MPIDR-NES Training Programme

Moscow, New Economic School,14th January - 1st February 2013

Population and Health

Лекции 20-21. Изучение факторов смертности и здоровья в России на основе микро-данных

Lectures 20-21. Studying factors of survival and health in Russia with micro-level data

MAX PLANCK INSTITUTE FOR DEMOGRAPHIC RESEARCH

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РЭШ
Российская экономическая школа

Outline of the Lecture

- ❖ The Russian mortality enigma. Knowledge gaps to be addressed by micro-data
- ❖ Types of micro-data
- ❖ Prevalence studies
  - Reported health and itы relationship to mortality
  - Tobacco and alcohol use
  - Hypertension and blood lipids
  - Metabolic syndrome: dangerous combinations of single factors
  - Muscle strength
- ❖ Explanatory studies
  - Traditional cardiovascular risk factors and death at older ages;
  - Alcohol and male death at working ages;
  - Alcohol and causes of death at working ages
- ❖ Further research agenda

The Russian mortality enigma

Life expectancy in Russia is the lowest among industrialized countries. The mortality pattern is characterized by relatively low child mortality but high midlife and old-age mortality from cardiovascular and external causes.

Why mortality in an industrialized country remains so high and why it has been not decreasing, but rising? How to explain its great elevation in the 1990s?

The Russian mortality phenomenon is very unexpected taking in account worldwide improvements in life standards and educational level, progress in medicine, availability of information about risk factors and health behaviors.

What causes the phenomenon? Are Russians too fat or too weak, are they drinking and smoking too much, are they depressed or stressed? And finally can these and/or some other factors explain the entire burden of excess death in the country?

Limitations of population-level studies

Routine population-level data provides very limited opportunities for answering these questions.

Difficulties:

- large parts of necessary data are either not available or unreliable in the routine statistics: health and morbidity, autopsy-validated causes of death, smoking, alcohol drinking, biomedical measurements, nutrition, use of medical care ;

- possible *ecological fallacy* in statistical relationships based on population-level data

Ecological fallacy

Ecological study is an analysis of a link between mortality (morbidity) and a factor through variation of mortality indicator and this factor across population groups rather than individuals. **EF** is a logical fallacy in the interpretation of statistical results in an ecological study, whereby inferences about the nature of individuals are based solely upon aggregate statistics collected for the group to which those individuals belong. **EF** is committed when a correlation observed at the population level is assumed to apply at the individual level.

Variability across individuals is greater than and may in many ways differ from variability of the same characteristics across the group-means.

<u>Example of false relationships.</u> Positive correlation between mortality and education across *oblasts* of Russia. It is explained by the fact that underdeveloped and climatically hard regions in the North, Siberia, and Far East of the country have low percentages of rural population and (consequently) higher percentages of people with higher levels of education.

At individual level, higher education is associated with lower mortality.

Types of micro-data

Types of micro-level studies

The micro-level (or epidemiological) studies rely on micro-data (or individual-level data). They are based on observations on all members of a population or (much more often) on samples drawn from populations.
Greater the sample size, higher the statistical power. Statistical power reflects ability of data to assure a low risk (e.g. 10% or 5%) of detecting of false negative association.

<u>Population-based</u> studies. Sample to be recruited from the general population. Samples drawn from highly selective groups (military personnel, miners, plant workers, hospital patients etc.) are not population-based.

<u>Representativeness</u>. A representative sample *represents* the general population with respect to characteristics that are likely to be correlated with the mortality/health outcome.
R depends on:
- method for selecting and recruiting participants;
- response rate and whether the response is selective;
- completeness and reliability of collected interview and biomedical data.

Types of micro-level studies (2)

Cross-sectional and longitudinal studies. Cross-sectional studies look at variation of health outcome or factors of health across individuals at one time point. Longitudinal studies follow individuals over an extended period of time.

<u>Retrospective and prospective design</u> of longitudinal studies. In studies of mortality, retrospective design is possible only if proxy respondents (e.g. relatives of deceased) are interviewed.

<u>Cohort studies</u>. These are prospective longitudinal studies with one examination or several examinations of individuals. In one-examination studies, individuals are interviewed and/or medically tested at baseline and then followed-up for mortality or disease incidence.

In studies with more than one round (panel studies), there are follow-up periods after each round. Within each of these periods, mortality/morbidity hazard has to be related to preceding values of explanatory variables.

Cohort data are examined by regression models with static or time-varying explanatory variables.

An element of cohort data

Elementary cohort data: deaths or diseases compared to person-years in presence of absence of a risk factor

	Factor B	Factor $\bar{B}$	Total
Death A	18 a=n(AB)	13 b=n(A$\bar{B}$)	31 a+b=n(A)
Person-years	1000 E(B)	950 E($\bar{B}$)	1950 E

Hazard rate ratio=(18/1000) / (13/950)=1.315

If there are multiple explanatory factors, the hazard rate ratios can be assessed by the proportional hazard (Cox) or by the intensity (Poisson) regression models.

Use textbooks and statistical package descriptions to learn about these statistical methods.

An element of case-control data

In a case-control study, odds of death or disease are being compared between the exposed and the unexposed.

Elementary case-control data: the deceased/alive status for smokers and non-smokers

	Smoker B	Non-smoker $\bar{B}$	Total
Deceased A	1418 n(AB)	47 n(A$\bar{B}$)	1465 n(A)
Alive $\bar{A}$	1345 n($\bar{A}$B)	120 n($\bar{A}$ $\bar{B}$)	1465 n($\bar{A}$)
Total	2763 n(B)	167 n($\bar{B}$)	2930 n

Odds ratio=(1418/1345) / (47/120)=(1418*120)/(1345*47)=2.7

If there are multiple explanatory factors, the odds ratios can be assessed by the logistic regression model.
More details about the method can be found in textbooks.

Prevalence studies

A study on self-rated health: Russia *vs*. Europe (Andreev et al., 2003)

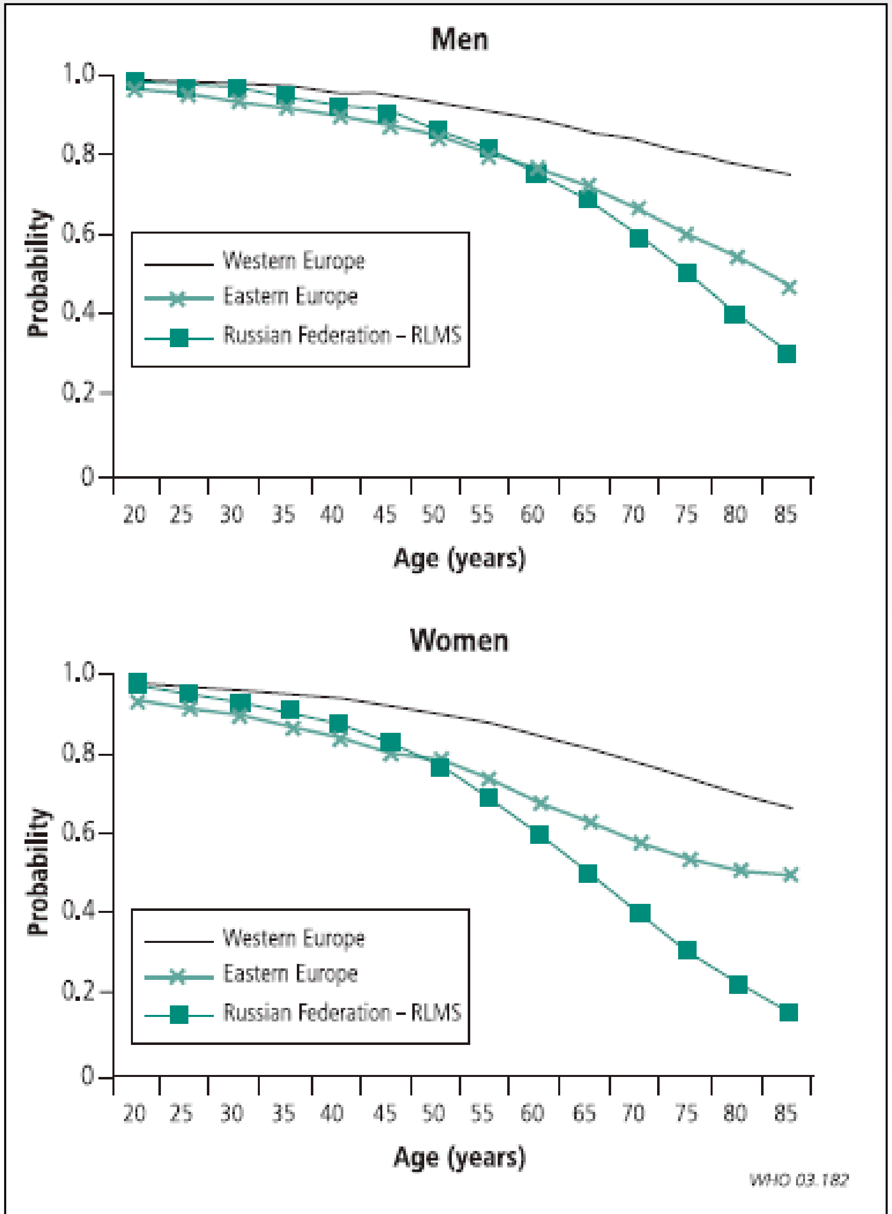
The self-rated health (SRH) question: “All in all, how would you describe your state of health these days? Would you say it is ...
Very good/Good/Average/Poor/Very poor?”
Data sources: the Russian Longitudinal Monitoring Survey (RLMS) http://www.cpc.unc.edu/projects/rlms-hse for Russia and the World Value Surveys (WVS) http://www.worldvaluessurvey.org/ for the comparator countries. Collected in 1995-99.

RLMS is a prospective panel survey on a nationally representative sample. Rounds carried out nearly annually. The sample is being partially replaced to compensate for attrition. Data of Round VIII (1998-99) include 6202 individuals aged 20 to 90.

The WVS data were divided into two groups: Eastern Europe and Western Europe. The **EE** sample includes 5,935 individuals and is based on pooled data from Bulgaria, the Czech Republic, Hungary, East Germany, Poland, and Romania. The **WE** sample includes 14,696 individuals from Belgium, France, Ireland, Italy, Spain, West Germany, and the UK.

Andreev et al., 2003

Age-specific prevalence of good and fair health



Russian population, especially women, experiences heavy burden of ill-health.

Andreev et al., 2003

A comparison: reported health and mortality (Perlman & Bobak, 2008)

Data of seven RLMS rounds (1994-2001) used to examine relations between: -
- SRH and mortality;
- between factors and SRH;
- the same factors and mortality.

Relationship between self-rated health and mortality. Cox regression hazard rate ratios (95% confidence limits)

SRH	Male	Female
Very good/good/average	1	1
Poor/very poor	1.69	1.74
	(1.36-2.10)	(1.38-2.20)

Perlman and Bobak, 2008

Adjustment for socioeconomic variables does not change these relationships. SRH predicts mortality independently from income or education.

Associations between selected characteristics and self-rated health (logistic regression ORs) and mortality (hazard rate ratios)

	Male		Female	
	Odds ratio for poor or very poor self-rated health at entry	Hazard ratio (95% confidence interval) for death during study)	Odds ratio for poor or very poor self-rated health at entry	Hazard ratio (95% confidence interval) for death during study)
Education				
Primary/incomplete secondary	1.70 (1.35–2.12)	2.30 (1.85–2.86)	1.32 (1.11–1.58)	3.09 (2.39–4.00)
Complete secondary	1.27 (0.99–1.63)	1.39 (1.09–1.78)	1.03 (0.86–1.24)	2.35 (1.63–3.40)
Higher	1	1	1	1
Continuous (per 1 category)	1.30 (1.16–1.45)	1.52 (1.36–1.70)	1.14 (1.04–1.24)	1.74 (1.54–1.97)
Household income per person				
(household income/square root no. in household)				
1 (lowest quintile)	1.64 (1.21–2.22)	1.41 (1.05–1.88)	1.34 (1.06–1.70)	1.19 (0.86–1.65)
2	1.21 (0.90–1.63)	0.98 (0.73–1.30)	1.20 (0.96–1.51)	0.94 (0.67–1.30)
3	1	1	1	1
4	1.06 (0.79–1.44)	0.89 (0.66–1.21)	0.99 (0.78–1.26)	1.00 (0.72–1.39)
5 (highest quintile)	0.68 (0.49–0.95)	1.12 (0.83–1.52)	0.87 (0.67–1.11)	0.75 (0.50–1.13)
Change per quintile	0.83 (0.77–0.89)	0.94 (0.88–1.02)	0.90 (0.85–0.95)	0.93 (0.85–1.01)
Alcohol frequency				
No alcohol	1.84 (1.38–2.47)	1.42 (1.05–1.93)	1.42 (1.17–1.71)	2.00 (1.34–3.00)
Once in last month	1	1	1	1
2–3 times a month	0.66 (0.47–0.94)	1.02 (0.72–1.46)	0.75 (0.57–0.98)	1.27 (0.71–2.27)
Once a week	0.54 (0.37–0.80)	1.10 (0.77–1.56)	0.63 (0.42–0.94)	1.08 (0.47–2.52)
More than once a week	0.83 (0.58–1.17)	1.93 (1.41–2.65)	0.92 (0.57–1.50)	2.46 (0.97–6.24)
Current smoker				
Yes (vs no)	0.98 (0.81–1.19)	1.92 (1.58–2.34)	1.17 (0.90–1.50)	2.77 (1.68–4.56)
Life satisfaction (5 point ordinal scale, high to low)	1.40 (1.27–1.54)	0.99 (0.91–1.08)	1.46 (1.35–1.58)	1.08 (0.98–1.19)

Perlman and Bobak, 2008

What makes a difference between mortality and self-rated health

Mortality is associated with low education, income, frequent alcohol, and smoking, but not with life satisfaction. SRH is linked to education, income, and life satisfaction, but not with alcohol and smoking.

SRH captures serious diseases and health conditions that are associated with mortality. On the other hand, SRH can be also related to painful but less dangerous conditions such as arthritis, head aches, and various consequences of overweight. They influence quality of life and perceived well-being.

Mortality is connected to major chronic diseases, a part of which are latent for a long time. Substantial parts of deaths are sudden and happen to apparently healthy people. These are deaths from trauma (accidents, violence, alcohol) that often kills apparently healthy people.

Perlman and Bobak, 2008

A study on prevalence of smoking (Perlman et al., 2007)

Table 2 Prevalence (%) of current smoking in the whole sample (standardised for age) and by 10-year age band

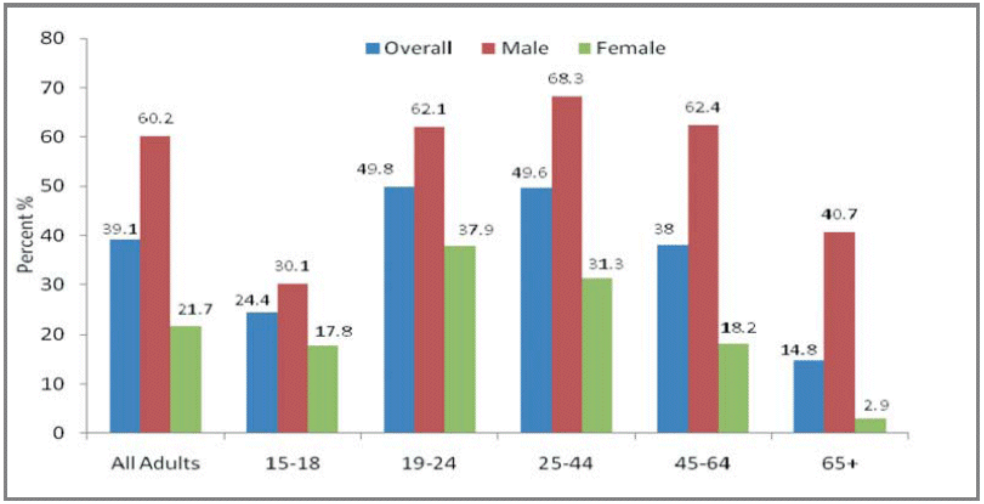
		Age group in years					
	Total (all ages)	18–24	25–34	35–44	45–54	55–64	≥65
Male							
1992	57.4 (56.0 to 58.8)	61.6 (57.4 to 65.9)	69.0 (66.0 to 72.0)	66.0 (63.1 to 68.8)	55.0 (51.3 to 58.7)	46.2 (42.6 to 49.8)	34.7 (30.6 to 38.9)
1993	60.8 (59.3 to 62.4)	60.2 (55.6 to 64.9)	71.6 (68.3 to 74.8)	71.7 (68.9 to 74.6)	58.6 (54.7 to 62.6)	51.3 (47.4 to 55.2)	38.3 (33.8 to 42.8)
1994	59.0 (57.5 to 60.5)	63.1 (58.8 to 67.5)	70.8 (67.6 to 74.0)	66.2 (62.9 to 69.4)	59.3 (55.2 to 63.5)	49.9 (45.9 to 54.0)	33.5 (28.9 to 38.1)
1995	61.3 (59.7 to 62.9)	62.2 (57.7 to 66.6)	74.3 (71.1 to 77.6)	67.0 (63.7 to 70.3)	63.8 (59.7 to 67.9)	53.3 (48.9 to 57.6)	35.0 (30.4 to 39.5)
1996	61.9 (60.3 to 63.5)	64.3 (59.9 to 68.8)	73.7 (70.4 to 77.0)	67.7 (64.4 to 71.0)	66.6 (62.3 to 70.9)	51.9 (47.5 to 56.2)	35.7 (31.1 to 40.2)
1998	61.0 (59.4 to 62.6)	61.0 (56.7 to 65.3)	70.0 (66.5 to 73.5)	67.4 (64.1 to 70.6)	68.2 (64.3 to 72.2)	54.0 (49.6 to 58.5)	34.2 (29.7 to 38.6)
2000	61.3 (59.7 to 62.8)	62.6 (58.5 to 66.7)	68.1 (64.7 to 71.6)	69.6 (66.4 to 72.8)	68.2 (64.6 to 71.9)	55.1 (50.3 to 59.9)	32.2 (27.9 to 36.5)
2001	62.2 (60.7 to 63.7)	62.1 (58.1 to 66.1)	71.4 (68.3 to 74.5)	70.9 (67.8 to 74.0)	68.0 (64.6 to 71.5)	54.8 (50.1 to 59.4)	32.8 (28.8 to 36.9)
2002	63.0 (61.5 to 64.5)	63.8 (60.0 to 67.6)	71.2 (68.2 to 74.3)	71.9 (68.8 to 74.9)	68.7 (65.3 to 72.1)	55.2 (50.4 to 59.9)	34.5 (30.2 to 38.8)
2003	62.6 (61.1 to 64.1)	63.8 (60.0 to 67.6)	70.4 (67.5 to 73.3)	71.6 (68.5 to 74.7)	65.4 (62.1 to 68.8)	57.4 (52.7 to 62.1)	34.9 (30.9 to 38.8)
p Value for linear trend	0.003*	0.68	0.45	0.01	<0.001	<0.001	0.07
Female							
1992	6.9 (6.3 to 7.6)	10.1 (7.6 to 12.5)	11.8 (9.9 to 13.7)	10.2 (8.5 to 11.9)	5.9 (4.4 to 7.5)	2.5 (1.5 to 3.4)	2.3 (1.5 to 3.2)
1993	7.7 (6.9 to 8.5)	12.3 (9.3 to 15.4)	12.9 (10.6 to 15.2)	11.1 (9.2 to 13.1)	7.1 (5.1 to 9.0)	2.1 (1.1 to 3.1)	2.6 (1.6 to 3.5)
1994	9.0 (8.3 to 9.8)	20.9 (17.5 to 24.2)	17.1 (14.6 to 19.6)	11.4 (9.3 to 13.4)	6.7 (4.7 to 8.6)	2.3 (1.2 to 3.3)	1.2 (0.5 to 1.8)
1995	9.1 (8.3 to 9.9)	18.1 (14.8 to 21.4)	18.0 (15.2 to 20.8)	10.6 (8.6 to 12.6)	9.0 (6.7 to 11.3)	2.2 (1.1 to 3.2)	1.3 (0.5 to 2.0)
1996	9.8 (9.0 to 10.7)	18.1 (15.0 to 21.3)	20.3 (17.4 to 23.2)	11.9 (9.8 to 14.0)	9.6 (7.2 to 11.9)	2.1 (1.0 to 3.1)	1.3 (0.5 to 2.0)
1998	10.5 (9.6 to 11.4)	18.9 (15.7 to 22.1)	21.8 (18.8 to 24.8)	12.6 (10.4 to 14.8)	10.4 (8.1 to 12.6)	1.8 (0.8 to 2.8)	1.8 (0.9 to 2.6)
2000	11.5 (10.7 to 12.4)	18.1 (15.2 to 21.0)	24.4 (21.4 to 27.3)	14.6 (12.3 to 16.9)	13.4 (11.1 to 15.7)	1.6 (0.6 to 2.6)	1.4 (0.7 to 2.1)
2001	13.9 (13.0 to 14.7)	22.3 (19.3 to 25.2)	26.3 (23.4 to 29.1)	17.8 (15.4 to 20.3)	16.0 (13.7 to 18.4)	3.9 (2.5 to 5.4)	2.0 (1.1 to 2.8)
2002	13.8 (12.9 to 14.7)	21.4 (18.4 to 24.3)	27.9 (25.0 to 30.7)	17.5 (15.0 to 20.0)	15.0 (12.6 to 17.3)	5.7 (3.7 to 7.6)	0.7 (0.2 to 1.3)
2003	14.8 (13.9 to 15.7)	23.1 (20.2 to 26.0)	28.1 (25.4 to 30.8)	20.6 (17.9 to 23.2)	14.2 (12.1 to 16.4)	5.9 (4.1 to 7.7)	1.5 (0.8 to 2.2)
p Value for linear trend	<0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	0.1

Values in parentheses are 95% CI.

Smoking: Russia *vs.* Europe

Analysis of the RLMS data by Perlman et al. (the previous slide) shows that the tobacco epidemic in Russia develops further. While smoking among adult men after a slight elevation remained very high (62-63%), female smoking has increased from 7% to nearly 15%. These estimates agree with data of other surveys. For example, of the Global Adult Tobacco Survey (GATS RF-2009).

Figure 4–1: Adult (15 and older) tobacco smoking by age and gender — GATS Russian Federation 2009.



Global Adult Tobacco Survey, RF 2009

In the EU-15 countries: 25-35% for men, 20-30% for women.

In Russia, tobacco is cheap – less that 0.8 Euro/pack. Taxes constitutes slightly over 30% of the retail price of filtered cigarettes. In EU countries – from 70% to nearly 90% (Zarubova Ross, Shariff, Gilmore, 2008).

How to estimate alcohol consumption

A frequency/quantity questionnaire is a traditional method for assessment of alcohol intake in surveys. People are asked about sorts of beverages they drink (beer, wine, liquors), how often, and how much is consumed per occasion. Then the ethanol concentrations in each of the beverages are used for computation of the annual alcohol intake in grams of pure ethanol per capita. These estimates usually grossly understate the real consumption (up to 50%).

Although these estimates are too low, they can be used for analysis of alcohol consumption and its correlates across individuals (assuming that everyone under-reports consumption by about the same percentage).

Plausible estimates of the Russian alcohol consumption by A. Nemtsov

In the soviet times, the TsSU has produced estimates of alcohol consumption by adding to the total alcohol sales in the state trade estimates of *samogon* production. The latter were calculated from excess per capita sugar consumption. Production of these estimates was terminated in 1989 because of the acute deficit of sugar in the USSR. Alternative estimates were produced by V.Treml on the basis of consumption/expenses data from the budget household surveys.

In 1991-92, A.Nemtsov proposed another method for estimation of the real alcohol intake. He used experience of the anti-alcohol campaign of 1985-86 and the estimates were based on the shares of deaths from external causes with alcohol in blood of deceased collected from the oblast-level forensic bureaus (Shkolnikov & Nemtsov, 1997, Немцов, 2005).

Hazardous alcohol drinking in IFHS (Tomkins et al., 2006)

The Izhevsk Family Health Study (see details later in this lecture) was focused on men aged 24 to 54. They were interviewed in 2003-5. In addition, proxy informants (their spouses/partners or other close relatives living in the same household) were interviewed. These proxy-data are less affected by the tendency for under-reporting. The IFHS questionnaire included questions highlighting hazardous drinking during the last year:

- Having drunk surrogates (surrogates = alcoholic substances not intended to be drunk as beverages = medical tinctures or substances for hygiene with high concentration of pure ethanol);

- Having been in *zapoi* (periods of continuous drunkenness lasting several days during which an individual is withdrawn from normal life);

- Frequent hangover (once a month or more often);

- Frequent drinking of vodka (every day or nearly every day)

Prevalence of hazardous drinking in the IFHS

Age- and marital-status standardized* percentages of hazardous drinking

	Age standardized	
Question	*%**	*(n)*
Consumed surrogates?		
Yes	7.2	(135)
No	90.9	(1590)
No response	1.9	(25)
Total	100.0	(1750)
Went on zapoi?		
Yes	10.6	(183)
No	78.1	(1348)
No response	11.2	(219)
Total	100.0	(1750)
Frequent hangovers?		
Yes	12.8	(224)
No	73.0	(1260)
No response	14.2	(266)
Total	100.0	(1750)
Spirits consumption frequency		
Daily or almost daily	21.0	(63)
Less often or not at all	77.7	(1669)
No response	1.3	(18)
Total	100.0	(1750)

* Direct standardization using age structure of the total male population of Izhevsk

Tomkins et al., 2006

Links between odds of hazardous drinking and education in IFHS

Association between education and hazardous drinking (age-adjusted ORs)

	Incomplete secondary	Secondary	Higher
Ever consumed surrogates	12.8 (5.6, 12.9)	3.9 (1.9, 7.7)	1 (referent)
Had been in zapoi	9.4 (4.5, 19.7)	4.0 (2.3, 7.0)	1 (referent)
Frequent hangover	5.8 (2.0, 11.3)	3.1 (2.0, 5.0)	1 (referent)
Frequent spirits drinking	1.6 (0.6, 4.7)	1.1 (0.6, 2.0)	1 (referent)

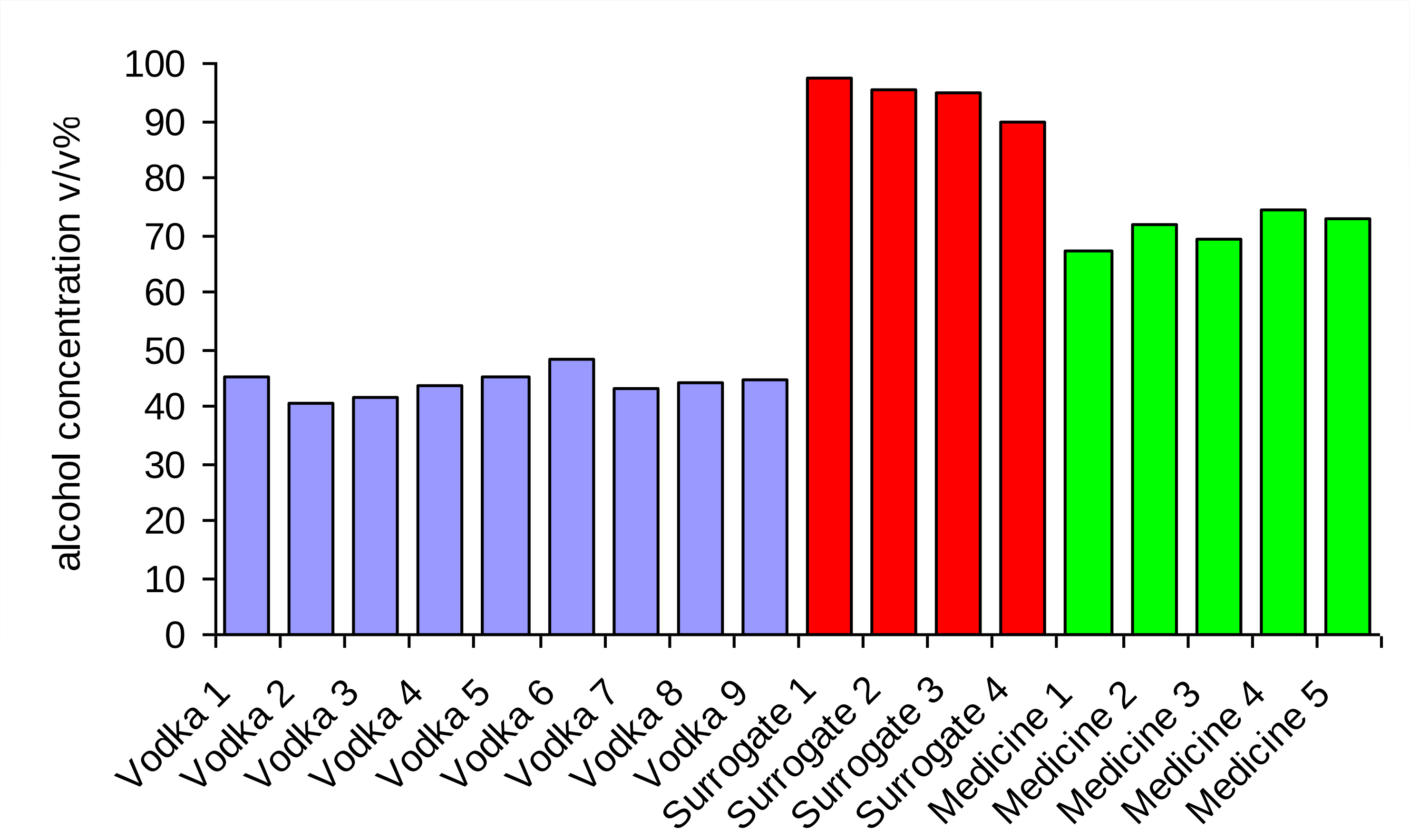
Similar strongly elevated death odds related hazardous drinking were also found among the unemployed and among the poor.

Tomkins et al., 2006

Liquids for hygiene with high ethanol concentration which are used as surrogate alcohols (IFHS)

Medical tinctures with high ethanol concentration which are used as surrogate alcohols (IFHS)

Concentration of pure ethanol in vodka and non-beverage alcohol-containing substances (IFHS)



McKee et al., 2005

Both surrogates and medical tinctures have very high ethanol concentrations. This may result in organ damages and elevated risk of death.

In Izhevsk, we found no evidence that surrogate alcohols contain other toxic agents other than ethanol (methanol etc.)

Traditional risk factors: blood pressure, lipid profile, and overweight in the LRC and MONICA studies

The Lipid Research Clinics (LRC) and the Multinational MONItoring of trends and determinants in Cardiovascular disease (MONICA) were carried out over the 1970s to the early 2000s. (See details later in this lecture)

Regarding the traditional cardiovascular risk factors, the Russian population does not differ much from western populations. In the 1990s, prevalence of hypertension (BP>140/90 mm Hg) in the nationally representative sample was 39% and 41% for men and women aged 18+, respectively (Shalnova, 1999).

According to MONICA and LRC, Russians aged 18 to 64 have relatively low total cholesterol and relatively high HDL (good) cholesterol.

In 1992, 47.3% of Russian men and 61.8% of women were overweight (BMI>25 kg/m^2). Compared to other countries, men are light, whereas women are among the most stout (WHO, 1998).

The Arkhangelsk study

A recent cohort follow-up study. Data collection in the year 2000. Study subjects were recruited from people registered in an outpatient clinic and visiting it for obligatory annual medical examinations.

1,584 men and 1,500 women aged 41.8 and 44.2 years on average, respectively.

Set of traditional measurements: blood pressure, blood lipids, smoking and BMI. Additional biomarkers such as blood glucose and markers of low-grade inflammation.

The study includes a mortality follow-up of the subjects.

Traditional cardiovascular risk factors in Arkhangelsk compared to cities in Finland and Norway (Averina et al., 2003)

Table 2. Age adjusted means (SD) of blood pressure (BP), serum lipids and body mass index (BMI) in men and women from the Arkhangelsk study compared with the Finnmark study[a,b] and the Tromsø study[c]

	Men			Women		
	Arkhangelsk N = 1968	Finnmark[a] N = 9012	Tromsø[c] N = 12736	Arkhangelsk N = 1737	Finnmark[a] N = 8797	Tromsø[c] N = 14153
Mean age, years	41.8 (16.3)	43.4 (5.3)	46.7 (14.5)	44.2 (15.9)	43.4 (5.3)	47.2 (15.5)
Total cholesterol, mmol/l	5.0 (1.2)	6.6 (1.3)	6.1 (1.2)	5.1 (1.2)	6.6 (1.4)	6.1 (1.4)
Triglycerides, mmol/l	1.4 (0.9)	2.1 (1.5)	1.8 (1.1)	1.3 (0.9)	1.6 (1.0)	1.3 (0.9)
HDL-cholesterol, mmol/l[b]	1.3 (0.4)	1.3 (0.4)	1.3 (0.4)	1.4 (0.4)	1.5 (0.4)	1.6 (0.4)
Systolic BP, mmHg[d]	133.5 (19.0)	135.1 (17.0)	137.5 (17.4)	128.1 (22.4)	129.5 (19.3)	131.9 (22.6)
Diastolic BP, mmHg[d]	75.7 (14.6)	81.2 (11.2)	79.9 (11.8)	73.0 (13.3)	77.7 (10.9)	76.1 (12.7)
BMI, kg/m^2	25.3 (4.0)	26.0 (3.4)	25.6 (3.3)	26.0 (5.7)	25.7 (4.5)	24.8 (4.2)
Cigarettes per day[e]	13.0 (7.3)	15.8 (7.7)	14.0 (7.1)	6.4 (5.1)	12.6 (6.0)	11.1 (5.4)

[a] Westlund et al. [23].
[b] DAta for Finnmark: Njølstad et al. [22].
[c] The database of the Tromsø study (1994–1995).
[d] In Arkhangelsk and Tromsø: mean of the 2nd and the 3rd of Dinamap measurements; in Finnmark: the lowest of three Dinamap measurements (systolic BP about 2.1 mmHg and diastloic BP 1.3 mmHg lower than the mean of the 2nd and 3rd Dianamap measurements).

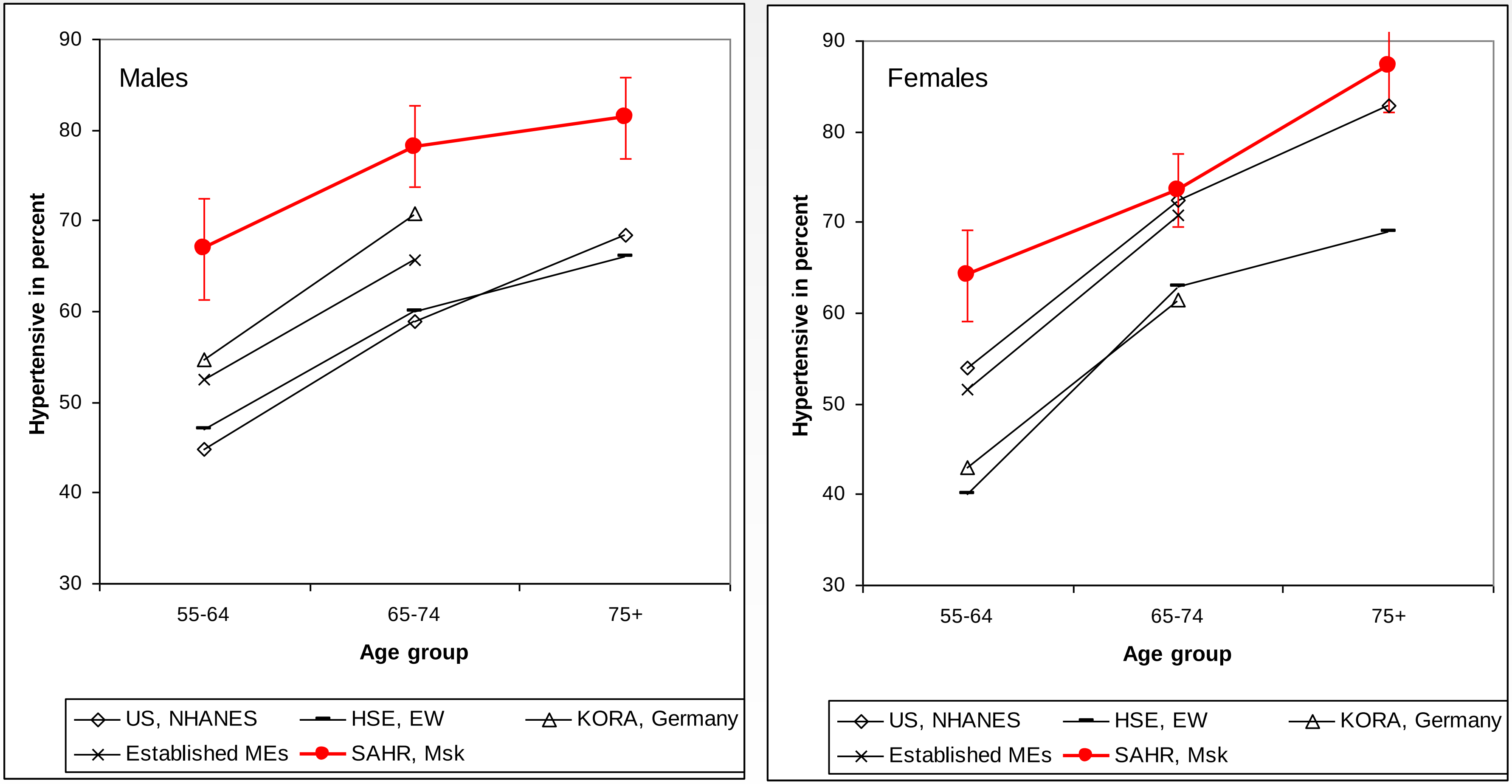
Values of cardiovascular factors are about the same (even slightly better) than those in Norway and Finland. Note that the variable “cigarettes per day” is not one. Percentage of smokers in men is high (56.7%) and is 21.3% in women.

The "Stress Aging and Health in Russia." A survey of the Russian elderly

In the modern aging populations, including the Russian population, health and quality of life of the elderly is a matter of high and growing importance.
The SAHR survey is a population-based survey fielded in 2006-9. It includes 1,800 Moscow residents aged 55 or older (68 years on average). Most of these individuals had taken part in earlier LRC or MONICA studies.

In addition to the traditional cardiovascular risk factors, the study included a detailed questionnaire with several modern physical and mental health batteries, and unusually extensive program of biomarker collection. Many of the measurements were taken first time in a sample of the general Russian population. These included: handgrip strength, new biochemical measurements, home blood pressure monitoring, and 24-hour ECG monitoring.

Hypertension at older ages in Moscow (SAHR)



In the SAHR sample, prevalence of hypertension (140/90 or ongoing antihypertensive treatment) is somewhat higher than in comparator international studies.

Metabolic syndrome among the elderly (Metelskaya et al., 2011)

Clustering of several metabolic abnormalities such as central obesity, hypertension, dyslipidemia, and impaired glucose metabolism, known as MetS, is associated with increased risk of diabetes, cardiovascular and all-cause mortality. MetS also substantially impairs the quality of life.

Definition. MetS is a combination of at least three of the following five conditions: (1) abdominal obesity (waist circumference>88 cm for women and >102 cm for men; (2) elevated BP (SBP≥130 mmHg or DBP≥85 mmHg) or ongoing antyhypertensive treatment; (3) serum triglycerides level≥1.7 mmol/L; (4) HDL cholesterol<1.0 mmol/L for men and <1.3 mmol/L for women; (5) fasting glucose≥6.1 mmol/L.

Data. All MetS measurements were available for 1788 individuals (955 women and 833 men) out of the 1,800. Mean age: 67.6 years for women and 68.9 years for men.

Prevalence of MetS in Moscow (Metelskaya et al., 2011)

The overall age-standardized (Segi's world population standard) prevalence of MetS: 28% for men and 42% for women. For ages 60+, this result is consistent with similar data from Arkhangelsk (24% and 44% respectively).

Table 2
Prevalence of MetS and its components by sex and age group.

Age/gender group	n	MetS, %	Abdominal obesity, %	Hypertension, %	Elevated TG, %	Depressed HDL C, %	Hyperglycemia, %
Women							
Ages							
55–59	146	43.8	64.4	52.1	25.3	44.5	31.5
60–69	428	40.4	51.9	60.5	25.0	45.3	29.4
70–79	304	41.1	54.3	72.0	21.1	46.4	22.4
80+	77	46.8	57.1	79.2	22.1	58.4	23.4
Ages 55+	955	41.7	55.0	64.4	23.6	46.6	27.0
Ages 55+, age-standardized[a]	955	42.3	56.4	61.6	24.1	47.4	28.1
Men							
Ages							
55–59	127	30.7	29.9	68.5	29.9	24.4	37.0
60–69	319	29.5	29.2	69.9	24.8	27.0	38.9
70–79	288	24.7	29.5	75.0	18.4	24.0	34.7
80+	99	19.2	26.3	67.7	13.1	23.2	22.2
Ages 55+	833	26.8	29.1	71.2	22.0	25.1	35.2
Ages 55+, age-standardized	833	28.3	29.3	70.0	24.5	25.4	36.0

[a] Segi's world population standard.

Metelskaya et al., 2011

Sex difference in MetS (Metelskaya et al., 2011)

For older women, the prevalence of MetS found in the SAHR sample is comparable to industrialized countries with the highest rates of MetS; for older men, the prevalence of MetS is roughly the same as the levels observed in industrialized countries with average or slightly higher-than-average levels of MetS.

According to our data, hypertension was the most common MetS component both in women and in men. It was followed by abdominal obesity in women and by an elevated fasting glucose in men. HDL cholesterol's depression was another highly prevalent MetS component among the Muscovite women.

Abdominal obesity was found in more than half of the women, and in less than one-third of the men. Additional analysis, showed that the 1.5-fold female-male gap in MetS was attributable to much higher prevalence of abdominal obesity among women and (to a lesser extent) to lower female levels of HDL cholesterol.

In women, but not in men, MetS was inversely related to education.

Importance of muscle strength in older people

Decline in physiological functions starts around age 30. Handgrip strength is a measure of isometric muscle strength that correlates with strength of many other muscle groups. The age-related decline in grip strength is a reflection of the overall aging and functioning degradation.

Prior research suggested that handgrip strength is a better marker of frailty than chronological age among older people of similar age. Grip strength predicts all-cause mortality and disability among middle-aged and elderly persons.

The course of the muscle strength decline with age is approximately linear but it slightly accelerates at ages above 70-75. It was also indicated that this decline is steeper in individuals with greater levels of muscle strength at baseline. Although the level of grip strength is always substantially higher in men, they also experience significantly steeper linear decline compared to women.

Data sources for an international GS comparison

Russia: The SAHR baseline survey of 2006-2009, the Moscow Pilot Survey of 2003.

Denmark: the study of Middle Aged Danish Twins (MADT) and the Longitudinal Study of Aging Danish Twins (LSADT). Data collected in 1998-99 and 2001.

England: The English Longitudinal Study of Aging (ELSA), wave 2 conducted in 2004-5.

The same device and the same protocol were in use in all these studies.

The Smedley's Dynamometer (TTM, Japan or Scandidact, Denmark). After adjusting the device (grip gauge) to suit the respondent’s hand and positioning the respondent correctly, the respondent was asked to squeeze the dynamometer as hard as (s)he could for a couple of seconds. Three values were recorded for each hand, starting with the non-dominant hand alternating between hands.

Are older Russians weaker than people in other countries ? (SAHR)

The age-adjusted GS values:

Males

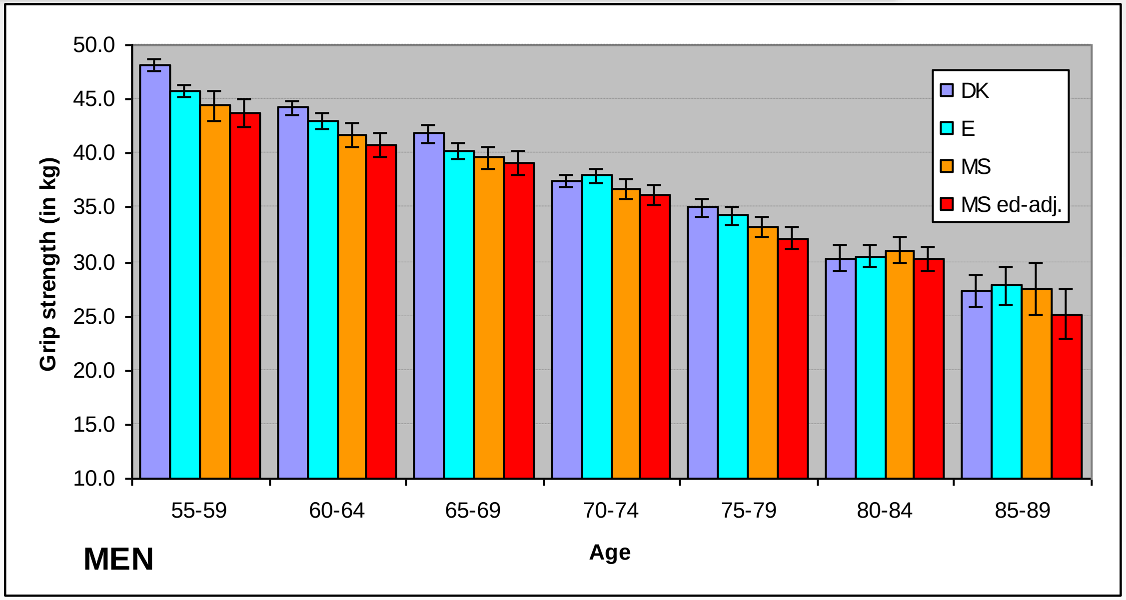
```
DK :  41.7 (±0.1) kg
ENG:  40.5 (±0.2) kg
MSK:  38.7 (±0.2) kg
```

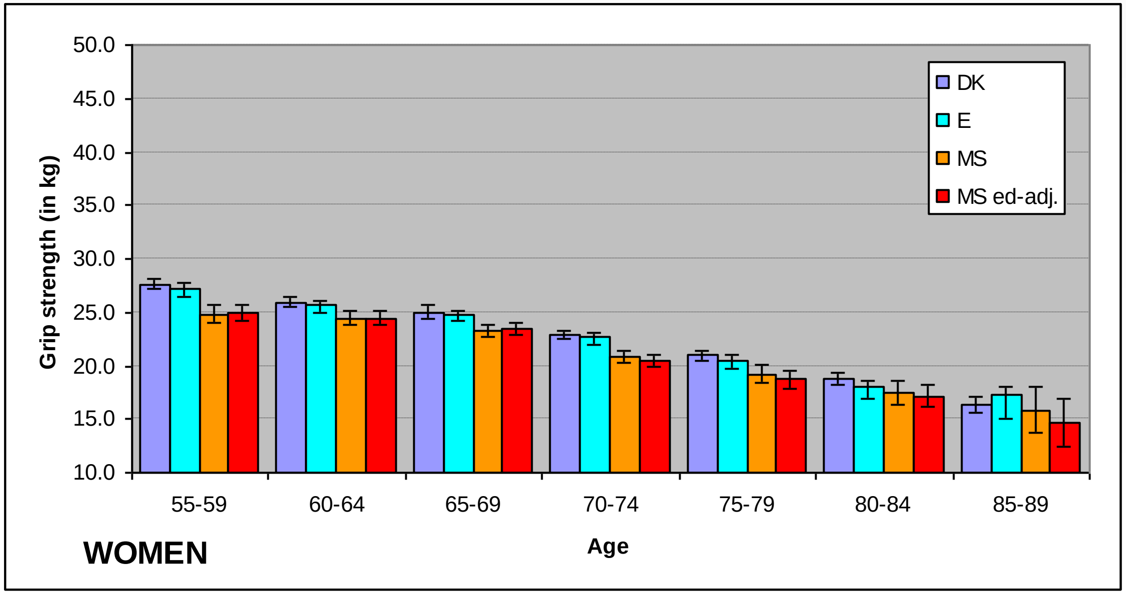
Females

```
DK :  24.6 (±0.1) kg
ENG:  24.4 (±0.2) kg
MSK:  22.6 (±0.2) kg
```

Muscovites are somewhat weaker than Danes and English.

The international SHARE (Survey on Health Aging and Retirement in Europe) data (Andersen-Ranberg et al., 2009) show a north-south divide within Europe with higher GS in Scandinavia and Germany compared to Italy, Spain, and Greece. GS in Moscow is comparable to that in Italy.





Summary of prevalence studies

- Russian men and (especially) women report large amounts of poor health.
- Although self-rated health is correlated with mortality, these two measures are connected to different factors. The former is related to the life satisfaction but not to smoking and alcohol drinking. The reverse is true for mortality.
- Prevalence of smoking among Russian men is very high and does not decrease. Smoking among women is relatively low, but it quickly increases.
- Many men are heavy drinkers and 10% to 15% of men experience hazardous forms of alcohol consumptions including drinking surrogates and *zapoi*.
- Blood pressure and lipids in Russians do not seriously differ from those in the West. In Russia, BP is slightly higher and blood cholesterol is slightly lower.
- Obesity and metabolic syndrome are highly prevalent among women in Moscow.
- According to the grip strength, Muscovites are somewhat weaker than their counterparts in Northern Europe, but close to Southern Europe.

Explanatory studies

Linking death to explanatory factors at the level of individuals

So far, we were looking at how micro-data are used to health and its determinants that are not reflected by routine statistical information. We will show now the analytical power of micro-level data.

Epidemiology is a science interested in causation of disease and death in humans. It concerns research looking at relationships between health events happening to individuals and exposure of these individuals to certain factors. Statistical models are used for assessment, and testing of associations between intensity of health events and the factors.

The Russian mortality pattern includes two major and somewhat overlapping components (see Lecture 18 for more details). First, Russia has very high mortality at ages 55 and older due to circulatory diseases, cancers and other chronic pathology that can be connected to gradual and long-term accumulation of exposures to various risks over the life course.
Second, Russia (especially its male population) experiences extremely high mortality at ages 15 to 60 with a large share of deaths from non-natural causes related to short-term exposures to very strong influences.

The LRC and MONICA cohort studies: a core of the Russian cardiovascular epidemiology

In the early 1970s, the US-USSR collaboration within the framework of the Lipid Research Clinics (LRC) program started. Later the USSR has joined the MONICA project of the World Health Organisation. In Russia, the LRC centers were established in Moscow and Leningrad (St.Peterburg since 1991), the MONICA centers were established in Moscow and Novosibirsk.

Both the LRC and MONICA were implemented in a sequence of cohort studies that followed similar protocols of interviewing and biomedical testing. The study questionnaires contained major health behaviors, self-reported health and diseases, certain cardiac symptoms, and socio-demographic characteristics. The medical tests' program included conventional cardiovascular risk factors: blood pressure, resting heart rate, blood lipids (total LDL and HDL cholesterol, triglycerides) and electrocardiography.

Cohort data of the LRC and MONICA studies

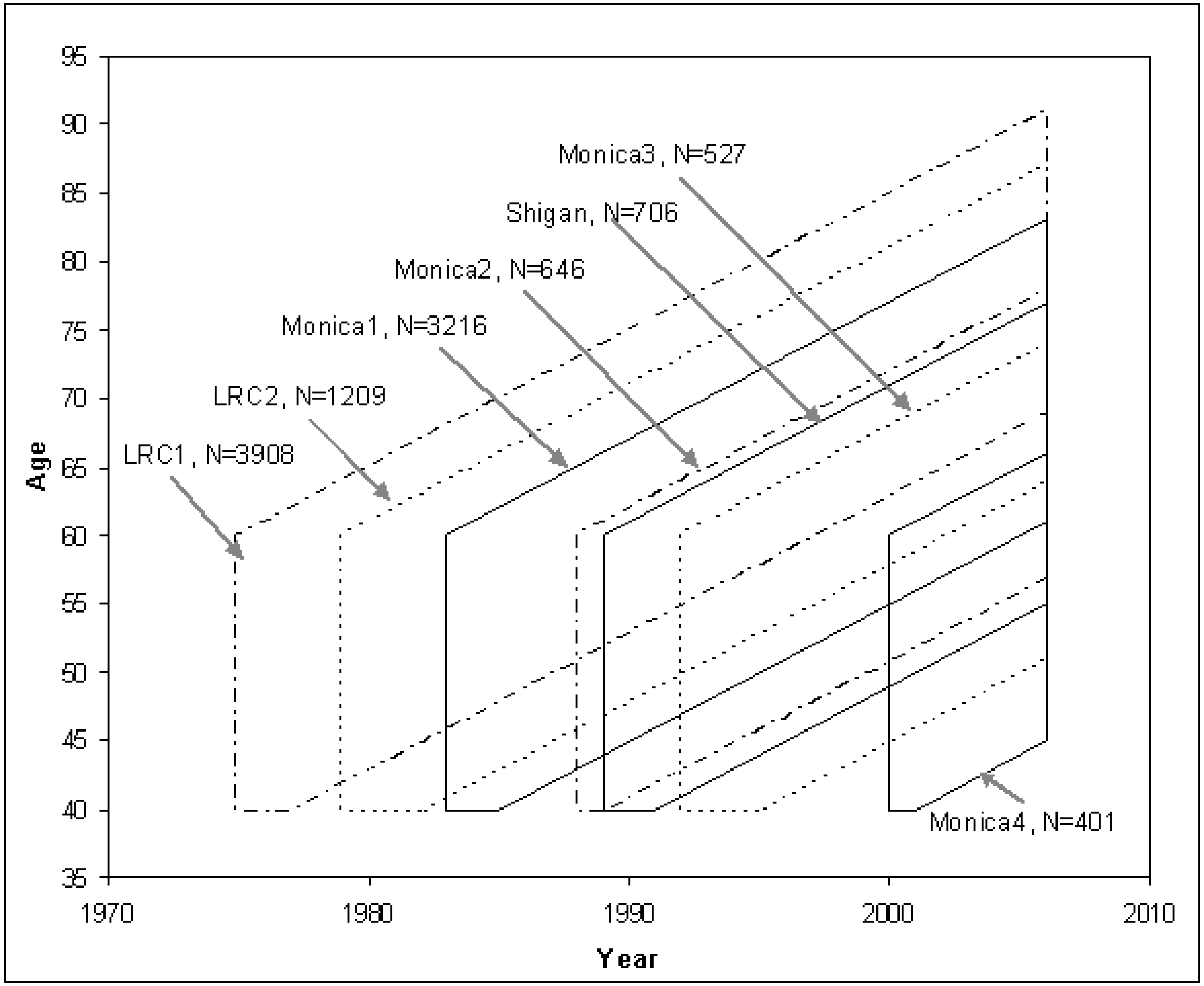
All LRC and MONICA studies had the same design: baseline survey (interviewing and medical testing) followed by long-term tracing of the study subjects for mortality. The earliest cohorts were formed in the mid-1970s, while the latest ones were formed in the early 2000s.

The table below presents basic characteristics of seven male epidemiological cohorts from Moscow.

Table 1. Characteristics of seven male cohorts from Moscow.

Name of cohort	Years of forming	Cohort size at the beginning of follow-up	Mean duration of follow-up (years)	Age at the beginning of follow-up			Deaths before 20.12.06	Percentage lost before 20.12.2006
				Mean	Min	Max		
LRC1	1975-7	3908	20.3	49.6	37	62	2790	2.8
LRC2	1979-82	1209	17.6	46.1	21	72	596	8.4
Monica1	1983-5	3216	16.1	43.5	19	71	987	5.1
Monica2	1988-9	646	15.6	50.9	32	70	214	3.8
Shigan	1989-91	706	11.9	47.1	23	82	197	4.3
Monica3	1992-5	527	12.1	48.5	37	77	99	0.8
Monica4	2000-1	401	5.9	50.7	34	72	23	4.3
Total		10613	16.9	47.3	19	82	4906	4.5

Shape of the pooled cohort data set of seven epidemiological cohorts



Characteristics of the pooled data set (see more details on slide 34):

Period covered: 1975–2006

Baseline number of subjects: 10,613

Mean age at baseline: 47.3 years

Mean length of the follow-up: 47.3 years

Observed deaths: 4,906

Figure 1. Regions of observation for seven Muscovite cohorts on the Lexis diagram.

Analyses linking old-age mortality to risk factors

Data of the LRC and MONICA cohorts have been extensively used in research to examine long-term CVD and all-cause mortality effects of health behaviors, cholesterol, blood pressure and social status variables (such as education). The LRC-based studies: Dennis et al., 1993; Perova et al., 1995; Davis et al., 1994; Deev, Shestov et al., 1998; Plavinski, Plavinskaya, Klimov, 2003 and other studies by the same authors.

Although themes differ among the studies, they use one and the same statistical method. The Cox proportional hazard regression is used for linking death hazard over follow-up periods with characteristics of individuals at the baseline.

Long-term mortality effects of traditional risk factors in men from LRC and MONICA cohorts

Our own estimates calculated from the pooled data of seven epidemiological cohorts.

Table 2. Outcomes of the Cox regression with all explanatory variables present in its right-hand side and adjustment for age and cohort.

Factor	Category	Beta-coef.	95% CI		Hazard ratio	95% CI	
			Lower	Upper		Lower	Upper
Education	Low	0.460	0.388	0.532	1.584	1.473	1.702
	Middle	0.267	0.189	0.344	1.306	1.208	1.411
	High	0[ref.]	-	-	1[ref.]	-	-
Smoking	Never	0[ref.]	-	-	1[ref.]	-	-
	Former	0.233	0.143	0.323	1.263	1.154	1.382
	1-14 cigs.	0.501	0.397	0.605	1.651	1.488	1.831
	15-19 cigs.	0.694	0.606	0.782	2.002	1.833	2.187
	20+ cigs.	1.039	0.934	1.145	2.827	2.544	3.142
SBP	≤120 mmHg	0[ref.]	-	-	1[ref.]	-	-
	121-134 mmHg	0.146	0.059	0.233	1.157	1.060	1.263
	135-151 mmHg	0.428	0.340	0.516	1.534	1.405	1.675
	152+ mmHg	0.769	0.676	0.861	2.157	1.967	2.367
Heart rate	≤80 beats/min.	0[ref.]	-	-	1[ref.]	-	-
	>80 beats/min.	0.185	0.108	0.262	1.204	1.115	1.300
Total cholesterol	≤6.45 mmol/L	0[ref.]	-	-	1[ref.]	-	-
	>6.45 mmol/L	0.107	0.039	0.176	1.113	1.040	1.192
HDL cholesterol	≤1.04 mmol/L	0.081	0.014	0.149	1.085	1.014	1.160
	>1.04	0[ref.]	-	-	1[ref.]	-	-
BMI	≤29.9 kg/m^2	0[ref.]	-	-	1[ref.]	-	-
	>29.9 kg/m^2	0.133	0.048	0.218	1.142	1.050	1.243

Considerations on studying premature male deaths at working ages

Enormous male mortality at working ages results in probabilities of survival from 20 to 60 of only 50%. What factors and circumstances are responsible for the phenomenon?
Cohort LRC data that links alcohol intake with deaths occurring many years or even decades later at old ages shows only very moderate risk elevation of about 20% in response to high alcohol consumption (Deev et al., 1998).

Scholars should take in account that many deaths at these ages:
-happen unexpectedly (without preceding history of disease) and quickly after an intensive exposure to severe risks;
- are related to alcohol abuse, violence and other socially unwelcomed phenomena that many people tend to hide;
- many of deceased belong to very poor and/or heavy drinking groups. Such people are likely to be under-represented in epidemiological cohorts.

These features lead to idea of the mortality follow-back or verbal autopsy method and to the case-control design of the study.

First implementation of the retrospective case-control design in the Udmurt Republic in 1998-99

Проект ПРООН/Россия «Политика по контролю смертности населения в переходный период»: выполнен в 1998-99 гг. Первое применение метода <u>ретроспективного опроса</u> для изучения смертности в России.

Метод позволяет анализировать быстротечные причинно-следственные цепочки, характерные для смертности в трудоспособных возрастах.

Метод позволяет собирать информацию о том, о чем многие не любят говорить.

Метод позволяет лучше охватить все слои населения, включая бедных и сильно пьющих людей.

Недостатки исследования – малое количество случаев и контролей (всего ок. 1100 наблюдений), недостатки анкеты, невозможность валидизации информации, полученной от близких лиц.

Design of the IFHS (Leon et al., 2007)

- Случаи (1750 мужчин, возраст 25-54)
  - Мужчины, умершие в возрасте 25-54 лет в г. Ижевске, имевших с октября 2003 по сентябрь 2005
  - Опрос прокси-респондентов (жен или близких), проживавших совместно с умершими.
- Контроли (1750 мужчин, та же возрастная структура, что у умерших)
  - Мужчины - жители Ижевска
  - Выбраны случайный образом из регистра населения
  - Опрос самих мужчин и их прокси-респондентов
- Дополнительные данные о случаях и контролях
  - Причины смерти из медицинских свидетельств о смерти
  - Данные судебно-медицинской экспертизы о содержании алкоголя в крови
  - Информация о регистрации в наркологическом диспансере по поводу проблем с алкоголем

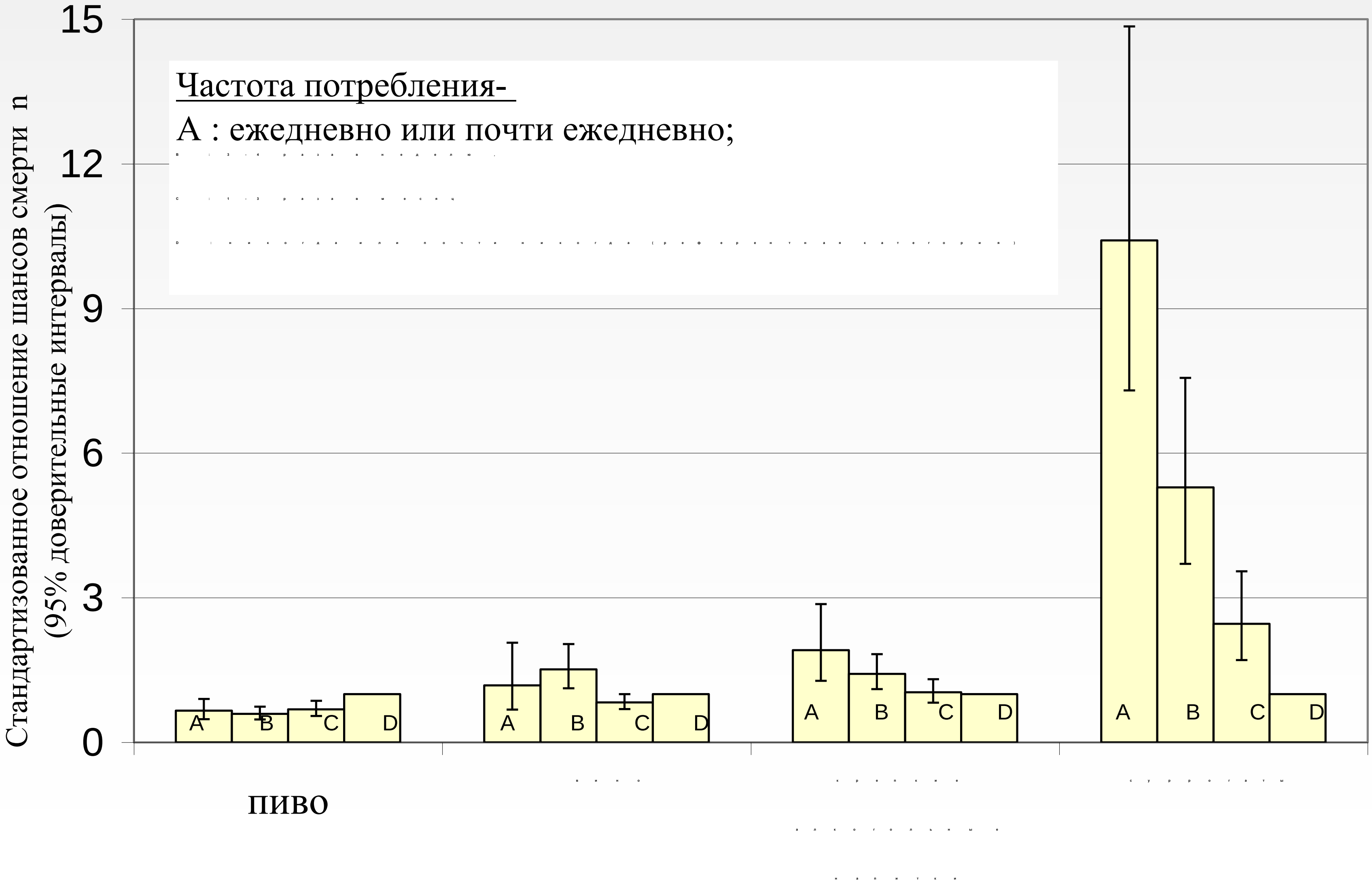
Leon et al., 2007

IFHS results: special role of non-beverage alcohol („surrogates“)

	Контроли	Случаи смерти	Отношение шансов смертности	(95% довери-тельные интервалы)
Не потребляют алкоголь	211	140	1.1	(0.8, 1.4)
Только обычные алкогольные напитки	1,357	821	1.0	[референ т-ная категор.]
Обычные алкогольные напитки и суррогаты	126	631	6.2	(5.0, 7.7)
Только суррогаты	2	46	27.2	(6.6,113.1)
Затрудняюсь сказать	54	112	2.9	(2.1, 4.1)

Leon et al., 2007

IFHS Results: age- and smoking-adjusted Ors depending on type of alcohol and frequency of drinking



Leon et al., 2007

Alcohol and causes of death

In the earlier lecture devoted to the health crisis in Russia, it was shown that mortality from many causes including circulatory disease experienced significant fluctuations in response to the drop in alcoho consumption in 1985-86 and ещ its sharp rise in 1992-94.
Among the IFHS death-cases, 18% (307 deaths) were caused by conditions directly related to alcohol such as: alcoholic psychosis (7) alcoholic cardiomyopathy (121), alcoholic liver cirrhosis (74), alcoho poisoning (95). Circulatory diseases caused 40% of the remaining deaths.
Is there a relationship between these deaths and alcohol at individua level? Can it be that there is a misclassification of cause (e.g. cardiovascular diagnosis instead of true alcohol poisoning ?

Data on blood alcohol concentration (BAC) can help to address thes question.

Autopsy BAC level by causes of death

Table 1 Blood alcohol concentrations determined at forensic autopsy by cause of death, men aged 25–54 years, Izhevsk, Russia, 2003–05

Cause of death	ICD10 codes	Total number of deaths[a]	Percentage (number) subject to forensic autopsy	Mean BAC g/l (*N*)	Percentage with BAC >2.5 g/l	Percentage with BAC ≥4 g/l
Circulatory disease	I00–I99	573	71.7 (411)	0.97 (401)	17.0	5.0
IHD	I20–25	258	76.7 (198)	0.80 (197)	13.2	4.1
MI	I21, I22, I25.2	66	43.9 (29)	0.55 (28)	0.0	0.0
Other IHD	Remainder I20–I25	192	88.0 (169)	0.84 (169)	15.4	4.7
Alcoholic cardiomyopathy	I42.6	121	95.9 (116)	1.45 (111)	27.0	8.1
Other cardiomyopathy	Remainder I42	61	93.4 (57)	0.96 (57)	15.8	3.5
Cerebrovascular disease	I60–I69	100	25.0 (25)	0.14 (21)	0.0	0.0
Haemorrhagic stroke	I61	45	40.0 (18)	0.09 (15)	0.0	0.0
Occlusive stroke	I63	21	4.8 (1)	– (0)	–	–
Other cerebrovascular disease	Remainder I60–I69	34	17.6 (6)	0.27 (6)	0.0	0.0
Other circulatory disease	Remainder I00–I99	33	45.5 (15)	1.00 (15)	20.0	6.7
Acute alcohol poisoning	X45	95	97.9 (93)	4.30 (93)	94.6	55.9
All causes	–	1750	69.1 (1209)	1.39 (1140)	23.8	8.2

[a]These are deaths with proxy interviews.

Leon et al., 2010

Note that the lethal or nearly lethal BAC levels are ≥ 4 g/L.

Autopsy BAC level by causes of death (2)

So, among men aged 25 to 54 high percentage of the lethal BAC (56%) is seen for the acute poisonings by alcohol only. It is followed by alcoholic cardiomyopathy (8%), other circulatory disease (7%) and other ischemic heart disease (5%). The latter two categories could also include deaths from heart failure and arrhythmia.

This result (Leon et al., 2010) suggests that misclassification of circulatory diagnoses can not substantially influence the observed associations between alcohol and circulatory death. The same result was recently obtained in the Arkhangelsk study using the same type of BAC autopsy data (Sidorenkov et al., 2011).

BAC levels exceeding 2.5 g/L are more common. 17% of all cardiovascular deaths happened to men aged 25 to 54 who had recently drunk substantial amounts of alcohol shortly before they died.

Alcohol problems and cause-specific mortality in IFHS

Table 3 Cause-specific mortality ORs by type of alcohol problem adjusted for education and smoking

Cause of death	Registered with narcology dispensary		Hazardous drinker[a] (proxy report)		*Zapoi* in previous week (proxy report)	
	OR (95% CI)	Cases	OR (95% CI)	Cases	OR (95% CI)	Cases
Circulatory disease	3.71 (2.52–5.47)	72/414	4.14 (3.23–5.31)	213/273	9.62 (6.2–14.91)	97/389
IHD	2.54 (1.50–4.31)	25/194	3.04 (2.17–4.24)	82/137	4.70 (2.64–8.39)	28/191
MI	0.62 (0.14–2.66)	2/57	1.17 (0.59–2.32)	12/47	2.03 (0.66–6.28)	4/55
Other IHD	3.26 (1.88–5.64)	23/137	4.04 (2.79–5.84)	70/90	5.85 (3.18–10.7)	24/136
Alcoholic cardiomyopathy	10.42 (6.05–17.9)	31/67	15.7 (9.5–25.94)	72/26	40.5 (23.0–71.4)	51/47
Other cardiomyopathy	2.86 (1.05–7.79)	5/46	3.84 (2.05–7.18)	21/30	7.87 (3.31–18.7)	9/42
Cerebrovascular disease	2.45 (1.16–5.17)	10/80	2.05 (1.24–3.40)	27/63	3.02 (1.28–7.11)	8/82
Haemorrhagic stroke	0.82 (0.19–3.56)	2/38	3.72 (1.90–7.27)	18/22	6.89 (2.8–16.99)	8/32
Occlusive stroke	4.72 (1.23–18.2)	3/15	–	4/14	–	0/18
Other cerebrovascular disease	4.61 (1.58–13.5)	5/27	0.93 (0.34–2.54)	5/27	–	0/32
Other circulatory disease	0.61 (0.08–4.70)	1/27	3.43 (1.51–7.81)	11/17	1.18 (0.15–9.38)	1/27
Acute alcohol poisoning	6.79 (3.62–12.8)	18/60	18.9 (10.7–33.3)	58/20	33.63 (18.1–62.4)	34/44
All causes	4.03 (2.93–5.54)	220/1226	5.46 (4.50–6.61)	698/748	11.41 (7.78–16.7)	316/1130

Leon et al., 2010

Alcohol problems and cause-specific mortality (2)

OR values in the table reflects mortality effects of three types of serious alcohol problems:
- being registered with narcology dispancery;
- being involved in hazardous drinking (surrogate alcohols, zapoi during the past year, excessive drunkenness twice a week or more, hangover or sleeping dressed because of being drunk);
- proxy-reported *zapoi* in previous week.

All these alcohol problems are associated with very high risks of death from alcoholic cardiomyopathy and many other circulatory causes.

The 40-fold OR linking death from hemorrhage stroke with zapoi in the previous week is remarkable. It is in line with literature pointing at hypertensive and coagulation-impairment effects of binge drinking.

For some of the observed associations, their underlying biological mechanisms are partly or entirely unknown.

Summary of explanatory studies

- There is a strong inverse association between education and mortality.
- Smoking and elevated BP measured at age 40-50 are the two strongest factors which cause elevated risks of death over the next three decades of age.
- Unfavorable lipid profiles and overweight are associated with moderate risk elevation.
- Among men of working age, higher alcohol consumption is associated with moderate risks, but the hazardous forms of alcohol drinking lead to extreme levels of the risk of death.
- Alcohol is connected to many causes of death including those directly linked to alcohol, various accidents and violence as well as stroke and heart attacks.

Further research agenda

Although valuable epidemiological studies exist, they are insufficient relative to the scale of health problems faced by the country.

- Existing research is very limited geographically. More cohorts and population-based samples in more regions needed.
- Nationally representative data allowing objective assessment of physical and mental health are nearly non-existent;
- Modern biomarker research needed for unrevealing alcohol-related and other mechanisms of premature cardiovascular death;
- Traditional risk factors can not explain very high CVD mortality. Need for more sophisticated biomarkers highlighting biological effects of effects on functioning of the heart and other systems;
- Studies should address health and mortality impacts of the medical care with respect to cardiovascular death;
- Need for research on human insecurity that causes numerous deaths from external causes deserves special research efforts.

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