Supplemental material

Adolescent Cardiorespiratory Fitness and Risk of Cancer in Late Adulthood: Nationwide Sibling-Controlled Cohort Study

Marcel Ballin, associated researcher[1,2,a], Daniel Berglind, associate professor[2,3,4], Pontus Henriksson, associate professor[5], Martin Neovius, professor[6], Anna Nordström, researcher[7,8], Francisco B. Ortega, professor[9,10], Elina Sillanpää, associate professor[10,11], Peter Nordström, professor[1,b], Viktor H. Ahlqvist, postdoctoral researcher[1,12,13,a,b]

[1]Department of Public Health and Caring Sciences, Clinical Geriatrics, Uppsala University, Uppsala, Sweden.

[2]Centre for Epidemiology and Community Medicine, Region Stockholm, Stockholm, Sweden.

[3]Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden.

[4]Center for Wellbeing, Welfare and Happiness, Stockholm School of Economics, Stockholm, Sweden.

[5]Department of Health, Medicine and Caring Sciences, Linköping University, Linköping, Sweden.

[6]Department of Medicine, Clinical Epidemiology Division, Karolinska Institutet, Stockholm, Sweden.

[7]Department of Medical Sciences, Uppsala University, Uppsala, Sweden.

[8]School of Sports Science, UiT The Arctic University of Norway, Tromsø, Norway.

[9]Department of Physical Education and Sports, Faculty of Sport Sciences, Sport and Health University Research Institute (iMUDS), University of Granada; CIBEROBN, ISCIII, Granada, Andalucía, Spain.

[10]Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland.

[11]Wellbeing Services County of Central Finland, Jyväskylä, Finland.

[12]Department of Biomedicine, Aarhus University, Aarhus, Denmark.

[13]Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden.

[a]Dr. Ballin and Dr. Ahlqvist are joint corresponding authors.

[b]Prof. Nordström and Dr. Ahlqvist are joint senior authors.

Supplementary table 1. Diagnostic codes used to define the outcomes in the study

Cancer outcomes	Code Type*	Codes
Head and neck	ICD-10	C00-C14, C30-C32
	ICD-9	140-149
	ICD-8	140-149
Oesophagus	ICD-10	C15
	ICD-9	150
	ICD-8	150
Lung	ICD-10	C34
	ICD-9	162
	ICD-8	162
Stomach	ICD-10	C16
	ICD-9	151
	ICD-8	151
Pancreas	ICD-10	C25
	ICD-9	157
	ICD-8	157
Liver, bile ducts, and gallbladder	ICD-10	C22-C24
	ICD-9	155-156
	ICD-8	155-156
Colon	ICD-10	C18
	ICD-9	153
	ICD-8	153
Rectum	ICD-10	C19-C20
	ICD-9	154
	ICD-8	154
Kidney	ICD-10	C64
	ICD-9	189
	ICD-8	189
Prostate	ICD-10	C61
	ICD-9	185
	ICD-8	185
Bladder	ICD-10	C67
	ICD-9	188
	ICD-8	188
Myeloma	ICD-10	C90
	ICD-9	203
	ICD-8	203
Melanoma skin	ICD-10	C43
	ICD-9	172
	ICD-8	172
Non-melanoma skin	ICD-10	C44
	ICD-9	173
	ICD-8	173
Overall cancer	ICD-10	C00-C97
	ICD-9	140-175, 179-208
	ICD-8	140-209

ICD = International Classification of Diseases.
*Codes from all versions (8,9,10) were available for the ascertainment of cancer mortality but codes from versions 8 and 9 were not available for the ascertainment of cancer diagnosis as we did not have access to those codes in the National Patient Register. However, we deem the number of such cases to have been very small given that most of the years of follow-up were covered using ICD-10. Moreover, ICD-8 and 9 are only available in inpatient care and are not validated to the same extent as ICD-10.

Supplementary table 2. Follow-up time, number of events, and numbers censored in cohort and sibling analysis.

Cancer outcome	Cohort analysis (N=1 124 049)	Sibling analysis (N=477 453)
Any cancer diagnosis		
Follow-up time, median (range)	37.7 (0.1-51.4)	38.3 (0.1-51.4)
Events	98 410 (8.8)	41 293 (8.7)
Death from non-cancer causes	47 320 (4.2)	18 579 (3.9)
Emigration	75 786 (6.7)	31 195 (6.5)
End of follow-up	902 533 (80.3)	386 386 (80.9)
Any cancer mortality		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	16 789 (1.5)	6908 (1.5)
Death from non-cancer causes	48 122 (4.3)	18 912 (4.0)
Emigration	76 274 (6.8)	31 377 (6.6)
End of follow-up	982 864 (87.4)	420 256 (88.0)
Head and neck		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	4026 (0.4)	1692 (0.4)
Death from other causes	63 867 (5.7)	25 385 (5.3)
Emigration	76 251 (6.8)	31 370 (6.6)
End of follow-up	979 905 (87.2)	419 006 (87.8)
Oesophagus		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	1178 (0.1)	464 (0.1)
Death from other causes	64 069 (5.7)	25 494 (5.3)
Emigration	76 274 (6.8)	31 377 (6.6)
End of follow-up	982 528 (87.4)	420 118 (88.0)
Lung		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	3131 (0.3)	1263 (0.3)
Death from other causes	62 755 (5.6)	24 971 (5.2)
Emigration	76 270 (6.8)	31 375 (6.6)
End of follow-up	981 893 (87.4)	419 844 (87.9)
Stomach		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	1430 (0.1)	599 (0.1)
Death from other causes	63 986 (5.7)	25 443 (5.3)
Emigration	76 272 (6.8)	31 375 (6.6)
End of follow-up	982 361 (87.4)	420 036 (88.0)
Pancreas		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	2255 (0.2)	943 (0.2)
Death from other causes	63 231 (5.6)	25 134 (5.3)
Emigration	76 273 (6.8)	31 377 (6.6)
End of follow-up	982 290 (87.4)	419 999 (88.0)
Liver, bile ducts, and gallbladder		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	2246 (0.2)	925 (0.2)
Death from other causes	63 322 (5.6)	25 160 (5.3)
Emigration	76 270 (6.8)	31 375 (6.6)
End of follow-up	982 211 (87.4)	419 993 (88.0)
Colon		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	5320 (0.5)	2177 (0.5)
Death from other causes	63 009 (5.6)	25 046 (5.3)
Emigration	76 259 (6.8)	31 374 (6.6)
End of follow-up	979 461 (87.1)	418 856 (87.7)
Rectum		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	3917 (0.4)	1625 (0.3)
Death from other causes	63 684 (5.7)	25 304 (5.3)
Emigration	76 267 (6.8)	31 372 (6.6)
End of follow-up	980 181 (87.2)	419 152 (87.8)
Kidney		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	2741 (0.2)	1151 (0.2)
Death from other causes	64 174 (5.7)	25 519 (5.3)
Emigration	76 267 (6.8)	31 373 (6.6)
End of follow-up	980 867 (87.3)	419 410 (87.8)
Prostate		
Follow-up time, median (range)	38.2 (0.1-51.4)	38.8 (0.1-51.4)
Events	24 225 (2.2)	10 042 (2.1)
Death from other causes	63 387 (5.6)	25 229 (5.3)

Emigration	76 211 (6.8)	31 353 (6.6)
End of follow-up	960 225 (85.4)	410 829 (86.1)
Bladder		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	3490 (0.3)	1432 (0.3)
Death from other causes	64 374 (5.7)	25 594 (5.4)
Emigration	76 256 (6.8)	31 367 (6.6)
End of follow-up	979 929 (87.2)	419 060 (87.8)
Myeloma		
Follow-up time, median (range)	38.3 (0.1-51.4)	38.9 (0.1-51.4)
Events	1460 (0.1)	580 (0.1)
Death from other causes	64 446 (5.7)	25 643 (5.4)
Emigration	76 271 (6.8)	31 374 (6.6)
End of follow-up	981 872 (87.4)	419 856 (87.9)
Melanoma		
Follow-up time, median (range)	38.2 (0.1-51.4)	38.8 (0.1-51.4)
Events	10 026 (0.9)	4216 (0.9)
Death from other causes	63 730 (5.7)	25 360 (5.3)
Emigration	76 207 (6.8)	31 359 (6.6)
End of follow-up	974 086 (86.7)	416 518 (87.2)
Non-melanoma		
Follow-up time, median (range)	38.1 (0.1-51.4)	38.7 (0.1-51.4)
Events	27 302 (2.4)	11 509 (2.4)
Death from other causes	63 579 (5.7)	25 284 (5.3)
Emigration	76 111 (6.8)	31 313 (6.6)
End of follow-up	957 057 (85.1)	409 347 (85.7)

Number of events and numbers censored are shown as n (%).

Supplementary table 3. Hazard ratios for cancer by quartiles of cardiorespiratory fitness in cohort and sibling analysis.

Cancer outcome by quartiles of cardiorespiratory fitness	Cohort analysis (N=1 124 049)		Sibling analysis (N=477 453)	
	Cases, n (%)	HR (95% CI)	Cases, n (%)	HR (95% CI)
Overall cancer diagnosis				
Q1	33 673 (12.0)	Ref.	13 621 (11.5)	Ref.
Q2	28 078 (9.8)	1.01 (0.99, 1.02)	11 693 (9.6)	1.00 (0.96, 1.03)
Q3	20 523 (7.4)	1.03 (1.01, 1.05)	8990 (7.6)	1.02 (0.97, 1.06)
Q4	16 136 (5.8)	1.08 (1.06, 1.11)	6989 (5.9)	1.00 (0.95, 1.06)
Overall cancer mortality				
Q1	7093 (2.5)	Ref.	2790 (2.4)	Ref.
Q2	4810 (1.7)	0.83 (0.80, 0.86)	1981 (1.6)	0.88 (0.81, 0.96)
Q3	2960 (1.1)	0.76 (0.73, 0.80)	1300 (1.1)	0.85 (0.77, 0.95)
Q4	1926 (0.7)	0.71 (0.67, 0.76)	837 (0.7)	0.78 (0.68, 0.89)
Site-specific cancers				
Head and neck				
Q1	1539 (0.6)	Ref.	629 (0.5)	Ref.
Q2	1148 (0.4)	0.85 (0.79, 0.93)	474 (0.4)	0.94 (0.78, 1.12)
Q3	782 (0.3)	0.80 (0.73, 0.88)	350 (0.3)	0.84 (0.68, 1.04)
Q4	557 (0.2)	0.75 (0.67, 0.85)	237 (0.2)	0.80 (0.62, 1.04)
Oesophagus				
Q1	536 (0.2)	Ref.	213 (0.2)	Ref.
Q2	346 (0.1)	0.75 (0.65, 0.86)	139 (0.1)	0.95 (0.69, 1.32)
Q3	185 (0.07)	0.60 (0.50, 0.72)	68 (0.06)	0.68 (0.45, 1.03)
Q4	111 (0.04)	0.53 (0.42, 0.66)	44 (0.04)	0.61 (0.36, 1.02)
Lung				
Q1	1562 (0.6)	Ref.	620 (0.5)	Ref.
Q2	871 (0.3)	0.74 (0.68, 0.80)	350 (0.3)	0.81 (0.67, 0.98)
Q3	460 (0.2)	0.62 (0.55, 0.69)	188 (0.2)	0.73 (0.56, 0.93)
Q4	238 (0.09)	0.49 (0.42, 0.57)	105 (0.09)	0.50 (0.36, 0.70)
Stomach				
Q1	597 (0.2)	Ref.	234 (0.2)	Ref.
Q2	405 (0.1)	0.79 (0.70, 0.90)	164 (0.1)	0.90 (0.67, 1.21)
Q3	256 (0.09)	0.74 (0.63, 0.86)	101 (0.08)	0.69 (0.49, 0.98)
Q4	172 (0.06)	0.71 (0.58, 0.86)	79 (0.07)	0.90 (0.60, 1.37)
Pancreas				
Q1	925 (0.3)	Ref.	369 (0.3)	Ref.
Q2	663 (0.2)	0.86 (0.78, 0.95)	270 (0.2)	1.05 (0.83, 1.33)
Q3	424 (0.2)	0.84 (0.74, 0.95)	191 (0.2)	0.98 (0.74, 1.30)
Q4	243 (0.09)	0.73 (0.62, 0.85)	113 (0.1)	0.83 (0.59, 1.18)
Liver, bile ducts, and gallbladder				
Q1	1038 (0.4)	Ref.	380 (0.3)	Ref.
Q2	657 (0.2)	0.77 (0.69, 0.85)	294 (0.2)	1.10 (0.86, 1.39)
Q3	333 (0.1)	0.60 (0.52, 0.68)	163 (0.1)	0.97 (0.73, 1.28)
Q4	218 (0.08)	0.59 (0.50, 0.69)	88 (0.07)	0.78 (0.54, 1.13)
Colon				
Q1	2001 (0.7)	Ref.	801 (0.7)	Ref.
Q2	1543 (0.5)	0.91 (0.85, 0.97)	618 (0.5)	0.89 (0.76, 1.04)
Q3	1050 (0.4)	0.84 (0.78, 0.91)	446 (0.4)	0.92 (0.76, 1.11)
Q4	726 (0.3)	0.75 (0.68, 0.83)	312 (0.3)	0.78 (0.62, 0.99)
Rectum				
Q1	1474 (0.5)	Ref.	615 (0.5)	Ref.
Q2	1154 (0.4)	0.94 (0.87, 1.02)	470 (0.4)	0.90 (0.75, 1.07)
Q3	764 (0.3)	0.88 (0.80, 0.96)	325 (0.3)	0.84 (0.68, 1.04)
Q4	525 (0.2)	0.81 (0.72, 0.91)	215 (0.2)	0.69 (0.53, 0.90)
Kidney				
Q1	1035 (0.4)	Ref.	416 (0.4)	Ref.
Q2	801 (0.3)	0.84 (0.76, 0.92)	352 (0.3)	1.01 (0.81, 1.26)
Q3	529 (0.2)	0.73 (0.65, 0.82)	226 (0.2)	0.91 (0.70, 1.18)
Q4	376 (0.1)	0.65 (0.57, 0.75)	157 (0.1)	0.86 (0.63, 1.18)
Prostate				
Q1	9678 (3.4)	Ref.	3887 (3.3)	Ref.
Q2	7507 (2.6)	1.04 (1.01, 1.07)	3061 (2.5)	1.00 (0.94, 1.08)
Q3	4449 (1.6)	1.05 (1.01, 1.09)	1947 (1.6)	1.03 (0.94, 1.12)
Q4	2591 (0.9)	1.10 (1.05, 1.16)	1147 (1.0)	1.01 (0.90, 1.13)
Bladder				
Q1	1427 (0.5)	Ref.	589 (0.5)	Ref.
Q2	1018 (0.4)	0.90 (0.82, 0.97)	405 (0.3)	0.98 (0.81, 1.19)
Q3	667 (0.2)	0.89 (0.81, 0.99)	270 (0.2)	0.85 (0.68, 1.05)
Q4	378 (0.1)	0.75 (0.65, 0.85)	168 (0.1)	0.89 (0.66, 1.19)
Myeloma				
Q1	516 (0.2)	Ref.	199 (0.2)	Ref.
Q2	429 (0.2)	0.99 (0.86, 1.13)	166 (0.1)	0.76 (0.55, 1.04)

Q3	301 (0.1)	1.00 (0.86, 1.17)	123 (0.1)	0.83 (0.57, 1.20)
Q4	214 (0.08)	1.00 (0.83, 1.20)	92 (0.08)	0.81 (0.50, 1.29)
Melanoma skin				
Q1	2622 (0.9)	Ref.	1031 (0.9)	Ref.
Q2	2682 (0.9)	1.13 (1.07, 1.19)	1113 (0.9)	1.08 (0.96, 1.22)
Q3	2396 (0.9)	1.28 (1.21, 1.37)	1067 (0.9)	1.22 (1.06, 1.40)
Q4	2326 (0.8)	1.50 (1.41, 1.61)	1005 (0.9)	1.30 (1.11, 1.52)
Non-melanoma skin				
Q1	8441 (3.0)	Ref.	3374 (2.9)	Ref.
Q2	7726 (2.7)	1.13 (1.09, 1.17)	3192 (2.6)	1.03 (0.96, 1.11)
Q3	5957 (2.2)	1.22 (1.18, 1.27)	2689 (2.3)	1.09 (1.01, 1.19)
Q4	5178 (1.9)	1.44 (1.37, 1.50)	2254 (1.9)	1.09 (0.99, 1.20)

CI = confidence interval. HR = hazard ratio. Q = quartile. HRs are adjusted for age at conscription, year of conscription, body mass index, parental education, and parental income. In both cohorts, the median (range) of W_{max} in Q1 was 217 (100-236), in Q2 it was 253 (237-270), in Q3 it was 290 (271-312), in Q4 it was 339 (313-999).

Supplementary table 4. Standardised cumulative incidence of cancer at 65 years of age by quartiles of cardiorespiratory fitness in cohort and sibling analysis.

Cancer outcome by quartiles of cardiorespiratory fitness	Cohort analysis (N=1 124 049)		Sibling analysis (N=477 453)	
	Standardised incidence at age 65 y, % (95% CI)	Difference, pp (95% CI)	Standardised incidence at age 65 y, % (95% CI)	Difference, pp (95% CI)
Overall cancer diagnosis				
Q1	18.1 (17.8, 18.3)	Ref.	17.8 (17.3, 18.4)	Ref.
Q2	18.6 (18.4, 18.9)	0.6 (0.2, 0.9)	17.8 (17.3, 18.3)	-0.004 (-0.9, 0.8)
Q3	19.0 (18.6, 19.2)	0.9 (0.5, 1.3)	18.1 (17.5, 18.6)	0.2 (-0.7, 1.2)
Q4	19.5 (19.2, 19.9)	1.5 (1.0, 1.9)	17.9 (17.3, 18.6)	0.08 (-0.9, 1.1)
Overall cancer mortality				
Q1	3.0 (2.9, 3.1)	Ref.	2.8 (2.6, 3.0)	Ref.
Q2	2.2 (2.1, 2.3)	-0.8 (-0.9, -0.7)	2.3 (2.1, 2.4)	-0.5 (-0.8, -0.2)
Q3	2.0 (2.0, 2.1)	-1.0 (-1.1, -0.8)	2.2 (2.0, 2.4)	-0.6 (-0.9, -0.3)
Q4	1.9 (1.8, 2.0)	-1.1 (-1.2, -0.9)	2.1 (1.8, 2.3)	-0.7 (-1.1, -0.4)
Site-specific cancers				
Head and neck				
Q1	0.8 (0.7, 0.8)	Ref.	0.7 (0.6, 0.8)	Ref.
Q2	0.6 (0.6, 0.6)	-0.2 (-0.3, -0.1)	0.6 (0.5, 0.7)	-0.1 (-0.3, 0.06)
Q3	0.6 (0.5, 0.6)	-0.2 (-0.3, -0.1)	0.6 (0.5, 0.7)	-0.2 (-0.3, -0.02)
Q4	0.5 (0.5, 0.6)	-0.2 (-0.3, -0.2)	0.5 (0.4, 0.7)	-0.2 (-0.4, -0.02)
Oesophagus				
Q1	0.3 (0.2, 0.3)	Ref.	0.2 (0.2, 0.3)	Ref.
Q2	0.2 (0.1, 0.2)	-0.1 (-0.2, -0.08)	0.2 (0.1, 0.2)	-0.05 (-0.1, 0.04)
Q3	0.1 (0.1, 0.2)	-0.1 (-0.2, -0.09)	0.1 (0.1, 0.2)	-0.08 (-0.2, 0.001)
Q4	0.1 (0.1, 0.2)	-0.2 (-0.2, -0.1)	0.1 (0.1, 0.2)	-0.09 (-0.2, -0.004)
Lung				
Q1	0.6 (0.6, 0.7)	Ref.	0.6 (0.5, 0.7)	Ref.
Q2	0.4 (0.3, 0.4)	-0.3 (-0.3, -0.2)	0.4 (0.3, 0.5)	-0.2 (-0.3, -0.07)
Q3	0.3 (0.3, 0.4)	-0.3 (-0.4, -0.3)	0.4 (0.3, 0.4)	-0.2 (-0.4, -0.09)
Q4	0.3 (0.2, 0.3)	-0.4 (-0.4, -0.3)	0.3 (0.2, 0.3)	-0.3 (-0.5, -0.2)
Stomach				
Q1	0.3 (0.2, 0.3)	Ref.	0.3 (0.2, 0.3)	Ref.
Q2	0.2 (0.2, 0.2)	-0.08 (-0.1, -0.05)	0.2 (0.2, 0.3)	-0.05 (-0.1, 0.04)
Q3	0.2 (0.2, 0.2)	-0.09 (-0.1, -0.05)	0.2 (0.1, 0.2)	-0.09 (-0.2, 0.002)
Q4	0.2 (0.1, 0.2)	-0.1 (-0.1, -0.06)	0.2 (0.2, 0.3)	-0.05 (0.2, 0.06)
Pancreas				
Q1	0.5 (0.4, 0.5)	Ref.	0.4 (0.3, 0.5)	Ref.
Q2	0.4 (0.3, 0.4)	-0.1 (-0.2, -0.05)	0.4 (0.3, 0.5)	0.0002 (-0.1, 0.1)
Q3	0.4 (0.3, 0.4)	-0.1 (-0.2, -0.05)	0.4 (0.3, 0.5)	-0.02 (-0.2, 0.1)
Q4	0.3 (0.3, 0.4)	-0.2 (-0.2, -0.08)	0.4 (0.3, 0.5)	-0.07 (-0.2, 0.09)
Liver, bile ducts, and gallbladder				
Q1	0.5 (0.5, 0.6)	Ref.	0.4 (0.3, 0.5)	Ref.
Q2	0.3 (0.3, 0.3)	-0.2 (-0.3, -0.1)	0.4 (0.3, 0.5)	0.01 (-0.1, 0.1)
Q3	0.3 (0.2, 0.3)	-0.3 (-0.3, -0.2)	0.4 (0.3, 0.4)	-0.02 (-0.2, 0.1)
Q4	0.3 (0.2, 0.3)	-0.3 (-0.3, -0.2)	0.3 (0.2, 0.4)	-0.08 (-0.2, 0.06)
Colon				
Q1	1.2 (1.1, 1.2)	Ref.	1.1 (1.0, 1.3)	Ref.
Q2	0.9 (0.9, 1.0)	-0.2 (-0.3, -0.1)	0.9 (0.8, 1.0)	-0.2 (-0.4, -0.02)
Q3	0.9 (0.8, 1.0)	-0.3 (-0.4, -0.2)	0.9 (0.8, 1.1)	-0.2 (-0.4, 0.07)
Q4	0.8 (0.8, 0.9)	-0.3 (-0.5, -0.2)	0.8 (0.7, 1.0)	-0.3 (-0.5, -0.02)
Rectum				
Q1	0.9 (0.8, 0.9)	Ref.	0.9 (0.7, 1.0)	Ref.
Q2	0.7 (0.7, 0.8)	-0.1 (-0.2, -0.04)	0.7 (0.6, 0.8)	-0.2 (-0.4, 0.003)
Q3	0.7 (0.6, 0.8)	-0.2 (-0.3, -0.07)	0.6 (0.5, 0.8)	-0.2 (-0.4, 0.01)
Q4	0.7 (0.6, 0.7)	-0.2 (-0.3, -0.09)	0.6 (0.5, 0.7)	-0.3 (-0.5, -0.09)
Kidney				
Q1	0.6 (0.6, 0.7)	Ref.	0.5 (0.4, 0.6)	Ref.
Q2	0.4 (0.4, 0.5)	-0.2 (-0.3, -0.1)	0.5 (0.4, 0.6)	-0.03 (-0.2, 0.1)
Q3	0.4 (0.4, 0.5)	-0.2 (-0.3, -0.2)	0.5 (0.4, 0.6)	-0.06 (-0.2, 0.1)
Q4	0.4 (0.3, 0.4)	-0.3 (-0.4, -0.2)	0.4 (0.3, 0.6)	-0.08 (-0.3, 0.09)
Prostate				
Q1	4.9 (4.7, 5.1)	Ref.	5.0 (4.7, 5.4)	Ref.
Q2	5.3 (5.1, 5.5)	0.4 (0.2, 0.6)	5.1 (4.8, 5.5)	0.06 (-0.4, 0.6)
Q3	5.4 (5.1, 5.6)	0.4 (0.2, 0.7)	5.2 (4.8, 5.6)	0.2 (-0.4, 0.7)
Q4	5.5 (5.3, 5.8)	0.6 (0.3, 0.9)	5.1 (4.7, 5.6)	0.08 (-0.6, 0.8)
Bladder				
Q1	0.7 (0.6, 0.7)	Ref.	0.6 (0.5, 0.7)	Ref.
Q2	0.5 (0.5, 0.6)	-0.1 (-0.2, -0.06)	0.5 (0.5, 0.6)	-0.05 (-0.2, 0.09)
Q3	0.5 (0.5, 0.6)	-0.1 (-0.2, -0.05)	0.5 (0.4, 0.6)	-0.1 (-0.3, 0.04)
Q4	0.5 (0.4, 0.5)	-0.2 (-0.3, -0.1)	0.5 (0.4, 0.6)	-0.09 (-0.3, 0.09)
Myeloma				
Q1	0.3 (0.2, 0.3)	Ref.	0.3 (0.2, 0.4)	Ref.

Q2	0.3 (0.2, 0.3)	-0.004 (-0.05, 0.04)	0.2 (0.2, 0.3)	-0.09 (-0.2, 0.02)
Q3	0.3 (0.2, 0.3)	0.00001 (-0.05, 0.05)	0.2 (0.2, 0.3)	-0.08 (-0.2, 0.05)
Q4	0.3 (0.2, 0.3)	0.001 (-0.06, 0.06)	0.2 (0.2, 0.3)	-0.08 (-0.2, 0.06)
Melanoma skin				
Q1	1.7 (1.5, 1.7)	Ref.	1.7 (1.5, 1.8)	Ref.
Q2	2.2 (2.1, 2.3)	0.6 (0.5, 0.8)	2.1 (1.8, 2.3)	0.4 (0.06, 0.7)
Q3	2.4 (2.3, 2.6)	0.8 (0.6, 1.0)	2.2 (2.0, 2.5)	0.6 (0.2, 0.9)
Q4	2.7 (2.5, 2.8)	1.0 (0.9, 1.3)	2.3 (2.0, 2.6)	0.6 (0.2, 1.1)
Non-melanoma skin				
Q1	4.4 (4.2, 4.5)	Ref.	4.7 (4.4, 5.0)	Ref.
Q2	5.7 (5.6, 5.9)	1.4 (1.1, 1.6)	5.1 (4.8, 5.4)	0.4 (-0.1, 0.9)
Q3	6.1 (5.9, 6.3)	1.7 (1.4, 2.0)	5.3 (5.0, 5.7)	0.6 (0.03, 0.1)
Q4	6.7 (6.5, 7.0)	2.4 (2.1, 2.7)	5.3 (4.9, 5.7)	0.6 (-0.05, 0.1)

CI = confidence interval. Q = quartile. All estimates are adjusted for age at conscription, year of conscription, body mass index, parental education, and parental income. In both cohorts, the median (range) of W_{max} in Q1 was 217 (100-236), in Q2 it was 253 (237-270), in Q3 it was 290 (271-312), in Q4 it was 339 (313-999).

Supplementary table 5. Population-attributable fraction for cancer at 65 years of age by cardiorespiratory fitness in cohort and sibling analysis, when considering a moderate (shifting those in quartile 1 to quartile 2) or a major intervention (shifting everyone to quartile 4).

	Moderate intervention		Major intervention	
	Cohort analysis (N=1 124 049)	Sibling analysis (N=477 453)	Cohort analysis (N=1 124 049)	Sibling analysis (N=477 453)
Cancer outcome	PAF, % (95% CI)	PAF, % (95% CI)	PAF, % (95% CI)	PAF, % (95% CI)
Overall cancer diagnosis	-2.0 (-3.0, -1.0)	-0.1 (-2.5, 2.2)	-5.3 (-6.8, -3.7)	-0.2 (-3.6, 3.6)
Overall cancer mortality	16.5 (14.4, 18.6)	11.3 (6.1, 16.6)	22.6 (19.2, 26.1)	17.2 (8.8, 25.5)
Site specific cancers				
Head and neck	14.0 (9.5, 18.4)	9.3 (-1.9, 20.6)	18.9 (12.0, 25.8)	15.5 (-1.2, 32.2)
Oesophagus	26.4 (19.8, 33.1)	16.2 (-2.5, 34.9)	38.0 (27.0, 49.0)	32.0 (5.3, 58.7)
Lung	27.9 (23.8, 32.0)	22.9 (12.7, 33.1)	42.8 (35.7, 50.0)	41.4 (26.5, 56.2)
Stomach	18.6 (11.6, 25.6)	11.6 (-5.9, 29.1)	23.3 (11.8, 34.8)	7.1 (-22.2, 36.3)
Pancreas	13.6 (7.7, 19.5)	1.6 (-14.7, 17.9)	21.4 (11.7, 31.0)	12.9 (-9.5, 35.3)
Liver, bile ducts, and gallbladder	24.8 (20.0, 29.8)	1.7 (-14.6, 17.9)	32.9 (24.3, 41.4)	17.9 (-5.8, 41.5)
Colon	11.1 (7.1, 15.1)	9.7 (0.2, 19.3)	18.7 (12.8, 24.6)	16.4 (2.5, 30.3)
Rectum	8.2 (3.4, 13.1)	12.7 (2.2, 23.2)	14.5 (7.2, 21.7)	26.7 (9.4, 37.9)
Kidney	17.6 (12.6, 22.7)	3.9 (-10.6, 18.3)	26.5 (19.2, 33.8)	10.6 (-10.3, 31.5)
Prostate	-4.2 (-6.4, -1.9)	-0.8 (-5.9, 4.3)	-7.2 (-10.1, -3.4)	-0.7 (-9.9, 7.4)
Bladder	10.9 (5.9, 15.8)	6.0 (-6.6, 18.5)	20.1 (12.1, 28.1)	9.1 (-11.7, 29.8)
Myeloma	0.5 (-8.5, 9.4)	16.0 (-2.3, 34.3)	0.2 (-13.5, 13.9)	14.2 (-13.9, 42.3)
Melanoma skin	-18.2 (-22.7, -13.7)	-12.9 (-21.6, -2.2)	-32.3 (-38.5, -26.2)	-19.1 (-32.2, -6.0)
Non-melanoma skin	-16.0 (-18.5, -13.5)	-4.3 (-9.5, 0.9)	-28.8 (-32.5, -25.0)	-5.9 (-13.1, 1.3)

CI = confidence interval. PAF = population-attributable fraction. All estimates were adjusted for age at conscription, year of conscription, body mass index, parental education, and parental income. Negative estimates imply a theoretically increased risk of the outcome in the population should the relevant intervention be carried out

Supplementary table 6. Hazard ratios for cancer by quartiles of cardiorespiratory fitness in cohort analysis (as reported in the main article), in the sibling cohort using standard analysis, and in the sibling cohort using sibling analysis (as reported in the main article).

Cancer outcome by quartiles of cardiorespiratory fitness	Total cohort (standard) analysis as reported in main article (N=1 124 049) HR (95% CI)	Standard analysis replicated in sibling cohort (N=477 453) HR (95% CI)	Sibling analysis as reported in main article (N=477 453) HR (95% CI)
Overall cancer diagnosis			
Q1	Ref.	Ref.	Ref.
Q2	1.01 (0.99, 1.02)	1.00 (0.98, 1.03)	1.00 (0.96, 1.03)
Q3	1.03 (1.01, 1.05)	1.06 (1.03, 1.09)	1.02 (0.97, 1.06)
Q4	1.08 (1.06, 1.11)	1.09 (1.06, 1.13)	1.00 (0.95, 1.06)
Overall cancer mortality			
Q1	Ref.	Ref.	Ref.
Q2	0.83 (0.80, 0.86)	0.83 (0.78, 0.88)	0.88 (0.81, 0.96)
Q3	0.76 (0.73, 0.80)	0.77 (0.72, 0.82)	0.85 (0.77, 0.95)
Q4	0.71 (0.67, 0.76)	0.68 (0.63, 0.74)	0.78 (0.68, 0.89)
Site-specific cancers			
Head and neck			
Q1	Ref.	Ref.	Ref.
Q2	0.85 (0.79, 0.93)	0.83 (0.73, 0.93)	0.94 (0.78, 1.12)
Q3	0.80 (0.73, 0.88)	0.80 (0.70, 0.92)	0.84 (0.68, 1.04)
Q4	0.75 (0.67, 0.85)	0.69 (0.58, 0.81)	0.80 (0.62, 1.04)
Oesophagus			
Q1	Ref.	Ref.	Ref.
Q2	0.75 (0.65, 0.86)	0.73 (0.58, 0.91)	0.95 (0.69, 1.32)
Q3	0.60 (0.50, 0.72)	0.52 (0.39, 0.69)	0.68 (0.45, 1.03)
Q4	0.53 (0.42, 0.66)	0.48 (0.34, 0.69)	0.61 (0.36, 1.02)
Lung			
Q1	Ref.	Ref.	Ref.
Q2	0.74 (0.68, 0.80)	0.71 (0.62, 0.81)	0.81 (0.67, 0.98)
Q3	0.62 (0.55, 0.69)	0.57 (0.48, 0.68)	0.73 (0.56, 0.93)
Q4	0.49 (0.42, 0.57)	0.47 (0.37, 0.59)	0.50 (0.36, 0.70)
Stomach			
Q1	Ref.	Ref.	Ref.
Q2	0.79 (0.70, 0.90)	0.76 (0.62, 0.93)	0.90 (0.67, 1.21)
Q3	0.74 (0.63, 0.86)	0.63 (0.49, 0.80)	0.69 (0.49, 0.98)
Q4	0.71 (0.58, 0.86)	0.67 (0.50, 0.90)	0.90 (0.60, 1.37)
Pancreas			
Q1	Ref.	Ref.	Ref.
Q2	0.86 (0.78, 0.95)	0.84 (0.71, 0.99)	1.05 (0.83, 1.33)
Q3	0.84 (0.74, 0.95)	0.86 (0.71, 1.04)	0.98 (0.74, 1.30)
Q4	0.73 (0.62, 0.85)	0.74 (0.58, 0.93)	0.83 (0.59, 1.18)
Liver, bile ducts, and gallbladder			
Q1	Ref.	Ref.	Ref.
Q2	0.77 (0.69, 0.85)	0.87 (0.74, 1.01)	1.10 (0.86, 1.39)
Q3	0.60 (0.52, 0.68)	0.69 (0.57, 0.84)	0.97 (0.73, 1.28)
Q4	0.59 (0.50, 0.69)	0.53 (0.41, 0.69)	0.78 (0.54, 1.13)
Colon			
Q1	Ref.	Ref.	Ref.
Q2	0.91 (0.85, 0.97)	0.88 (0.79, 0.98)	0.89 (0.76, 1.04)
Q3	0.84 (0.78, 0.91)	0.83 (0.74, 0.95)	0.92 (0.76, 1.11)
Q4	0.75 (0.68, 0.83)	0.74 (0.64, 0.86)	0.78 (0.62, 0.99)
Rectum			
Q1	Ref.	Ref.	Ref.
Q2	0.94 (0.87, 1.02)	0.88 (0.77, 0.99)	0.90 (0.75, 1.07)
Q3	0.88 (0.80, 0.96)	0.83 (0.71, 0.95)	0.84 (0.68, 1.04)
Q4	0.81 (0.72, 0.91)	0.72 (0.60, 0.86)	0.69 (0.53, 0.90)
Kidney			
Q1	Ref.	Ref.	Ref.
Q2	0.84 (0.76, 0.92)	0.91 (0.79 1.05)	1.01 (0.81, 1.26)
Q3	0.73 (0.65, 0.82)	0.75 (0.63, 0.90)	0.91 (0.70, 1.18)
Q4	0.65 (0.57, 0.75)	0.65 (0.53, 0.80)	0.86 (0.63, 1.18)
Prostate			
Q1	Ref.	Ref.	Ref.
Q2	1.04 (1.01, 1.07)	1.01 (0.96, 1.06)	1.00 (0.94, 1.08)
Q3	1.05 (1.01, 1.09)	1.05 (0.99, 1.12)	1.03 (0.94, 1.12)
Q4	1.10 (1.05, 1.16)	1.07 (0.99, 1.15)	1.01 (0.90, 1.13)
Bladder			
Q1	Ref.	Ref.	Ref.
Q2	0.90 (0.82, 0.97)	0.82 (0.72, 0.93)	0.98 (0.81, 1.19)
Q3	0.89 (0.81, 0.99)	0.80 (0.68, 0.93)	0.85 (0.68, 1.05)
Q4	0.75 (0.65, 0.85)	0.72 (0.59, 0.87)	0.89 (0.66, 1.19)
Myeloma			

Q1	Ref.	Ref.	Ref.
Q2	0.99 (0.86, 1.13)	0.97 (0.78, 1.19)	0.76 (0.55, 1.04)
Q3	1.00 (0.86, 1.17)	1.02 (0.80, 1.29)	0.83 (0.57, 1.20)
Q4	1.00 (0.83, 1.20)	1.06 (0.80, 1.41)	0.81 (0.50, 1.29)
Melanoma skin			
Q1	Ref.	Ref.	Ref.
Q2	1.13 (1.07, 1.19)	1.18 (1.08, 1.29)	1.08 (0.96, 1.22)
Q3	1.28 (1.21, 1.37)	1.43 (1.31, 1.57)	1.22 (1.06, 1.40)
Q4	1.50 (1.41, 1.61)	1.66 (1.50, 1.84)	1.30 (1.11, 1.52)
Non-melanoma skin			
Q1	Ref.	Ref.	Ref.
Q2	1.13 (1.09, 1.17)	1.15 (1.09, 1.20)	1.03 (0.96, 1.11)
Q3	1.22 (1.18, 1.27)	1.34 (1.26, 1.41)	1.09 (1.01, 1.19)
Q4	1.44 (1.37, 1.50)	1.52 (1.43, 1.62)	1.09 (0.99, 1.20)

CI = confidence interval. HR = hazard ratio. Q = quartile. All estimates were adjusted for birth cohort, year of conscription, body mass index, parental education, and parental income. In both cohorts, the median (range) of W_{max} in Q1 was 217 (100-236), in Q2 it was 253 (237-270), in Q3 it was 290 (271-312), in Q4 it was 339 (313-999).

Supplementary table 7. Hazard ratios for cancer by quartiles of cardiorespiratory fitness in cohort and sibling analysis, with and without adjusting for body mass index.

Cancer outcome by quartiles of cardiorespiratory fitness	Cohort analysis (N=1 124 049)		Sibling analysis (N=477 453)	
	HR (95% CI) without adjustment for BMI	HR (95% CI) with adjustment for BMI	HR (95% CI) without adjustment for BMI	HR (95% CI) with adjustment for BMI
Overall cancer diagnosis				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	1.01 (1.00, 1.03)	1.01 (0.99, 1.02)	1.00 (0.96, 1.04)	1.00 (0.96, 1.03)
Q3	1.04 (1.02, 1.06)	1.03 (1.01, 1.05)	1.02 (0.98, 1.06)	1.02 (0.97, 1.06)
Q4	1.10 (1.08, 1.12)	1.08 (1.06, 1.11)	1.01 (0.96, 1.06)	1.00 (0.95, 1.06)
Overall cancer mortality				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.87 (0.84, 0.90)	0.83 (0.80, 0.86)	0.90 (0.83, 0.98)	0.88 (0.81, 0.96)
Q3	0.81 (0.78, 0.85)	0.76 (0.73, 0.80)	0.88 (0.79, 0.97)	0.85 (0.77, 0.95)
Q4	0.78 (0.74, 0.82)	0.71 (0.67, 0.76)	0.82 (0.72, 0.93)	0.78 (0.68, 0.89)
Site-specific cancer				
Head and neck				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.90 (0.83, 0.97)	0.85 (0.79, 0.93)	0.93 (0.78, 1.11)	0.94 (0.78, 1.12)
Q3	0.86 (0.79, 0.95)	0.80 (0.73, 0.88)	0.83 (0.68, 1.03)	0.84 (0.68, 1.04)
Q4	0.84 (0.75, 0.93)	0.75 (0.67, 0.85)	0.79 (0.61, 1.03)	0.80 (0.62, 1.04)
Oesophagus				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.83 (0.73, 0.95)	0.75 (0.65, 0.86)	0.99 (0.72, 1.37)	0.95 (0.69, 1.32)
Q3	0.69 (0.58, 0.82)	0.60 (0.50, 0.72)	0.72 (0.48, 1.08)	0.68 (0.45, 1.03)
Q4	0.63 (0.51, 0.79)	0.53 (0.42, 0.66)	0.66 (0.39, 1.09)	0.61 (0.36, 1.02)
Lung				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.74 (0.68, 0.81)	0.74 (0.68, 0.80)	0.79 (0.65, 0.95)	0.81 (0.67, 0.98)
Q3	0.62 (0.56, 0.70)	0.62 (0.55, 0.69)	0.70 (0.55, 0.89)	0.73 (0.56, 0.93)
Q4	0.50 (0.43, 0.58)	0.49 (0.42, 0.57)	0.48 (0.34, 0.66)	0.50 (0.36, 0.70)
Stomach				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.87 (0.76, 0.99)	0.79 (0.70, 0.90)	0.94 (0.70, 1.25)	0.90 (0.67, 1.21)
Q3	0.83 (0.71, 0.97)	0.74 (0.63, 0.86)	0.73 (0.52, 1.02)	0.69 (0.49, 0.98)
Q4	0.83 (0.69, 1.00)	0.71 (0.58, 0.86)	0.98 (0.65, 1.47)	0.90 (0.60, 1.37)
Pancreas				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.92 (0.83, 1.02)	0.86 (0.78, 0.95)	1.11 (0.88, 1.41)	1.05 (0.83, 1.33)
Q3	0.92 (0.81, 1.04)	0.84 (0.74, 0.95)	1.07 (0.81, 1.41)	0.98 (0.74, 1.30)
Q4	0.82 (0.70, 0.96)	0.73 (0.62, 0.85)	0.93 (0.66, 1.30)	0.83 (0.59, 1.18)
Liver, bile ducts, and gallbladder				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.83 (0.76, 0.92)	0.77 (0.69, 0.85)	1.16 (0.92, 1.47)	1.10 (0.86, 1.39)
Q3	0.67 (0.59, 0.76)	0.60 (0.52, 0.68)	1.06 (0.80, 1.39)	0.97 (0.73, 1.28)
Q4	0.68 (0.58, 0.80)	0.59 (0.50, 0.69)	0.87 (0.61, 1.25)	0.78 (0.54, 1.13)
Colon				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.93 (0.87, 1.00)	0.91 (0.85, 0.97)	0.90 (0.78, 1.05)	0.89 (0.76, 1.04)
Q3	0.88 (0.81, 0.95)	0.84 (0.78, 0.91)	0.94 (0.78, 1.13)	0.92 (0.76, 1.11)
Q4	0.80 (0.72, 0.88)	0.75 (0.68, 0.83)	0.81 (0.64, 1.01)	0.78 (0.62, 0.99)
Rectum				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.96 (0.89, 1.04)	0.94 (0.87, 1.02)	0.94 (0.78, 1.12)	0.90 (0.75, 1.07)
Q3	0.90 (0.82, 0.99)	0.88 (0.80, 0.96)	0.90 (0.73, 1.10)	0.84 (0.68, 1.04)
Q4	0.84 (0.75, 0.94)	0.81 (0.72, 0.91)	0.75 (0.58, 0.97)	0.69 (0.53, 0.90)
Kidney				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.93 (0.85, 1.02)	0.84 (0.76, 0.92)	1.06 (0.86, 1.32)	1.01 (0.81, 1.26)
Q3	0.85 (0.76, 0.95)	0.73 (0.65, 0.82)	0.98 (0.76, 1.25)	0.91 (0.70, 1.18)
Q4	0.79 (0.69, 0.91)	0.65 (0.57, 0.75)	0.95 (0.70, 1.29)	0.86 (0.63, 1.18)
Prostate				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	1.04 (1.01, 1.07)	1.04 (1.01, 1.07)	1.00 (0.93, 1.07)	1.00 (0.94, 1.08)
Q3	1.05 (1.01, 1.09)	1.05 (1.01, 1.09)	1.02 (0.94, 1.11)	1.03 (0.94, 1.12)
Q4	1.10 (1.05, 1.15)	1.10 (1.05, 1.16)	1.00 (0.90, 1.12)	1.01 (0.90, 1.13)
Bladder				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	0.92 (0.85, 1.00)	0.90 (0.82, 0.97)	0.99 (0.82, 1.20)	0.98 (0.81, 1.19)
Q3	0.93 (0.84, 1.02)	0.89 (0.81, 0.99)	0.86 (0.69, 1.07)	0.85 (0.68, 1.05)
Q4	0.78 (0.69, 0.89)	0.75 (0.65, 0.85)	0.91 (0.68, 1.21)	0.89 (0.66, 1.19)
Myeloma				

Q1	Ref.	Ref.	Ref.	Ref.
Q2	1.04 (0.90, 1.18)	0.99 (0.86, 1.13)	0.78 (0.57, 1.07)	0.76 (0.55, 1.04)
Q3	1.07 (0.92, 1.25)	1.00 (0.86, 1.17)	0.87 (0.61, 1.26)	0.83 (0.57, 1.20)
Q4	1.09 (0.91, 1.31)	1.00 (0.83, 1.20)	0.86 (0.55, 1.36)	0.81 (0.50, 1.29)
Melanoma skin				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	1.17 (1.10, 1.23)	1.13 (1.07, 1.19)	1.11 (0.98, 1.25)	1.08 (0.96, 1.22)
Q3	1.34 (1.27, 1.43)	1.28 (1.21, 1.37)	1.26 (1.11, 1.44)	1.22 (1.06, 1.40)
Q4	1.60 (1.50, 1.71)	1.50 (1.41, 1.61)	1.36 (1.17, 1.59)	1.30 (1.11, 1.52)
Non-melanoma skin				
Q1	Ref.	Ref.	Ref.	Ref.
Q2	1.10 (1.06, 1.13)	1.13 (1.09, 1.17)	1.01 (0.95, 1.09)	1.03 (0.96, 1.11)
Q3	1.17 (1.13, 1.21)	1.22 (1.18, 1.27)	1.06 (0.98, 1.15)	1.09 (1.01, 1.19)
Q4	1.35 (1.30, 1.40)	1.44 (1.37, 1.50)	1.05 (0.96, 1.15)	1.09 (0.99, 1.20)

BMI = body mass index. CI = confidence interval. HR = hazard ratio. Q = quartile. All estimates were adjusted for birth cohort, year of conscription, parental education, and parental income. In both cohorts, the median (range) of W_{max} in Q1 was 217 (100-236), in Q2 it was 253 (237-270), in Q3 it was 290 (271-312), in Q4 it was 339 (313-999).

Supplementary table 8. Net risk and crude risk of cancer at 65 years of age by quartiles of cardiorespiratory fitness in cohort and sibling analysis.

Cancer outcome by quartiles of fitness	Cohort analysis (N=1 124 049)[a]				Sibling analysis (N=477 453)[a]			
	Net risk[b]		Crude risk[c]		Net risk[b]		Crude risk[c]	
	Risk at age 65 y, % (95% CI)	Difference, pp (95% CI)	Risk at age 65 y, % (95% CI)	Difference, pp (95% CI)	Risk at age 65 y, % (95% CI)	Difference, pp (95% CI)	Risk at age 65 y, % (95% CI)	Difference, pp (95% CI)
Overall cancer diagnosis								
Q1	18.1 (17.8, 18.3)	Ref.	16.9 (16.7, 17.1)	Ref.	17.8 (17.3, 18.4)	Ref.	16.9 (16.4, 17.4)	Ref.
Q2	18.6 (18.4, 18.9)	0.6 (0.2, 0.9)	17.9 (17.7, 18.2)	1.1 (0.7, 1.5)	17.8 (17.3, 18.3)	-0.004 (-0.9, 0.8)	17.2 (16.7, 17.7)	0.3 (-0.5, 1.1)
Q3	19.0 (18.6, 19.2)	0.9 (0.5, 1.3)	18.3 (18.0, 18.6)	1.5 (1.1, 1.9)	18.1 (17.5, 18.6)	0.2 (-0.7, 1.2)	17.5 (16.9, 18.0)	0.6 (-0.3, 1.5)
Q4	19.5 (19.2, 19.9)	1.5 (1.0, 1.9)	19.0 (18.7, 19.4)	2.2 (1.7, 2.6)	17.9 (17.3, 18.6)	0.08 (-0.9, 1.1)	17.4 (16.7, 18.0)	0.5 (-0.5, 1.5)
Overall cancer mortality								
Q1	3.0 (2.9, 3.1)	Ref.	2.8 (2.7, 2.9)	Ref.	2.8 (2.6, 3.0)	Ref.	2.6 (2.5, 2.8)	Ref.
Q2	2.2 (2.1, 2.3)	-0.8 (-0.9, -0.7)	2.1 (2.0, 2.2)	-0.7 (-0.8, -0.6)	2.3 (2.1, 2.4)	-0.5 (-0.8, -0.2)	2.2 (2.0, 2.3)	-0.5 (-0.7, -0.2)
Q3	2.0 (2.0, 2.1)	-1.0 (-1.1, -0.8)	2.0 (1.9, 2.1)	-0.8 (-1.0, -0.7)	2.2 (2.0, 2.4)	-0.6 (-0.9, -0.3)	2.1 (1.9, 2.3)	-0.5 (-0.8, 0.2)
Q4	1.9 (1.8, 2.0)	-1.1 (-1.2, 0.9)	1.9 (1.8, 2.0)	-0.9 (1.1, -0.8)	2.1 (1.8, 2.3)	-0.7 (-1.1, -0.4)	2.0 (1.8, 2.2)	-0.7 (-1.0, -0.3)
Site-specific cancers								
Head and neck								
Q1	0.8 (0.7, 0.8)	Ref.	0.7 (0.7, 0.8)	Ref.	0.7 (0.6, 0.8)	Ref.	0.7 (0.6, 0.8)	Ref.
Q2	0.6 (0.6, 0.6)	-0.2 (-0.3, -0.1)	0.6 (0.5, 0.6)	-0.2 (-0.2, -0.09)	0.6 (0.5, 0.7)	-0.1 (-0.3, 0.06)	0.6 (0.5, 0.7)	-0.1 (-0.2, -0.06)
Q3	0.6 (0.5, 0.6)	-0.2 (-0.3, -0.1)	0.5 (0.5, 0.6)	-0.2 (-0.3, -0.1)	0.6 (0.5, 0.7)	-0.2 (-0.3, -0.02)	0.5 (0.5, 0.6)	-0.1 (-0.3, 0.03)
Q4	0.5 (0.5, 0.6)	-0.2 (-0.3, -0.2)	0.5 (0.5, 0.6)	-0.2 (0.3, -0.1)	0.5 (0.4, 0.7)	-0.2 (-0.4, -0.02)	0.5 (0.4, 0.7)	-0.2 (-0.3, 0.03)
Oesophagus								
Q1	0.3 (0.2, 0.3)	Ref.	0.3 (0.2, 0.3)	Ref.	0.2 (0.2, 0.3)	Ref.	0.2 (0.2, 0.3)	Ref.
Q2	0.2 (0.1, 0.2)	-0.1 (-0.2, -0.08)	0.2 (0.1, 0.2)	-0.1 (-0.1, -0.06)	0.2 (0.1, 0.2)	-0.05 (-0.1, 0.04)	0.2 (0.1, 0.2)	-0.04 (-0.1, 0.04)
Q3	0.1 (0.1, 0.2)	-0.1 (-0.2, -0.09)	0.1 (0.1, 0.2)	-0.1 (-0.2, -0.08)	0.1 (0.1, 0.2)	-0.08 (-0.2, 0.001)	0.1 (0.1, 0.2)	-0.07 (-0.2, 0.005)
Q4	0.1 (0.1, 0.2)	-0.2 (-0.2, -0.1)	0.1 (0.1, 0.2)	-0.1 (-0.2, -0.09)	0.1 (0.1, 0.2)	-0.09 (-0.2, -0.004)	0.1 (0.1, 0.2)	-0.08 (-0.2, 0.001)
Lung								
Q1	0.6 (0.6, 0.7)	Ref.	0.6 (0.5, 0.6)	Ref.	0.6 (0.5, 0.7)	Ref.	0.5 (0.5, 0.6)	Ref.
Q2	0.4 (0.3, 0.4)	-0.3 (-0.3, -0.2)	0.4 (0.3, 0.4)	-0.2 (0.3, -0.2)	0.4 (0.3, 0.5)	-0.2 (-0.3, -0.07)	0.4 (0.3, 0.4)	-0.2 (-0.3, -0.06)
Q3	0.3 (0.3, 0.4)	-0.3 (-0.4, -0.3)	0.3 (0.3, 0.3)	-0.3 (-0.3, -0.2)	0.4 (0.3, 0.4)	-0.2 (-0.4, -0.09)	0.3 (0.3, 0.4)	-0.2 (-0.3, -0.08)
Q4	0.3 (0.2, 0.3)	-0.4 (-0.4, -0.3)	0.3 (0.2, 0.3)	-0.3 (-0.4, -0.3)	0.3 (0.2, 0.3)	-0.3 (-0.5, -0.2)	0.3 (0.2, 0.3)	-0.3 (-0.4, -0.2)
Stomach								
Q1	0.3 (0.2, 0.3)	Ref.	0.3 (0.2, 0.3)	Ref.	0.3 (0.2, 0.3)	Ref.	0.2 (0.2, 0.3)	Ref.
Q2	0.2 (0.2, 0.2)	-0.08 (-0.1, -0.05)	0.2 (0.2, 0.2)	-0.07 (-0.1, -0.04)	0.2 (0.2, 0.3)	-0.05 (-0.1, 0.04)	0.2 (0.2, 0.3)	-0.04 (-0.1, 0.04)
Q3	0.2 (0.2, 0.2)	-0.09 (-0.1, -0.05)	0.2 (0.1, 0.2)	-0.08 (-0.1, -0.04)	0.2 (0.1, 0.2)	-0.09 (-0.2, 0.002)	0.2 (0.1, 0.2)	-0.08 (-0.2, 0.007)
Q4	0.2 (0.1, 0.2)	-0.1 (-0.1, -0.06)	0.2 (0.1, 0.2)	-0.08 (-0.1, -0.04)	0.2 (0.2, 0.3)	-0.05 (0.2, 0.06)	0.2 (0.1, 0.3)	-0.04 (-0.1, 0.07)
Pancreas								
Q1	0.5 (0.4, 0.5)	Ref.	0.4 (0.4, 0.5)	Ref.	0.4 (0.3, 0.5)	Ref.	0.4 (0.3, 0.5)	Ref.
Q2	0.4 (0.3, 0.4)	-0.1 (-0.2, -0.05)	0.3 (0.3, 0.4)	-0.1 (-0.1, -0.04)	0.4 (0.3, 0.5)	0.0002 (-0.1, 0.1)	0.4 (0.3, 0.5)	0.008 (-0.1, 0.1)
Q3	0.4 (0.3, 0.4)	-0.1 (-0.2, -0.05)	0.3 (0.3, 0.4)	-0.1 (-0.1, -0.03)	0.4 (0.3, 0.5)	-0.02 (-0.2, 0.1)	0.4 (0.3, 0.5)	-0.009 (-0.2, 0.1)
Q4	0.3 (0.3, 0.4)	-0.2 (-0.2, -0.08)	0.3 (0.3, 0.4)	-0.1 (-0.2, -0.06)	0.4 (0.3, 0.5)	-0.07 (-0.2, 0.09)	0.3 (0.3, 0.5)	-0.05 (-0.2, 0.09)
Liver, bile ducts, and gallbladder								
Q1	0.5 (0.5, 0.6)	Ref.	0.5 (0.4, 0.5)	Ref.	0.4 (0.3, 0.5)	Ref.	0.3 (0.3, 0.4)	Ref.
Q2	0.3 (0.3, 0.3)	-0.2 (-0.3, -0.1)	0.3 (0.3, 0.3)	-0.2 (-0.2, -0.1)	0.4 (0.3, 0.5)	0.01 (-0.1, 0.1)	0.4 (0.3, 0.4)	0.02 (-0.09, 0.1)
Q3	0.3 (0.2, 0.3)	-0.3 (-0.3, -0.2)	0.2 (0.2, 0.3)	-0.2 (-0.3, -0.2)	0.4 (0.3, 0.4)	-0.02 (-0.2, 0.1)	0.3 (0.3, 0.4)	-0.01 (-0.1, 0.01)
Q4	0.3 (0.2, 0.3)	-0.3 (-0.3, -0.2)	0.2 (0.2, 0.3)	-0.2 (-0.3, -0.2)	0.3 (0.2, 0.4)	-0.08 (-0.2, 0.06)	0.3 (0.2, 0.4)	-0.06 (-0.2, 0.07)
Colon								

Q1	1.2 (1.1, 1.2)	Ref.	1.1 (1.0, 1.1)	Ref.	1.1 (1.0, 1.3)	Ref.	1.0 (0.9, 1.2)	Ref.
Q2	0.9 (0.9, 1.0)	-0.2 (-0.3, -0.1)	0.9 (0.8, 1.0)	-0.2 (-0.3, -0.09)	0.9 (0.8, 1.0)	-0.2 (-0.4, -0.02)	0.9 (0.7, 1.0)	-0.2 (-0.4, 0.03)
Q3	0.9 (0.8, 1.0)	-0.3 (-0.4, -0.2)	0.9 (0.8, 0.9)	-0.2 (-0.3, -0.1)	0.9 (0.8, 1.1)	-0.2 (-0.4, 0.07)	0.9 (0.8, 1.0)	-0.1 (-0.4, 0.09)
Q4	0.8 (0.8, 0.9)	-0.3 (-0.5, -0.2)	0.8 (0.7, 0.9)	-0.3 (-0.4, -0.2)	0.8 (0.7, 1.0)	-0.3 (-0.5, -0.02)	0.8 (0.7, 0.9)	-0.2 (-0.5, 0.008)
Rectum								
Q1	0.9 (0.8, 0.9)	Ref.	0.8 (0.7, 0.9)	Ref.	0.9 (0.7, 1.0)	Ref.	0.8 (0.7, 0.9)	Ref.
Q2	0.7 (0.7, 0.8)	-0.1 (-0.2, -0.04)	0.7 (0.7, 0.8)	-0.1 (-0.2, -0.007)	0.7 (0.6, 0.8)	-0.2 (-0.4, 0.003)	0.6 (0.5, 0.8)	-0.2 (-0.4, 0.02)
Q3	0.7 (0.6, 0.8)	-0.2 (-0.3, -0.07)	0.7 (0.6, 0.7)	-0.1 (-0.2 (-0.03)	0.6 (0.5, 0.8)	-0.2 (-0.4, 0.01)	0.6 (0.5, 0.7)	-0.2 (-0.4, 0.007)
Q4	0.7 (0.6, 0.7)	-0.2 (-0.3, -0.09)	0.6 (0.6, 0.7)	-0.2 (-0.3, -0.05)	0.6 (0.5, 0.7)	-0.3 (-0.5, -0.09)	0.5 (0.4, 0.7)	-0.3 (-0.5, -0.007)
Kidney								
Q1	0.6 (0.6, 0.7)	Ref.	0.6 (0.5, 0.6)	Ref.	0.5 (0.4, 0.6)	Ref.	0.5 (0.4, 0.6)	Ref.
Q2	0.4 (0.4, 0.5)	-0.2 (-0.3, -0.1)	0.4 (0.4, 0.5)	-0.2 (-0.2, -0.1)	0.5 (0.4, 0.6)	-0.03 (-0.2, 0.1)	0.5 (0.4, 0.6)	-0.01 (-0.2, 0.1)
Q3	0.4 (0.4, 0.5)	-0.2 (-0.3, -0.2)	0.4 (0.3, 0.4)	-0.2 (-0.3, -0.1)	0.5 (0.4, 0.6)	-0.06 (-0.2, 0.1)	0.4 (0.4, 0.5)	-0.05 (-0.2, 0.1)
Q4	0.4 (0.3, 0.4)	-0.3 (-0.4, -0.2)	0.4 (0.3, 0.4)	-0.2 (-0.3, -0.2)	0.4 (0.3, 0.6)	-0.08 (-0.3, 0.09)	0.4 (0.3, 0.5)	-0.06 (-0.2, 0.1)
Prostate								
Q1	4.9 (4.7, 5.1)	Ref.	4.5 (4.3, 4.7)	Ref.	5.0 (4.7, 5.4)	Ref.	4.7 (4.3, 5.0)	Ref.
Q2	5.3 (5.1, 5.5)	0.4 (0.2, 0.6)	5.0 (4.8, 5.2)	0.5 (0.3, 0.7)	5.1 (4.8, 5.5)	0.06 (-0.4, 0.6)	4.8 (4.5, 5.2)	0.2 (-0.3, 0.6)
Q3	5.4 (5.1, 5.6)	0.4 (0.2, 0.7)	5.1 (4.9, 5.3)	0.6 (0.4, 0.9)	5.2 (4.8, 5.6)	0.2 (-0.4, 0.7)	4.9 (4.5, 5.3)	0.3 (-0.3, 0.8)
Q4	5.5 (5.3, 5.8)	0.6 (0.3, 0.9)	5.3 (5.1, 5.6)	0.8 (0.6, 1.1)	5.1 (4.7, 5.6)	0.08 (-0.6, 0.8)	4.9 (4.5, 5.4)	0.2 (-0.4, 0.9)
Bladder								
Q1	0.7 (0.6, 0.7)	Ref.	0.6 (0.6, 0.7)	Ref.	0.6 (0.5, 0.7)	Ref.	0.6 (0.5, 0.6)	Ref.
Q2	0.5 (0.5, 0.6)	-0.1 (-0.2, -0.06)	0.5 (0.5, 0.6)	-0.1 (-0.2, -0.03)	0.5 (0.5, 0.6)	-0.05 (-0.2, 0.09)	0.5 (0.4, 0.6)	-0.04 (-0.2, 0.09)
Q3	0.5 (0.5, 0.6)	-0.1 (-0.2, -0.05)	0.5 (0.5, 0.6)	-0.1 (-0.2, -0.02)	0.5 (0.4, 0.6)	-0.1 (-0.3, 0.04)	0.5 (0.4, 0.6)	-0.09 (-0.2, 0.05)
Q4	0.5 (0.4, 0.5)	-0.2 (-0.3, -0.1)	0.5 (0.4, 0.5)	-0.2 (-0.2, -0.08)	0.5 (0.4, 0.6)	-0.09 (-0.3, 0.09)	0.5 (0.4, 0.6)	-0.07 (-0.2, 0.1)
Myeloma								
Q1	0.3 (0.2, 0.3)	Ref.	0.2 (0.2, 0.3)	Ref.	0.3 (0.2, 0.4)	Ref.	0.3 (0.2, 0.4)	Ref.
Q2	0.3 (0.2, 0.3)	-0.004 (-0.05, 0.04)	0.3 (0.2, 0.3)	0.006 (-0.04, 0.005)	0.2 (0.2, 0.3)	-0.09 (-0.2, 0.02)	0.2 (0.2, 0.3)	-0.09 (-0.2, 0.02)
Q3	0.3 (0.2, 0.3)	0.00001 (-0.05, 0.05)	0.3 (0.2, 0.3)	0.01 (-0.04, 0.06)	0.2 (0.2, 0.3)	-0.08 (-0.2, 0.05)	0.2 (0.2, 0.3)	-0.07 (-0.2, 0.05)
Q4	0.3 (0.2, 0.3)	0.001 (-0.06, 0.06)	0.3 (0.2, 0.3)	0.01 (-0.04, 0.07)	0.2 (0.2, 0.3)	-0.08 (-0.2, 0.06)	0.2 (0.1, 0.3)	-0.07 (-0.2, 0.06)
Melanoma skin								
Q1	1.7 (1.5, 1.7)	Ref.	1.5 (1.4, 1.6)	Ref.	1.7 (1.5, 1.8)	Ref.	1.5 (1.4, 1.7)	Ref.
Q2	2.2 (2.1, 2.3)	0.6 (0.5, 0.8)	2.1 (2.0, 2.2)	0.6 (0.5, 0.8)	2.1 (1.8, 2.3)	0.4 (0.06, 0.7)	2.0 (1.8, 2.2)	0.5 (0.09, 0.7)
Q3	2.4 (2.3, 2.6)	0.8 (0.6, 1.0)	2.3 (2.2, 2.5)	0.9 (0.7, 1.0)	2.2 (2.0, 2.5)	0.6 (0.2, 0.9)	2.1 (1.9, 2.4)	0.6 (0.2, 1.0)
Q4	2.7 (2.5, 2.8)	1.0 (0.9, 1.3)	2.6 (2.4, 2.7)	1.1 (0.9, 1.3)	2.3 (2.0, 2.6)	0.6 (0.2, 1.1)	2.2 (2.0, 2.5)	0.7 (0.3, 1.1)
Non-melanoma skin								
Q1	4.4 (4.2, 4.5)	Ref.	4.0 (3.9, 4.1)	Ref.	4.7 (4.4, 5.0)	Ref.	4.4 (4.2, 4.7)	Ref.
Q2	5.7 (5.6, 5.9)	1.4 (1.1, 1.6)	5.5 (5.3, 5.6)	1.4 (1.2, 1.7)	5.1 (4.8, 5.4)	0.4 (-0.1, 0.9)	4.9 (4.6, 5.2)	0.5 (-0.02, 0.9)
Q3	6.1 (5.9, 6.3)	1.7 (1.4, 2.0)	5.8 (5.6, 6.0)	1.8 (1.6, 2.1)	5.3 (5.0, 5.7)	0.6 (0.03, 0.1)	5.1 (4.8, 5.4)	0.7 (0.1, 1.2)
Q4	6.7 (6.5, 7.0)	2.4 (2.1, 2.7)	6.5 (6.3, 6.7)	2.5 (2.2, 2.8)	5.3 (4.9, 5.7)	0.6 (-0.05, 0.1)	5.1 (4.7, 5.5)	0.7 (0.1, 1.2)

[a]The flexible parametric models were performed in the full sample, from which the standardised incidences were computed in a random subsample of 10%.
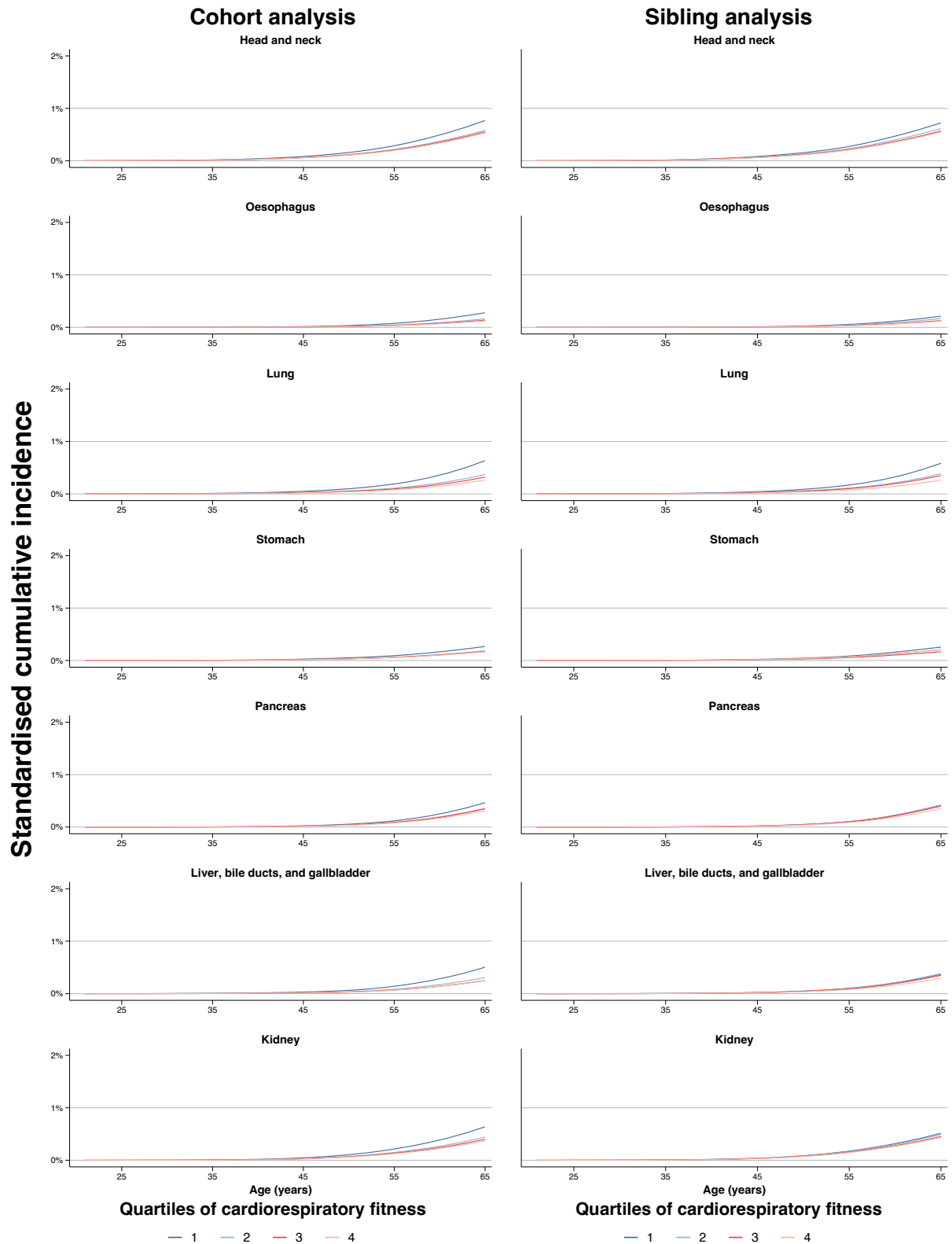
[b]Standardised cumulative incidences as obtained in the main analysis, assuming conditional independence between time to the cancer outcome and the competing event (death from other causes).

[c]Cause-specific standardised cumulative incidence functions, accounting for the competing risk of death from non-cancer causes.
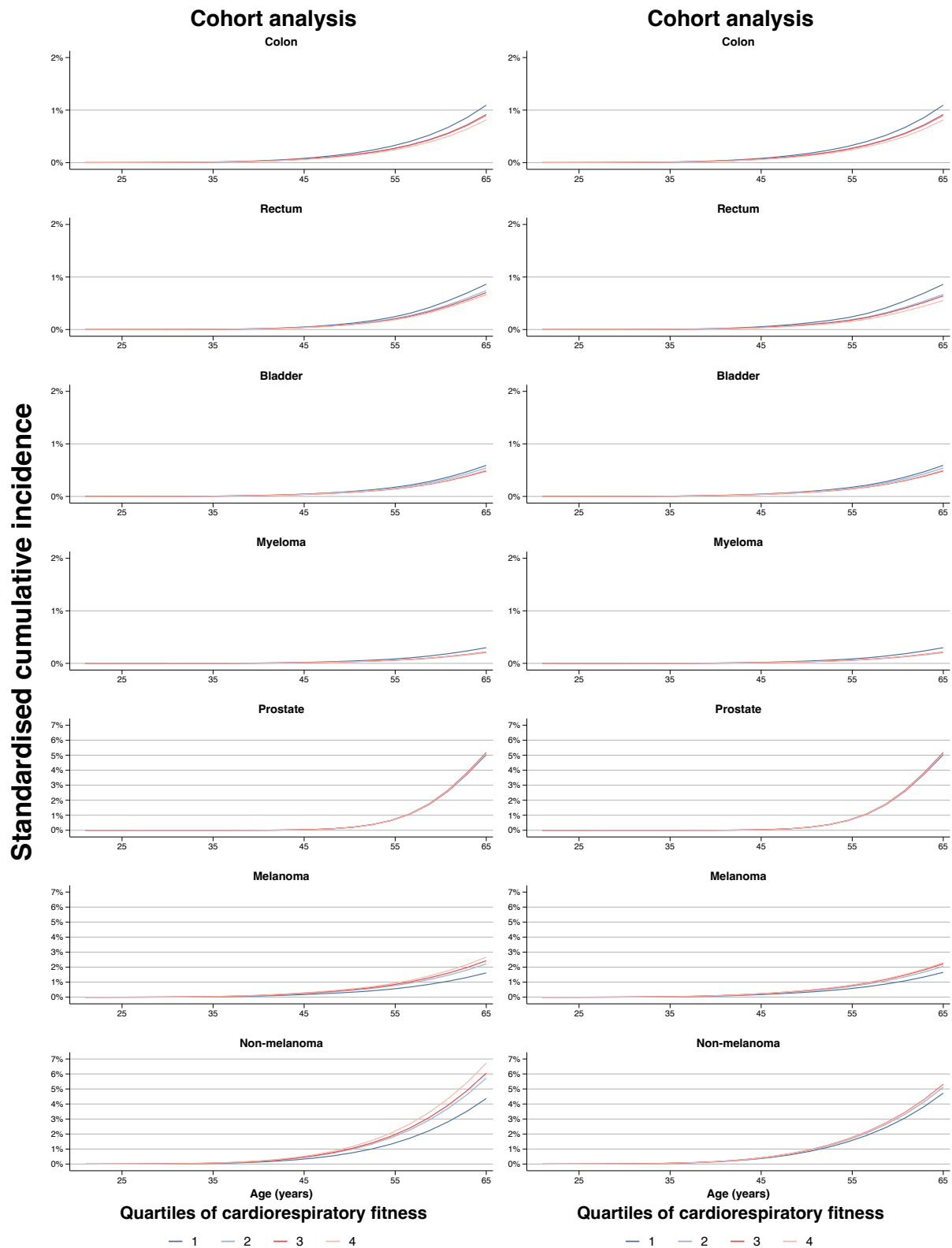
CI = confidence interval. Q = quartile. All estimates are adjusted for age at conscription, year of conscription, body mass index, parental education, and parental income. In both cohorts, the median (range) of W_{max} in Q1 was 217 (100-236), in Q2 it was 253 (237-270), in Q3 it was 290 (271-312), in Q4 it was 339 (313-999).
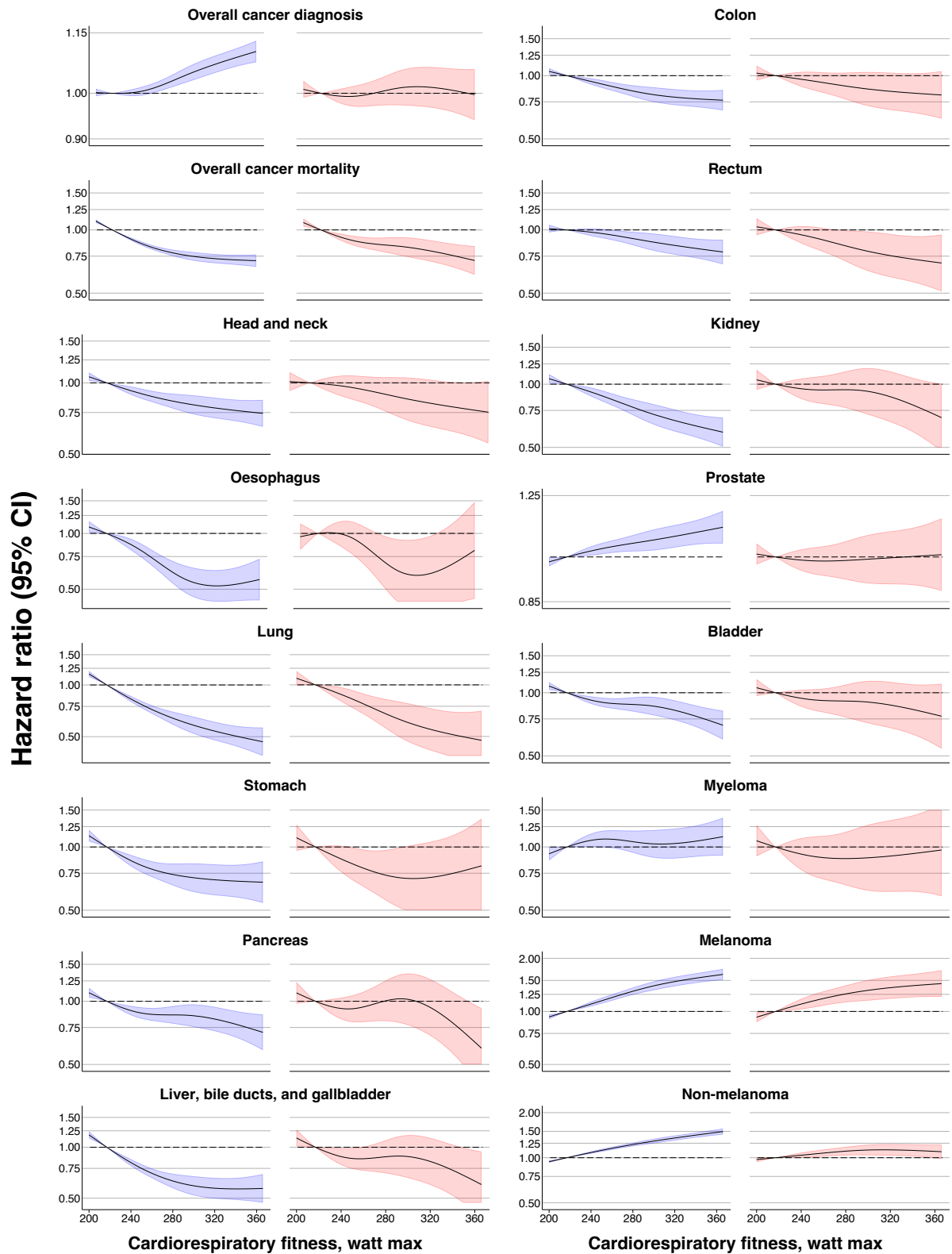
Supplementary figure 1. Hazard ratios for cancer across restricted cubic splines of cardiorespiratory fitness in cohort (blue) and sibling analysis (red). Estimates were obtained using flexible parametric survival models, extended to a marginalised between-within model in the sibling cohort, with knots placed at the 5th, 35th, 65th, and 95th percentile, and using age as the underlying time scale. The referent was set to the median value of the bottom quartile (217 W_{max}). The models were adjusted for age at conscription, year of conscription, body mass index, parental education, and parental income. For graphical purposes, the x-axis was limited to span from the 5th to the 95th percentile of the distribution.

Supplementary figure 2. Standardised cumulative incidence for site-specific cancer by quartiles of cardiorespiratory fitness in cohort and sibling analysis. Estimates obtained using flexible parametric survival models, extended to a marginalised between-within model in the sibling cohort, with baseline knots placed at the 5th, 27.5th, 50th, 72.5th, and 95th percentile of the uncensored log survival times, and using age as the underlying time scale. All models were adjusted for age at conscription, year of conscription, body mass index, parental education, and parental income. Inferential measures for the incidences were omitted for clarity as they are also reflected in supplementary table 3 and 4.

Supplementary figure 3. Standardised cumulative incidence for site-specific cancer by quartiles of cardiorespiratory fitness in cohort and sibling analysis. Estimates obtained using flexible parametric survival models, extended to a marginalised between-within model in the sibling cohort, with baseline knots placed at the 5th, 27.5th, 50th, 72.5th, and 95th percentile of the uncensored log survival times, and using age as the underlying time scale. All models were adjusted for age at conscription, year of conscription, body mass index, parental education, and parental income. Inferential measures for the incidences were omitted for clarity as they are also reflected in supplementary table 3 and 4.