

Supplementary Online Materials

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Web Appendix 1: The Questions on Sports and Exercises That List the Two Strength Promoting Exercise Exposures Used in This Study (Items 3 and 10 in the list below)

ASK ALL AGE 16+

ActPhy

SHOW CARD N

Can you tell me if you have done any activities on this card during the last 4 weeks, that is since *(date of interview – 4 weeks)*? Please include teaching, coaching, training and practice sessions.

- 1 Yes
- 2 No

IF ActPhy = Yes THEN

WhtAct

SHOW CARD N

Which have you done in the last four weeks?

PROBE: Any others?

CODE ALL THAT APPLY.

- 1 Swimming
- 2 Cycling
- 3 Workout at a gym/Exercise bike/Weight training
- 4 Aerobics/Keep fit/Gymnastics/ Dance for fitness
- 5 Any other type of dancing
- 6 Running/Jogging
- 7 Football/Rugby
- 8 Badminton/tennis
- 9 Squash
- 10 Exercises (e.g. press-up, sit-ups).

Web Table 1: Age and Sex-Specific Percentages^a of Total Gym-Based Activity That was Reported to be “Strength Work Out at a Gym Using Machines or Free Weights”

	Males (% of total)	Females (% of total)
Age group		
30-35	86	52
36-44	79	58
45-54	69	60
55-64	55	53
64-74	53	44
75+	61	57

^aCalculated using in the pooled samples of participants aged ≥ 30 years in the 2008 (n=12,360) and 2012 (n=6883) Health Surveys for England.

Web Table 2: Sex-Specific Median Values of Weekly Volume (Minutes) of Strength-Promoting Exercise^b

	Minutes/Week
Own bodyweight SPE^a	
Women	52.5
Men	50.0
Gym-based SPE^a	
Women	39.0
Men	59.5
All Strength Exercise	
Women	66.0
Men	52.5

^aSPE: strength promoting exercise; ^b Calculated using data from participators only, i.e. excluding zeros

Web Table 3: Description and justification/purpose of sensitivity analyses undertaken

Description	Purpose/Justification
We repeated all main Cox analyses with additional adjustment for fruit and vegetable consumption (27) in a sub-sample.	To examined the role of dietary confounding
We repeated various Cox models with adherence to the SPE guidelines calculated using own bodyweight exercise only.	To minimize the possibility that the associations between SPE and mortality are not due to the aerobic exercise element included in the gym-based SPE question.
We included an non-strength promoting physical activity*SPE term in the fully adjusted Cox models and we performed stratified Cox analyses by physical activity level.	To examined whether total activity is an effect modifier of the association between SPE and the mortality outcomes.
We carried out a sensitivity analysis restricted to non-smokers.	Smoking is a causal risk factor for all three-study outcomes and is strongly associated to participation of SPE.

Web Table 4: Hazard Ratios Describing the Associations Between Strength-Promoting Exercise and Cardiovascular Disease Mortality. Adults Aged 30 Years and Over With No Cardiovascular Disease^a at Baseline who Survived the First 24 Months of Follow-Up (n=73,937).

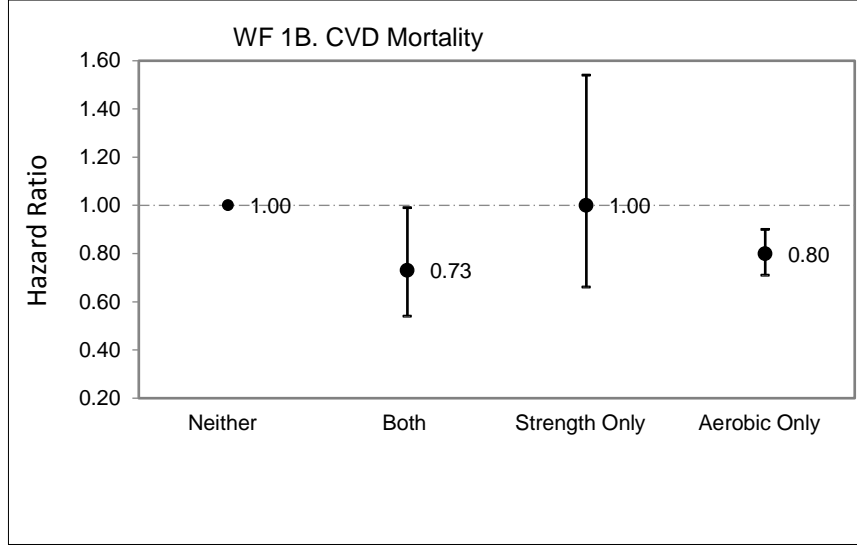
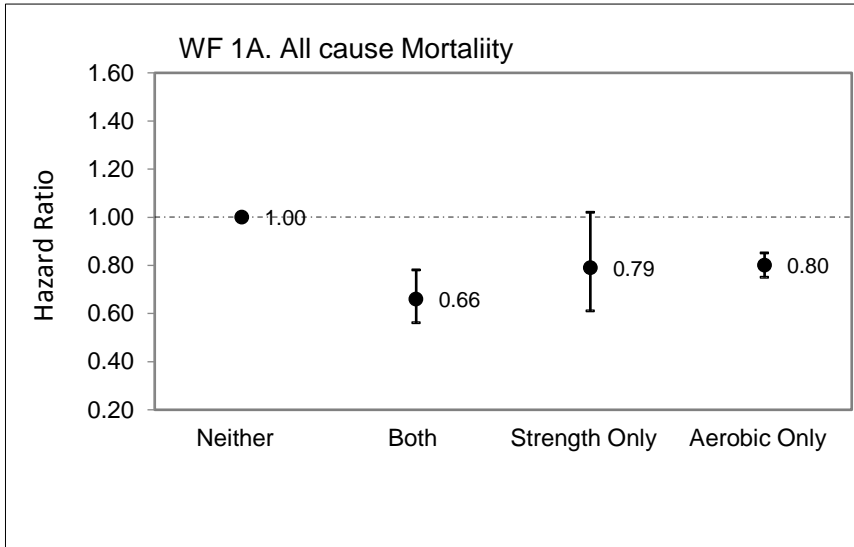
		Model 1 ^c		Model 2 ^d	
		HR	95% CIs	HR	95% CIs
Own bodyweight exercises					
<i>Overall participation</i>					
None	1648/66756	1.00		1.00	
Any	75/7181	0.72	0.57, 0.91	0.86	0.68, 1.09
<i>P for trend</i>		0.007		0.223	
<i>Weekly volume^b</i>					
None	1648/66756	1.00		1.00	
Low	29/3589	0.68	0.47, 0.99	0.80	0.56, 1.16
High	46/3592	0.75	0.56, 1.01	0.91	0.67, 1.22
<i>P for trend</i>		0.181		0.724	
Gym-based					
<i>Overall participation</i>					
None	1690/67164	1.00		1.00	
Any	33/6773	0.72	0.51, 1.02	0.91	0.64, 1.29
<i>P for trend</i>		0.068		0.606	
<i>Weekly volume^{b e}</i>					
None	1690/67164	1.00		1.00	
Low	22/3334	0.82	0.54, 1.25	.01	0.66, 1.54
High	11/3439	0.58	0.32, 1.06	0.76	0.42, 1.38
<i>P for trend</i>		0.105		0.376	
All Strength Exercise					
<i>Overall participation</i>					
None	1623/62253	1.00		1.00	
Any	100/11684	0.73	0.59, 0.89	0.88	0.71, 1.08
<i>P for trend</i>		0.002		0.208	

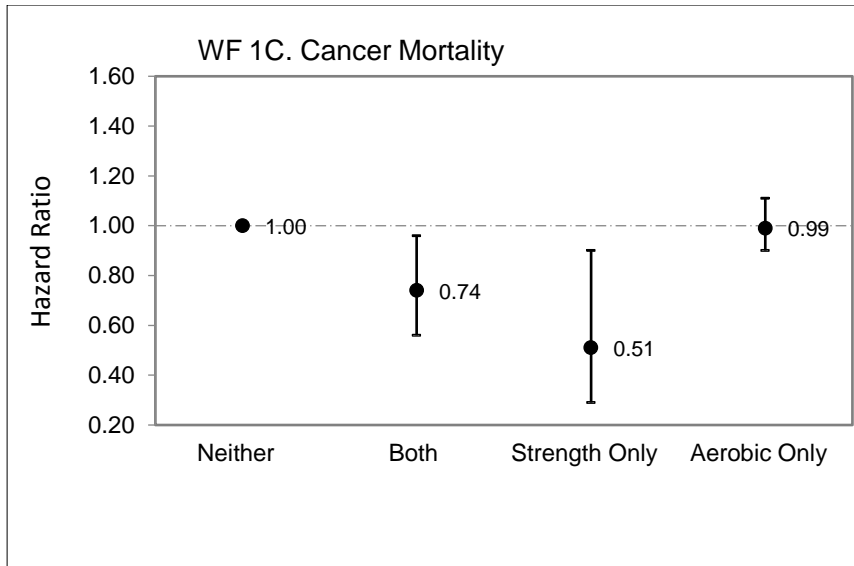
<i>Weekly volume^{c e}</i>					
None	1623/62253	1.00		1.00	
Low	49/5794	0.75	0.56, 1.00	0.89	0.67, 1.19
High	51/5890	0.71	0.53, 0.93	0.86	0.65, 1.14
<i>P for trend</i>		<i>0.044</i>		<i>0.364</i>	
<i>Adherence to strength exercise guideline^f</i>					
Do not meet the guideline	1651/67,059	1.00		1.00	
Meet the guideline	72/6878	0.77	0.60, 0.97	0.92	0.72, 1.12
<i>P for trend</i>		<i>0.027</i>		<i>0.469</i>	
<p>^a Prevalent cardiovascular disease was defined as doctor-diagnosed or self-reported ischemic heart disease, angina, or stroke; ^bGroups were defined using the sex-specific medians of the corresponding variable (see <i>Web Table 2</i>) ^cModel adjusted for age and sex ^dModel also adjusted for long-standing illness, alcohol drinking frequency, psychological distress, body mass index, smoking status, education level, and weekly physical activity volume excluding the volume of strength-promoting activity that is the main exposure in the corresponding model; ^eGym-based exercise weekly volumes were weighted using age (10 year bands) and sex-specific proportions of total gym-based activity that was “Strength work out at a gym using machines or free weights” derived from the Health Survey for England 2008 and 2012 datasets (see <i>Web Table 1</i>); ^fDefined as two sessions of strength promoting exercise per week</p>					

Web Table 5: Hazard Ratios Describing the Associations^a Associations Between Strength-Promoting Exercise and All-Cause, Cardiovascular Disease related, and Cancer Mortality. *Non-Smokers Aged 30 Years who Survived the First 24 Months of Follow-Up.*

	All-Cause Mortality			CVD Mortality			Cancer Mortality		
	Deaths/n	HR	95% CIs	Deaths/n	HR	95% CIs	Deaths/n	HR	95% CIs
Own bodyweight exercises									
<i>Overall participation</i>									
None	3892/48,599	1.00		1205/49,691	1.00		1364/52,102	1.00	
Any	189/5686	0.77	0.66, 0.89	58/5770	0.84	0.64, 1.10	64/5876	0.66	0.51, 0.85
<i>P for trend</i>		<0.001			0.199			0.001	
Gym-based									
<i>Overall participation</i>									
None	3996/48,655	1.00		1237/49,756	1.00		1394/52,214	1.00	
Any	85/5630	0.81	0.65, 1.00	26/5705	0.97	0.65, 1.40	34/5764	0.62	0.44, 0.88
<i>P for trend</i>		0.062			0.877			0.007	
All Strength Exercise									
<i>Overall participation</i>									
None	3824/44,850	1.00		1185/45,888	1.00		1335/48,240	1.00	
Any	255/9404	0.78	0.69, 0.89	78/9542	0.87	0.69, 1.1	92/9706	0.67	0.54, 0.83
<i>P for trend</i>		<0.001			0.238			<0.001	
Strength Exercise Guideline ^b									
Do not meet the guideline	3908/48,743	1.00		1210/49,833	1.00		1366/52,262	1.00	
Meet the guideline	173/5542	0.77	0.66, 0.89	53/5628	0.84	0.63, 1.10	62/5716	0.69	0.53, 0.89
<i>P for trend</i>		0.001			0.205			0.005	
^a Adjusted for age, sex, long-standing illness, alcohol drinking frequency, psychological distress, body mass index, smoking status, education level, and weekly physical activity volume excluding the strength-promoting activity that is the main exposure in the corresponding model; ^b Defined as two sessions of strength promoting exercise per week									

Web Figure 1A to Web Figure 1C: Hazard Ratios Describing The Association Of Adherence To The Strength Promoting Guideline, Adherence To The Alternative Definition Of The Aerobic Physical Activity Guideline, With Mortality. *Analyses were adjusted for age, BMI, educational attainment, presence of longstanding illness, weekly frequency of alcohol consumption, smoking habits, psychological distress/depression, and total volume of physical activity. Adherence to the physical activity guidelines reflects average weekly MET-hrs from domestic activity, walking of any intensity, and recreational physical activity (including sports and exercises). Achieving at least 7.5 MET-hrs on non-strength promoting exercise denoted adherence to the aerobic guideline. Sample sizes for all-cause mortality (cases/n): Neither (2971/24,625), Both (168/5800), Strength Only (59/978), Aerobic Only (2565/41,056); CVD mortality: Neither (919/25,270), Both (50/5884), Strength Only (22/994), Aerobic Only (732/41,789); Cancer mortality: Neither (946/27,510), Both (65/5,934), Strength Only (12/1,031), Aerobic Only (1,066/42,720).*





Web Figure 2A to Web Figure 2C Hazard Ratios Describing The Associations Of Adherence To The Aerobic Physical Activity Guideline And The Alternative Definition Of The Strength Promoting Guidelines, With Mortality. *Analyses adjusted for age, BMI, educational attainment, presence of longstanding illness, weekly frequency of alcohol consumption, smoking habits, psychological distress/depression, and total volume of physical activity. Adherence to the physical activity guideline reflects moderate to vigorous physical activity only: at least 150 minutes/week of moderate intensity or 75 minutes/week of vigorous intensity or equivalent combinations of moderate and vigorous non-strength promoting / non-domestic physical activity. Adherence to the strength promoting exercise guidelines refers to reporting at least two session of own bodyweight strength promoting exercise per week. Sample sizes for all-cause mortality (cases/n): Neither (4172/ 39,228), Both (77/2685),Strength Only (107/1504), Aerobic Only (1407/29,042); CVD mortality: Neither (1286/40,161), Both (21/2717), Strength Only (36/1538), Aerobic Only (380/29,521); Cancer mortality: Neither (1416/42,948), Both (30/2727), Strength Only (29/1593), Aerobic Only (614/29,927).*

