

## SUPPLEMENTARY MATERIAL

### Supplement to:

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**Decreasing grip strength and subsequent loneliness: English Longitudinal Study of Ageing**

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**Supplementary Table 1.** Distribution of baseline characteristics and missingness (N = 9084), by sex.

	Men	Women
	n = 4056	n = 5028
	45 (%)	55 (%)
	n (%)	n (%)
Grip strength (kg) (mean (SD))	41.2 (9.8)	24.4 (6.7)
Available	3576 (88)	4348 (86)
Missing*	480 (12)	680 (14)
Age (years) (median)	62	62
Available	4056 (100)	5028 (100)
Missing	0	0
Employment status		
Retired	1912 (47)	2304 (46)
Employed	1771 (44)	1672 (33)
Unemployed	113 (3)	802 (16)
Permanently sick or disabled	259 (6)	248 (5)
Missing	1 (0)	2 (0)
Socio-economic classification (NS-SEC) by occupation		
Managerial, professional occupations	1684 (42)	1398 (28)
Intermediate occupations	804 (20)	1392 (28)
Routine and manual occupations	1499 (37)	2150 (43)
Missing	69 (2)	88 (2)
Living alone		
No	3343 (82)	3594 (71)
Yes	713 (18)	1434 (29)
Missing	0	0
Arthritis		
No	3710 (91)	4407 (88)
Yes	344 (8)	619 (12)
Missing	2 (0)	2 (0)
Cancer		
No	3955 (98)	4886 (97)
Yes	98 (2)	139 (3)
Missing	3 (0)	3 (0)
Diabetes		
No	3844 (95)	4847 (96)
Yes	210 (5)	181 (4)
Missing	2 (0)	0
Cardiovascular diseases		
No	3804 (94)	4805 (96)
Yes	250 (6)	223 (4)
Missing	2 (0)	0
Stroke		
No	3992 (98)	4968 (99)
Yes	62 (2)	60 (1)
Missing	2 (0)	0
UCLA loneliness scale score 3 to 9 (median (IQR))	3 (3 - 5)	4 (3 - 5)
Available	3568 (88)	4455 (89)
Missing	488 (12)	573 (11)

The baseline comprises 9084 participants who provided data in all three or two consecutive waves of ELSA.

\*The main reason for missing grip strength measurements is a refusal to participate in the nurse visit.

**Supplementary Table 2.** Change in loneliness score estimated from the UCLA loneliness scale for each 5 kg change in grip strength, complete-case analysis after recoding change in grip strength between - 2 kg to + 2 kg as no change.

	Men (n = 2769)		Women (n = 3349)	
	$\beta$ (95% CI)	P value	$\beta$ (95% CI)	P value
<b>Decrease in grip strength</b>				
Unadjusted	0.05 (0.03 to 0.08)	< 0.001	0.08 (0.03 to 0.12)	< 0.001
Adjusted*	0.04 (- 0.001 to 0.07)	0.057	0.03 (- 0.02 to 0.08)	0.265
<b>Increase in grip strength</b>				
Unadjusted	0.02 (- 0.03 to 0.08)	0.405	0.01 (- 0.06 to 0.08)	0.751
Adjusted*	0.01 (- 0.05 to 0.07)	0.699	-0.02 (- 0.10 to 0.06)	0.579

\*Adjusted for age, living alone, employment status, NS-SEC occupation category, diagnoses of arthritis, cancer, diabetes, cardiovascular diseases, and stroke.

**Supplementary Table 3.** Change in loneliness score estimated from the UCLA loneliness scale for each 5 kg change in grip strength, complete-case analysis after excluding the highest 1% (n=77) of grip strength values.

	Men (n = 2769)		Women (n = 3349)	
	$\beta$ (95% CI)	P value	$\beta$ (95% CI)	P value
<b>Decrease in grip strength</b>				
Unadjusted	0.05 (0.03 to 0.08)	< 0.001	0.08 (0.03 to 0.12)	0.001
Adjusted*	0.04 (- 0.004 to 0.08)	0.076	0.03 (- 0.03 to 0.08)	0.365
<b>Increase in grip strength</b>				
Unadjusted	0.02 (- 0.03 to 0.08)	0.428	0.01 (- 0.06 to 0.08)	0.726
Adjusted*	0.01 (- 0.05 to 0.07)	0.686	-0.03 (- 0.11 to 0.05)	0.520

\*Adjusted for age, living alone, employment status, NS-SEC occupation category, diagnoses of arthritis, cancer, diabetes, cardiovascular diseases, and stroke.

**Supplementary Table 4.** Change in loneliness score estimated from the UCLA loneliness scale for each 5 kg change in grip strength, complete-case analysis after excluding the lowest 1% (n = 48) of grip strength values.

	Men (n = 2769)		Women (n = 3349)	
	$\beta$ (95% CI)	P value	$\beta$ (95% CI)	P value
<b>Decrease in grip strength</b>				
Unadjusted	0.05 (0.03 to 0.08)	< 0.001	0.08 (0.04 to 0.12)	< 0.001
Adjusted*	0.04 (- 0.004 to 0.07)	0.075	0.04 (-0.02 to 0.09)	0.188
<b>Increase in grip strength</b>				
Unadjusted	0.04 (- 0.02 to 0.09)	0.210	0.03 (- 0.04 to 0.10)	0.359
Adjusted*	0.02 (- 0.04 to 0.09)	0.454	- 0.0002 (- 0.08 to 0.08)	0.996

\*Adjusted for age, living alone, employment status, NS-SEC occupation category, diagnoses of arthritis, cancer, diabetes, cardiovascular diseases, and stroke.

**Supplementary Table 5.** Change in loneliness score estimated from the UCLA loneliness scale for each 5 kg change in grip strength, complete-case analysis after excluding participants with the highest UCLA loneliness score of nine at baseline.

	<b>Men (n = 2769)</b>		<b>Women (n = 3349)</b>	
	$\beta$ (95% CI)	P value	$\beta$ (95% CI)	P value
<b>Decrease in grip strength</b>				
Unadjusted	0.06 (0.03 to 0.08)	< 0.001	0.10 (0.06 to 0.14)	< 0.001
Adjusted*	0.04 (- 0.003 to 0.08)	0.068	0.03 (- 0.02 to 0.09)	0.231
<b>Increase in grip strength</b>				
Unadjusted	0.04 (- 0.01 to 0.09)	0.095	0.03 (- 0.05 to 0.10)	0.485
Adjusted*	0.03 (- 0.02 to 0.08)	0.291	- 0.03 (- 0.11 to 0.05)	0.433

\*Adjusted for age, living alone, employment status, NS-SEC occupation category, diagnoses of arthritis, cancer, diabetes, cardiovascular diseases, and stroke.

### Multiple imputation

We applied multiple imputation by chained equations and generated 5 imputations for all participants who participated in the main interview on three or two consecutive occasions. The imputation model included all variables used in the analysis and was weighted using the weight provided in data. The auxiliary variables used for imputation included the following: whether the respondent felt lonely during the past week (yes, no), how often the respondent feels lonely (hardly ever or never, some of the time, often), how often the respondent feels out of tune with people around them (hardly ever or never, some of the time, often), how many children the respondent believes they have a close relationship with (0 or no children, 1, 2,  $\geq 3$ ), how close the respondent's relationship is to their spouse/partner (very close, quite close, not very close/not at all close), how many family members the respondent has a close relationship with (no close relatives or close with none, 1-2,  $\geq 3$ ), how many friends the respondent has a close relationship with (count), whether the respondent has a hobby or pastime (yes, no), access to a car when needed, either as a passenger or a driver (yes, no), self-reported general health (excellent/very good, good, fair/poor), employed (yes, no), frequency of vigorous, moderate and mild sports or activities categorized into >1 time/week, 1 time/week to 1-3 times/month, and hardly ever or never, and height (cm).

**Supplementary Table 6.** Change in loneliness score estimated from the UCLA loneliness scale for each 5 kg change in grip strength with imputed datasets.

	<b>Men (n = 3251)</b>		<b>Women (n = 4065)</b>	
	$\beta$ (95% CI)	P value	$\beta$ (95% CI)	P value
<b>Decrease in grip strength</b>				
Unadjusted	0.06 (0.03 to 0.09)	< 0.001	0.09 (0.05 to 0.13)	< 0.001
Adjusted*	0.04 (- 0.002 to 0.07)	0.066	0.04 (- 0.02 to 0.09)	0.181
<b>Increase in grip strength</b>				
Unadjusted	0.01 (- 0.03 to 0.06)	0.598	0.02 (- 0.04 to 0.09)	0.480
Adjusted*	0.003 (- 0.05 to 0.06)	0.919	- 0.02 (- 0.10 to 0.05)	0.550

\*Adjusted for age, living alone, employment status, NS-SEC occupation category, diagnoses of arthritis, cancer, diabetes, cardiovascular diseases, and stroke.