9 kg/m^2, the highest (100%) in patients with BMI <18.5 kg/m^2. Univariate analysis (the Cox proportional hazards model with age and sex adjustment) demonstrated that compared to patients with BMI 18.5-24.9 kg/m^2 (reference category) the risk of death during follow-up in subjects with BMI 25.0-29.9 kg/m^2 was 44% lower, and in those with BMI < 18.5 kg/m^2 turned out to be approximately 9 times higher (Table 2 and Figure 1).

The probability of death was not affected neither by the history of starvation (either in childhood or adolescence, or during the war) nor by history of compliance with any diet for weight loss. Increase in the risk of death (HR 1.58, 95% CI 1.08–2.34, p=0.049) was associated with the use of less than 1 liter of liquid per day (the total amount of any liquid, including water, tea, soup, juice, etc.). There was also a trend towards an increase in mortality (HR 1.79, 95% CI 0.94–3.06, p=0.079) in patients taking meals 1-2 times a day compared to patients eating 3-6 times a day.

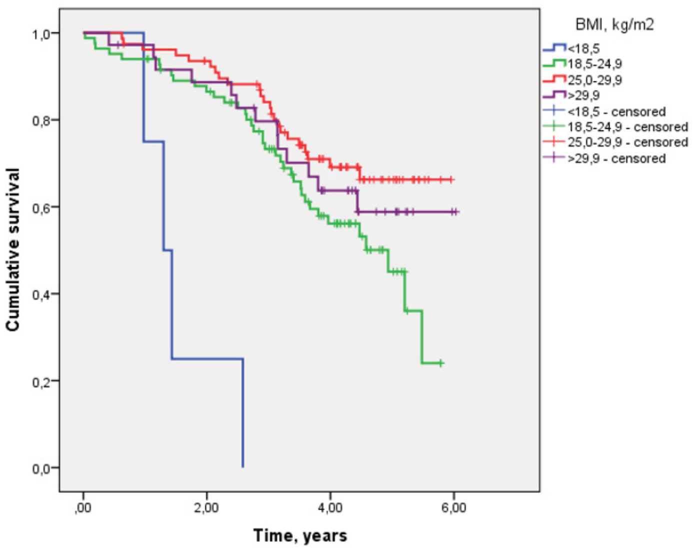
Table 1: Summary of study population characteristics (n=229).

Variables	Value
Gender (Female), n (%)	177 (77,3%)
Age, years (M ± SD)	87,9 ± 2,4
Body Mass Index, kg/m^2 (M ± SD)	26,1 ± 4,3
<18.5 kg/m^2, n/N (%)	4/201 (2%)
18.5-24.9 kg/m^2, n/N (%)	83/201 (41,3%)
25.0-29.9 kg/m^2, n/N (%)	78/201 (38,8%)
≥30.0 kg/m^2, n/N (%)	36/201 (17,9%)
Current smoking, n/N (%)	2/223 (0,9%)
Current alcohol consumption, n/N (%)	7/223 (3,1%)
World War II Veterans, n/N (%)	162/227 (71,4%)
Marital status, n/N (%)	
Married	36/214 (16,8%)
Unmarried	4/214 (1,9%)
Divorced	8/214 (3,7%)
Widowed	166/214 (77,6%)
Education, n/N (%)	
Primary school	14/211 (6,6%)
Full school	35/211 (16,6%)
College	50/211 (23,7%)
University	112/211 (53,1%)
Living conditions, n/N (%)	
Single	81/211 (38,4%)
With family	126/211 (59,7%)
Nursing home	4/211 (1,9%)

Table 2: A 5-year hazard ratios of death by body mass index in subjects aged 85 years and older.

BMI category, kg/m²	BMI range	M ± SD	HR	95% CI	P-value
18.5–24.9	18.7–24.9	22.4 ± 1.6	1,00 (reference)	–	–
25.0–29.9	25.0–29.9	27.4 ± 1.5	0.56	0.33–0.95	0.03
30.0 and higher	30.1–37.6	32.9 ± 1.7	0.71	0.37–1.33	0.281
<18.5	17.3–18.1	17.6 ± 0.4	9.41	3.02–29.30	<0.001

M: Mean; SD: Standard Deviation; HR: Hazard Ratio; CI: Confidence Interval; BMI: Body Mass Index



Note: Blue line: BMI <18.5 kg/m²; **Green line:** BMI 18.5-24.9 kg/m²; **Red line:** BMI 25.0-29.9 kg/m²; **Purple line:** BMI >29.9 kg/m²; «+»: censored; **BMI:** Body Mass Index

Figure 1: The Kaplan-Meier curves for 5-years mortality by body mass index in subjects aged 85 years and older.

Sleeping habits

The association between the probability of mortality rate and their sleeping habits was found. Late sleep pattern (going to bed after midnight) was associated with increased risk of death by 78% (HR 1.78, 95% CI 1.01-3.12, p=0.045) experienced by late sleepers, compared with subjects who sleep before midnight. Univariate analysis revealed a U-shaped relationship between the awakening time and death rate (p for the trend=0.05), with the lowest (23.8%) death rate in patients waking up at 4-6 am, and the highest (67%) in those who hawked before 4 am. The death rate of patients who wake up after 8 am was significantly higher (48.8%) than those with awakening time at 4-6 am (23.8%, p=0.056). Nonetheless, the Kaplan-Meier analysis did not confirm this finding (chi-square=5.1; p=0.162). Daytime sleep (siesta) had no effect on mortality.

The duration of night sleep ranged from 2 to 12 hours, mean 7.4 ± 1.8 hours. Short (≤ 4 hours) sleep duration was reported in 7.8% of patients, medium (5-9 hours) in 82.8% and long (≥10 h) in 9.3% of patients. Univariate analysis revealed a U-shaped relationship between the duration of night sleep and the rate of fatal outcomes (p for the trend=0.011). The lowest (34.3%) death rate was found in subjects with average sleep duration, and it was almost similar in those with sleep duration of 5-6 hours (33.9%) and 7-9 hours (34.8%). Short and long sleep duration was associated with a 2-fold increase in the risk of death during follow-up compared with average sleep duration (reference category), HR 1.76, 95% CI 1.03-3.21, p=0.048 and 2.11, 95% CI 1.09-4.11, p=0.028, respectively). Kaplan-Meier analysis revealed that only long duration of night sleep affected the mortality in the studied population significantly (chi-square=5.1, p=0.024).

Physical activity

In this study, while 42,4% of patients reported that they practiced physical activities on a daily basis, 55.2% of patients answered that they did not practice any physical activity and instead followed a sedentary lifestyle. 2.3% reported irregular physical exercises. In patients with regular or irregular physical activity, the risk of death was 44% lower than that of people with a sedentary lifestyle (HR 0.56, 95% CI 0.34-0.93, p=0.025).

Blood donation

Among the study population, 3.5% of patients reported regular blood donation, 18.7% reported episodic blood donation, while 77.8% of patients maintained that they had never been blood donors. Univariate analysis revealed that blood donation was associated with lower *mortality*, and risk of death was 59% lower in patients who reported regular or episodic blood donation than in those who had never donated blood (HR 0.41, 95% CI 0.21-0.80, p=0.009).

Chronic diseases and comorbidity

Kaplan-Meier analysis identified 6 chronic diseases which were associated with 5-years mortality: atrial fibrillation (chi-square 24.7; p<0.001), chronic anemia (chi-square 8.2; p=0.004), degenerative valvular heart disease (chi-square 12.8; p<0.001), vascular Parkinsonism (chi-square 4.2; p=0.041), dementia (chi-square 4.1; p=0.044), and rheumatoid arthritis (chi-square 9.1; p=0.003). Multivariate Cox regression with age and sex adjustment showed that atrial fibrillation (HR 3.55; 95% CI 1.88 to 6.71; p<0.001), chronic anemia (HR 2.36; 95% CI 1.34 to 4.18; p=0.003), degenerative valvular heart disease (HR 9.26; 95% CI 1.07 to 80.27; p=0.043), and vascular Parkinsonism (HR 3.89; 95% CI 1.20 to 12.61; p=0.024) are independent predictors of 5-years mortality in very old patients.

CCI was varied from 4 to 13 (median 6, IQR 5 to 7) points. 5-years total mortality in patients who had 4–5 points of CCI was 32.3%, and in patients who had 6–13 points of CCI was 47.2% (p=0.022). Univariate Cox regression with age and sex adjustment showed that comorbidity (CCI ≥6 points) is associated with a 1.7-fold increase of 5-years mortality risk (HR 1.66; 95% CI 1.08 to 2.55; p=0.022). Kaplan-Meier analysis confirmed that comorbidity (CCI ≥6 points) influence 5-years mortality (chi-square 6.5; p=0.011). We did not find a connection between blood donation and comorbidity.

Polypharmacy

During hospitalization, all patients received from 4 to 21 (mean 10.8 ± 3.2) of any drugs, including from 1 to 11 (mean 5.1 ± 2.1) of injectable drugs and from 0 to 12 (mean 5.6 ± 2.2) of oral drugs. At that time in medical practice injectable low evidence-based medicines, such as Mildonium Digidrati (100 mg), Actovegini (80mg), solution potassium chloride (as a supportive infusion) were commonly used in medical practice. Kaplan-Meier analysis showed that taking ≥5 injectable drugs was associated with increased of 5-years mortality (chi-square 5.8; p=0.016). 5-years total mortality in patients who received 1-4 injectable drugs was 28.7%, and in patients who received ≥five injectable drugs was 46.3% (p=0.011). Univariate Cox regression with age and sex adjustment showed that use of ≥5 injectable drugs during hospitalization is associated with a 1.8-fold increase of 5-years mortality risk (HR 1.78; 95% CI 1.11 to 2.88; p=0.018).

Hypertension

While the mean Systolic blood pressure was 143.6+/-21.0 mmHg, Diastolic Blood Pressure 82.4 +/- 10.9 mmHg, Pulse Blood Pressure 61.3+/-16 mmHg at the admission time, the mean SBP was 129.1+/-9.5 mmHg, DBP 78.0+/-5.7 mmHg, PBP 51.1+/-8.9 mmHg at discharge time.

The changes in BP (delta %) was estimated by using excavation:

Delta % $=((N_1-N_0)/N_0)) \times 100\%$.

where N_0 is the blood pressure level at the admission and N_1 is the blood pressure at the discharge day. On the last day of hospitalization, blood pressure levels were lower when compared to the first day. The delta for SBP was -7.7 (-14.9; 0)%, for DBP - 0 (-11.1%; 0), for PBP -16.7% (-28.6; 0). The systolic blood pressure dropped on 8%, PBP on 17%. However, the DBP does not change.

The patients who died had the lower systolic and pulse blood pressure during hospitalization 139.2%+/-19.1compared to 146.4+/-21.8% (p=0.032) and 58.1+/-14.5 compared to 63.3+/-16.6 (p=0.03), respectively.

The Kaplan-Meyer analysis showed that SBP less than 140 mmHg during hospitalization increased mortality by five years (χ^2=3.94; p=0.047). Univariate analysis showed that with patients who have a SBP lower than 140 mmHg, the death risk increased by 56% compared to patients whose SBP was higher than 140 mmHg (RR 1.56, CI 1.00-2.42; p= 0.049). Changes in blood pressure from the admission to discharge day did not correlate with five years mortality.

Kaplan-Meier analysis

The results of the Kaplan-Meier analysis showed that factors associated with decreased mortality included BMI <18.5 kg/m^2, consumption of less than 1 liter of liquid per day, going to bed after midnight, and having a night sleep duration ≥10 hours. Factors associated with lower mortality included BMI 25.0-29.9 kg/m^2, any kind of physical activity and having a history of blood donation (Table 3).

Multivariate analysis

To find the independent predictors of 5-year mortality in patients older than 85 years, the factors with a significance level of p <0.05, selected from the Kaplan-Meier mortality analysis, were included in the multivariate analysis (Cox proportional hazards model adjusted for age and sex; forward stepwise variable selection method). Based on the results of multivariate analysis, five factors that affect the 5-year mortality rate were identified (Table 4).

DISCUSSION

To our knowledge, this study is the first prospective observational study with a comprehensive analysis of the social, demographic and behavioral predictors of 5-year mortality in persons aged 85 years and older (mean age of 88 years, 77% female) living in Moscow. In general, the results of this study are consistent with the available literature and suggest that mortality in older people over 85 years of age is likely higher in those with healthier lifestyle habits, including physical activity, better nutrition, and sleeping habits.

In total, about 50 factors were included into the univariate analysis to identify those associated with fatal outcomes with a significance level of p < 0.05 for subsequent inclusion in multivariate analysis to find independent predictors of 5-year mortality in this Moscow elderly population. The final multivariate regression model identified five independent predictors of mortality; negative predictors included BMI<18.5 kg/m^2, going to sleep after midnight, night sleep duration ≥ten h, positive predictors included BMI 25.0-29.9 kg/m^2 and history of blood donation. Negative predictors increased the 5-year risk of all-cause mortality by 2.4-6.9 times, while the positive predictors decreased it by 51% and 72%. The most significant independent negative predictor of 5-year mortality was BMI<18.5 kg/m^2, which was associated with an approximately 11-fold increase in the risk of death compared to the reference category.

The prognostic value of BMI is well-established in many populations, but the associations of BMI and outcomes are complex. Thus, patients with acute and chronic heart failure are characterized by "obesity paradox", meaning that better mortality is associated with BMI over traditional normal ranges [2,3]. The complex association between BMI and mortality was further confirmed in general population studies [4]. A lot of studies have been carried out to

Table 3: Kaplan-Mayer's analysis of factors affecting 5-year mortality in patients aged 85 years and older.

Factors	χ^2	p (Log Rank)
BMI <18.5 kg/m^2	32.7	<0.001
BMI 25.0-29.9 kg/m^2	4.8	0.028
Liquid consumption less than 1 liter per day	2.9	0.049
Going to sleep after midnight	1.9	0.042
Nighttime sleep duration ≥10 h	5	0.024
Physical activity	5.2	0.023
History of blood donation	7.2	0.007

*BMI – Body Mass Index

Table 4: Independent predictors of 5-year mortality in patients aged 85 years and older.

Factors	HR	95% CI	P-value
BMI <18.5 kg/m^2	6.91	1.71–27.83	0.007
BMI 25.0–29.9 kg/m^2	0.49	0.26–0.92	0.026
Going to sleep after midnight	2.37	1.20–4.67	0.013
Nighttime sleep duration ≥10 h	4	1.79–8.91	0.001
History of blood donation	0.28	0.12–0.69	0.005

HR: Hazard Ratio; CI: Confidence Interval; BMI: Body Mass Index evaluate the relationship between body weight and mortality in the elderly, and their results are homogeneous and suggest that low body weight increases the risk of death, whereas overweight and sometimes obesity have a protective effect on mortality [5-12]. Those findings are consistent across the studies despite their ethnic and geographical heterogeneity and different classifications of body weight used.

Univariate analysis showed that SBP less than 140 mmHg during hospitalization was associated with higher 5 years mortality (p-0.049). At that time, the practice guidelines for the management of arterial hypertension (2007) recommend keeping SPB below 140 mmHg, when it successful and well tolerated.

Besides, this study showed that poly pharmacology (and especially with low evidence-based medication) increased the death rate. To this end, physicians should pay attention to the number of drugs taken by the patient and should not prescribe medication without clear evidence that improve prognosis or quality of life.

The recent meta-analysis included data from 20 studies involving 19,538 elderly patients living in nursing homes. During the follow-up (median two years), 5,223 patients died. Compared with patients with a healthy weight, the risk of death from any cause associated with patients with a body weight deficit was significantly higher (OR 1.41; 95% CI 1.26-1.58), and such a risk was significantly lower in those who were overweight (0.85; 95% CI 0.73-0.99) or obese (0.74; 95% CI 0.57-0.96). Low body weight was also associated with increased mortality from infectious diseases (RR 1.65, 95% CI 1.13-2.40). The exact causes of the "obesity paradox" are still unclear, but its multidimensional nature is evolving depression, nutrition, immunity, sarcopenia, cognition, and many other factors are generally considered to be the most likely. Our study was not designed to evaluate the contribution of any possible factors to the low body weight [12].

Amount of fluid intake and number of meals per day are considered among the ESPEN criteria of malnutrition [13]. In a recent trial malnutrition diagnosed according to the ESPEN criteria was associated with significantly higher mortality in elderly patients: the death rate from all causes within 3 years was 41.7% in patients with malnutrition versus 15.3% in those without malnutrition (p <0.001, RR 2.98, 95% CI 1.87-4.86) [14]. In our study, it was shown that intake of less than 1 liter of fluid per day was associated with 68% (p=0.017) increase in the risk of death from any cause and there was a trend to higher mortality in patients taking food 1-2 times a day (HR 1.79; p=0.079) versus patients taking meal more frequently. Both factors can be considered as signs of malnutrition, it should be noted that patients consuming less than 1 liter of liquid per day represented 37.6% of the study population, and those who took meals 1-2 times per day represented 10.3%.

Sleep characteristics, such as its quality and duration, time of going to bed and awakening, are very important factors of mortality in older adults. Numerous studies in general population found a U-shaped relationship between the duration of night sleep and the all-cause mortality with the nadir at 7-8 hours. However, results of similar studies conducted in elderly patients are not consistent and mechanisms of increasing mortality with prolonged sleep at night in elderly people remain unclear, although frailty and multi-morbidity are discussed as possible causes. In the study of Lee et al. [15] 3,427 patients aged ≥ 65 years were assessed for general health, mood status, sleep problems (insomnia, daytime sleep, sleep apnea, nighttime sleep, use of sleeping pills) and frailty. During 5 years of follow-up, 12.9% of men and 4.5% of women died. The average duration of night sleep was 7.3 hours. The proportion of participants with a sleep time of ≥ 10 h increased along with the rise of frailty prevalence. After the adjustment for age, the RR of 5-year mortality in individuals with a sleep duration ≥10 h was 2.10 (95% CI 1.33-3.33) in men and 2.70 (95% CI 0.98-7, 46) in women. After adjustment for frailty and other covariates, the risk of death in men decreased (RR 1.75, 95% CI 1.09-2.81), while in women, on the contrary, increased (RR 2.88, 95% CI 1.01-8.18). Independent predictors of 5-year mortality in elderly patients included the duration of night sleep ≥ 10 h (RR 1.75 in men and 2.88 in women) and frailty (RR 2.43 in men, RR 2.08, P=0.08 in women).

A large recent meta-analysis of 27 cohort studies involving more than 70,000 elderly people with a follow-up period of 3.4 to 35 years, showed that both long and short duration of nighttime sleep was associated with an increased risk of all-cause mortality (RR 1.33, 95% CI 1.24-1.43 and RR 1.07, 95% CI 1.03-1.11, respectively) compared with the reference population [16]. For cardiovascular death, the combined RR was 1.43 (95% CI 1.15-1.78) for long sleep duration and 1.18 (95% CI 0.76-1.84) for shorter sleep duration. Thus, in older people, both long and short duration of night sleep was associated with an increased risk of all-cause mortality, while the long duration of night sleep was associated with cardiovascular mortality. The results of our study are consistent with the mentioned above data and demonstrate that late (after midnight) going to bed is associated with a 2.4-fold increase of death, and that in terms of mortality 4-6 am is the optimal time for awakening.

Regular physical activity is a well-recognized important factor that slows down aging processes, preserves cognitive function, prevents frailty and prolongs life. Beneficial effects of physical activity on mortality rates have been proven in numerous studies. The study involving 77,541 elderly (≥65 years) patients revealed the inverse relationship between the level of physical activity and all-cause mortality, mortality from cardiovascular diseases and malignancies [17]. Physical activity defined as any activity of ≥ 30 minutes 1-2 times a week in the previous 6 months was associated with 23% decrease in risk of death from any causes (RR 0.77, 95% CI 0.71-0.85) and 36% decrease (RR 0.64, 95% CI 0.58-0.70) of such risk if physical activity was more frequent (3-5 times a week).

In another recent small cohort study involving 152 independently living octogenarians followed up for 10 years mortality was higher (40%) among those practicing outdoor walking ≥15 minutes 4 times a week compared to patients walking less frequently (22%). After adjusting for age, sex, education, smoking status, BMI, chronic diseases and CD4/CD8 ratio, the reduced risk of death in elderly people walking outdoors 4 times a week for > 15 minutes was 47% (RR 0.53, 95% CI 0.32-0.88, p=0.01) [18].

Unexpectedly, our findings show some protective effect of blood donation history on mortality. It is known that blood donation positively affects not only the health of the donor but also the duration of his/her life. According to data from the World Health Organization, people who donate blood regularly live on average five years longer than an average person. The results of the recently published Scandinavian study, which used a SCANDAT database of 1,182,495 donors (15,401 of whom died during 9,526,627 patient-years of follow-up), also suggest that each additional blood donation leads to 18.6% (95% CI 16.8-20.4%) reduction in the risk of death [19]. Formally, old age is not a contraindication for blood donation, but usually, donors are young people, since elderly subjects are often rejected from blood donation for medical reasons. Given that the average age of the participants in our study was 88 years, the results were surprising not only because the positive effect of the blood donation was persisting for many years after the termination of donations, but also because episodic blood donation was an independent predictor of 5-year mortality and reduced the risk of death by 72%.

CONCLUSION

This study is the first prospective observational study with a comprehensive analysis of the social, demographic and behavioral factors of 5-year mortality in persons aged 85 years and older (mean age of 88 years, males 23%) living in Moscow. The study identified five independent predictors of 5-year mortality, which include: negative ones - BMI <18.5 kg/m^2; going to bed after midnight; night sleep duration ≥ten h; positive ones - BMI 25.0-29.9 kg/m^2 and blood donation. The results obtained are generally consistent with other studies and confirm the importance of having a healthy lifestyle in attaining a longer life. The main limitation of the study is the absence of widely accepted measures of physical and cognitive functioning, which had not been introduced into geriatric care in Russia at the moment of the study planning and conduction.

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