

## **WEB-EXTRA MATERIALS**

**Appendix Table A. Baseline characteristics of the study sample.**

**Appendix Table B. Baseline characteristics of the sample according to tenths of muscular strength.**

**Appendix Table C. Mortality rates according to exposure categories for all-cause death, cardiovascular disease death and suicide death.**

**Appendix Table D. Healthy muscular fitness zones for handgrip strength (kg) in European adolescents.**

**Appendix Table E. Healthy muscular fitness zones for standing long jump (cm) in European adolescents.**

**Appendix Figure A. Flow diagram.**

**Appendix Figure B. Distribution of the strength variables as histograms.**

**Appendix Figure C. Hazard ratios and 95% confidence intervals for the relation of muscular strength, body mass index and diastolic blood pressure with premature death due to non-intentional accidents.**

Models were adjusted for birth cohort, conscription age, conscription office (N=1,122,301).

**Appendix Figure D. Hazard ratios and 95% confidence intervals for the relation of muscular strength, body mass index and blood pressure with premature death due to any other cause.**

Models were adjusted for birth cohort, conscription age, conscription office (N=1,123,036).

**Appendix Figure E. Hazard ratios and 95% confidence intervals for the relation of muscular strength, body mass index and diastolic blood pressure, mutually adjusted, with premature death due to cancer, non-intentional accidents and other-causes.**

Models were adjusted for birth cohort, conscription age, conscription office.

**Appendix Figure F. Odds ratios and 95% confidence intervals of psychiatric diagnosis at conscription (baseline) and after conscription (follow-up), according to muscular strength levels.**

Models were adjusted for birth cohort, conscription age, conscription office (N= 1,132,939).

Participants with psychiatric diagnosis before conscription were excluded (N=9,609)

**Appendix Table A. Baseline characteristics of the study sample.**

No. participants	1,142,599	
	<b>Mean (SD)</b>	<b>Range</b>
Age - years	18.3 (0.5)	16.0-19.9
Knee extension strength - N	568.1 (117.4)	50-999*
Handgrip strength - N	615.9 (97.8)	100-999*
Elbow flexion strength - N	387.0 (84.3)	100-999*
Body mass index - kg/m <sup>2</sup>	21.6 (2.8)	15-55
Diastolic blood pressure - mmHg	67.5 (10.0)	40-100
Systolic blood pressure - mmHg	128.5 (10.9)	100-180
	<b>No.</b>	<b>%</b>
<b>Mother's socioeconomic position</b>		
Others	710,399	62.3
Unskilled worker	187,990	16.5
Skilled worker	38,124	3.3
Nonmanual (low)	98,046	8.6
Nonmanual (high/intermediate)	105,227	9.2
Total†	1,139,786	100.0
<b>Father's socioeconomic position</b>		
Others	142,269	12.6
Unskilled worker	306,478	27.2
Skilled worker	271,713	24.1
Nonmanual (low)	112,922	10.0
Nonmanual (high/intermediate)	292,015	25.9
Total†	1,125,397	100.0
<b>Mother's education</b>		
<9 years of primary school	532,274	48.9
9–10 years of primary school	168,541	15.5
Secondary school	300,953	27.7
Higher education	85,962	7.9
Total†	1,087,730	100.0
<b>Father's education</b>		
<9 years of primary school	499,271	47.4
9–10 years of primary school	83,084	7.9
Secondary school	365,520	34.7
Higher education	105,718	10.0
Total†	1,053,593	100.0
<b>Own education</b>		
<9 years of primary school	13,306	1.2
9–10 years of primary school	145,303	12.9
Secondary school	596,150	52.7
Higher education	375,576	33.2
Total†	1,130,335	100.0

\* The maximum value registered by the dynamometers was 999 N and 0.003-0.14% of the population achieved this value. This minor ceiling effect cannot influence our results because of the small proportion of participants with the maximum value and because the main analyses were done using categorized variables (tenths) as exposures and the participants scoring the maximum value would anyhow belong to the top tenth. †These variables were available only in a subset to the study sample as indicated with the sample size.

**Appendix Table B. Baseline characteristics of the sample according to tenths of muscular strength.**

Tenths of Knee extension strength	Body mass index (kg/m <sup>2</sup> )		Diastolic Blood Pressure (mmHg)		Systolic Blood Pressure (mmHg)	
	Mean	SD	Mean	SD	Mean	SD
1	19.9	2.4	67.6	9.8	126.8	10.9
2	20.4	2.3	67.7	9.8	127.4	10.8
3	20.9	2.4	67.6	9.8	127.8	10.8
4	21.1	2.4	67.5	9.9	128.1	10.8
5	21.4	2.4	67.4	10.0	128.3	10.8
6	21.7	2.5	67.6	10.0	128.6	10.8
7	22.0	2.6	67.3	10.0	128.8	10.8
8	22.4	2.7	67.3	10.0	129.2	10.8
9	22.9	2.8	67.1	10.1	129.5	10.7
10	23.8	3.2	67.2	10.1	130.4	10.8
Tenths of Handgrip strength	Mean	SD	Mean	SD	Mean	SD
1	20.34	2.735	67.43	9.914	126.94	10.935
2	20.79	2.616	67.08	9.909	127.50	10.823
3	21.06	2.619	67.23	9.909	127.79	10.818
4	21.30	2.634	67.14	9.939	128.08	10.807
5	21.50	2.644	67.47	9.956	128.31	10.785
6	21.74	2.662	67.22	9.972	128.70	10.821
7	21.92	2.684	67.54	9.971	128.85	10.781
8	22.16	2.728	67.54	9.973	129.16	10.845
9	22.49	2.815	67.73	10.006	129.44	10.767
10	23.12	2.993	68.04	10.042	130.01	10.788
Tenths of Elbow flexion strength	Mean	SD	Mean	SD	Mean	SD
1	19.51	2.192	67.62	9.732	126.47	10.869
2	20.31	2.211	67.55	9.768	127.33	10.776
3	20.73	2.254	67.40	9.848	127.82	10.817
4	21.08	2.360	67.44	9.910	128.06	10.807
5	21.39	2.406	67.44	9.937	128.34	10.818
6	21.69	2.452	67.52	9.951	128.65	10.796
7	22.07	2.585	67.30	10.028	128.90	10.738
8	22.52	2.720	67.35	10.048	129.26	10.817
9	22.95	2.838	67.37	10.134	129.54	10.818
10	23.84	3.220	67.52	10.222	130.09	10.807

**Appendix Table C. Mortality rates according to exposure categories for all-cause death, cardiovascular disease death and suicide death.**

<b>All-cause premature mortality</b>				
Muscular strength levels: Knee extension	N	No. Cases	Person-years	Mortality rate per 100,000 person-years
Very low strength (1th tenth)	113,517	3,737	3,055,311	122.3
Low to middle strength (2nd-4th tenths)	353,036	8,933	9,029,917	98.9
Middle to very high strength (≥5th tenth)	676,046	13,475	15,503,722	86.9
Muscular strength levels: Handgrip	N	No. Cases	Person-years	Mortality rate per 100,000 person-years
Very low strength (1th tenth)	108,659	3,048	2,660,889	114.5
Low to middle strength (2nd-4th tenths)	332,240	7,723	8,006,341	96.5
Middle to very high strength (≥5th tenth)	701,700	15,374	16,921,720	90.9
<b>Cardiovascular disease premature mortality</b>				
Muscular strength levels: Knee extension	N	No. Cases	Person-years	Mortality rate per 100,000 person-years
Very low strength (1th tenth)	110,061	281	2,962,293	9.5
Low to middle strength (2nd-4th tenths)	344,747	644	8,817,901	7.3
Middle to very high strength (≥5th tenth)	663,426	855	15,214,309	5.6
Muscular strength levels: Handgrip	N	No. Cases	Person-years	Mortality rate per 100,000 person-years
Very low strength (1th tenth)	105,827	216	2,591,538	8.3
Low to middle strength (2nd-4th tenths)	325,094	577	7,834,136	7.4
Middle to very high strength (≥5th tenth)	687,313	987	16,574,773	6.0
<b>Suicide premature mortality</b>				

Muscular strength levels: Knee extension	N	No. Cases	Person-years	Mortality rate per 100,000 person-years
Very low strength (1th tenth)	110,513	733	2,974,459	24.6
Low to middle strength (2nd-4th tenths)	345,895	1,792	8,847,265	20.3
Middle to very high strength (≥5th tenth)	665,146	2,575	15,253,753	16.9
Muscular strength levels: Handgrip				
Very low strength (1th tenth)	106,194	583	2,600,525	22.4
Low to middle strength (2nd-4th tenths)	326,064	1,547	7,857,511	19.7
Middle to very high strength (≥5th tenth)	689,296	2,970	16,622,594	17.9

Note: Mortality rates for cancer were not calculated since no associations between measures of muscle strength and cancer death was observed.

**Appendix Table D. Healthy muscular fitness zones for handgrip strength (kg)\* in European adolescents.**

Muscular strength level **	Very low strength (1 <sup>th</sup> tenth)	Low to middle strength (2 <sup>nd</sup> -4 <sup>th</sup> tenths)	Middle to very high strength (≥5 <sup>th</sup> tenth)
Associated risk **	High risk zone	Healthier muscular fitness zone	Healthiest muscular fitness zone
Boys			
13 y	≤19.2	19.3 – 24.7	>24.7
14 y	≤23.4	23.5 – 30.4	>30.4
15 y	≤28.1	28.2 – 35.7	>35.7
16 y	≤33.0	33.1 – 40.0	>40.0
17 y	≤37.4	37.5 – 43.5	>43.5
Girls			
13 y	≤18.1	18.2 – 22.5	>22.5
14 y	≤19.8	19.9 – 24.1	>24.1
15 y	≤20.7	20.8 – 25.1	>25.1
16 y	≤21.2	21.3 – 25.4	>25.4
17 y	≤22.2	22.3 – 26.4	>26.4

\* Values expressed as average of right and left hands. To be converted to N multiply the value shown in the table (expressed in Kg) by 9.81.

\*\* These three muscular strength categories are based on the mortality risks observed in the present study (e.g. see Figure 6). However, the current study engaged only male adolescents 17-19 years of age from Sweden. In order to make the present reference data useful for more people and interesting from a public health perspective, the reference values shown in the table are taken from the HELENA study (2006-2008), which gathered male and female adolescents aged 13 to 17 years from nine European countries (including Sweden)<sup>45</sup>.

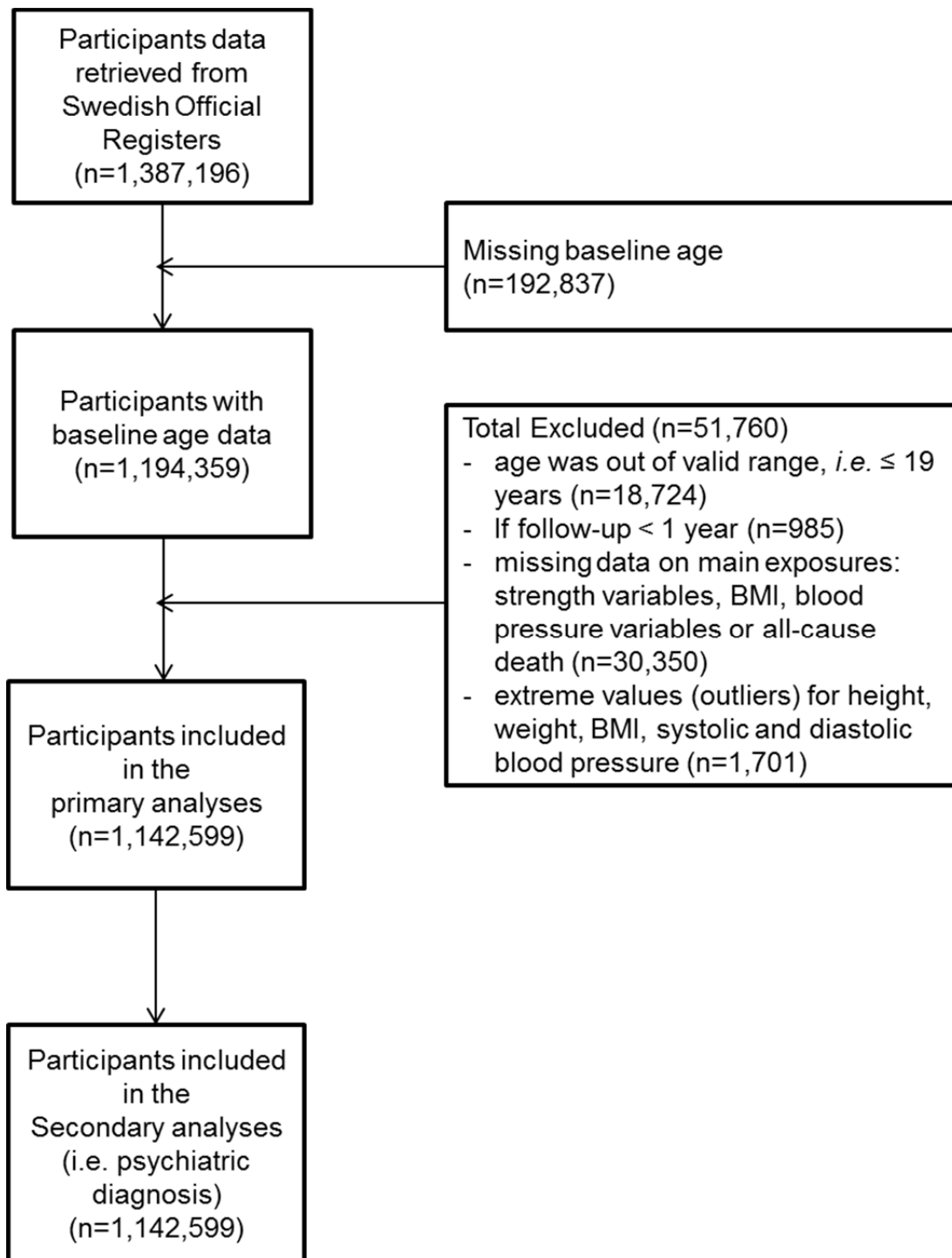
Important note: These reference values are tentative and further research in younger adolescents and female adolescents, as well as in different countries and ethnic groups, is needed before firm conclusions can be drawn.

**Appendix Table E. Healthy muscular fitness zones for standing long jump (cm) in European adolescents.**

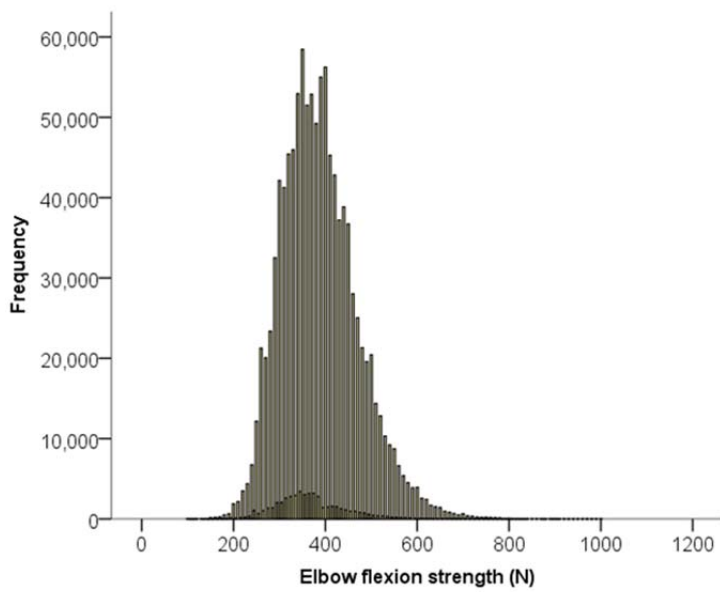
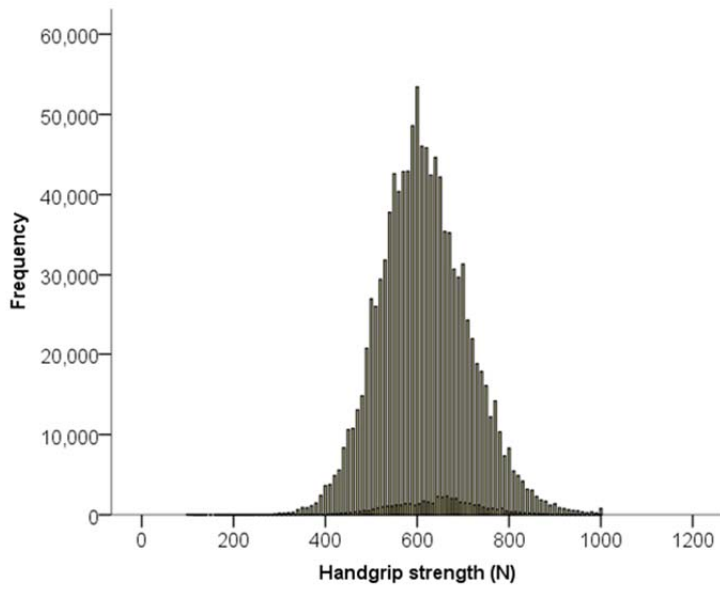
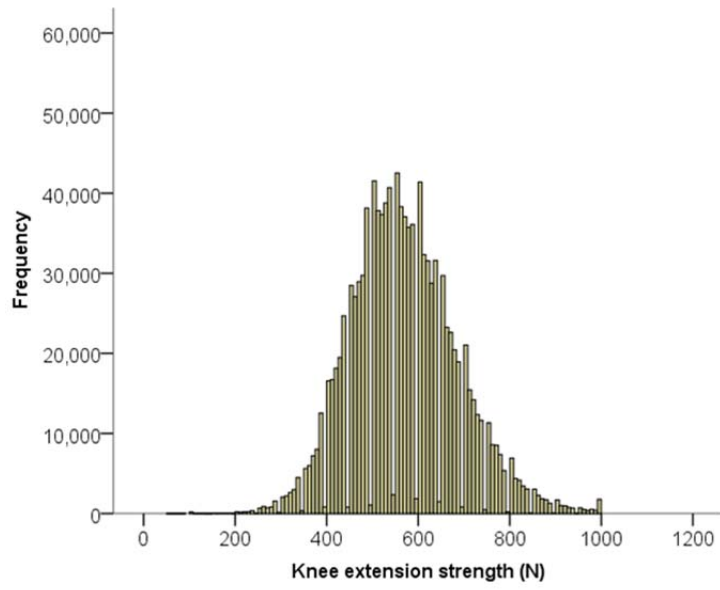
Muscular strength level *	Very low strength (1 <sup>th</sup> tenth)	Low to middle strength (2 <sup>nd</sup> -4 <sup>th</sup> tenths)	Middle to very high strength (≥5 <sup>th</sup> tenth)
Associated risk *	High risk zone	Healthier muscular fitness zone	Healthiest muscular fitness zone
Boys			
13 y	≤123	124 – 152	>152
14 y	≤138	139 – 169	>169
15 y	≤152	153 – 183	>183
16 y	≤162	163 – 193	>193
17 y	≤169	170 – 202	>202
Girls			
13 y	≤107	108 – 134	>134
14 y	≤110	111 – 137	>137
15 y	≤112	113 – 138	>138
16 y	≤115	116 – 141	>141
17 y	≤119	120 – 144	>144

\* These three muscular strength levels are based on the mortality risks observed in the present study (e.g. see Figure 6). However, the current study engaged only male adolescents 17-19 years of age from Sweden. In order to make the present reference data useful for more people and interesting from a public health perspective, the reference values shown in the table are taken from the HELENA study (2006-2008), which gathered male and female adolescents aged 13 to 17 years from nine European countries (including Sweden)<sup>45</sup>. Important note: These reference values are tentative and further research in younger adolescents and female adolescents, as well as in different countries and ethnic groups, is needed before firm conclusions can be drawn.



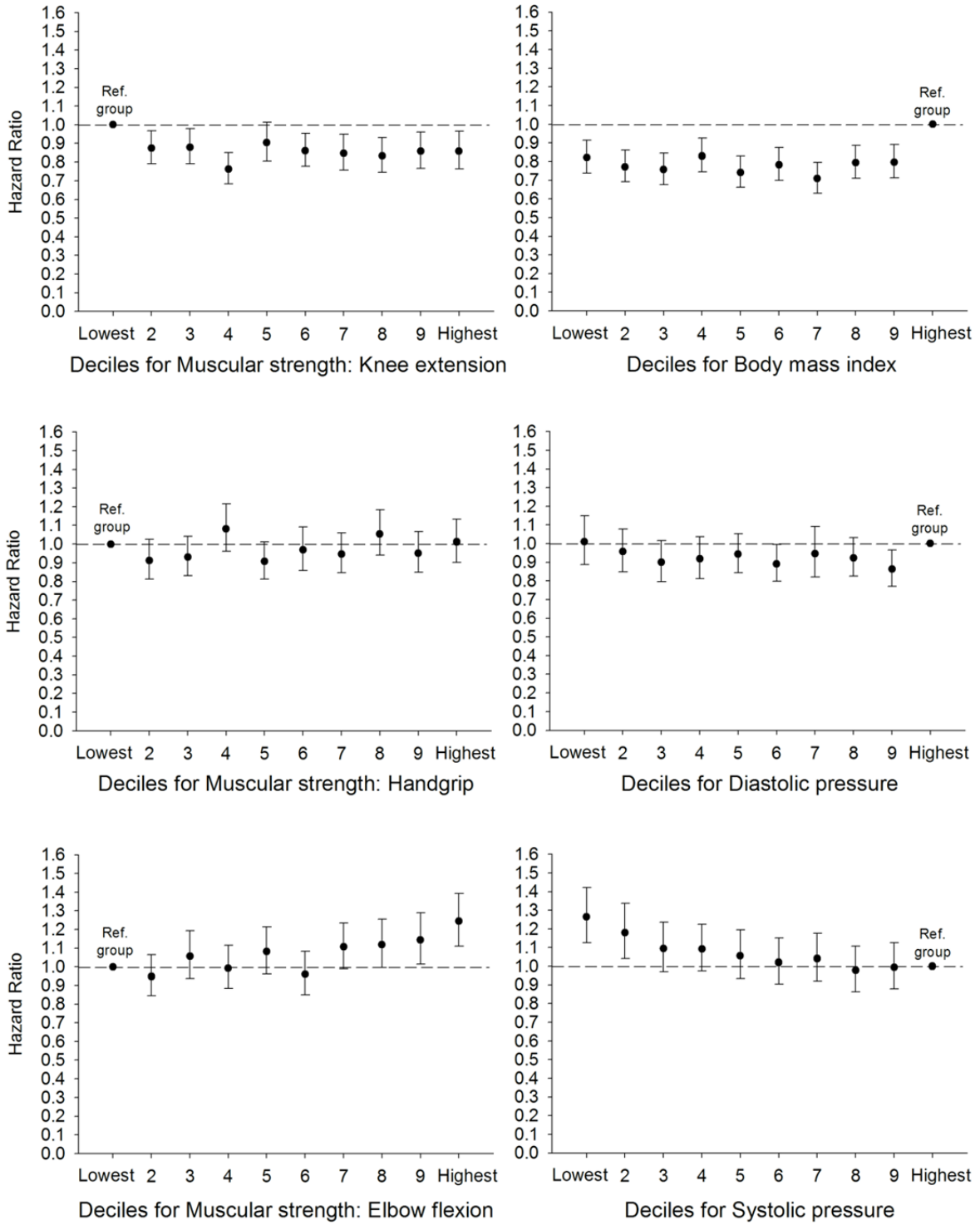


**Appendix Figure A.**



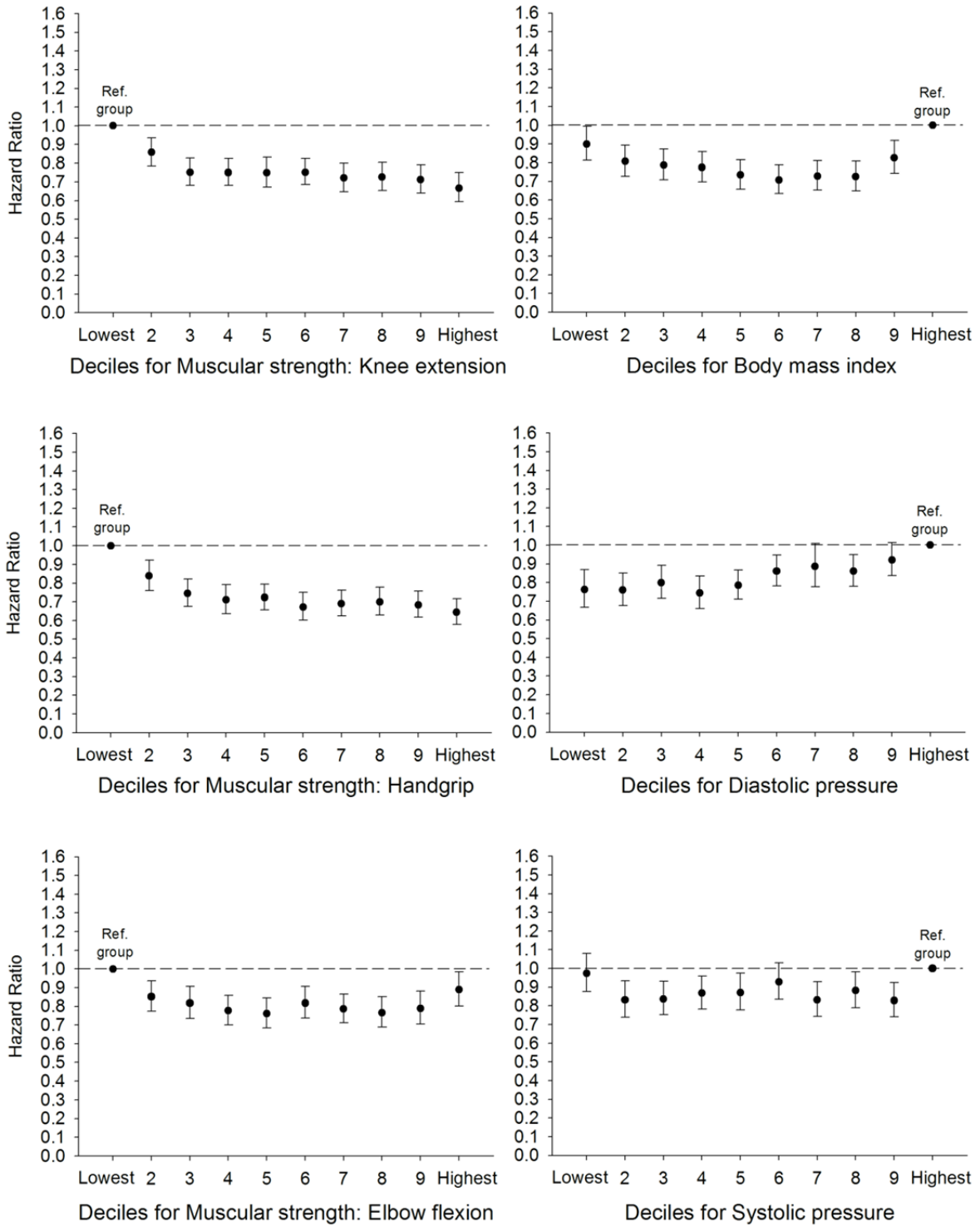
**Appendix Figure B.**

### Non-intentional Accident Mortality

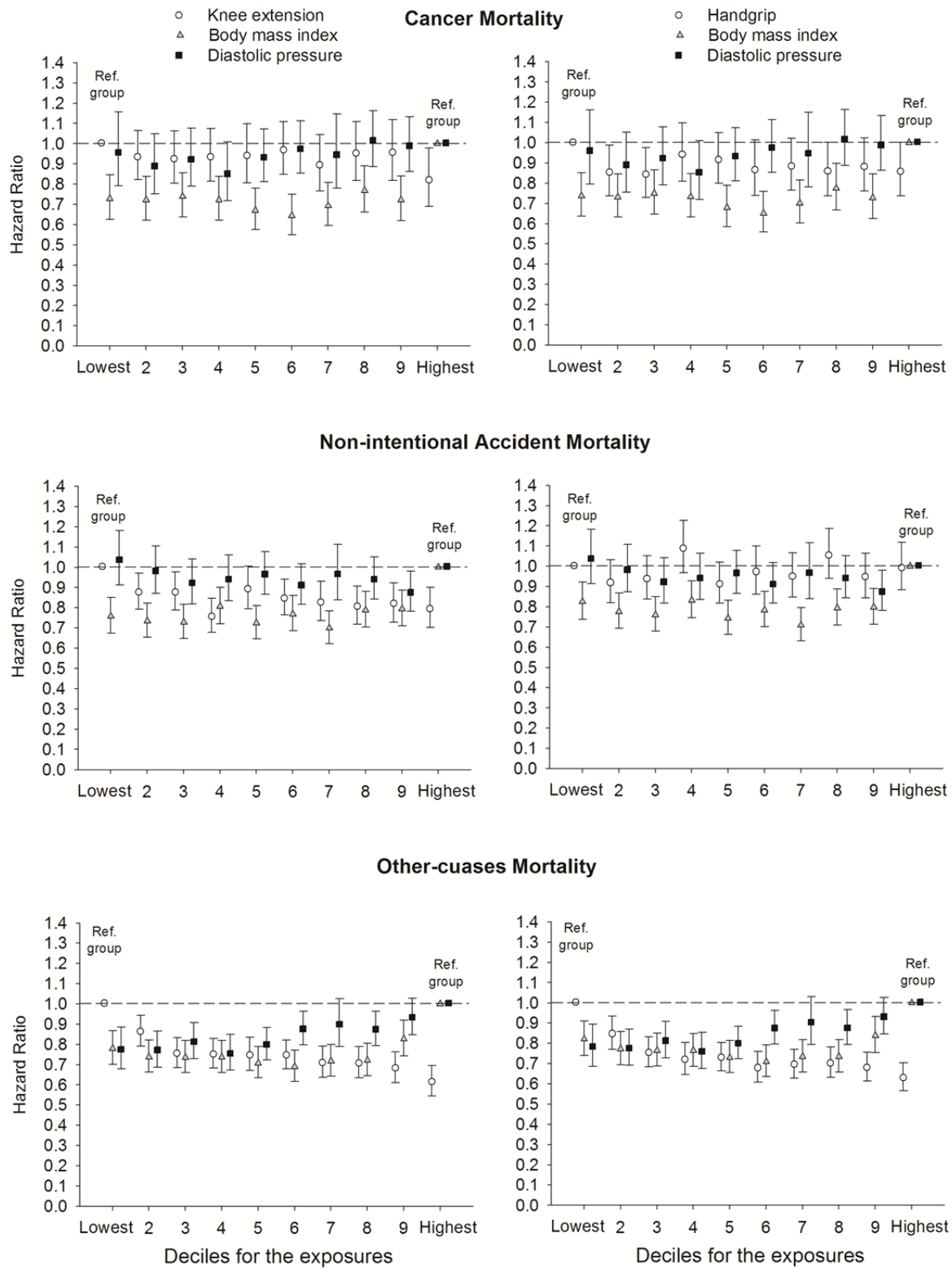


Appendix Figure C.

### Other-causes Mortality

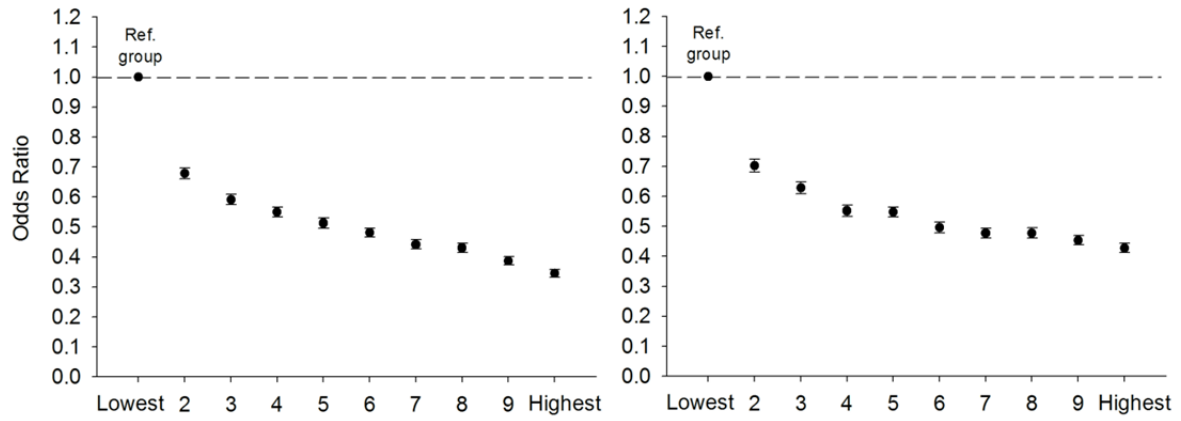


**Appendix Figure D.**

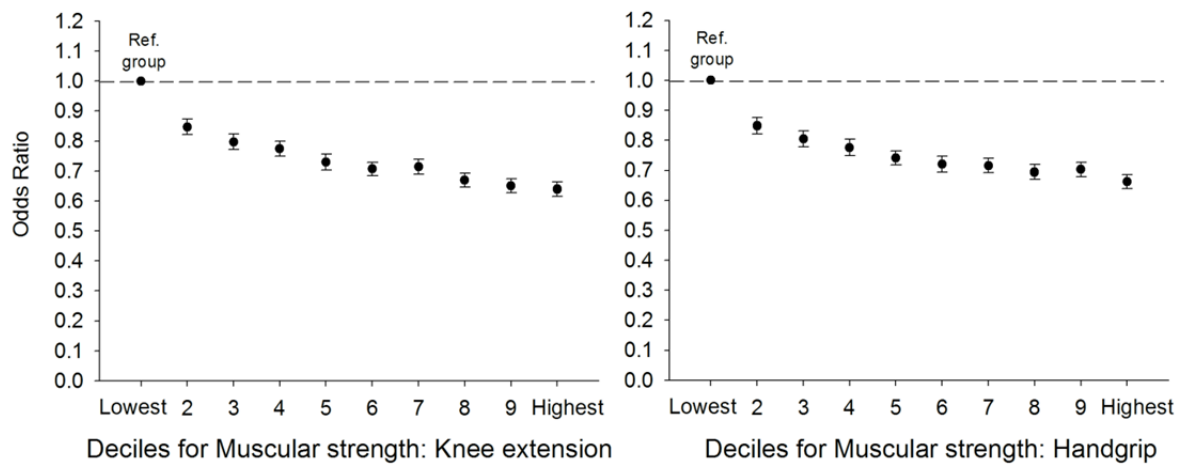


**Appendix Figure E.**

**Psychiatric diagnosis at baseline (cross-sectional analysis)**



**Psychiatric diagnosis years later (longitudinal analysis)**



**Appendix Figure F.**