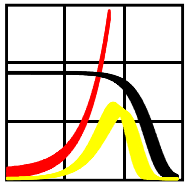
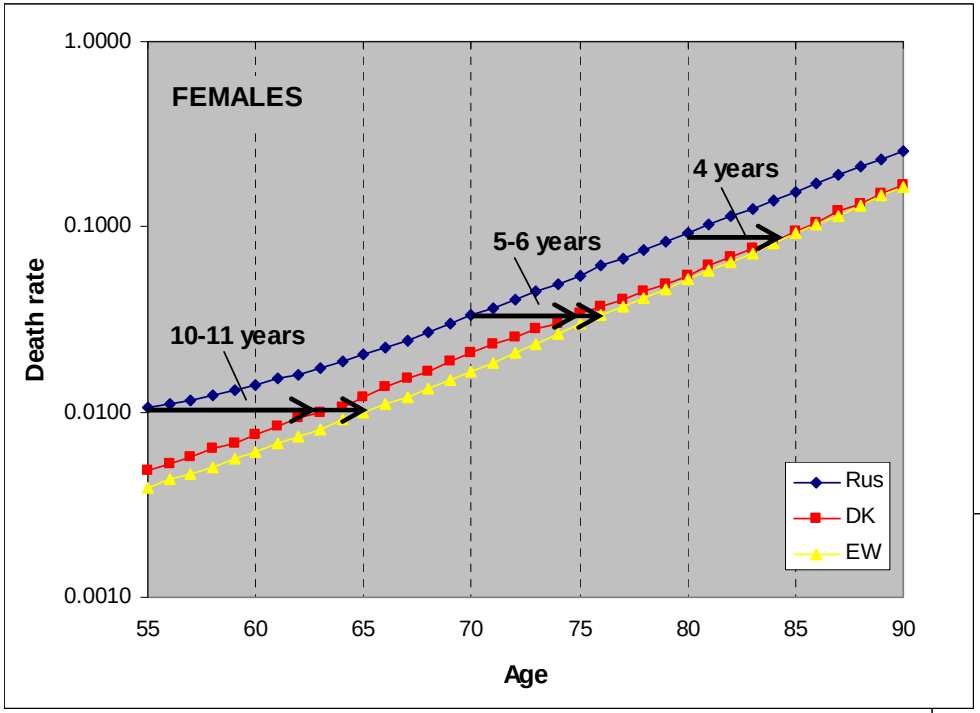
21st REVES Conference
"Reducing gaps in health expectancy"
26-29 May 2009, Copenhagen

Shkolnikov V.M., Andreev E.M., Demakakos P., Oksuzian A., Christensen K., Shkolnikova M.A. and J.W.Vaupel

Patterns of grip strength in Moscow as compared to Denmark and England

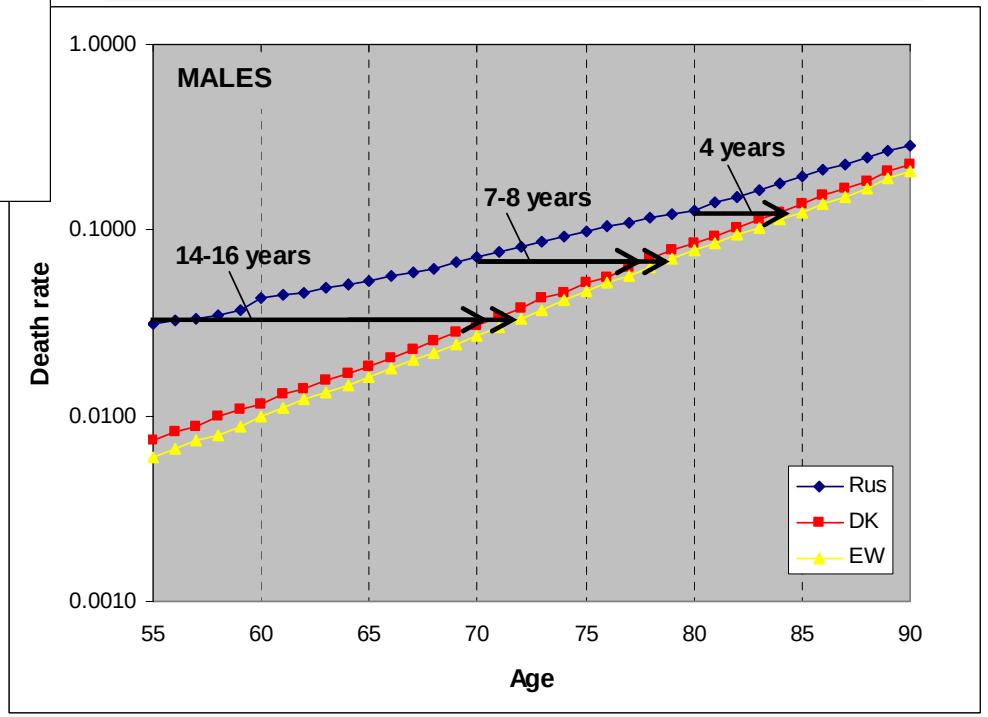


Mortality at ages 55+: Russia vs. Denmark and England and Wales



Life expectancy at age 55 in 2000-2005(6):

	Women	Men
Russia	22.6	15.7
Denmark	27.0	23.5
England and Wales	28.1	24.6



Background

Russia experiences the highest mortality and has the shortest life expectancy among all industrialized countries.

However, there is only very limited information about classic cardiovascular risk factors such as cholesterol and blood pressure. Nearly no data on physical performance of Russians are available so far.

This study begins to fill this gap by analyzing new data on grip strength of Russians from the survey on Stress Aging and Health in Russia (SAHR) together with similar data from Denmark and England.

Data sources

Hand grip strength is a measure of isometric muscle strength that correlates also with strength of many other muscle groups. It was found to be a good predictor of mortality and health events among old and middle aged people.

Russia, SAHR baseline survey of 2006-2009 on Muscovites aged 55+:
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 they could for a couple of seconds. Three values were recorded for each hand, starting with the non-dominant hand alternating between hands.
The idea, the devices, and the protocol had been advised to us by K.Christensen and H.Fredericksen (Fredericksen et al., 2002, 2006). **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: Longitudinal Study of Aging (ELSA), wave 2 conducted in 2004-5.

The same device and the same protocol were in use.

Now the whole procedure is being replicated also in in the Eastern Europe HAPIEE study.

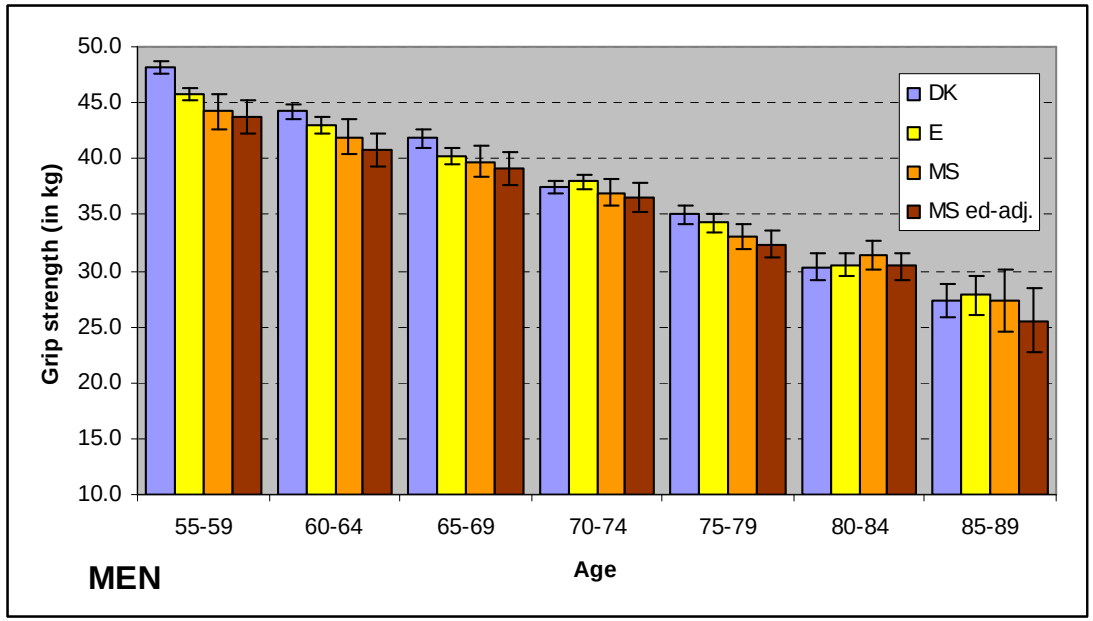
Characteristics of the samples

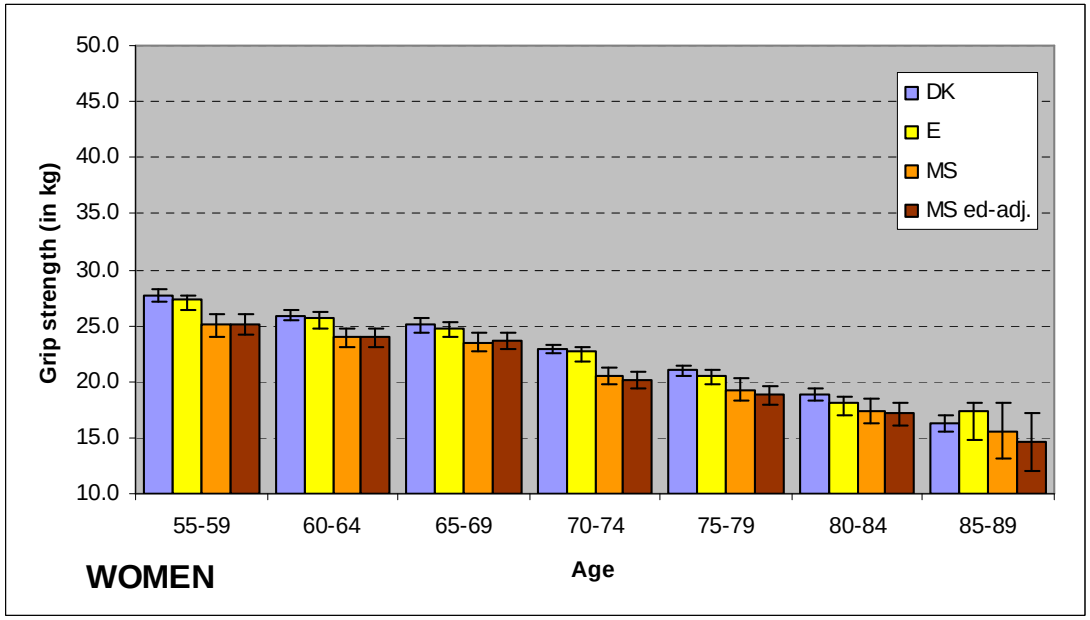
All disposable individuals aged 55 to 89 are under consideration. Smaller sample size in Moscow (1,317). It will increase to about 2,000 by the end of June 2009.

The sample has unusually high educational level corresponding to unusually high educational status of Muscovites. For comparisons with DK and EW, we produce additional (weighted) estimates for Moscow corresponding to the educational structure of the entire Russian population.

	Denmark (MADT, LSADT)		England (ELSA)		Moscow (SAHR)		Education-adjusted	
	Men	Women	Men	Women	Men	Women	Men	Women
N	2324	2643	2770	3078	641	676	641	676
Socio-demographic characteristics								
Mean age	68.4	70.0	67.0	67.3	70.9	69.1	71.0	69.3
Percentage, secondary and lower educatio	87.2	90.8	68.0	78.1	52.2	57.2	75.0	80.0
Percentage, unmarried	23.1	46.2	23.3	41.5	23.9	61.5	25.2	63.9
Physical measurements								
Height (cm), Mean	173.9	162.7	172.5	159.0	171.4	158.3	170.8	158.0
Weight (kg), Mean	77.6	64.3	83.1	70.9	80.1	74.1	79.8	74.5
BMI (kg/m2), Mean	25.7	24.3	27.9	28.0	27.2	29.6	27.3	29.9

Age-specific means of GS





Age-specific means of GS (continued)

	DK			E			MS			MS education-adjusted		
	N	Mean	STD	N	Mean	STD	N	Mean	STD		Mean	STD
MEN												
55-59	501	48.2	7.3	689	45.8	8.2	87	44.2	7.6	86	43.8	7.2
60-64	470	44.2	7.6	527	43.0	8.9	79	42.0	7.1	84	40.8	7.3
65-69	294	41.8	7.4	538	40.2	8.2	100	39.7	6.9	91	39.2	7.3
70-74	679	37.4	7.6	448	38.0	7.2	114	37.0	6.8	107	36.5	6.7
75-79	338	35.0	7.4	311	34.3	7.1	135	33.1	6.9	151	32.4	7.2
80-84	131	30.3	7.1	186	30.5	7.2	82	31.3	5.8	83	30.4	5.8
85-89	86	27.3	6.9	71	27.8	7.6	31	27.4	8.0	27	25.5	7.6
All ages	*2499*	*40.3*	*9.4*	*2770*	*40.1*	*9.4*	*628*	*37.0*	*8.4*	*628*	*36.2*	*8.6*
WOMEN												
55-59	462	27.7	5.5	756	27.3	6.1	100	25.1	5.1	101	25.1	4.8
60-64	472	25.9	5.2	593	25.7	5.9	102	23.9	4.5	100	23.9	4.6
65-69	270	25.0	5.1	556	24.8	5.3	153	23.5	4.9	142	23.6	4.8
70-74	677	23.0	5.2	439	22.7	5.3	136	20.5	4.7	136	20.2	4.7
75-79	410	21.0	4.8	370	20.6	5.2	96	19.3	4.9	99	18.8	4.3
80-84	249	18.8	4.4	259	18.0	4.9	72	17.3	4.9	82	17.1	4.9
85-89	148	16.3	4.5	105	17.3	4.2	12	15.6	4.4	11	14.6	4.3
All ages	*2688*	*23.4*	*6.0*	*3078*	*23.9*	*6.3*	*671*	*21.8*	*5.5*	*671*	*21.6*	*5.5*

The crude *all-age totals* are influenced by differences in age structures. The Moscow sample is considerably older.

Next steps

A GS comparison between Russians, Danes and English. Are Russians weaker?

GS variation within populations: age, weight, height, social and marital status.

Are Russians weaker ?

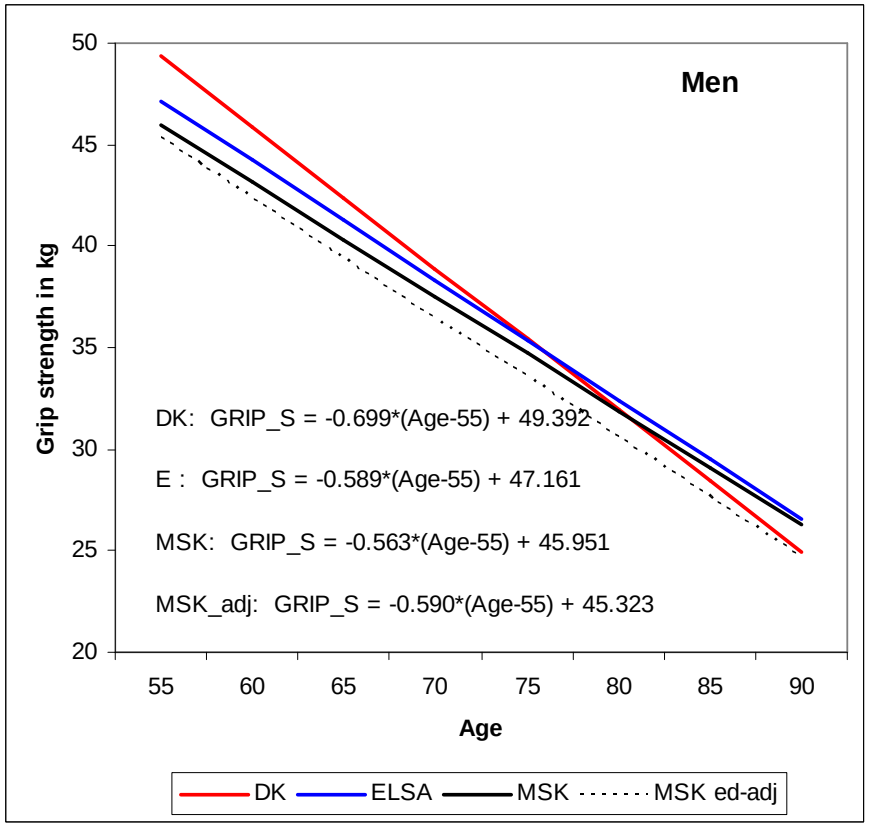
There are three ways for comparison of age-aggregated GS values:
direct standardization, indirect standardization, and regression of GS on age, education and the DK/EW/MS variable.
All the three methods return the same affirmative answer and similar quantitative differences. The direct standardization yields:

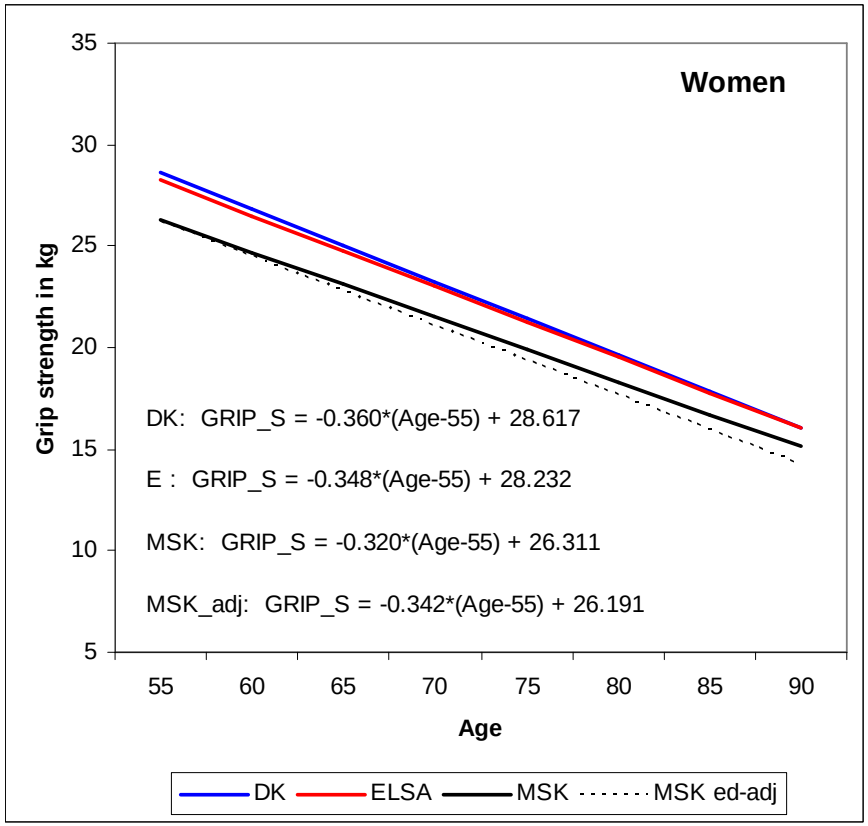
Comparisons between age-standardized mean GS values. GS in Denmark and England minus GS in Moscow or MS education-adjusted. (kg)

MALES	DK	E	MS	MS, ed-adj.
Age-adj. mean	41.7	40.5	39.5	38.8
SE	0.1	0.2	0.3	0.3
Diff. from MS	2.2	1.0	-	-0.7
t-value	6.7	3.0	-	-1.9
Diff from MS ed-adj.	2.9	1.7	0.7	-
t-value	9.0	5.3	1.9	-
FEMALES	DK	E	MS	MS, ed-adj.
Age-adj. mean	24.6	24.4	22.6	22.5
SE	0.1	0.1	0.2	0.2
Diff. from MS	2.0	1.7	-	-0.1
t-value	9.5	8.2	-	-0.5
Diff from MS ed-adj.	2.1	1.9	0.1	-
t-value	10.3	9.0	0.5	-

Red color marks statistically significant differences (at least $p<0.05$)

Age trajectories of GS





Effects of age in kg per an additional year of age: loss of 560-700g/year in men and of 320-260 g for women

	Denmark			England			Moscow			Moscow, ed.-adj		
	Coef	Lower 95%	Upper 95%	Coef	Lower 95%	Upper 95%	Coef	Lower 95%	Upper 95	Coef	Lower 95%	Upper 95%
MEN												
Age-55	-0.700	-0.735	-0.665	-0.589	-0.624	-0.554	-0.563	-0.627	-0.500	-0.577	-0.641	-0.512
Const	49.392	48.855	49.928	47.161	46.648	47.674	45.951	44.801	47.101	45.388	44.221	46.555
WOMEN												
Age-55	-0.360	-0.381	-0.338	-0.348	-0.370	-0.326	-0.320	-0.366	-0.274	-0.338	-0.382	-0.294
Const	28.617	28.253	28.980	28.232	27.896	28.567	26.311	25.564	27.057	26.371	25.642	27.100

Age trajectories of GS (continuation)

After age 55, GS is decreasing nearly linearly and steeply: by about 600-700 g/year of age among men and by about 350 g/year for women.

In Russia the starting GS at age 55 is substantially lower but the decrease with age seems to be slower compared to DK (signif.) and E (insign.).
[Differential survival of the strongest in Russia?]

The age-trajectories (if taken as true ones) suggest that in terms of GS:

male age 55 in MS is comparable to age 61 in DK and 58 in E;
male age 65 in MS ------ age 69 in DK and 68 in E;
male age 75 in MS ------ age 78 in DK and 78 in E.

female age 55 in MS is comparable to age 62 in DK and 61 in E;
female age 65 in MS ----- age 71 in DK and 71 in E;
female age 75 in MS ----- age 81 in DK and 81 in E.

High burden of bad SRH in Russian women

Table 2. **Life expectancy and healthy life expectancy of men and women at different ages**

Sex	Region	Age (years) 20 e_x[a]	20 h_x[b]	40 e_x	40 h_x	65 e_x	65 h_x
Men	Russian Federation	41.9	36.7	22.4	17.3	11.4	6.7
	Eastern Europe	49.1	41.9	26.6	20.5	12.7	8.3
	Western Europe	54.5	50.4	31.2	27.6	15.0	12.5
Women	Russian Federation	54.2	40.6	31.1	18.5	15.2	5.8
	Eastern Europe	56.8	44.5	32.8	22.7	15.9	9.3
	Western Europe	60.2	53.7	36.0	30.3	18.1	14.0
Female–male gap	Russian Federation	12.3	3.9	8.7	1.2	3.9	-0.9
	Eastern Europe	7.6	2.6	6.2	2.2	3.3	1.1
	Western Europe	5.7	3.3	4.8	2.7	3.1	1.5

[a] e_x = life expectancy at age x.
[b] h_x = healthy life expectancy at age x.

ANDREEV, Evgueni M.; MCKEE, Martin and SHKOLNIKOV, Vladimir M.. Bull WHO, 81(11), 2003.

Russia is known for its high excess in mortality of men compared to women. However, Russia faces also a huge toll of reported poor health among women.

GS effects of height (kg per cm) and weight (kg per kg)

	MEN			WOMEN		
Denmark	Coef	L95	U95	Coef	L95	U95
Age-55	-0.61	-0.65	-0.58	-0.32	-0.34	-0.30
Height-165	0.19	0.14	0.23	0.16	0.13	0.20
Weight-65	0.17	0.14	0.19	0.08	0.06	0.09
Const	44.48	43.75	45.22	25.62	25.12	26.12
England						
Age-55	-0.50	-0.53	-0.46	-0.28	-0.30	-0.26
Height-165	0.26	0.21	0.30	0.23	0.20	0.26
Weight-65	0.10	0.07	0.12	0.02	0.00	0.03
Const	42.41	41.68	43.13	26.19	25.75	26.64
Moscow						
Age-55	-0.48	-0.54	-0.42	-0.28	-0.32	-0.23
Height-165	0.28	0.20	0.37	0.17	0.11	0.24
Weight-65	0.08	0.04	0.12	0.05	0.02	0.08
Const	41.58	40.20	42.97	23.95	22.93	24.97

As expected, GS increases with height and weight everywhere. Depending on country, additional cm increases GS by 200 to 300 g in men and by 150 to 250 g in women. Additional kg increases GS by 80 to 170 g in men and 20 to 80 g in women.

GS effects of education and marriage (in kg)

	MEN			WOMEN		
	Coef	L95	U95	Coef	L95	U95
Denmark						
Age-55	-0.68	-0.72	-0.65	-0.35	-0.37	-0.32
Low education	-0.15	-1.04	0.73	-1.06	-1.73	-0.39
Medium educ.	0.34	-0.71	1.40	-1.11	-1.85	-0.36
Non-married	-1.41	-2.11	-0.71	-0.46	-0.88	-0.04
Const	49.58	48.70	50.46	29.58	28.91	30.25
Engloand						
Age-55	-0.56	-0.59	-0.52	-0.31	-0.34	-0.29
Low education	-2.73	-3.47	-1.99	-1.88	-2.39	-1.37
Medium educ.	-1.43	-2.15	-0.70	-0.70	-1.25	-0.15
Non-married	-1.02	-1.72	-0.31	-0.64	-1.06	-0.23
Const	48.42	47.79	49.05	29.21	28.73	29.69
Moscow						
Age-55	-0.54	-0.60	-0.47	-0.31	-0.36	-0.26
Low education	-5.19	-6.63	-3.76	-1.85	-2.99	-0.71
Medium educ.	-2.27	-3.44	-1.10	-0.66	-1.46	0.13
Non-married	-1.69	-2.93	-0.44	0.36	-0.42	1.14
Const	47.66	46.43	48.89	26.52	25.63	27.42

Red color marks statistically significant effects (at least p<0.05)

Huge effect of low education among MS men. Substantial effects in EW and in Russian women. Less important effect (women) or no effect (men) in DK. No negative effect of being unmarried in the MS women.

SUMMARY OF FINDINGS

• Muscovites are characterized by significantly lower grip strength: by about 2 kg for both men and women on average. The difference is greater at age 55 to 69 and becomes smaller at older ages. In terms of GS, Muscovites aged 55 are comparable with Danes and English, who are 3 to 6 years older.

• The GS disadvantage of Muscovites is about the same for both sexes. This fact disagrees with the tremendous gender gap in the Russian mortality. This also means that the female disadvantage of Moscow is more important in *relative terms* than the male one. This fact disagrees with the well-known sex mortality differential in Russia, but agrees with especially high self-reported ill-health among Russian women.

• Muscovites (especially men) experience very pronounced educational differences in GS. No non-marital GS disadvantage was found in Muscovite women. These patterns are consistent with the corresponding mortality patterns.

• Magnitude of the GS between Moscow and western countries and within the Moscow population can explain only a moderate part of the corresponding mortality differentials.